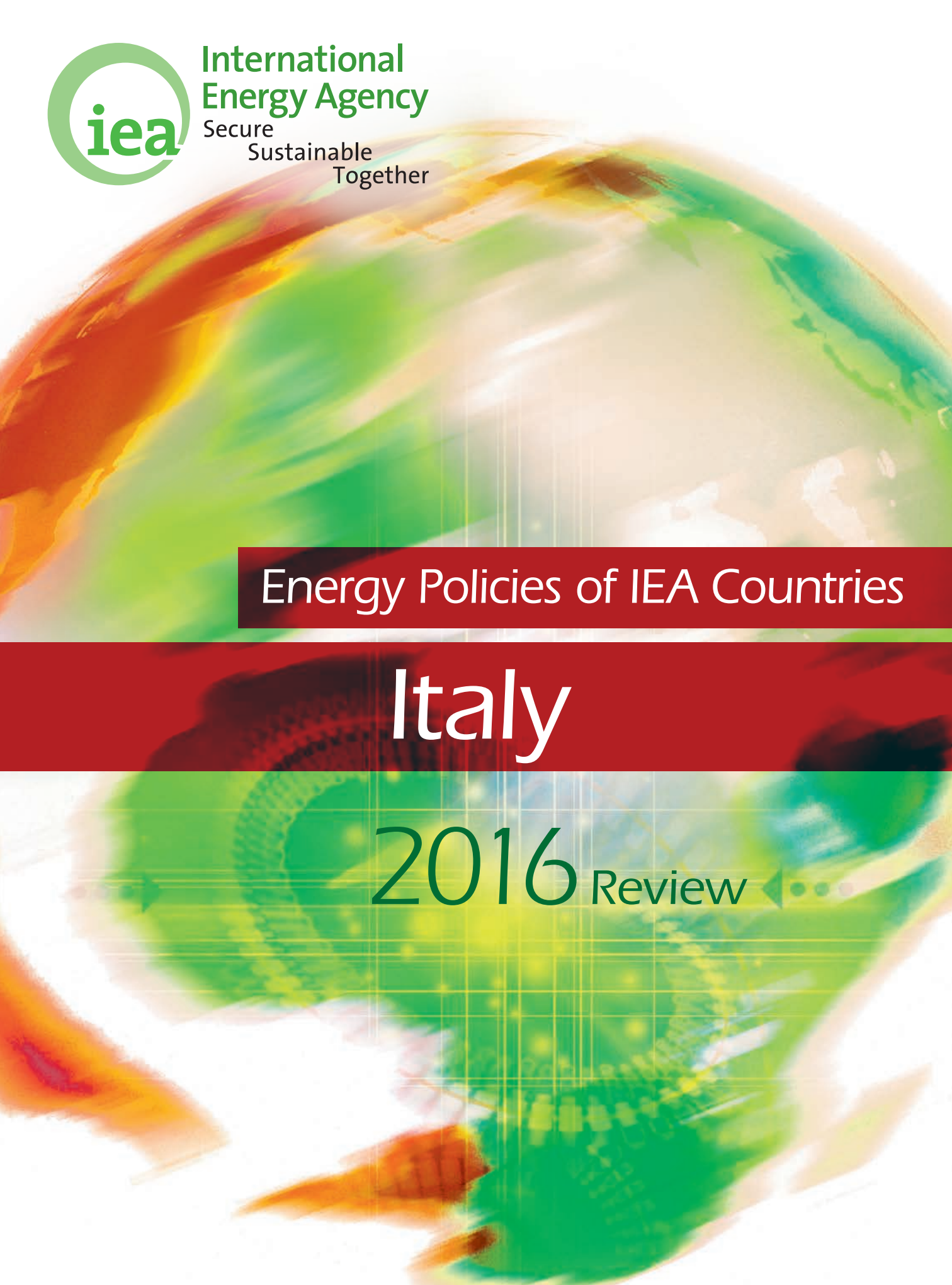
International
Energy Agency
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Energy Policies of IEA Countries
Italy
2016 Review

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Energy Policies of IEA Countries

Italy

2016 Review

INTERNATIONAL ENERGY AGENCY

The International Energy Agency (IEA), an autonomous agency, was established in November 1974. Its primary mandate was – and is – two-fold: to promote energy security amongst its member countries through collective response to physical disruptions in oil supply, and provide authoritative research and analysis on ways to ensure reliable, affordable and clean energy for its 29 member countries and beyond. The IEA carries out a comprehensive programme of energy co-operation among its member countries, each of which is obliged to hold oil stocks equivalent to 90 days of its net imports. The Agency's aims include the following objectives:

- Secure member countries' access to reliable and ample supplies of all forms of energy; in particular, through maintaining effective emergency response capabilities in case of oil supply disruptions.
- Promote sustainable energy policies that spur economic growth and environmental protection in a global context – particularly in terms of reducing greenhouse-gas emissions that contribute to climate change.
- Improve transparency of international markets through collection and analysis of energy data.
- Support global collaboration on energy technology to secure future energy supplies and mitigate their environmental impact, including through improved energy efficiency and development and deployment of low-carbon technologies.
- Find solutions to global energy challenges through engagement and dialogue with non-member countries, industry, international organisations and other stakeholders.

IEA member countries:

Australia
Austria
Belgium
Canada
Czech Republic
Denmark
Estonia
Finland
France
Germany
Greece
Hungary
Ireland
Italy
Japan
Korea
Luxembourg
Netherlands
New Zealand
Norway
Poland
Portugal
Slovak Republic
Spain
Sweden
Switzerland
Turkey
United Kingdom
United States

The European Commission also participates in the work of the IEA.

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1. EXECUTIVE SUMMARY AND KEY RECOMMENDATIONS

EXECUTIVE SUMMARY

Over the period since the last in-depth review in 2009, Italy has made strong progress in the development and implementation of energy policy. Key policy recommendations contained in the last review such as the need to develop a comprehensive long-term energy strategy and the necessity for Italy to step up its efforts to comply with its European Union (EU) goals for 2020 regarding climate change and renewables obligations have been implemented. A national greenhouse gas (GHG) emissions reduction plan was adopted in 2013 and subsequently updated. The most notable achievement, consistent with one of the key recommendations in the previous review, has been the development of the National Energy Strategy (NES, hereafter the Strategy) in 2013, which was the outcome of a comprehensive consultation process with the energy sector and all interested stakeholders.

The country has the goal of exceeding the EU 2020 environmental and decarbonisation objectives and taking a lead role in implementing the EU Roadmap 2050. More specifically, the country has established a 21% emissions reduction target by 2020 compared to 2005. Conversely, development of a national climate adaptation strategy has been under way for some time and this process should be completed without any further delay. Progress in the road transport sector, the second-largest GHG-emitting sector, has slowed and it is unlikely that Italy will meet its targets in this sector.

Problems with lengthy authorisation processes for new energy infrastructure appear to have eased over the period since 2009. The government has introduced a fast-track application procedure for projects of common interest (PCI). These procedures also apply to strategic projects identified in the NES. Nonetheless, some problems remain, for example the veto rights of Regions that have to give their support for a project. Efforts to streamline competences between the State and the Regions and the recent intervention of the Council of Ministers to override a regional veto to authorise the Trans-Adriatic Pipeline indicate the need to establish strategic energy governance.

Italy has continued to make progress in implementing energy efficiency policies and the NES has made energy efficiency a national priority. The National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA) has been designated as the national energy efficiency monitoring agency. ENEA has undertaken and published a number of comprehensive evaluations of the cost-effectiveness of energy efficiency policies, including the energy efficiency certificate scheme (white certificates). The country has also developed and implemented an energy efficiency action plan in line with the requirements of EU Directive 2012/27/EU, and has updated this plan a number of times. Italy uses a variety of regulatory measures and economic instruments to promote energy efficiency, including tax incentives and an innovated trading mechanism, the white certificates scheme. Nonetheless, multiple and overlapping incentives create risks of over-promoting some types of energy efficiency projects while leaving out others, as well as of creating regulatory complexity and ambiguities.

Since 2009, Italy has experienced impressive growth in the renewable energy (RE) sector. According to the Italian government, the share of renewables in total final consumption reached 13.5% at the end of 2013, up from 10% in 2010 and trends suggest that Italy is on track to exceed its 2020 target of 17%. The country has been successful in integrating variable renewable generation while also maintaining a stable power system, and without significant negative impacts on the wholesale market. Containing the costs of RE growth is a priority for the Italian government. In this regard, the government pressured owners of existing photovoltaic (PV) installations to extend their incentive payment periods, cut payments in the short term and increase them at a later point in time, or sell off the net present value of receivable payments on the financial market. The pending changes to the support scheme are bound to change the remuneration structure of existing installations. As such, these measures have created uncertainty, undermining investor confidence and arguably increasing the cost of capital for future investments. Alternative approaches available to the government could include broadening the base on which costs for RE incentives are recovered as well as long-term refinancing of financial commitments on capital markets. Policies, however, will need to increasingly focus on bringing down deployment costs towards international benchmarks. In this regard, the move towards competitive awarding of support for large installations is commendable and recent experiences with the auction procedure can inform the process.

In the oil sector, the government has established a new stockholding agency, the Italian Central Stockholding Entity (OCSIT), a state-owned organisation, overseen by the Ministry of Economic Development. Its purpose is to hold and manage state-owned stocks of products within Italy, and to organise and provide a service for the storage and transport of oil stocks for emergency and commercial purposes. Since July 2014, OCSIT has begun to progressively assume responsibility for an increasing proportion of the country's stockholding obligation from industry with a ten-year target to reach 30 days (or one-third) of compulsory stocks held. The government has initiated a major programme of reform in the fuel distribution sector in order to meet the government's principal objectives of enhanced security of supply, increased competitiveness and greater quality of service.

The research, development, demonstration and deployment of new energy technologies has been identified as a priority in the NES and some progress has been made since 2009 despite the decline in funding available to this sector. In order to achieve the objectives set out in the NES, the possibilities provided by effective research, development and innovation policy should be fully exploited. The NES has the potential of filling the gap of clean energy technology policy guidelines that can catalyse the interest and resources of the scientific and industrial communities.

REFORM OF THE ELECTRICITY AND NATURAL GAS SECTORS

ELECTRICITY MARKET

Italy has continued to progress in terms of market liberalisation and infrastructure development. In the wholesale electricity market, transmission improvements between north and south have resulted in price convergence throughout Italy and prices are falling in line with wholesale prices elsewhere in Europe. Although the market share of Enel, the previously state-owned incumbent, has reduced, it remains the largest single supplier of electricity. While the relatively high liquidity and the price performance of the wholesale market suggest that market power abuse is not present or is at least not

significant, the relative share of Enel should be examined more carefully, in particular with regard to how often its plants are setting the marginal price.

Despite the administrative unbundling of retail supply and distribution grid ownership and operation, the establishment of a fully functional retail market remains incomplete. Notably, a significant portion of wholesale market purchases comes from *Acquirente Unic*o (AU), the single buyer. Italy is at present the only country in Europe to retain the single buyer model. As AU purchases its power from the wholesale market, it is in practice competing with competitive retailers. While its relative share of purchases in the wholesale market has been declining, the presence of such a large single buyer in a market place raises concerns about overall competitiveness.

Evidence suggests that Italy's electricity retail tariffs are among the highest in Europe. Furthermore, electricity tariffs cover a very broad range of charges, and are presented in a complex form. High prices impact on their relative competitiveness of Italian industry.

NATURAL GAS MARKET

There have been a number of significant improvements in the natural gas sector since the previous review, both in terms of pipeline capacity and competition rules. Snam Rete Gas has been ownership-unbundled and the country has one of the largest storage capacities in Europe. The NES foresees the development of Italy as a Southern European gas hub: importing liquefied natural gas (LNG) and pipeline gas and exporting it to its northern and eastern neighbours. Accordingly, when planning gas infrastructure, Italy is not only looking at domestic demand but at regional integration as well. While the International Energy Agency (IEA) supports Italy in its efforts as regards regional integration of the Italian gas market, the development of a gas hub should be second to the establishment of a fully functioning wholesale gas market in Italy.

The Ministry of Economic Development (*Ministero dello Sviluppo Economico*, MSE) is preparing to restructure the natural gas distribution sector and the first auctions for new distribution service concessions are under way. This represents a welcome step towards more competition and transparency in the sector. Nonetheless, the structure and rules for these auctions are complex: the critical step in this procedure is the definition of the residual value of assets (the distribution grid and connected equipment). In fact, the incoming operator will acquire the ownership of the asset but will need to pay off the residual value to the former owner. Finding an agreement on the correct residual value can be a challenge. The MSE has been compelled to publish guidelines that ensure consistency throughout the country and support tendering authorities in the drafting and publishing of tenders.

In the natural gas market, retail prices remain above the European average. Despite significant restructuring, the Italian natural gas market remains notable for the absence of a liquid trading hub where market participants can observe transparent price formation and buy and sell natural gas on terms similar to their counterparts across Europe. In the recent past, high prices and a lack of liquidity in the natural gas market had an impact throughout the energy system, placing both large users and domestic consumers at a disadvantage. This situation contrasts with developments in the electricity market where transmission grid developments over the past decade have reduced congestion and eased bottlenecks, and facilitated the emergence of a more liquid wholesale market.

Retail markets continue to be dysfunctional and Italy maintains a very broad definition of what constitutes a vulnerable customer necessitating the need for an administered price in the retail markets for both natural gas and electricity. While a number of suppliers have entered the market, switching rates remain low in the absence of a transparent retail price. The regulator and the government must work together to draw up a timetable for the introduction of full retail competition. The goal must be the elimination of administered prices while at the same time protecting vulnerable customers. There is also a strong need to restructure the retail tariff, with a view to increase transparency and eliminate signals that are inconsistent with overall economic objectives, for example competitiveness of small and medium-sized enterprises.

By June 2014, there were approximately 1.14 million natural gas-powered vehicles in the European Union, of which 77% were registered in Italy. The country makes extensive use of compressed natural gas for road transportation. With close to 900 000 vehicles adapted to this technology and over 1 000 filling stations, it is the most mature market in Europe. This market is supported by the evolution of a relatively well developed refuelling infrastructure complemented by a series of fiscal incentives and other subsidies. Italy is also developing activities to increase the use of LNG as fuel for maritime use (including the Italian naval fleet) and land transport, and is carrying out a techno-economic analysis to evaluate the feasibility of a national plan on the use of LNG in transport.

Regarding electricity and natural gas data, Italy provides the IEA with limited information regarding prices: the government must work with the relevant market authorities to develop a mechanism that ensures the timely delivery of this information to the IEA.

THE NATIONAL ENERGY STRATEGY

The development of the NES in 2013 sent a strong signal to the market and to stakeholders as to the government's medium- and long-term goals for the energy sector. It establishes clear goals: reduce energy costs, meet environmental targets, strengthen security of energy supply and foster sustainable economic growth. The NES also identifies a series of priority actions needed to meet its goals: clear targets for emissions reductions, renewable energy and energy efficiency. It also prioritises the need to develop competitive energy markets, transform the hydrocarbon sector and modernise energy governance. The government is to be commended not only for adopting the new Strategy but also for the open manner in which it engaged with stakeholders and institutions during the consultation process.

Nonetheless, the adoption of the Strategy is only a first step towards achieving the government's energy goals. Monitoring and maintaining momentum will present a challenge for the government. As elsewhere, consideration should be given to the establishment of a mechanism to review, independently evaluate and monitor the implementation of all phases of the Strategy and ensure the cost-effective delivery of outcomes. This evaluation process should also include publication of regular performance reports and tools to revise the Strategy when necessary.

INSTITUTIONAL ARRANGEMENTS

Despite all the positive progress Italy has made, there remains scope for further improvement. Institutional arrangements within the energy sector remain complex and oversight rests with two key ministries: the MSE and the Ministry for the

Environment, Land and Sea (MATTM). While the competences of each are clear, this is not always the case among the various institutions that fall under the aegis of the ministries. Despite recent progress in the renewables, energy efficiency and research and development sectors, management and oversight of these policies often involve a number of different agencies and institutions. This appears to result in co-ordination difficulties and higher transaction costs than may otherwise be the case. In the past, overlapping measures evolved, which have also changed several times in the recent years. This has contributed to unnecessary complexity and regulatory uncertainty for sector stakeholders. Implementation of the Strategy provides timely opportunity to address these challenges in a comprehensive way.

Moreover, the policy landscape is further complicated by the 2001 reform of the Italian Constitution, which gave greater policy authority to the Regions, notably impacting on climate change, and energy efficiency policies, as well as infrastructure planning, development and consenting processes. While some measures have been introduced to streamline many of the processes affected by the 2001 decision, the IEA strongly encourages co-operation among the Regions and the government to ensure the delivery of the goals contained in the Strategy.

RECOMMENDATIONS

The government of Italy should:

- *Complete its programme of reform in the energy markets, notably in the wholesale natural gas markets and in the operation of both the electricity and natural gas retail markets. End-user tariffs in both sectors should be simplified and the role of the Acquirente Unico reduced.*
- *Develop a reporting mechanism to regularly monitor and evaluate progress in the medium-term implementation of the Strategy against its goals, and ensure the timely and cost-effective delivery of policy.*
- *Reduce the complexity and regulatory uncertainty for energy sector stakeholders by vesting clear responsibility for the implementation of the different elements of the Strategy with the most appropriate institutions, and reduce overlapping authorities.*

PART I
POLICY ANALYSIS

Figure 2.1 Map of Italy

This map is without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries, and to the name of any territory, city or area.

2. GENERAL ENERGY POLICY

Key data (2015 estimated)

Energy production: 35.5 Mtoe (biofuels and waste 32.2%, oil 15.9%, natural gas 15.6%, geothermal 15.4%, hydro 10.6%, solar 6.6%, wind 3.6%, coal 0.1%), +17.7% since 2005

TPES: 150.7 Mtoe (natural gas 36.7%, oil 34.2%, biofuels and waste 9.7%, coal 8.2%, geothermal 3.6%, electricity net imports 2.6%, hydro 2.5%, solar 1.6%, wind 0.8%), -19.1% since 2005

TPES per capita: 2.5 toe (IEA average: 4.5 toe)

TPES per GDP: 0.08 toe/USD 1 000 PPP (IEA average: 0.11 toe/USD 1 000 PPP)

Electricity generation: 280.7 TWh (natural gas 38.3%, coal 16.6%, hydro 15.6%, solar 9.3%, biofuels and waste 7.8%, wind 5.2%, oil 4.8%, geothermal 2.2%), -5.4% since 2005

Electricity and heat generation per capita: 5.6 MWh (IEA average: 9.9 MWh)

COUNTRY OVERVIEW

Italy, with the exception of the Po plain in the north, is a largely mountainous country that runs from the Alps to the central Mediterranean Sea. It includes the large islands of Sicily and Sardinia as well as about 70 minor islands. Its surface area is 301 300 km², 165 200 km² of which is arable. Italy is home to almost 61.6 million inhabitants of whom 22 million are in active employment. Italian is the official language, but there are German-, French- and Slovenian-speaking minorities in some regions.

The Italian Republic is governed by a bicameral national legislature, a Senate and a Chamber of Deputies. The Council of Ministers is headed by the prime minister and appointed by the president on the basis of ability to form a government with parliamentary support. The most recent elections in April 2013 resulted in the formation of a government led by Mr. Enrico Letta, who was replaced as prime minister in February 2014 by Mr. Matteo Renzi. The present government is an alliance of a number of political parties including the Democratic Party, the New Centre-Right, the Union of the Centre and the Civic Choice. The President of the Republic, elected for a seven-year term by an electoral college of the Senate, the Chamber of Deputies and representatives of the Regions, has no executive powers. Mr. Sergio Mattarella was elected president in January 2015 following the resignation of the previous incumbent, President Giorgio Napolitano.

The country is organised into 20 Regions, including four autonomous Regions and two autonomous Provinces, all of which are part of the constitutional structure of the country. In recent years, Italy has experienced a rapid devolution of legislative and regulatory powers to the Regions. In 2001, constitutional amendments provided a new framework for sharing regulatory competences, including energy, between the State and the Regions, in particular in areas of concurrent legislation (between the State and the Regions) and those that are now of the exclusive competence of the Regions.

THE ECONOMY

The Italian economy is struggling to emerge from a prolonged recession caused by fiscal austerity, weak business and consumer confidence, deteriorating labour market conditions, modest wage growth and tight credit conditions (EIU, 2015). After a long period of contraction, growth was positive in 2015 but remains well below the European Union (EU) average and the ratio of public debt to gross domestic product (GDP) is set to increase further. By late 2014, Italy's real GDP was back to levels seen in the early 2000s, a contrast with the broader euro area GDP, which was more than 10% higher than its early 2000 levels. During the global economic crisis, not only did Italy's GDP contract significantly more than the euro area average, but Italy's industrial output also declined. An ageing population and weak labour market participation also contributed negatively to potential growth. In addition, the government's fiscal consolidation effort combined with private sector deleveraging has had a detrimental impact on capital accumulation (EC, 2015).

Inflation is projected to turn negative owing to the fall in oil prices. Unemployment remains historically high and domestic demand is weak. Increasing global demand, a lower euro and falling oil prices could support economic growth in the future. Current account surplus is expected to strengthen slightly. The government deficit reached 3% of GDP in 2014 and is set to decrease in 2015 and 2016. Italy's public debt-to-GDP ratio is expected to peak in 2015 at 133% of GDP according to the EU Commission 2015 winter forecast. The current low growth and inflation outlook pose a challenge to its reduction.

SUPPLY AND DEMAND

SUPPLY

Italy produced 35.5 million tonnes of oil-equivalent (Mtoe) of energy in 2015. Energy production has been on an upward trend since 2001, and has increased by 17.7% from 2005 to 2015. Before 2001, production was mildly volatile albeit declining from a 1997 local peak of 30.4 Mtoe (Figure 2.2).

Renewable energy development is the main driver of recent production growth. Renewable energy represented 68.4% of total energy production in 2015, up from 61.9% in 2010 and 46.4% in 2005. In 2015, biofuels and waste accounted for 32.2%, followed by geothermal (15.4%), hydro (10.6%), solar (6.6%) and wind (3.6%). Solar, wind, and biofuels and waste have experienced the strongest development over the past decade, with various spurs in production. The most notable among them was solar energy, stimulated by generous subsidies, which increased production by 259% during 2010-11.

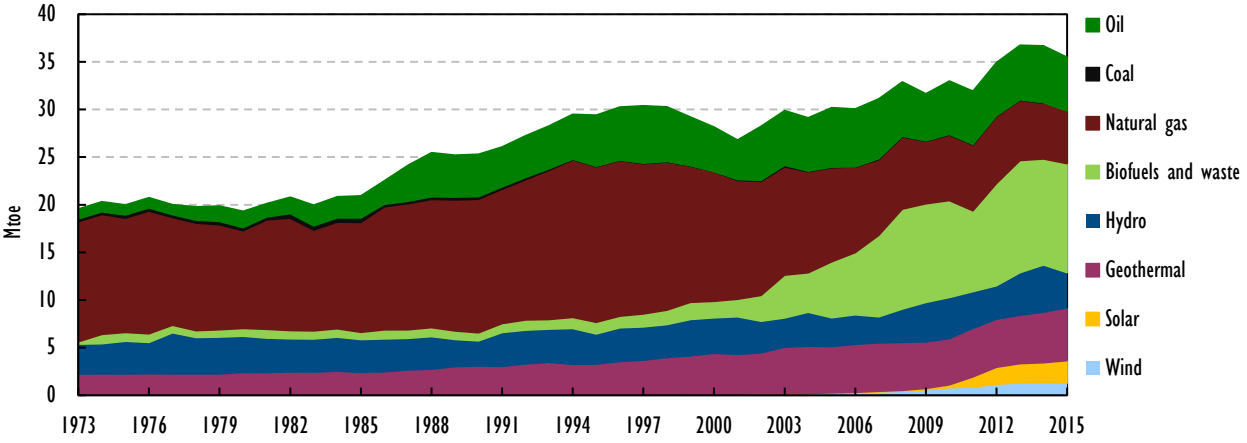
Approximately a third of energy production is from crude oil (15.9%) and natural gas (15.6%) combined, while coal production is negligible at 0.1%. Natural gas production was 43.9% lower in 2015 than in 2005 as resources are depleting, down from 32.7% of total production. Crude oil production was 9.8% lower over the ten years.

Italy's total primary energy supply (TPES) was 150.7 Mtoe in 2015. It has declined by 19.1% over the past ten years, down from 186.4 Mtoe in 2005 (Figure 2.3).[1] TPES has

1. TPES is made up of production + imports - exports - international marine bunkers - international aviation bunkers ± stock changes. This equals the total supply of energy that is consumed domestically, either in transformation (for example, refining)

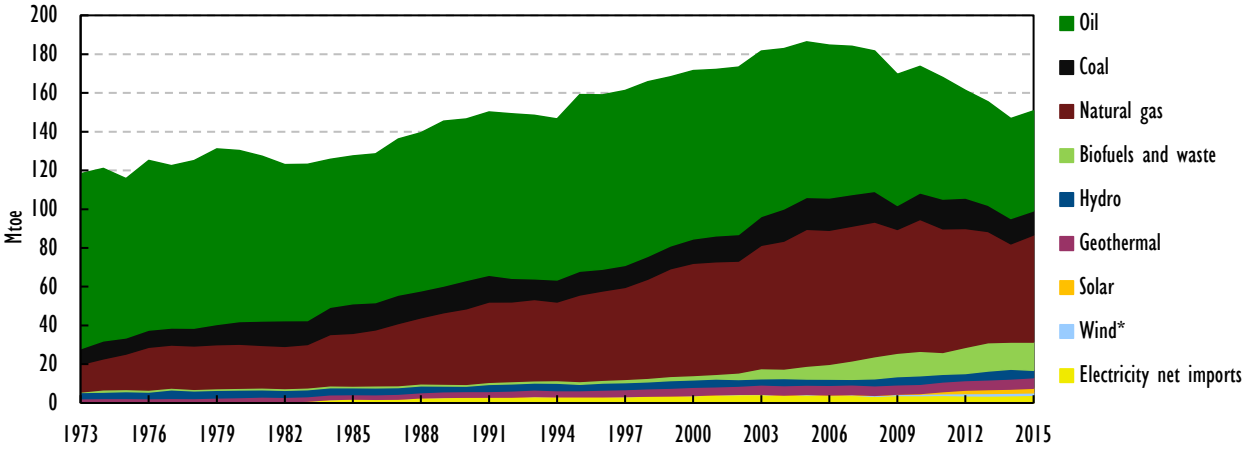
declined despite the increase in energy production, owing to falling domestic demand. Fossil fuels accounted for 79.1% of TPES in 2015, broken down in natural gas (36.7%), oil (34.2%) and coal (8.2%). Over the past decade, the fossil fuels share has shrunk from 89.8% of TPES, as renewable energy has gained a larger share of the total energy mix. Energy from oil was 35.7% lower in 2015 than in 2005, while natural gas and coal were 21.7% and 24.6% below, respectively.

Figure 2.2 Energy production by source, 1973-2015[2]



Note: data are estimated for 2015.
Source: IEA (2016), Energy Balances of OECD Countries 2016, www.iea.org/statistics/.

Figure 2.3 Total Primary Energy Supply, 1973-2015



* Negligible

Note: data are estimated for 2015.

Source: IEA (2016), *Energy Balances of OECD Countries 2016*, www.iea.org/statistics/.

Renewables represented 18.2% of TPES in 2015, up from 7.9% ten years earlier. Biofuels and waste contributed 9.7% to TPES in 2015, followed by geothermal (3.6%), hydro (2.5%), solar (1.6%) and wind (0.8%).

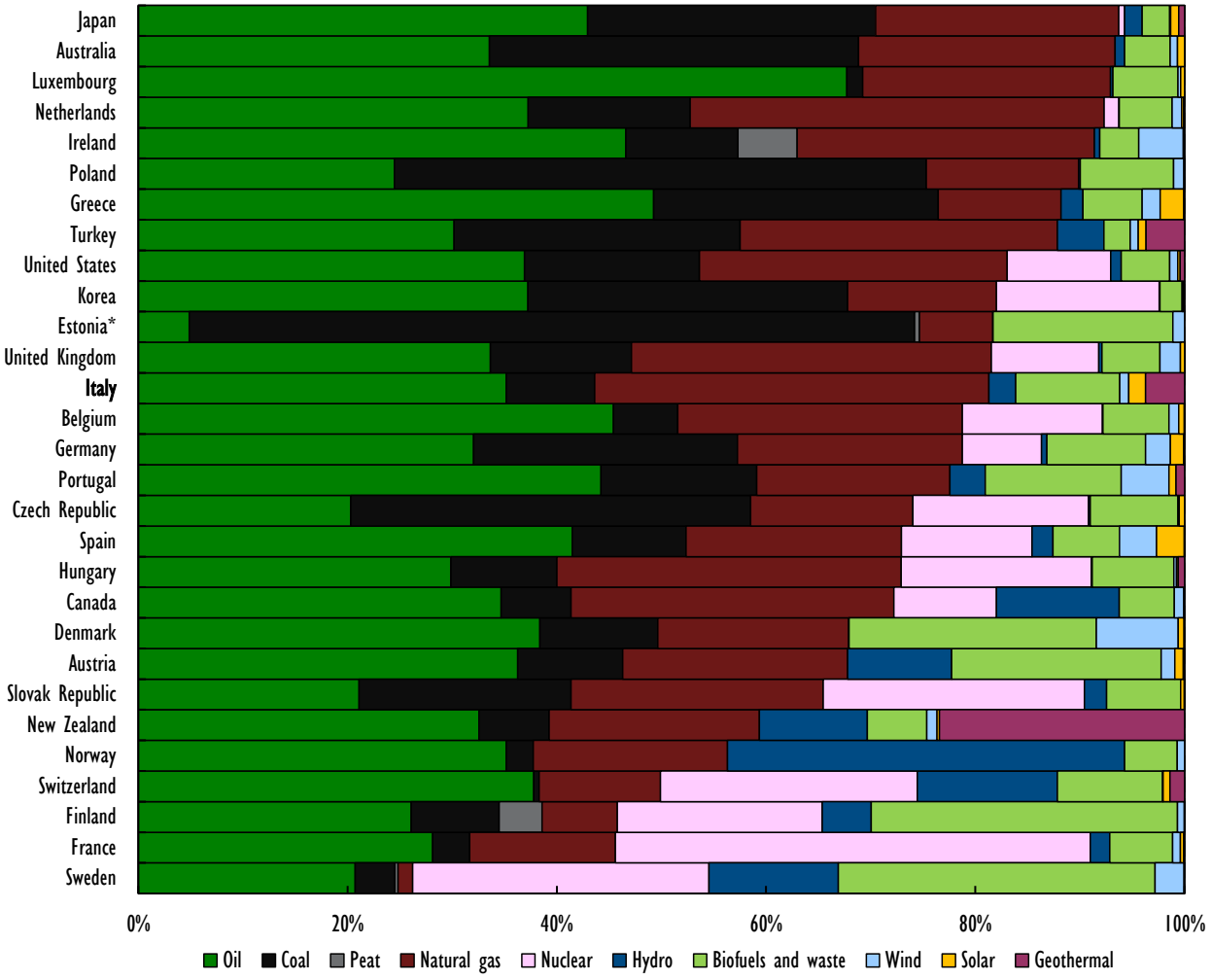
or in final use.

2.Italy changed the methodology used to calculate solid biomass consumption in the residential sector for 2002-2011

Solar energy has outpaced other renewables in Italy, increasing from 0.03 Mtoe in 2005 to 2.4 Mtoe in 2015 (around 80 times greater). Wind energy has increased by a factor of six over the same period, although it remains the lowest contributor to TPES. Energy from biofuels and waste more than doubled during 2005-15, increasing its share in TPES from 3.6% in 2005 to 9.7% in 2015. Energy from geothermal was 14.1% higher in 2015 than in 2005, exhibiting the slowest growth among renewable energy sources.

Italy's net electricity imports account for 2.6% of TPES, a share that has remained relatively unchanged around 2-2.5% over the past decade. Italy ranks thirteenth-highest among IEA member countries with respect to the share of fossil fuels in TPES, a level that is similar to that of the United States (Figure 2.4).

Figure 2.4 Breakdown of TPES in IEA member countries, 2015



* Estonia's coal represents oil shale.

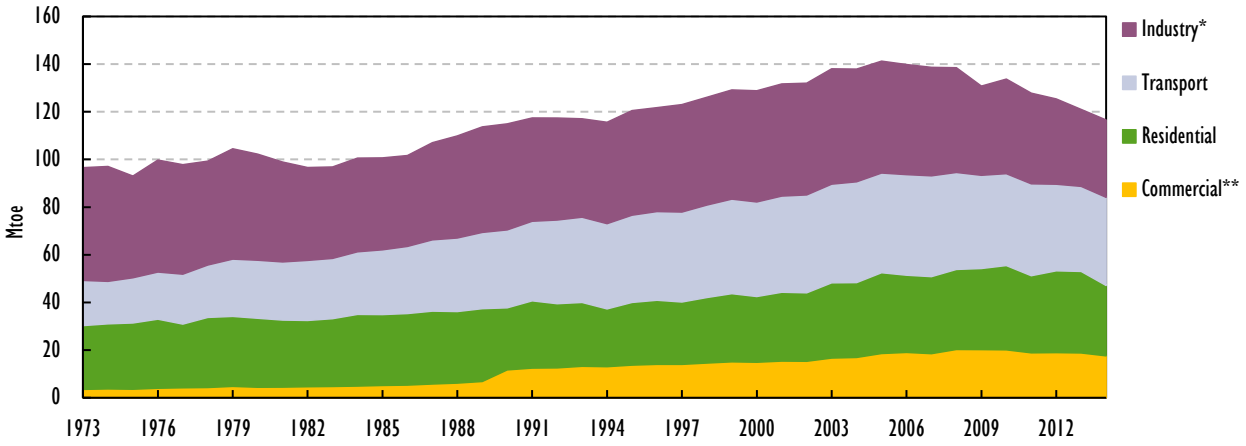
Note: data are estimated.

Source: IEA (2016), *Energy Balances of OECD Countries 2016*, www.iea.org/statistics/.

DEMAND

Italy's total final consumption (TFC) amounted to 116.6 Mtoe in 2014 (the latest year for which consumption data are available). TFC represents around 79% of TPES, with the remainder used in power generation and other energy industries.[3] TFC has declined by 10.8% from 2004 to 2014, peaking at 141.3 Mtoe in 2005 (Figure 2.5). Energy demand is split relatively equally between transport, households and industry. These sectors account for 31.7%, 25.3% and 27.9% of consumption. The commercial and other services sector (including agriculture and fishing) has the smallest share of 15.1%. Demand in transport and industry contracted over the decade to 2014. The industry sector cut consumption by 31.4% over the ten years, losing its 34.3% share of TFC in 2004. Transport demand was 12.5% lower in 2014 than in 2004.

Figure 2.5 TFC by sector, 1973-2014



* *Industry* includes non-energy use.

** *Commercial* includes commercial and public services, agriculture, fishing and forestry.

Source: IEA (2016), *Energy Balances of OECD Countries 2016*, www.iea.org/statistics/.

Consequently, demand for oil and natural gas in TFC has also fallen. However, the consumption in both the industry sector and transport sector increased slightly in 2014 from the year before.

The residential sector experienced the strongest growth in demand in the years to 2013, but dropped in 2014, giving a total decrease of 6.0% over ten years. As a result of stronger decreases in other sectors, the residential sectors' share of total demand went up from 22.8% of TFC in 2004 to 25.3% in 2014.

The commercial sector's consumption increased by 20% from 2004 to 2008, but has decreased year by year since and was 13% lower in 2014 than in the peak year.

3. TFC is the final consumption by end-users, i.e. in the form of electricity, heat, gas, oil products, etc. TFC excludes fuels used in electricity and heat generation and other energy industries (transformations) such as refining.

INSTITUTIONS

The **Ministry of Economic Development** (**MSE,** *Ministero dello Sviluppo Economico*) is the ministry responsible for formulating and implementing Italy's energy policy. The **Ministry for the Environment, Land and Sea** (**MATTM***, Ministero dell'Ambiente e della Tutela del Territorio e del Mare*) has responsibility for co-ordinating climate policy issues. It also co-signs policy measures promoting renewable energy and energy efficiency with the MSE.

The **Inter-Ministerial Committee for Economic Planning** (**CIPE**) is a collective governmental body chaired by the President of the Council of Ministers responsible for the co-ordination and horizontal integration of national policies. Its competences, among many others, include climate change. The committee approves national GHG emissions reduction programmes.

In 2002, the **Inter-Ministerial Technical Committee for Emissions of GHGs** (**CTE**) was established to support the CIPE's climate-related work. The **Institute for Environmental Protection and Research** (**ISPRA**) and the **National Agency for New Technologies, Energy and Sustainable Economic Development** (**ENEA**) provide data, information, and technical and scientific support. ISPRA is also in charge of national emissions reporting to the European Union and the United Nations Framework Convention on Climate Change (UNFCCC).

Before the adoption of the National Energy Strategy (NES, hereafter the Strategy) in 2013, each of **the Regions and autonomous Provinces** developed and adopted their own Regional Energy–Environment Plans, which established regional energy policy objectives and their impact on GHG emissions (OECD, 2013a).

The **Regulatory Authority for Electricity, Gas and Water** (**AEEGSI**, *Autorità per l'Energia Elettrica, il Gas e il Sistema Idrico*) is an independent regulatory body established under Law 481 of November 1995 to regulate and oversee the electricity, natural gas and, more recently, water sectors. The agency is sufficiently funded and staffed and is independent from government, the commissioners being nominated by Parliament. Its regulatory powers include the setting of tariffs and the definition of service quality standards, and the technical and economic conditions governing access and interconnections to the networks. The AEEGSI is funded by means of compulsory annual contributions paid by the service providers.

The **Competition Authority** (**AGCM**, *Autorità Garante della Concorrenza e del Mercato*,) is the independent competition body, which was established by Law No. 287 of 1990. The AGCM enforces rules against anticompetitive agreements among undertakings, abuses of dominant position as well as mergers and acquisitions, joint ventures which may create or strengthen dominant positions detrimental to competition. The AGCM has undertaken a number of investigations in the electricity and natural gas sectors in the past five years.

Gestore dei Sistemi Energetici (**GSE**) is the state-owned company which promotes and supports renewable energy sources (RES) in Italy. In particular, GSE works to foster sustainable development by providing support for electricity generated from renewables and by taking actions to build awareness of environmentally efficient energy uses. GSE is also the parent company of three subsidiaries: ***Acquirente Unico*** (**AU**), ***Gestore dei Mercati Energetici*** (**GME**), and ***Ricerca sul Sistema Energetico*** (**RSE**).

KEY POLICIES

NATIONAL ENERGY EFFICIENCY ACTION PLAN

National Energy Efficiency Action Plans (NEEAPs), prepared by member states of the European Union, set out estimated energy consumption, planned energy efficiency measures and the improvements individual EU member states expect to achieve. Under the EU Energy Efficiency Directive, states must draw up these plans every three years.

Italy's NEEAP 2014 sets out the energy efficiency targets established for 2020, the policy measures implemented for achieving them and the progress made to date. Specifically, in line with the guidelines for its preparation provided by the European Commission and with the contents of the NES, the NEEAP sets out the national targets for the reduction of primary and end-use energy consumption and specifies the savings in end-uses of energy expected in 2020 by economic sector and by main energy efficiency promotion scheme, which are all described in detail in the plan.

NATIONAL RENEWABLE ENERGY ACTION PLAN

Directive 2009/28/EC on the promotion of the use of energy from renewable sources establishes the basis for the achievement of the European Union's 20% renewable energy target. Under the terms of the directive, each member state is to set an individually binding renewable energy target, which will contribute to the achievement of the overall EU goal. Member states are to achieve their individual target across the heat, transport and electricity sectors and, apart from a sub-target of a minimum of 10% in the transport sector that applies to all member states, there is flexibility for each country to choose how to achieve their individual target across the sectors.

Italy's Renewable Energy Action Plan was adopted in 2010 and its overall target is to achieve 17% of final energy consumption from renewable sources by 2020. The development of RES is among the priorities of Italy's energy policy alongside the promotion of energy efficiency. The objectives of such a policy are: energy supply security, lower energy costs for consumers, promotion of innovative new technologies, environmental protection (including lower GHG emissions) and therefore, ultimately, sustainable development. In the medium to long term, Italy aims to redress the balance of its energy mix, which remains overly dependent on imported fossil fuels.

Table 2.1 National 2020 target and estimated trajectory of energy from renewable sources

	2005	2010	2015	2020
RES heating and cooling	2.8%	6.53%	10.09%	17.09%
RES electricity	16.29%	18.71%	22.39%	26.39%
RES transport	0.87%	3.5%	6.63%	10.17%
Overall share of RES	4.92%	8.05%	11.24%	17%

Source: Italy's National Renewable Energy Action Plan in line with Directive 2009/28/EC.

NATIONAL ENERGY STRATEGY

In October 2012, 13 years since the process to liberalise the electricity and natural gas markets commenced (between 1962 and 1998, periodic national energy plans were issued and these bound the strategies of the stated-owned monopolies), the government published a NES consultation document for all energy stakeholders. The outcome of this process, the *National Energy Strategy*, was published in March 2013. The new NES defines objectives, key policies and priority measures for the energy sector. The measures defined in the new Strategy, which has both medium- and long-term elements (2020 and 2050), aim at fostering sustainable growth by strengthening the competitiveness of the Italian economy. The Strategy also recognises that the consequences of climate change must also be addressed while granting secure and accessible energy to all citizens. The Strategy acknowledges that a radical transformation of both the energy system and society is need and has identified four key goals:

- align energy prices in Italy with prices and costs elsewhere in Europe
- meet and surpass the environmental objectives set out in the EU Climate and Energy Package 2020 and decrease GHG emissions by 19% compared to the 18% target
- enhance security of supply, especially in the gas sector, and reduce import dependence, lowering it from 84% in 2013 to 67% in 2020 and saving EUR 14 billion per year in external energy costs
- foster sustainable economic growth by developing the energy sector. Leverage Italy's industrial heritage to extend all segments of the green economy and to realise its full potential.

The Strategy also identifies seven priorities of action and the expected results by 2020:

- *Strengthen energy efficiency*: Improvements in energy efficiency will absorb a substantial portion of expected increases in energy demand by 2020, in terms of both primary supply and final consumption. Energy demand will, therefore, remain steady, at levels comparable to present levels.
- *The development of a competitive and liquid natural gas market*: This market will be fully integrated with other European countries. Italy will become an important cross-road for the entry of gas to Europe from North Africa, the Middle East and Caspian region.
- *Sustainable development of renewable energy*: Italy will go beyond the objectives of Europe 20-20-20. This will contribute significantly to emissions reductions and energy security.
- *Develop electricity infrastructure and the electricity market*: Maintain and develop an efficient electricity market, fully integrated with Europe, in terms of both infrastructure and rules, and with prices gradually converging with those in Europe. Renewable energy production will be fully integrated into the networks and the market.
- *Restructure the refining industry and the fuel distribution sector*: The downstream industry is inefficient and needs to be transformed. This must be done so that its competitiveness is increased and its technology improved. Fuel distribution also needs to be modernised in order to be more efficient, competitive and to provide better levels of service for customers.

- *Sustainable production of domestic hydrocarbons*: Italy has large reserves of oil and gas and it should take advantage of these resources, given the benefits in terms of employment and economic growth while recognising the potential environmental impacts that development will bring. Italy will not pursue shale gas projects.
- *Modernisation of the system's governance*: More effective and efficient decision-making systems are needed. Italy's procedures are much longer and more cumbersome than those of other governments.

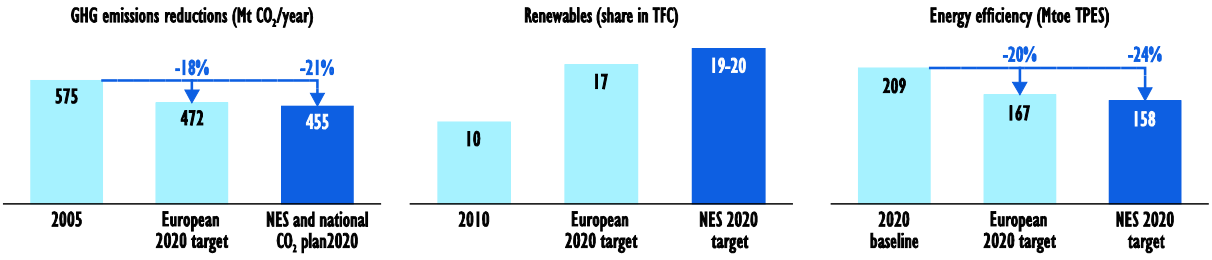
Over the longer term, to 2050, three of the main objectives set out in the Strategy for 2020 remain relevant and reflect the long-terms goals of the European Union: progressive decarbonisation of the economy; ensuring that transition does not penalise the Italian and European economy, especially in sectors exposed to international competition; and strong reduction of dependence on non-European sources of energy.

Table 2.2 Projected results of NES by 2020

Sector	Outcome
Renewables	* The share of renewable energy in gross final consumption will rise to 19% or 20% (compared to about 10% in 2010). * The share of renewables in primary energy consumption will rise to 23%, leading to a fall in the share of fossil fuel consumption to 76% (from 84%). * Renewables will reach or exceed natural gas as source number one in the electricity sector, accounting for approximately 34% to 38% of consumption (compared to 23% in 2010).
Energy demand	* 24% reduction in energy demand. * Savings of about EUR 9 billion on national electricity and gas bills: this is the result of about EUR 4 billion to EUR 5 billion a year in additional costs compared to 2012, and approximately EUR 13.5 billion a year in savings, including both lower prices (assuming constant international prices), and a reduction in volumes.
GHG emissions	* Achieving and exceeding all European environmental targets for 2020 including a reduction in greenhouse gas emissions by 21%.
Energy security	* Increased security, reduced dependence on supply and greater flexibility of the system: a reduction of the external energy bill of about EUR 14 billion a year. * Reduction from 84% to 67% (equivalent to about 1% of additional GDP) of import dependence as a result of energy efficiency, increased renewable production, lower electricity imports and increased production of national resources.
Economic growth	* About EUR 170 billion to EUR 180 billion will be invested by 2020, both in white and in green economy (renewables and energy efficiency), and in the traditional sectors (electricity and gas networks, liquefied natural gas terminals, storage facilities, hydrocarbons development).

Source: MSE (2013), *National Energy Strategy for a More Competitive and Sustainable Energy*, Ministry of Economic Development, Rome.

Figure 2.6 NES targets versus EU targets



* Priority initiatives introduced are consistent with the national CO_2 reduction plan which envisages 455 Mt/year emissions in 2020.

Source: MSE, IDR country submission.

The Strategy also emphasises the role technology will play. It recognises that the progressive decarbonisation of the economy will require greater levels of investment in research and development in advanced technologies. Italy will contribute to the global effort not only by investing in research and development, but also by offering to guide the debate and policy making towards greater international efforts.

THE NATIONAL REFORM PROGRAMME

The European Union has developed a ten-year jobs and growth strategy known as Europe 2020. It was launched in 2010 to create the conditions for smart, sustainable and inclusive growth within the European Union. As part of the strategy, the EU goals have been translated into national targets and trajectories which, in the case of Italy, are further developed in its National Reform Programme, which was launched by Prime Minister Renzi in September 2014. The purpose of the reform programme is to guide Italy towards overcoming the deep-seated structural problems that led to productivity stagnating since the end of the 1990s (OECD, 2015). The programme identifies high energy costs among the competitive disadvantages facing Italian businesses. An EU review of the Italian programme identified a number of areas in which the energy sector could be improved: among them insufficient electricity grid capacity, which hampers the smooth functioning of the electricity market and contributes to higher wholesale prices, and changes to support mechanisms for renewable energy. Italy has identified the categories of infrastructures to be considered as "strategic" but not the individual projects, a step that was foreseen in the 2013 NES (EC, 2015).

ENERGY TAXATION

On 27 October 2003, the European Union adopted Directive 2003/96/EC, which restructured the European Commission framework for the taxation of energy products and electricity. The directive sets out common rules for the taxation of energy products and is intended to reduce distortions of competition, both between EU member states with divergent rates of tax on energy products, and between mineral oils and the other energy products.

In Italy, energy taxes are levied within the framework of Directive 2003/96/EC. In general tax rates are above the minimum rates set out in the EU directive with the exception of natural gas used in transport, which is set at the minimum rate, a more favourable rate than competing fuels. Taxes on fuels used in transport differ widely according to fuel type, whereas in the heating and process fuel category they are defined according to the user. With respect to transport, fuels for aviation and shipping are exempt, and energy consumed in rail transport is taxed at a reduced rate. Heating and process fuel is in general taxed at a lower rate for commercial and industrial use than for residential use. Gasoline, diesel oil and liquefied petroleum gas (LPG) are taxed at a reduced rate when used in agriculture and fishing. The tax rate for natural gas is differentiated by geographical location and consumption level. Electricity is taxed differently when consumed by business and non-business users. Fuels used to generate electricity are also taxed at significantly lower rates (almost nil) than other uses. Electricity used in transport is exempt. Waste, biomass, and the different forms of renewable energy are not taxed when used to produce heat or electricity. The consumption of heat is not taxed (OECD, 2013a).

In 2008, following a period of rising energy taxes, the government introduced a new energy tax with the objective of capturing some of the energy sector's higher profits. The new tax was first imposed in 2008 at a rate of 5.5%. The rate was increased to 6.5% in 2010, and then to 10.5% for the 2011 to 2013 tax years. In the most recent past, it was levied on companies with an annual turnover of more than EUR 3 million and taxable income of at least EUR 300 000. In February 2015, however, the Constitutional Court has ruled that this tax is illegal with immediate, but not retroactive, effect.

ENERGY SECURITY

The IEA defines energy security as the uninterrupted availability of energy sources at an affordable price. Energy security lies at the heart of the NES and the successful implementation of the Strategy is projected to deliver secure supplies of indigenous energy, reduced energy imports alongside lower costs and reduced GHG emissions.

A number of factors influence energy security policies in Italy. Since 1973, the share of natural gas has continued to increase almost displacing oil as the largest contributor to TPES. Oil's share has fallen from 76% in 1973 to 35.1% of the TPES in 2014. Natural gas share was 34.5% of TPES in the same year, after a few years of holding a dominant share in TPES. The main driver of this change has been the increased use of natural gas in the power sector with the opening of the power sector in 1999, facilitated by large investments in cross-border pipeline capacity and LNG facilities. Import dependence for natural gas is very high and has been around 90% since 2006. The residential sector is the biggest source of growth in demand for natural gas, as it is the preferred choice for domestic uses in new buildings.

Italy is the largest importer of electricity in IEA Europe and, having experienced a number of security problems in the past, notably the nationwide blackout of 2003, has put in place a number of protective measures. The country is vulnerable to the effects of complex climate patterns owing to its high mountain ranges (the Alps, Dolomites and Apennines) and the Mediterranean Sea.

OIL SECTOR

In the oil sector, Italy consistently meets its 90-day IEA stockholding obligation, and generally holds storage well in excess of the obligated amount. The 90-day stockholding obligation was 11.5 million tonnes of crude oil-equivalent (Mtcoe), and the actual amount of stock held as of end-December 2014 was 15.7 Mtcoe. The stock held in excess of the IEA 90-day obligation was therefore 4.2 Mtcoe or 33 days.

Since 1 July 2014, the newly established Italian Central Stockholding Agency (OCSIT) has begun to progressively assume responsibility for an increasing proportion of the country's stockholding obligation from industry. The build-up of OCSIT stocks will be a gradual process. The initial target was to hold 0.11 million tonnes (Mt) (one day) of finished products starting from 1 April 2014, and to gradually increase this amount over a ten-year timeframe until the organisation holds 100% of the country's obligated specific stocks (3.34 Mt or 30 days). As OCSIT's stock levels increase, the compulsory stockholding obligation of Italy's oil industry will be progressively reduced at a rate proportional to the rate of stock build. In the event of an emergency, the government has a number of other tools at its disposal, including demand restraint measures and limited fuel-switching capacity in the power sector. In order to contribute to the

optimisation of national oil stocks, OCSIT manages a newly created data flows and operational management system (*Sistema Informatico di Monitoraggio delle Scorte Petrolifere Italiane*), capable of localising all compulsory stocks.

NATURAL GAS

Given the vital role natural gas plays in the economy, Italy has developed over decades an articulate natural gas emergency response policy, which provides for mandatory measures on security of supply such as minimum requirements for strategic and working gas storage. Each year, minimum natural gas storage volumes are set by a MSE notice. Storage capacities are among the largest in Europe. Storage levels are expected to be sufficient to cover the equivalent of a 50% disruption of peak capacity at the main national entry point for a period of 60 days, and are determined on the basis of imports through the system's major entry points. Italy's maximum withdrawal capacity from storage could theoretically cover almost 70% of peak winter demand. All natural gas imports from outside the Union are included in this calculation. Ownership of the natural gas stocks resides with the storage companies.

Italy's natural gas emergency response policy provides for mandatory security measures in the national gas system (e.g. dispatching rules) aimed at reducing price fluctuation, increasing security of supply, co-ordinating the storage system and reducing the vulnerability of the gas system. Italy, together with most of Central and Eastern Europe, was affected by a disruption of gas supplies over the winter of 2008-09, and has since taken significant measures to better prepare for another such situation. MSE updated its legislation regarding specific emergency procedures in 2013 with the adoption of the emergency plan as provided for by European regulation.

ELECTRICITY

Terna, the Italian transmission system operator (TSO) has primary operational responsibility for electricity emergency response. The electricity distribution networks also have an important role in planning electricity emergency response. Distribution system operators (DSOs) are required to support the TSO where a network crisis occurs. The growing proportion of variable renewables in the electricity supply means that real-time information sharing, robust communication and co-ordination of real-time power system management between the TSO and DSOs has become more important. Arguably, Italy is moving towards an electricity system in which the distribution networks, as a result of the growing number of distributed generation power plants connected to the network, need to progressively move from being passive to active players in the system. This means that DSOs need to become increasingly capable of exchanging signals with distributed loads and generators as well as with Terna, in order to maintain voltage and current standards, adequate performance in case of relevant incidents and, in general, the security of the Italian power system.

The nature and volume of emergency and other resources available to Terna and other responsible parties to manage emergency events are set out in the Italian Grid Code. Chapter 10 of the code, known as the Defence Plan, is designed to deal with multiple contingencies − which can lead to a system cascading effect or emergency/interruption conditions − in order to avoid the partial or total collapse of the system. Italy imports large volumes of power. Over the years, operational procedures for emergency operation

enclosed in multilateral procedures have been developed with all neighbours. With ELES (Slovenia), emergency conditions are managed by an automatic special protection scheme. Bilateral agreements have been signed with all neighbours for mutual emergency assistance service to supply real-time service in case of any emergency operation. Written agreements have been concluded with all adjacent TSOs which take into consideration emergency procedures, between Austrian Power Grid AG (APG) (Austria), Swissgrid (Switzerland), RTE (France), ELES (Slovenia) and HTSO/DESMIE (Greece).

NATIONAL ADAPTATION PLANNING

National adaptation planning refers to the development of evidence-based and systematic responses by national governments to the current and future effects of climate change (OECD, 2013b). Many IEA member countries are undertaking national adaptation planning. In Italy, the MATTM has primary responsibility for the preparation, establishment and implementation of a national adaptation strategy (NAS). In December 2014, MATTM published a number of documents related to the process, including a paper on the Elements for a *National Strategy for Adaptation to Climate Change*. Italy is currently in the process of finalising its NAS, which is expected to be adopted in 2015.

ASSESSMENT

Over the period since the last in-depth review was conducted, Italy has made strong progress in the development and implementation of energy policy. Key policy actions then recommended by the IEA, such as the need to develop a comprehensive long-term energy strategy and the necessity for Italy to step up its efforts to comply with its EU 2020 obligations, have been implemented. The most notable achievement has been the development of the NES, which was the outcome of a comprehensive consultation with the energy sector and all interested stakeholders.

Despite the positive progress Italy has made by publishing its NES, there remains scope for further improvement. Institutional arrangements within the energy sector remain complex and oversight rests with the MSE with co-signing powers on environmental matters attributed to the MATTM. While the competences of each are clear, it is not always the case among the various institutions that fall under the aegis of the ministries. Despite recent progress in the renewables, energy efficiency and research and development sectors, management and oversight of these policies often involves numerous different agencies and institutions. This appears to result in co-ordination difficulties and higher transaction costs than may otherwise be the case. In the past, there were overlapping measures, which have also changed several times in the recent years. This has contributed to unnecessary complexity and regulatory uncertainty for sector stakeholders. Implementation of the Strategy provides timely opportunity to address these challenges in a comprehensive way.

The policy landscape has grown very complicated as a result of the 2001 reform of the Italian Constitution while at the same time various energy sectors (electricity, gas, upstream) were being liberalised. The constitutional reform gave greater policy authority to the Regions, notably those having an impact on climate change, energy efficiency policies as well as infrastructure planning, development and consenting processes. While some measures have been introduced to streamline many of the processes affected by the 2001 decision, the IEA strongly encourages co-operation among the regions and government to ensure the delivery

of the goals contained in the Strategy. The current efforts to constitutionally streamline competences between the State and the Regions, and the recent use of the Council of Ministers to override a regional veto to authorise the Trans-Adriatic Pipeline indicate the necessity to establish strategic energy governance.

The development of the Strategy sends a strong signal to the market and to stakeholders as to the government's medium- and long-term goals for the energy sector. It establishes goals: reduce energy costs, meet environmental targets, strengthen security of energy supply and foster sustainable economic growth. The Strategy also identifies a series of priority actions needed to meet its goals: clear targets for emissions reductions, renewable energy and energy efficiency. It also prioritises the need to develop competitive energy markets, transform the hydrocarbon sector and modernise energy governance. The government is to be commended not only for adopting the new Strategy but also for the open manner in which it engaged with stakeholders and institutions during the consultation process. Nonetheless, the adoption of the Strategy is only an early first step towards achieving the government's energy goals.

Costs of implementing the NES between 2012 and 2020 are estimated to be between EUR 4 billion and EUR 5 billion per year compared to the economic benefits accruing of approximately EUR 13.5 billion per year, which includes EUR 9 billion in energy cost savings for end-users.

The apparent lack of consistency in some elements of the Strategy and the energy policy framework would benefit from an explicit statement, for the medium and long term, on the role of natural gas in Italy's energy mix, specifying the increased investment needed in infrastructure to offset the market power of Italy's gas suppliers and the necessity to maintain the flexibility of gas-fired power generation that is being crowded out by renewable electricity. The Strategy would also benefit from a clear statement of intent and roadmap for the short and medium term; in other words, when stakeholders can expect the government to implement the various policy measures and targets it contains.

Long-term implementation of the Strategy will also require careful monitoring and evaluation. Achieving its long-term objectives will require investments today and in the years to come. There is a need to develop a detailed delivery programme containing costs and projected benefits of all policies complemented with clear delivery milestones and institutional responsibility for the implementation of each measure. The establishment of an independent monitoring group reporting to the two ministers or to the CIPE could be helpful for the process and deliver greater stakeholder support. This mechanism should review, evaluate and monitor the implementation of all phases of the Strategy and ensure the cost-effective delivery of outcomes. This evaluation process should also include publication of regular performance reports. Publication of regular progress reports every two years to assess the implementation of the measures contained in the Strategy will support the delivery of its objectives and promote transparency. A first such report is expected by the end of 2016.

The European energy and climate policy framework will strongly influence the implementation of the Strategy. In October 2014, EU leaders gave a commitment to transform Europe into a highly energy-efficient, low-carbon economy (the 2030 framework for climate and energy policies). The European Union has set targets for reducing its GHG emissions (alongside reform of the EU Emissions Trading Scheme), and for increasing renewable energy supply and energy efficiency. Italy needs to ensure that the medium-

and long-terms goals contained in the Strategy remain consistent with EU ambitions and that efforts to exceed EU targets do not impose additional costs on consumers.

In 2012, environmental tax revenues expressed as a percentage of GDP were among the highest in the European Union (3.49% compared to 2.44%), thereby making increased energy taxes politically difficult (Eurostat, 2015). Most of this comes from energy (2.3% of GDP) and transport taxation (0.7 % of GDP) which are relatively high compared with the EU average. Nonetheless, there is scope for change such as restructuring energy taxes and expanding the use of other environment-related taxes. For example, taxes on car ownership are based on pollutant emission standards, but not on CO_2 emission levels, while those on heavy goods vehicles are not linked to any environmental criterion (OECD, 2013a). Revision of energy and transport taxation could help Italy to reach the agreed 2020 climate targets in a more cost-effective way.

RECOMMENDATIONS

The government of Italy should:

- *Develop a clear programme for the implementation of the NES. This programme should include clear timelines for all policy goals and regular monitoring and evaluation, as well as policy goals for the period beyond 2020 to guide Italy towards 2050.*
- *Strengthen the competitiveness of the Italian economy by taking firm actions to reduce energy prices. To this end, complete the establishment of competitive electricity and natural gas markets by improving market oversight, simplifying retail electricity and natural gas tariff design, and increasing liquidity in wholesale gas markets.*
- *Strengthen the framework for strategic energy governance with clear-cut competences between the State and the Regions, identifying projects and infrastructure of national interest, establishing early co-ordination with the Regions, introducing cost-benefit analysis of planned works and infrastructure at both national and local levels and strengthening the recently introduced "public debate" procedure.*

References

EC (European Commission) (2015), *Country Report Italy 2015 including an in-depth review on the prevention and correction of macroeconomic imbalances*, European Commission, Brussels.

EIU (Economist Intelligence Unit) (2015), *Country Report Italy*, The Economist Intelligence Unit Limited, London.

Eurostat (2015), *Environmental Tax Revenues* (database), appsso.eurostat.ec.europa.eu/nui/submitViewTableAction.do (accessed on 1 April 2015).

IEA (International Energy Agency) (2016), *Energy Balances of OECD Countries 2016*, www.iea.org/statistics/, OECD/IEA, Paris.

MSE (Ministero dello Sviluppo Economico), (2013), *National Energy Strategy for a More Competitive and Sustainable Energy*, Ministry of Economic Development, Rome.

MSE (2014), *Italian Energy Efficiency Action Plan*, Ministry of Economic Development, Rome.

OECD (Organisation of Economic Co-operation and Development) (2015), *OECD Economic Surveys: Italy 2015*, OECD Publishing, Paris.

OECD (2013a), *Taxing Energy Use: A Graphical Analysis*, OECD Publishing, Paris.

OECD (2013b*), National Adaptation Planning, Lessons From OECD Countries*, OECD Environment Working Papers No. 54, OECD Publishing, Paris.

3. CLIMATE CHANGE

Key data (2014 provisional)

GHG emissions without LULUCF*: 418.6 $MtCO_2$-eq, -19.8% from 1990 to 2014

GHG emissions with LULUFC*: 392.0 $MtCO_2$-eq, -24.0% from 1990 to 2014

2008-12 target: -6.5% since 1990; **actual reduction:** -4.5% since 1990

CO_2 emissions from fuel combustion: 319.7 $MtCO_2$, -17.9% since 1990

CO_2 emissions by fuel: oil 45.5%, natural gas 36.7%, coal 16.2%, other 1.6%

CO_2 emissions by sector: power generation 32.3%, transport 33.0%, residential 13.1%, industry 11.2%, commercial and other services, including agriculture and fishing 7.1%, other energy industries 3.2%

* Source: UNFCCC, 2016.

OVERVIEW

Since 2008, Italy's domestic greenhouse gas (GHG) emissions have declined. Several factors such as greater use of natural gas and renewable energy in the power sector and improvements in energy efficiency have contributed to this decline. The economic recession has contributed significantly. Overall, GHG emissions declined by almost 15% from 2008 to 2012 (ISPRA, 2014). In 2013 and 2014, the trend seemed to be confirmed at least in the industrial sectors. The latest data, published by the European Environment Agency (EEA), which are limited to the industrial installations covered by the European Union emissions trading system (EU-ETS), account for a further decline of emissions in those sectors by 5.6% (62 million tonnes of carbon dioxide-equivalent [$MtCO_2$-eq]) in 2014 compared to 2012 (65.7 $MtCO_2$-eq) (EEA, 2015). The already relatively low energy and carbon intensities of the Italian economy also decreased further.

TARGETS AND OBJECTIVES

Under the Kyoto Protocol, the EU-15 has agreed to reduce its greenhouse gas (GHG) emissions by 8% in the period 2008-12 compared to base-year levels. In the framework of the EU Burden Sharing Agreement, Italy committed to reducing its GHG emissions by 6.5% below base-year levels (1990) over the first commitment period, 2008-12. According to the United Nations Framework Convention on Climate Change (UNFCCC) data, average 2008-12 GHG emissions without land use, land-use change and forestry (LULUCF) were 495.4 $MtCO_2$-eq, which is 4.6% lower than 519.1 $MtCO_2$-eq in 1990. Average 2008-12 GHG emissions with LULUCF were 470.1 $MtCO_2$-eq, which is 8.6% lower than 515.4 $MtCO_2$-eq in 1990. GHG emissions from Italy in 2013 were down to 437 $MtCO_2$-eq and 403 $MtCO_2$-eq without and with LULUCF respectively. This corresponds to decreased emissions since 1990 by 16% and 22% respectively.

Within the framework of the European Climate and Energy Package, Italy has agreed to even more ambitious targets by 2020 and 2030. As for 2020, Italy committed to reduce its emissions by 13% in the so-called effort sharing sectors (transport, agriculture, buildings, service, etc.) compared to 2005 levels, while industry will share the responsibility of reducing GHG emissions in the sectors covered by the EU-ETS by 21% below 2005 levels. Furthermore, in advance of COP21 in Paris, the EU and its member states committed to a binding target of an at least 40% domestic reduction in greenhouse gas emissions by 2030 compared to 1990, to be fulfilled jointly, as set out in the conclusions by the European Council of October 2014. The individual national contributions are yet to be defined.

ENERGY-RELATED CO_2 EMISSIONS

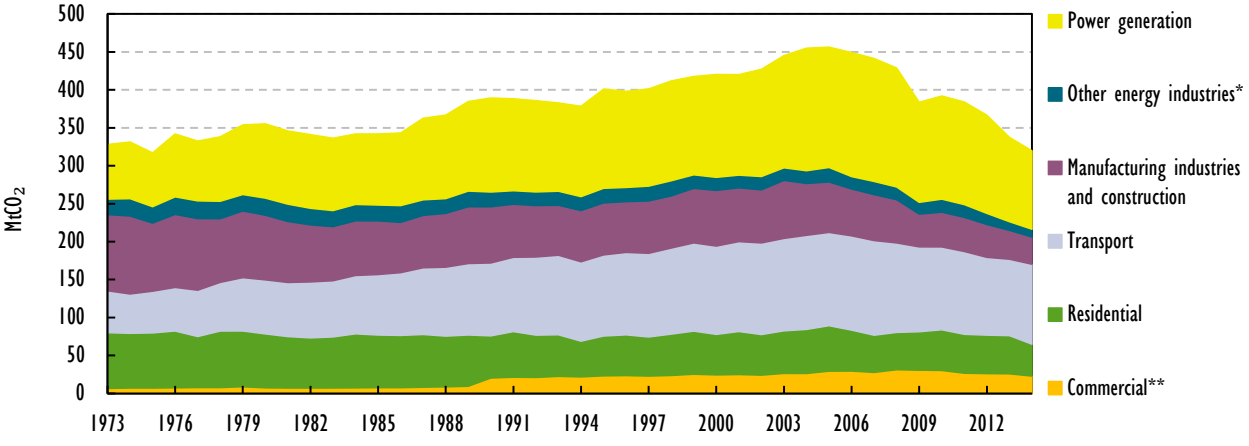
EMISSION TYPES

According to the UNFCCC (2016), Italy's largest GHG emissions in 2014 were carbon dioxide (CO_2), accounting for 81.9% of total GHG emissions, followed by methane (CH_4) for 10.3%, nitrous oxide (N_2O) for 4.4%, and other sources including hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6) collectively accounted for 3.3%. UNFCCC data show that Italy's energy sector accounted for 81.2% of total GHG emissions, followed by agriculture and industrial processes (7.2% each), and waste and solvents (4.3%).

SOURCES OF CO_2 EMISSIONS

Energy-related CO_2 emissions were 319.7 million tonnes (Mt) in 2014. Emissions were then 17.9% lower than in 1990 and 29.9% lower than a peak of 456.3 Mt in 2005 (Figure 3.1). Emissions have been declining in line with falling energy supply, brought on by the economic downturn, the contracting manufacturing sector, and the increased share of renewables in the energy mix, notably in the power sector.

Figure 3.1 CO_2 emissions by sector, 1973-2014



* *Other energy industries* includes other transformations and energy own-use.

** *Commercial* includes commercial and public services, agriculture/forestry and fishing.

Source: IEA (2016a), *CO_2 Emissions from Fuel Combustion 2016*, www.iea.org/statistics/.

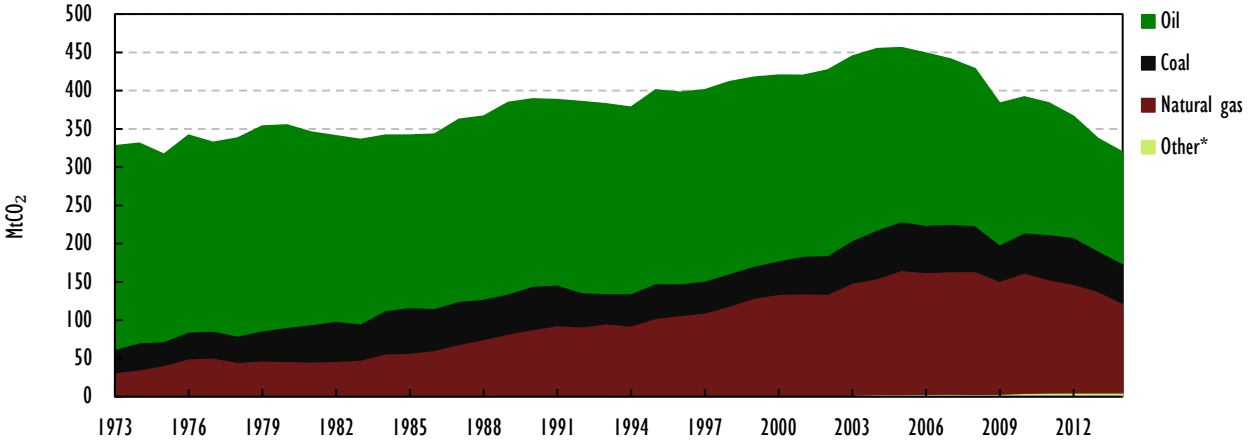
The power generation sector, which used to be the largest CO_2 emitter in Italy, was in 2014 the second-largest emitting sector with 103.4 $MtCO_2$ or 32.3% of the total. The transport sector accounted for 105.4 $MtCO_2$ or 33% of the total emissions, and was the largest emitting sector. Households accounted for 13.1%, while the manufacturing and construction sector, commercial and other services sector (including agriculture and fisheries) and other energy industries (including refining) emitted 11.2%, 7.1% and 3.2% of the total, respectively.

In the years since 1990, emissions in power generation, manufacturing and construction, and other energy industries, and from households have declined, while emissions from commercial services and transport have increased. However, since the peak in 2005, all sectors have reduced emissions.

Power generation, other energy industries and manufacturing with construction have emitted respectively 34.8%, 45.9% and 46.1% less in 2013 compared to 2005. Transport sector emissions were 14.3% lower, while emissions from households and commercial services were down by 29.8% and 22.2%, in that order.

Oil and oil products accounted for 45.5% of energy-related CO_2 emissions in Italy in 2013, while 36.7% came from natural gas and 16.2% from coal. Emissions from industrial and non-renewable municipal waste were 1.6% of total energy-related emissions (Figure 3.2).

Figure 3.2 CO_2 emissions by fuel, 1973-2014



* *Other* includes industrial waste and non-renewable municipal waste.

Source: IEA (2016a), *CO_2 Emissions from Fuel Combustion 2016*, www.iea.org/statistics/.

The driving force behind a decline in CO_2 emissions from fuel combustion has been a reduction in oil consumption, followed by reduction in natural gas in recent years. Emissions from oil were 40.5% lower in 2014 compared to 1990 and 35.9% compared to 2005. Emissions from coal were 8.4% lower in 2014 compared to 1990 and 18.8% lower compared to 2005. Emissions from natural gas have increased over time, up by 34.7% since 1990, albeit 27.8% lower since 2005.

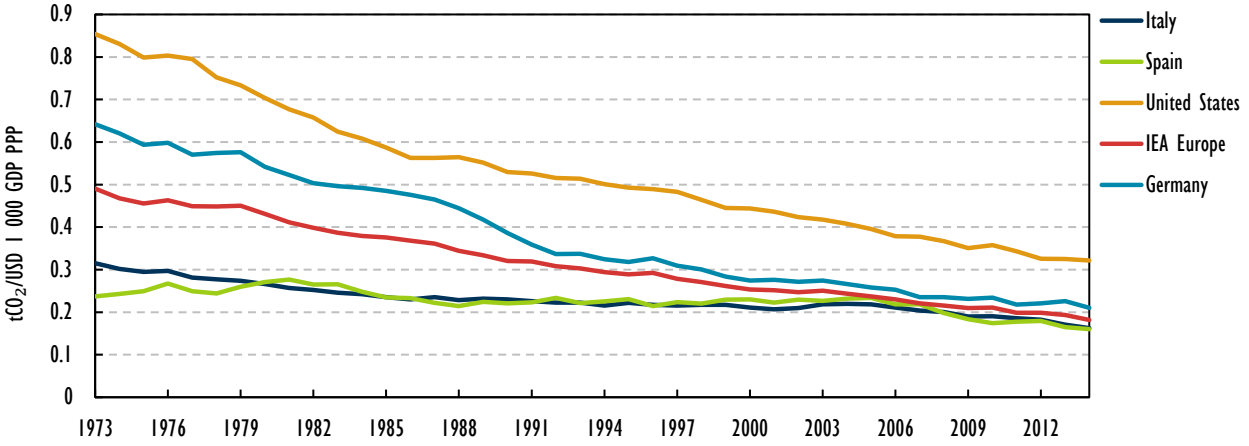
CARBON INTENSITY

Carbon intensity, measured as CO_2 emissions by real gross domestic product adjusted for purchasing power parity (GDP PPP), amounted to 0.16 tonnes of CO_2 per USD 1 000 PPP

(tCO_2/USD 1 000 PPP) in Italy in 2014. Italy's carbon intensity is lower than the IEA average of 0.3 tCO_2/USD 1 000 PPP and less than the IEA Europe average of 0.23 tCO_2/USD 1 000 PPP.

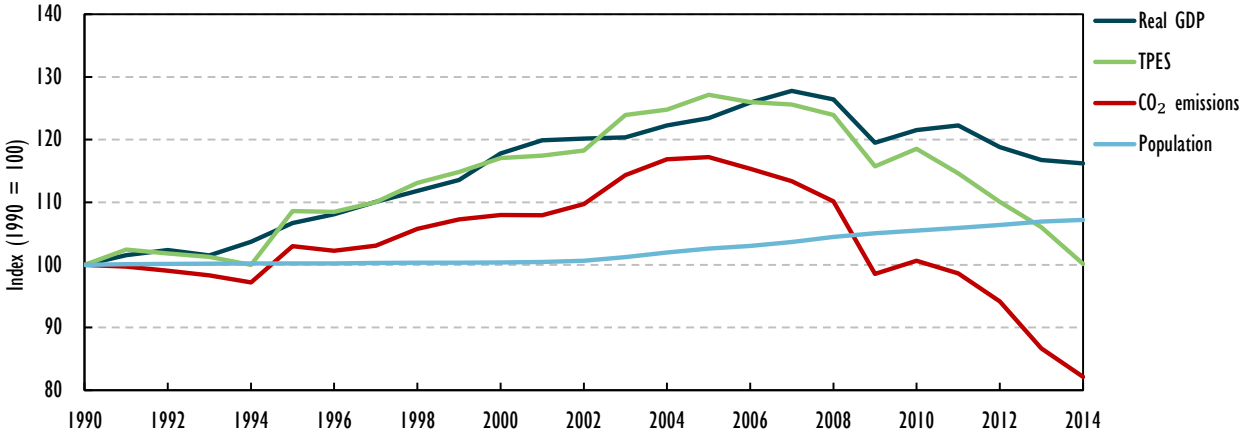
Italy's carbon intensity was 25.6% lower in 2013 than in 1990, continuously decreasing over decades (Figure 3.3). The sharpest drop in intensity was a 5.3% fall during 2009 when the economic recession resulted in a decline of energy consumption which outpaced the negative economic growth (Figure 3.4).

Figure 3.3 Energy-related CO_2 emissions per unit of GDP in Italy and in other selected IEA member countries, 1973-2014



Source: IEA (2016a), *CO_2 Emissions from Fuel Combustion 2016*, www.iea.org/statistics/.

Figure 3.4 CO_2 emissions and its main drivers in Italy, 1990-2014



Sources: IEA (2016a), *CO_2 Emissions from Fuel Combustion 2016*, www.iea.org/statistics/; IEA (2016b), *Energy Balances of OECD Countries 2016*, www.iea.org/statistics/.

INSTITUTIONS

The **Ministry for the Environment, Land and Sea** (**MATTM**), established in 1986, has overall responsibility for co-ordinating climate policy issues. It also shares responsibility for promoting renewable energy and energy efficiency with the **Ministry of Economic Development** (**MSE**), which is in charge of national energy policy. As for the definition

and management of measures, the MSE has the lead in the energy and industrial sectors and the **Ministry of Agriculture** and the **Ministry of Transport and Infrastructure** have the lead roles in their respective sectors.

The **Inter-Ministerial Committee for Economic Planning** (**CIPE**) is a collective governmental body, chaired by the President of the Council of Ministers, responsible for the co-ordination and horizontal integration of national policies. Its competences, among many others, include climate change. The committee approves national GHG emissions reduction programmes.

In 2002, the **Inter-Ministerial Technical Committee for Emissions of GHGs** (**CTE**) was established to support CIPE's climate-related work. The CTE is chaired by the MATTM and composed of representatives of all relevant ministries and of the Presidency of the Council of Ministers. The CTE is responsible for monitoring implementation of policies and measures identified in the National Energy Strategy (NES, hereafter the Strategy) (see below) and their impacts on emission trends, as well as for identifying further measures to meet targets. The CTE can also propose updates to the overall national strategy to the CIPE. The **Italian Carbon Fund** (**ICF**) was established at the World Bank in 2003 to purchase carbon credits as necessary.

The Inter-ministerial Committee for the implementation in Italy of Directive 2003/87/CE and the support to the implementation of the Kyoto Protocol's project mechanisms (ETS Committee) is in charge of the administration of the EU-ETS at the national level. The ETS Committee includes representatives of the Ministries of the Environment, Economic Development, Transport and Infrastructures, Economy and Finance, Foreign Affairs and International Co-operation.

The **Institute for Environmental Protection and Research** (**ISPRA**) and the **National Agency for New Technologies, Energy and Sustainable Economic Development** (**ENEA**) provide data, information, and technical and scientific support. ISPRA is also in charge of national emission reporting to the European Union and the UNFCCC and is the national administrator of the EU Registry within the framework of the EU-ETS**.** ***Gestore dei Servizi Energetici*** (**GSE**) is responsible for estimating avoided emissions resulting from the increase in the share of renewables in the energy mix and is the auctioneer of the Italian share of EU-ETS allowances.

Before the adoption of the Strategy in 2013, each of **the Regions and autonomous Provinces** developed and adopted their own Regional Energy–Environment Plans, with their regional energy policy objectives and their impact on GHG emissions (OECD, 2013a). The financial and legislative instruments are approved by the national Parliament, which allocates public funding in the framework of annual Financial Laws to central and local bodies according to their respective competences.

PROJECTED EMISSIONS

Projected CO_2 emissions from the energy sector are expected to decline between 2015 and 2030 owing to many different factors, some of them structural and others temporary. The most notable are:

- the higher than expected share of renewable sources attributable to the anticipated development of photovoltaic production and greater use of biomass for heating
- increased efficiency of electricity generation following the entry into service of many combined-cycle gas turbines

- reduced fuel consumption in transportation as a result of lower activity levels
- the sharp reduction of energy consumption in the industrial sector resulting from structural changes in production and the increase in efficiency of final end-use devices.

ISPRA has developed GHG emissions scenarios up to 2030. These projections of future emissions are divided into two scenarios; with measures (WM), including all measures implemented or adopted up to 2010; and with additional measures (WAM), including all planned measures.

Table 3.1 WAM scenario's GHG emissions from 1990 to 2030, by source of emissions ($MtCO_2$-eq)

	1990	1995	2000	2005	2010	2015	2020	2030
Emissions from energy uses								
Energy industries	137.2	140.5	152.6	160.6	135.9	128.6	106.4	97.1
Industry	86.9	86.6	83.8	80.2	61.4	62.1	68.7	66.0
Transport	103.1	114.1	122.4	127.5	117.3	110.0	102.2	99.0
Residential and commercial	69.4	68.7	72.1	85.2	80.7	79.9	74.1	64.0
Agriculture (energy use)	9.2	9.6	8.9	9.3	8.1	7.9	7.3	7.1
Other	11.6	11.6	9.9	9.1	8.0	7.6	7.4	6.9
Total of energy uses	417.7	431.1	449.7	471.9	411.4	396.1	366.0	340.1
Emissions from other sources								
Industrial Processes + F-gas	38.4	35.9	36.2	42.6	31.9	33.3	37.4	42.4
Agriculture	40.7	40.5	40.1	37.4	34.2	33.5	33.4	33.4
Waste	19.7	20.4	22.9	20.5	17.9	17.4	16.5	13.3
Other	2.5	2.2	2.3	2.1	1.8	1.7	1.7	1.8
Total of other sources	101.2	99.1	101.6	102.5	85.7	85.8	89.0	90.9
Emissions total	**519.0**	**530.2**	**551.3**	**574.4**	**497.1**	**482.0**	**455.0**	**431.0**

Source: MATTM (2013b), Italy's Sixth National Communication under the UN Framework Convention on Climate Change, Ministry for the Environment, Land and Sea, Rome.

The NES also contains projections, similar to the WAM scenario, as it includes the effects on emissions of a series of actions to reach EU objectives and other national objectives. ENEA has also developed a set of energy scenarios in order to evaluate the effects of many energy policies and GHG mitigation measures. Using ENEA analysis, the MSE together with the MATTM adopted a single scenario which is the result of the effects of a subset of policies and measures that were envisaged as feasible in the timeframe up to 2020, and represented separately in various energy scenarios. The resulting scenario (SEN scenario, which is a WAM scenario) is the one that better represents the implementation of all the feasible measures envisaged (MATTM, 2013b).

The emissions resulting from the WAM scenario have been calculated by ISPRA, in collaboration with the other institutions involved in the NES. This working group also extended the scenario up to 2030. The emission projections at sector level have been expanded by ISPRA and MATTM.

In the WAM scenario, the planned expansion of renewable energy production, the stability of electricity consumption, and reduced activity in refineries owing to the increased efficiency of vehicles, will reduce GHG emissions. A further reduction of emissions is expected between 2020 and 2030 in the WAM scenario, as more electricity consumption is met by renewable sources, while thermoelectric production remains quite constant, with further efficiency increases for end-users.

In the transport sector, the WAM scenario projects a 12.8% decrease in emissions from 2010 to 2020. This outcome is linked to lower road demand growth (modal shift) and to the effect of national commitments to increase efficiency of motor cars alongside further use of natural gas in the sector. Between 2020 and 2030 the emissions show only a slight decrease in the WAM scenario as further efficiency improvements will offset projected increases in transport activity.

In the buildings sector, a reduction of 13.6% is foreseen between 2020 and 2030 as a result of further improvements in thermal insulation and expansion of heat pumps. In industry, emissions are projected to increase by 11.8% between 2010 and 2020 mainly as result of greater co-generation use notwithstanding an increase in energy efficiency.[1] Emissions will remain constant from 2020 to 2030 as any expansion in industrial activity will be balanced by further increases in energy inefficiency.

THE NATIONAL POLICY FRAMEWORK

Italy's climate change policy has largely been developed in the framework of EU climate and energy policies. At domestic level, the central government has overall responsibility for climate policy, although regions have acquired increased policy making and implementation responsibilities (OECD, 2013a). Within the framework of the Covenant of Mayors, almost 1 300 local administrations elaborated plans and measures in order to contribute locally to the reduction of emissions.

EUROPEAN POLICY FRAMEWORK

The ETS in the European Union as a whole will result in cutting emissions by 21% from 2005 to 2020. Beyond 2020, the Union is pledging a -40% GHG target from 1990 to 2030, as agreed by the European Council in October 2014. Emissions reductions below 2005 levels would be 43% in the EU-ETS sector and 30% in the non-ETS sector. The level of effort to be made by each member state to achieve this EU target has not yet been decided. Importantly, however, the plan is to meet the target with EU measures alone, without the contribution from international credits. This would arguably increase compliance costs above today's levels. By 2050, Italy and other developed countries are aiming to reduce GHG emissions by 80% to 95% below their level in 1990.

Under its obligations under the Kyoto Protocol and the EU Burden Sharing Agreement, Italy had a target to reduce its GHG emissions by 6.5% below base-year levels over the first commitment period (2008-12). The Kyoto target was therefore determined at 483.3 $MtCO_2$-eq. According to the latest available data, over the period 2008-12, Italian emissions were approximately 503 M CO_2-eq per year, but taking into account forest sinks amounting to 15.1 $MtCO_2$-eq. per year, the distance to the Kyoto target is estimated to be around 4.7 $MtCO_2$-eq per year (MATTM, 2013a).

1. *Co-generation* refers to the combined production of heat and power.

Italy was the fourth-largest emitter in the European Union in 2012, behind Germany, the United Kingdom and France, with a 10% share in the EU total, but its GHG emissions were 11% below 1990 levels in 2012. Italy's GHG emissions increased from 1990 primarily as a result of increases in road transport, electricity and heat production, and petroleum refining. Emissions decreased from 2004, however, with significant drops in 2009 and 2012, which were mainly a consequence of the economic crisis and reductions in industrial output during these years (EEA, 2014a).

The European Union has committed to cutting its emissions to 20% below 1990 levels by 2020. This commitment is one of the headline targets of the Europe 2020 Growth Strategy and is being implemented through a package of binding legislation. The European Union has offered to increase its emissions reduction to 30% by 2020 if other major emitting countries in the developed and developing worlds commit to a greater share of a global emissions reduction effort.

In the Climate and Energy Policy Framework for 2030, EU leaders agreed on 23 October 2014 the domestic 2030 GHG reduction target of at least 40% compared to 1990, as proposed by the European Commission in January 2014, together with the other main building blocks of the 2030 Policy Framework: an EU-level binding target on renewable energy sources of at least 27% and an indicative EU-level energy savings target of at least 27%, bearing in mind a target of 30%.[2] [3] The new framework proposes that the EU-ETS will be the main European instrument to achieve the 2030 GHG target. For 2050, EU leaders have endorsed the objective of reducing Europe's GHG emissions by 80% to 95% below 1990 levels as part of efforts by developed countries as a group to reduce their emissions by that much. The European Commission has published a roadmap for building the low-carbon European economy that this will require.

The Effort Sharing Decision sets national emission targets for 2020, expressed as percentage changes from 2005 levels. It also lays down how the annual emission allocations (AEAs) in tonnes are to be calculated for each year from 2013 to 2020.

The national emission targets for 2020 have been agreed unanimously. They have been set on the basis of EU member states' relative wealth (measured by gross domestic product per capita). They range from a 20% emissions reduction by 2020 (below 2005 levels) for the richest member states to a 20% increase for the least wealthy one, Bulgaria. Italy is required to reduce its emissions by 13% in 2020 compared to 2005.

The national emission targets for 2030 are currently being negotiated, on the basis of GDP per capita criteria, but also taking into account flexibility mechanisms in order to achieve the targets in a cost-effective manner.

NATIONAL ACTION PLAN

A National Action Plan for the Reduction of Greenhouse Gases for the Period 2013-2020 was approved on 8 March 2013 and later updated in accordance with emissions data for 2011 and 2012. The plan integrates the actions contained in the national plans for renewables and energy efficiency, as well as regional actions supported by the European Union and national funds for regional developments (OECD, 2013a). Many of the

2. European Council, Conclusions (2014 EUCO 169/14), 23 and 24 October 2014, Brussels.

3. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, *A policy framework for climate and energy in the period from 2020 to 2030.*

measures included in the plan are described below in Chapter 4 on Energy Efficiency and Chapter 5 on Renewable Energy. The following paragraphs, however, offer an overall evaluation of the approach chosen by Italy in terms of effectiveness in reducing emissions.

Italy tends to use economic instruments as the main tools in its climate mitigation policy. The EU-ETS covers over 1 200 industrial installations or about 40% of Italy's GHG emissions. This is a lower share than in other large EU economies, leaving most emission abatements to be achieved by domestic measures in the non-ETS sectors (OECD, 2013a).

Table 3.2 Italy's GHG emissions, 2008-12

GHG emissions ($MtCO_2$-eq)	2008	2009	2010	2011	2012
EU-ETS	201.72	201.72	201.72	201.72	201.72
Non-EU-ETS	320.06	305.51	308.35	297.52	282.1
CERs/ERUs already purchased*	1.43	1.43	1.43	1.43	1.43
National emissions (including CERs/ERUs)	520.35	505.8	508.64	497.8	482.38
Kyoto target	483.26	483.26	483.26	483.26	483.26
Distance to Kyoto target	37.09	22.54	25.38	14.55	-0.87
LULUCF activities (art. 3.3, 3.4)	-14.61	-15.34	-15.95	-14.55	-14.82
AAU, CER, ERU to bridge the gap	22.48	7.2	9.43	0	-15.7

Notes: AAU = assigned amount unit; CER = certified emissions reductions; ERU = emissions reduction units.

* Emission credits that are generated by a project aimed at reducing emissions, respectively, or in a developing country or in a country with economy in transition.

Source: Ministry of Economy and Finance, Economic and Financial Paper 2015, Annex – Report of the Minister for the protection of the Environment, Land and Sea on the state of implementation of Italian commitments for GHG reductions. MEF (2015) *Economic and Financial Paper 2015, Annex – Report of the Minister for the Protection of the Environment, Land and Sea on the state of implementation of Italian commitments for GHG reductions,* Ministry of Economy and Finance, Rome.

Unlike in most other countries participating in the EU-ETS in the early years of the 2008-12 commitment period, installations in Italy bought allowances on the market since their emissions were above the allocations. The approach to emissions trading changed significantly following the economic crisis and many Italian operators accumulated allowances and became sellers.

Italy's strategy for achieving climate mitigation goals has relied heavily on increased use of renewable energies and energy efficiency mechanisms (notably tradable white certificates in the industrial sector, but also tax rebates and capital funding for the residential sector and public administration). Economic incentives for electricity generation, in the form of feed-in tariffs and tradable renewable energy certificates (green certificates); have been at the core of the renewables policy mix. These support programmes have driven a dramatic increase in generation of electricity from renewable sources and have helped stimulate growth and employment in the renewables sector.

Taxes

GHG emissions outside the EU-ETS sector do not face an explicit carbon price. Nonetheless, energy consumption faces a high level of taxation in Italy and the carbon prices implied in energy tax rates applied to industrial processes, heating and other non-transport uses are higher than in competing economies such as Germany or France.

Conversely, industrial users of fuel benefit from some tax exemptions, while fuel consumption in the agricultural sector (in decline both in absolute and in relative terms) benefits from a reduced rate of taxation on diesel (22% of the rate applied to diesel for transport purposes) (OECD, 2013b). The highest fuel taxes in the European Union are levied in the Netherlands (for gasoline), Italy and the United Kingdom (for both gasoline and diesel) (Aarnink et al., 2012). Although above the EU-28 average, environmental taxes on transport (fuel and other taxes) as a percentage of total taxation in Italy are among the lowest in the European Union (EU, 2014).

Renewable energy supply and energy efficiency policies

Energy efficiency is afforded priority of the NES, which targets a reduction in GHG emissions of about 55 $MtCO_2$-eq annually. In other words, energy efficiency measures will be the main driver in lowering CO_2 emissions. Sustainable development of renewable energy is also a priority in the NES and Italy intends to go beyond the objectives set out in the EU 2020 energy and climate change targets. The government foresees renewable energy making a significant contribution to the reduction of emissions: GSE estimates that renewable energy sources contributed to avoiding over 250 Mt of GHG emissions between 2009 and 2012 (Italy's Second Progress Report under Directive 2009/28/EC) and to meeting the objective of energy security. Both of these sectors are considered in greater detail later in this report.

Transport sector

The Italian economy is heavily dependent on natural gas and oil: in 2014, oil accounted for 35.2% of TPES and natural gas for 34.7%. The NES highlights the need to strengthen efforts in energy efficiency, notably in the buildings and transport sectors.

The transport sector is the largest consuming sector of the economy, accounting for 29.6% of total final consumption (TFC) in 2013. In 2012, total GHG emissions from the road transport sector were about 92.6% of the total national emissions from transport, 25.8% of the energy sector and about 21.3% of the GHG national total. From 1990 to 2012, GHG emissions from the sector increased by 3.3%. This trend has a twofold explanation: a strong increase starting in 1990 until 2007 (26.3%), owing to a growing vehicle fleet, total mileage and consequently fuel consumption and, on the other side, in the more recent past from 2007 onwards, a decrease in fuel consumption and emissions as a result of the economic crisis. As from 2007, the mean annual decrease is about -3.9%; from 2007 to 2011 it is about -2.3%; but during 2012 a decrease of about –10.2% was observed (ISPRA, 2014). In addition, Italy has implemented Regulation 443/2009/EC, which has led to significant reductions in fuel consumption.[4] The regulation, which came into force in 2009, established standards to control CO_2 emissions from new passenger cars and set a limit of 130 grams of CO_2 per kilometre (gCO_2/km). From 2020, this level is to be reduced to 95 gCO_2. In April 2014, the European Commission published Regulation 333/2014 amending Regulation 443/2009 to define the modalities for reaching the 2020 target to reduce CO_2 emissions from new passenger cars.

Recently, in the framework of the first Italian ministerial event on climate change, the Minister of Transport and Infrastructures announced a revision of the national plan on infrastructure that will focus investments on 25 projects (out of the 400 originally

4. Regulation (EC) No. 443/2009 of the European Parliament and of the Council dated 23 April 2009 setting emission performance standards for new passenger cars as part of the Community's integrated approach to reduce CO_2 emissions from light-duty vehicles.

planned), 70% of which will involve strengthening the railway system. A national initiative for sustainable urban mobility, including metro and cycle paths, was also announced, together with national measures to favour the renewal of the urban bus fleet. Measures were announced also for the sustainability of ports and the maritime sectors.

Vehicle fleet

Among EU member states, France, Italy and Spain have the lowest average CO_2-specific emissions. In the case of Italy, this is the result of a combination of reasons: the country, along with Denmark and Portugal, has one of the lowest average vehicle mass (the fifth-lowest among the EU member states) and engine power values (second-lowest value among those EU member states reporting engine power). In addition, Italy has a high share of diesel cars (54%) and, at 15%, by far the highest share of alternative fuel vehicle (AFVs). These AFVs are mainly liquefied petroleum gas (LPG)-fuelled cars (9% of all new registrations) with an average CO_2 value of 119 gCO_2/km and natural gas-fuelled cars (5% of all new registrations) with an average CO_2 value of 99 gCO_2/km (EEA, 2014b). Vehicle taxes and scrapping incentives have been the main measures implemented to encourage renewal of the fleet in favour of less emitting vehicles (OECD, 2013a). For example, a major driver of the dieselisation of passenger cars and light commercial vehicle fleets is the tax incentives: diesel used in transport is taxed at a lower rate than gasoline, by energy content per litre, and CO_2 content basis (OECD, 2013b). Conversely, little is being done to promote the renewal of the heavy goods vehicle fleet.

Urban transport systems

Limited progress has been made in developing integrated urban transport systems. In general, in most Italian cities and metropolitan areas, local public transport systems remain underdeveloped, in terms of infrastructure and service quality, to provide an adequate alternative to the use of private vehicles. This is especially true in the southern regions (OECD, 2013a). Some new measures for sustainable urban transport have been announced.

Transport and the NES

The NES also identifies the promotion of sustainable mobility in urban areas as a means to stimulate the use of electric and other low-emissions vehicles. Furthermore, the NES also highlights the need to continue pursuing to shift the mix towards sustainable mobility, notably by encouraging modal shift from road to rail and from individual to collective transport. It is appropriate that these matters are handled within a comprehensive national plan for transport, outlining development guidelines and investment, in particular for rail and metropolitan transport.

The policies and measures considered in the NES for the transport sector include:

- *Infrastructural measures*: High-capacity and high-speed networks and tuning of regional networks for commuting and goods; management measures regarding enhancement of road urban public transport network.
- *Intermodal measures*: Shifting from private to public road traffic and shifting goods transport from the road to the sea; management measures to support efficiency in private road transport and improve road circulation in urban areas.

- *Fleet update measures*: Further subsidy to change older cars with new ones with average emissions of 120 gCO_2/km (130 gCO_2/km engine efficiency and −10 gCO_2/km from additional reduction tools).
- *Mandatory requirement of Directive 2009/28/EC*: 10% use of biofuel for transport at 2020.

The budget laws 2007, following European Directive CE30/2003, prescribe that the minimum quota of biofuel in 2009 be 3% of the total sold and 5.75% by 2010, later moved to 2013. Italy has promoted the use of biofuels with the aim of reducing transport-related GHG emissions and complying with the EU biofuel target. With about 700 000 tonnes of biodiesel and 100 000 tonnes of bioethanol produced each year, Italy is the fourth-largest producer of biofuels in Europe.

NATIONAL ADAPTATION STRATEGY

Studies indicate that the Mediterranean region is expected to face negative impacts as a consequence of climate change over the next decades. Coupled with the effects of anthropogenic stress on natural resources, they make this region one of the most vulnerable parts of Europe. The Italian peninsula appears to be particularly vulnerable, as it is characterised by complex climate patterns due to the presence of high mountain ranges (the Alps and Apennines) and the Mediterranean Sea (OECD, 2013a).

MATTM has primary responsibility for the preparation, establishment and implementation of a national adaptation strategy. The ministry focuses on the integration of adaptation into sectoral policies, while state governments are in charge of the implementation of adaptation action plans at the local level (BASE, 2014). In December 2014, MATTM published a number of documents related to the process, among these a paper on the *Elements for a National Strategy for Adaptation to Climate Change*. Italy is currently in the process of finalising the elaboration of such strategy, which is foreseen to be adopted in 2015.

In the framework of the first Italian ministerial event on climate change, it was announced that the adaptation plan will focus measures and resources on hydrogeological instability.

ASSESSMENT

Italy is the eighth-largest emitter of GHGs in the OECD and the fourth-largest in the European Union. Nonetheless, GHG emissions per capita are lower than the OECD Europe and OECD averages; and its carbon intensity, measured in tonnes of CO_2 emitted per unit of GDP, is below the IEA median. Decarbonising the economy is one of the four main goals of the NES, and the country sets the goal of exceeding the EU 2020 environmental and decarbonisation objectives and of taking a lead role in implementing the EU Roadmap 2050. More specifically, the country has established a 21% emissions reduction target below 2005 levels by 2020. In accordance with the Kyoto Protocol, Italy agreed to reduce its emissions by 6.5% below 1990 levels in the period 2008 to 2012 (a part of the EU Burden Sharing Agreement). During the 1990-2012 period, Italy's GHG emissions, excluding emissions and removals from LULUCF, decreased by 11.1%. The energy sector is the largest contributor to national total GHG emissions with a share, in 2012, of 82.4%, a decrease of about 9.1% compared

to 1990. The global economic recession has had a significant influence on GHG emission levels delivering a notable reduction of total emissions, especially in the four years from 2008.

In 2002, Italy adopted a national GHG emissions reduction plan. It outlined the main approaches for meeting Italy's Kyoto target and included a set of potential mitigation measures. The country also established an annual monitoring and reporting process. The plan also delegated responsibility for identifying specific measures to the competent ministries and authorities. Since the last in-depth review was published in 2009, the plan was updated in 2012 in order to identify measures able to fill the "distance to target". Mostly because of time constraints, purchasing international carbon credits was indicated as the principal adjustment measure.

In 2013, the MATTM presented its draft plan for achieving the EU-related target to 2020. This plan overcomes many of the weaknesses of previous plans. It integrates the measures foreseen in the national plans for renewables and energy efficiency, as well as regional actions supported by the European Union and national funds for regional development. Further efforts should be made to assess the cost-effectiveness of measures included in the plan. Furthermore, at national policy level, the NES has identified a pathway to achieving the 2020 targets, which is largely dependent on policies related to energy efficiency and renewable energy use, and sets out a list of policy measures that should be implemented across all sectors.

The NES leans heavily on the growth of the renewables sector for achieving climate mitigation goals and incentives for electricity generation from renewable energy sources. In this regard, Italy has experienced a remarkable increase in the supply of renewable electricity since the preparation of the previous review visit in 2008. This focus on renewable energy and energy efficiency is commendable and has reduced Italy's import dependence. Nonetheless, the rapid expansion in renewable energy supply has brought with it high costs, largely as a result of the rapid growth in installed solar photovoltaic capacity. Italy's incentives to use renewables have been generous but have led to increasing costs for retail electricity consumers and entailed high GHG abatement costs (OECD, 2015).

Italy has also put in place a suite of measures to promote energy efficiency, notably tax incentives and tradable energy efficiency certificates. These measures have contributed to cost-effective energy savings, of which the market for energy efficiency certificates (or white certificates) has been the most successful. Conversely, potential interactions between the EU-ETS and other policy instruments, such as tradable energy efficiency certificates and feed-in tariffs, should be afforded greater consideration in policy design in order to avoid overlaps that could lead to increasing the overall cost of mitigating GHG emissions (OECD, 2013a).

Progress in the road transport sector, the second-largest GHG-emitting sector, has slowed and it is unlikely that Italy will meet its targets. While the economic downturn has resulted in a decline in GHG emissions from the sector, and there has been some success with efforts to promote modal shift, there is scope for additional policy measures in this sector. There is also some scope to restructure transport tax rates to reflect the negative externalities. The effect could be twofold: reduced consumption of transport fuel and differences in consumer behaviour when it comes to purchasing vehicles. This could also influence modal shift patterns.

Furthermore, other than the use of charging for parking facilities, the use of price-based mechanisms to manage transport demand and reduce emissions from private vehicle use has been limited and could be expanded. In general, public transports systems in most cities remain insufficiently developed (in terms of infrastructure and service quality) and fail to provide an adequate alternative to the use of private vehicles. There are a number of national transport infrastructure plans but the country lacks a comprehensive transport strategy aimed at rebalancing the modal split of both passenger travel and freight haulage. Furthermore, despite strong progress in the passenger transport and light goods fleets, little has been done to encourage the renewal of the fleet of heavy goods vehicles, which remains old and relatively energy-inefficient (OECD, 2013a). Development of an integrated transport strategy should be a priority and its implementation consistent with the NES.

Another notable feature of Italian transport policy is its support for alternative-fuelled vehicles as there are still many natural gas vehicles in circulation on Italian roads and the sector is growing. The government has put in place generous support mechanisms, including lower fuel taxes and vehicle taxes and scrapping incentives to encourage renewal of the road transport fleet in favour of less emitting vehicles. The government has introduced a Strategic National Plan for the use of liquefied natural gas (LNG) in Italy consistent with the EU 2030 Climate and Energy Framework. The government's proposal to displace bunker fuel in shipping with LNG is commendable. In addition, the Navy's green fleet project aims to reduce its dependence on oil by 40% by 2020 through the use of blending components such as advanced biofuels and LNG. The Strategic National Plan for the use of LNG should include detailed analysis of the GHG and environmental benefits of gas-fired road transportation to ensure that all consumers can take an informed decision.

The Italian energy system is exposed to a number of climate change risks over the coming decades. Its complex climate patterns resulting from its topography of high mountain ranges and the Mediterranean Sea mean that there are many challenges ahead such as huge variations in water levels in hydropower plants to much higher demand for cooling in summer. The development of an adaptation strategy has been under way for some time and this process should be completed without any further delay.

RECOMMENDATIONS

The government of Italy should:

- *Take steps to restructure taxation of private transport to more accurately reflect CO_2 emissions and other environmental externalities.*
- *Develop and implement a comprehensive and integrated national transport strategy. This should include a strategic line for infrastructure development that increases coherence between investments at national and local levels, proposals for greater use of price-based mechanisms, such as pollution and congestion charges, upgrading the size and efficiency of the heavy goods vehicle fleet and sustainable urban transport measures, including consideration for electric mobility.*
- *Include detailed analysis GHG emissions and the environmental benefits of gas-fired road transportation in the Strategic National Plan for the use of LNG to ensure that all consumers can take an informed decision.*

- *Complete the preparation of the national adaptation strategy without delay.*
- *Introduce a structured policy assessment mechanism; in order to evaluate* ex post *the effectiveness of and the interaction among European and national measures on energy and climate. Structure co-ordination among the bodies in charge of statistics in the sector of renewables, energy efficiency and emissions.*

References

Aarnink S. et al. (2012), *An Inventory of Measures for Internalising External Costs in Transport*, Transport & Mobility Leuven for the Directorate-General for Mobility and Transport, European Commission, Brussels.

BASE (2014), *Policy Brief, Climate adaptation strategies in the EU,* Issue No. 2, May 2014, Bottom up Climate Adaptation Strategies Towards a Sustainable Europe, http://base-adaptation.eu/sites/default/files/BASE_Policy_May%202014_0.pdf .

EEA (European Environment Agency) (2015), *EUTL extractions*, http://ec.europa.eu/clima/policies/ets/registry/documentation_en.htm, last accessed 14 September.

EEA (2014a), *Annual European Union greenhouse gas inventory 1990–2012 and inventory report 2014*, EEA, Copenhagen.

EEA (2014b), *Monitoring CO_2 emissions from passenger cars and vans in 2013*, European Environment Agency, Copenhagen.

EU (2014), *EU Transport in Figures – Statistical Pocketbook 2014*, Publications Office of the European Union.

IEA (International Energy Agency) (2016a), *CO_2 Emissions from Fuel Combustion 2016*, www.iea.org/statistics/, OECD/IEA, Paris.

IEA (2016b), *Energy Balance of OECD Countries 2016*, www.iea.org/statistics/, OECD/IEA, Paris.

ISPRA (2014), *Italian Greenhouse Gas Inventory 1990-2012, National Inventory Report 2014*, Istituto Superiore per la Protezione e la Ricerca Ambientale, Rome.

Italy's Second Progress Report under Directive 2009/28/EC, (2013), http://ec.europa.eu/energy/en/topics/renewable-energy/progress-reports.

MATTM (2013a), *Report of the Minister for the Environment, Land and Sea on the status of implementation of commitments to reduce greenhouse gases emissions (L. 39/2011, Article. 2, paragraph 9)*, Ministry of the Economy and Finance, Rome.

MATTM (2013b*), Sixth National Communication under the UN Framework Convention on Climate Change Italy*, Ministry for the Environment, Land and Sea, Rome.

OECD (2015), *OECD Economic Surveys: Italy 2015*, OECD Publishing, Paris.

OECD (2013a), *OECD Environmental Performance Reviews: Italy 2013*, OECD Publishing, Paris.

OECD (2013b), *Taxing Energy Use: A Graphical Analysis*, OECD Publishing, Paris.

UNFCCC (United Nations Framework Convention on Climate Change) (2015*), National greenhouse gas inventory data for the period 1990-2013 (FCCC/SBI/2015/21)*, UNFCCC, Paris.

4. ENERGY EFFICIENCY AND DISTRIBUTION HEATING

Key data (2015 estimated)

ENERGY EFFICIENCY

Energy supply per capita: 2.5 toe (IEA average: 4.5 toe), -22.9% since 2005

Energy intensity: 0.08 toe/USD 1 000 PPP (IEA average: 0.11 toe/USD 1 000 PPP), -14.6% since 2005

TFC (2014): 116.6 Mtoe (oil 41,0%, natural gas 26,9%, electricity 20.8%, biofuels and waste 6.4%, heat 3.2%, coal 1.4%, geothermal 0.1%, solar 0.2%), -15.5% since 2004

Consumption by sector (2014): transport (31.7%), residential (25.3%), industry (27.9%), commercial and public services, including agriculture and fishing (15.1%)

DISTRICT HEATING

Heat generation: 223.5 PJ, +15.8% since 2005

Heat generation mix: natural gas 63.6%, biofuels and waste 19.5%, oil 14.7%, coal 1.8%, geothermal 0.4%

Installed capacity: 1 368 MW_{th}, 929 MW_e

Heat consumption (2014): industry 70.2%, residential 21.8%, commercial and public services, including agriculture 8.0%

ENERGY EFFICIENCY OVERVIEW

In line with European Union (EU) directives, and in support of its National Energy Efficiency Action Plan (NEEAP), Italy has been steadily expanding its range of public energy efficiency programmes that have, along with some of the highest electricity prices in Europe, leveraged private investments and widened the energy efficiency market.

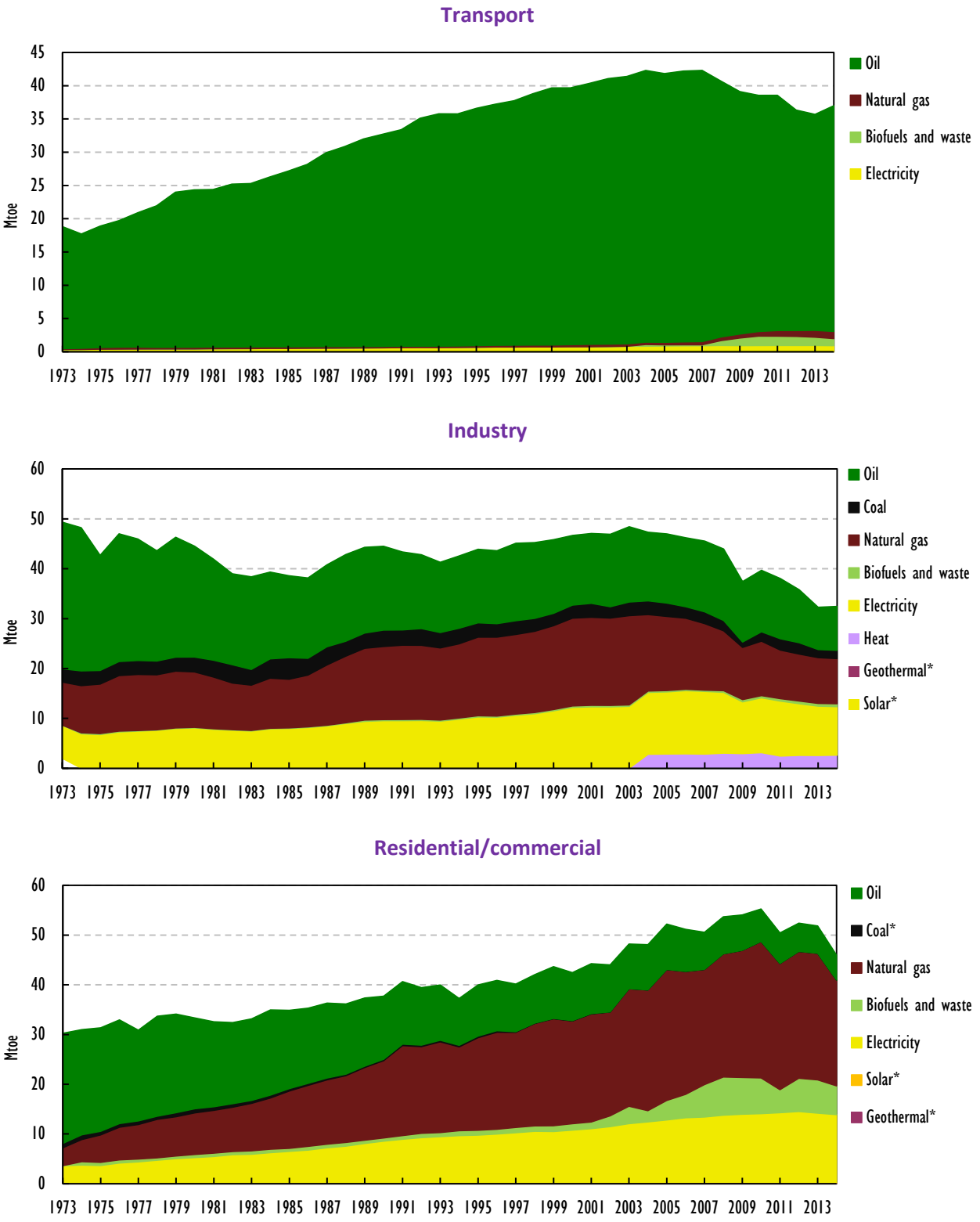
FINAL ENERGY USE

FINAL CONSUMPTION BY SECTOR

Italy's total final consumption (TFC) was 116.6 million tonnes of oil-equivalent (Mtoe) in 2014. TFC peaked at 141.3 Mtoe in 2005 and has been declining since, with a slight recovery during 2010. TFC was 17.5% lower in 2014 compared to 2005 and 15.5% lower compared to ten years prior in 2004.

Transport is the largest consuming sector in Italy, with final consumption of 37.0 Mtoe in 2014 or 31.7% of TFC (Figure 4.1). Demand from the transport sector peaked at 42.3 Mtoe in 2007 and has fallen by 12.5% in the following seven years. However, its share in TFC has never been higher than in 2014. Italy had the eleventh-highest share of transport in TFC among IEA member countries in 2014.

Figure 4.1 TFC by sector and by source, 1973-2014



* Negligible.

Source: IEA (2016), *Energy Balances of OECD Countries 2016*, www.iea.org/statistics/.

The residential sector experienced a drop in energy consumption from 34.2 Mtoe in 2013 to 29.5 Mtoe in 2014. The sector represented 25.3% of TFC in 2014, while the commercial and other services sector (including agriculture and fishing) accounted for 15.1%. The commercial sector has experienced growth in demand over the past decade, increasing 4.0% since 2004. Residential demand also grew from 2004 and reached a record in 2010 with 35.4 Mtoe, while demand in the services sector peaked in 2009 and has contracted slightly since. Together these two sectors accounted for 40.4% of TFC in 2014, up from 35.0% in 2004.

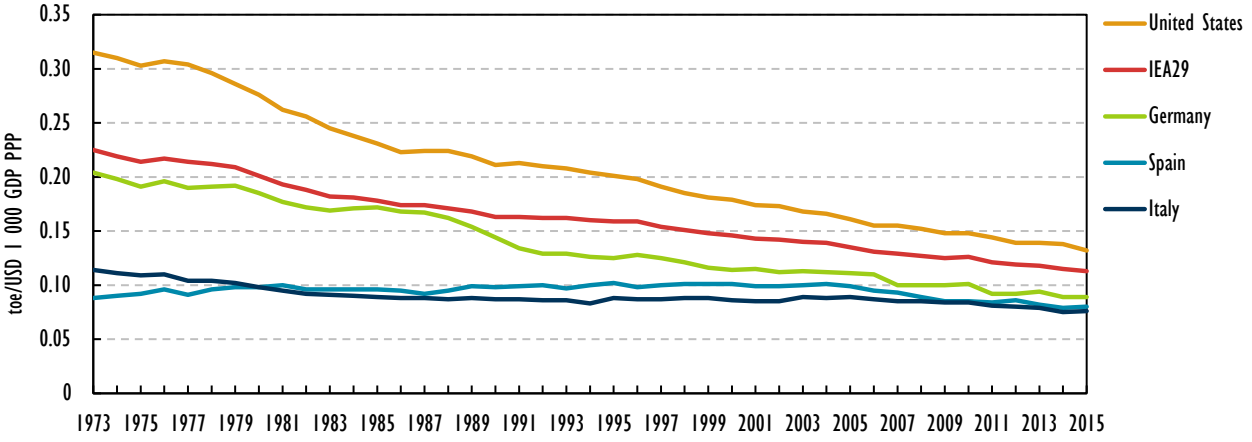
The industry sector represents 27.9% of TFC or 32.5 Mtoe in 2014. Industry demand peaked in 2003 and has been falling since, declining by a total of 31.4% during 2004-14. Industry was the largest consuming sector up to 2009 when transport gained the largest share. Italy's industry share in TFC ranked ninth-lowest among IEA member countries in 2014.

Oil is the most dominant fuel in TFC with a 41.0% share in 2014. It accounts for 92% of transport demand and 27% of industry demand. Natural gas represented 31.4% of TFC in 2014, with a 45% share in residential and commercial use and 28% share in industry use. Consumption of both oil and natural gas has declined compared to 2004, by 25.0% and 21.4%, respectively. Coal use (mainly consumed in industry) was 40.0% lower in 2014 compared to 2004, while biofuels and waste, and solar consumption increased by 167% and 847%, respectively.

ENERGY INTENSITY

Energy intensity, measured as the ratio of total primary energy supply (TPES) by real gross domestic product adjusted for purchasing power parity (GDP PPP), was 0.08 tonnes of oil-equivalent per USD 1 000 PPP (toe/USD 1 000 PPP) in 2015 (Figure 4.2). The ratio is lower than the IEA average of 0.11 toe/USD 1 000 PPP and slightly lower than the IEA Europe average of 0.09 toe/USD 1 000 PPP. Italy's energy intensity is ranked sixth-lowest among IEA member countries, higher only than Ireland, Switzerland, the United Kingdom, Denmark and Luxembourg. Energy intensity in Italy was 14.6% lower in 2015 than ten years earlier, while the average IEA intensity declined by 16.3% over the same period.

Figure 4.2 Energy intensity in Italy and in other selected IEA member countries, 1973-2015

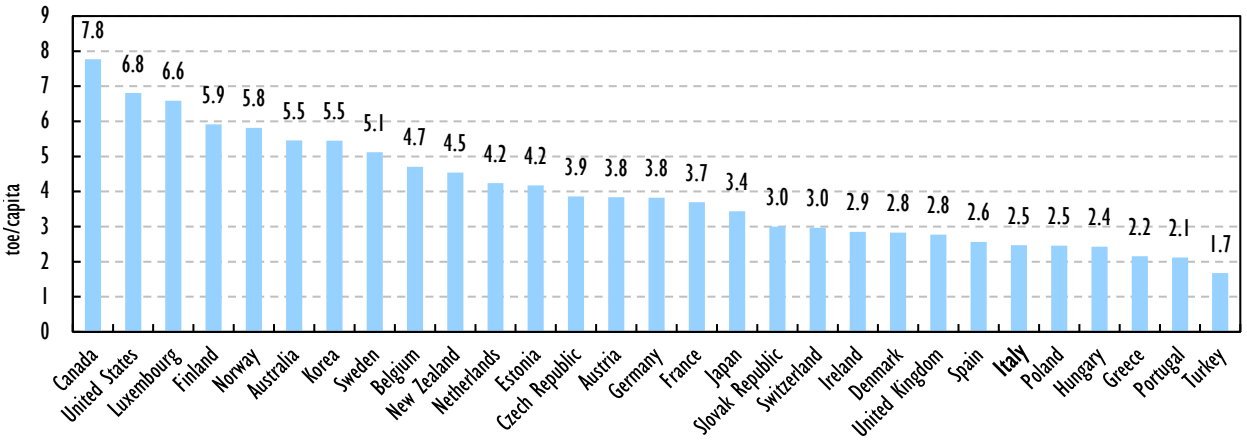


Note: data are estimated for 2015.

Source: IEA (2016), *Energy Balances of OECD Countries 2016*, www.iea.org/statistics/.

A further common indicator for international comparisons is energy supply per capita (see Figure 4.3). Italy's rate of 2.5 toe per capita per year is sixth-lowest among IEA member countries.

Figure 4.3 TPES per capita in IEA member countries, 2015



Note: data are estimated.

Source: IEA (2016), *Energy Balances of OECD Countries 2016*, www.iea.org/statistics/.

INSTITUTIONS

The **Ministry of Economic Development** (**MSE**) is responsible for a wide variety of policies, including economic development and cohesion, energy and mineral resources, telecommunications, internationalisation and business incentives. It was set up in 2006, from the former Ministry of Productive Activities, which had already absorbed the portfolio of the Department of Cohesion and Development (previously under the Ministry of Economy and Finance). The MSE optimises policies to support the competitiveness of large companies in strategic sectors, promotes policies of industrial development for small and medium-sized enterprises (SMEs). It elaborates and implements national energy policy and has jurisdiction in respect of postal, telecommunications and innovative technologies applied to communications.

Established in 1986,the Italian **Ministry for the Environment, Land and Sea** (**MATTM**) was is in charge of governing and supervising environmental issues: sustainable development, protection of the territory, pollution and industrial risks, international protection of the environment, environmental impact assessment, nature conservation, waste, protection of seas and inland waters. More specifically, its institutional mandate includes promoting, protecting and restoring the environment, with the aim to grant a high quality of life, to enhance a sustainably wise use of natural resources and to prevent and control pollution. It shares responsibility for promoting renewable energy and energy efficiency with the Ministry of Economic Development.

ENEA, the designated National Agency for Technologies, Energy and Sustainable Economic Development, supports research and development of technologies aimed at increasing the efficiency of energy production and use. It supports government with advice to define methodologies for quantifying energy savings, to be used at central and local levels as a means to implement regulations and disseminate the culture of energy efficiency. The strategic objective of its **Technical Unit for Energy Efficiency** is to develop and transfer knowledge, systems, methods and technologies for energy

saving and efficiency in residential and tertiary buildings, industry, agriculture, transport, and in systems crucial for Italy's growth and competitiveness.

Gestore dei Servizi Energetici **(GSE)** is the state-owned company which promotes sustainable development by providing support for renewable electricity generation and by taking actions to build awareness of environmentally efficient energy uses. With the support of ENEA and MSE, since 2013 GSE manages, evaluates and certifies the energy savings associated with energy efficiency projects under the white certificate (WC) scheme.

ENERGY EFFICIENCY POLICIES AND MEASURES

EUROPEAN POLICY FRAMEWORK

The 2012 Energy Efficiency Directive established a set of binding measures to help the European Union reach its 20% energy efficiency target by 2020.[1] Under the directive, all EU member countries are required to use energy more efficiently at all stages of the energy chain, from its production to its final consumption. EU countries were required to transpose the directive's provisions into their national laws by 5 June 2014. To reach the European Union's 20% energy efficiency target by 2020, individual EU countries have set their own indicative national energy efficiency targets. Depending on country preferences, these targets can be based on primary or final energy consumption, primary or final energy savings, or energy intensity. In the case of Italy, its indicative national energy efficiency target for 2020 is a 20 Mtoe primary energy reduction by 2020 and a 15.5 Mtoe final energy reduction by 2020. In its National Energy Strategy (NES, hereafter the Strategy), the government has indicated that Italy intends to outdo the European target, generating expected savings of up to 24%.

In the Climate and Energy Policy Framework for 2030, the European Commission originally proposed a 30% energy savings target for 2030, following a review of the Energy Efficiency Directive. The proposed target builds on the achievements already reached: new buildings use half the energy they did in the 1980s and industry is about 19% less energy-intensive than in 2001. The European Council, however, endorsed an indicative target of 27% to be reviewed in 2020 having in mind a 30% target.

NATIONAL ENERGY STRATEGY

The Strategy has identified energy efficiency as the top priority of energy policy: strong energy efficiency policies will contribute to lowering energy costs, reducing emissions and their impact on the environmental, improving the safety and independence of supply and development of economic growth. By 2020, the Strategy foresees a 24% reduction in primary energy consumption compared to 2007 business-as-usual projection driven largely by energy efficiency measures. Over the longer term, to 2050, the Strategy highlights the need to decouple economic growth from energy consumption in order to reduce the latter by 17% to 26% below 2010 levels by 2050.

The Strategy identified a number of barriers across all sectors that have impeded the full implementation of energy efficiency policies to date and makes elimination of these barriers a priority. Existing instruments and measures will therefore be strengthened or new ones introduced, the aim being to match instruments with targets. In the first instance, the Strategy proposes:

1. Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC.

- Stronger minimum and legal standards as well as greater compliance, control and sanctions in the building industry (new buildings and major renovation works), in the transport sector and for products falling within the scope of the Ecodesign Directive.[2]
- An extension of the timescale for tax deductions, generally for the civil construction sector (refurbishment and renovations).
- The introduction of direct incentives for government and public sector initiatives, which cannot benefit from tax deductions, by means of the Heating Account, in force since July 2013. Diffusion of contract standards for the public sector based on energy performance improvements is also envisaged.
- More ambitious targets and strengthening of the WC mechanism as a whole.

NATIONAL ENERGY EFFICIENCY ACTION PLAN

National Energy Efficiency Action Plans (NEEAPs) set out estimated energy consumption, planned energy efficiency measures and the improvements individual EU member states expect to achieve. Under the 2012 Energy Efficiency Directive, each EU member state must draw up these plans every three years and also provide annual reports. Italy's NEAAP 2014, which replaced the 2011 edition, sets out the energy efficiency targets established for 2020, the policy measures implemented for achieving them and the progress made to date (as at 2012).

Table 4.1 Final energy savings expected in 2020 by sector (Mtoe per year)

Sector	2011-20 measures					Final energy	Primary energy
	Standards and regulations	Measures and investments in the transport sector	Heating account scheme	55% / 65% fiscal deduction	WCs	Expected savings 2020	Expected savings 2020
Residential	1.60		0.54	1.26	0.17	3.57	5.00
Non-residential	0.20		0.93		0.20	1.33	1.86
Public	*0.10*		*0.43*		*0.10*	*0.63*	*0,88*
Private	*0.10*		*0.50*		*0.10*	*0.70*	*0,98*
Industry					5.10	5.10	7.14
Transport	3.43	1.97			0.10	5.50	6.05
Total (Mtoe/year)	**5.23**	**1.97**	**1.47**	**1.26**	**5.57**	**15.50**	**20.05**

Source: MSE (2014), *Italian Energy Efficiency Action Plan*, Ministry of Economic Development, Rome.

Specifically, in line with the guidelines for its preparation provided by the European Commission and with the contents of the NES, the NEEAP sets out the national targets for the reduction of primary and end-use energy consumption and specifies the savings

2. Directive 2009/125/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products.

in end-uses of energy expected in 2020 by economic sector and by main energy efficiency promotion scheme, each of which is described in detail in the plan.

TRANSPOSITION OF THE ENERGY EFFICIENCY DIRECTIVE

Legislative Decree 102 of 4 July 2014 establishes a framework of measures for the promotion and improvement of energy efficiency in many areas that are able to contribute to the achievement of national energy saving targets at 2020.

More specifically, for the building sector there will be a strong boost to the renovation of buildings, with the exemplary role to be played by the public sector; for the industry sector, the strengthening of instruments such as WCs and energy audits. Besides, a large section is devoted to the measurement and billing of energy consumption.

Finally, the decree foresees the establishment of a national fund for energy efficiency (EUR 5 million for 2014 and EUR 25 million for 2015), whose priorities are: employment growth; whole-building energy efficiency; zero-energy buildings; energy upgrading and seismic protection; district heating and cooling in agriculture or connected to biomass distributed generation.

TARGETS AND PROGRESS

The 2007 and 2011 NEEAPs established targets related to the 2005-16 period. Consistent with the Strategy, the 2014 NEEAP established 2020 targets related to the 2011-20 period. Thus, 2016 and 2020 targets are not comparable. Nonetheless, the monitoring activities carried out for the 2016 targets provided the basis for the definition of 2020 targets and the strengthening/development of the tools to achieve them, such as the definition of the 2013-16 WC targets, the revision and extension of 55%/65% tax deduction and the development of the new Heating Account incentive scheme.

The 2007 and 2011 NEEAPs established an indicative energy savings target by 2016 equal to 9.6% of average 2001-05 final energy consumption. Table 4.2 sets out the energy savings achieved in 2013, compared to the 2016 targets: more than 88 000 gigawatts/hour (GWh) that corresponds to about 70% of the 2016 target. The industry sector, largely thanks to the WC scheme, already met the 2016 target.

Italy intends to achieve its final energy saving targets, calculated in accordance with Article 7(1) of the Energy Efficiency Directive (EED), by means of three basic mechanisms, already implemented at national level:

- the WC obligation scheme
- tax deductions for improving the energy efficiency of existing buildings
- the thermal account to promote the uptake of renewable thermal energy sources and energy efficiency actions by the public sector.

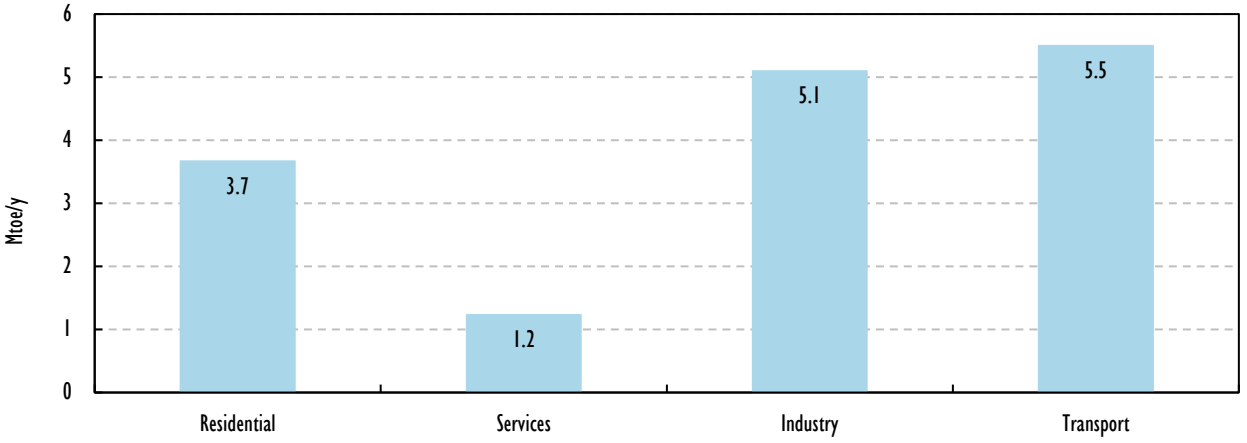
Taken as a whole, these measures are estimated to reach EUR 25 billion (including the amounts already committed) in public support by 2020. This could stimulate EUR 50 billion to EUR 60 billion of aggregate investment, with major spin-offs in an industrial sector where the aim is to achieve international leadership and savings of about EUR 8 billion per year in fuel imports by 2020.

Table 4.2 Final energy savings achieved in the period 2005-13 (GWh)

	Residential	Non-residential	Industry	Transport	Total
Law Decree	17 020	1 354	21 156	-	**39 530**
WCs	9 187	238	489	-	**9 914**
Fiscal deduction	25 658	790	1 900	-	**28 348**
Incentive for new cars & trucks and EU rule 443/2009	-	-	-	9 132	**9 132**
Other measures	1 080			1 040	**2 120**
Achieved energy savings at 2012	51 963	2 382	23 557	10 172	**88 074**
Expected savings at 2016	60 027	24 590	20 140	21 783	**126 540**
Achieved target (%)	0.066	0.097	1.17	0.467	**0.696**

Source: ENEA (2015), *Energy Efficiency Annual Report 2013-2014,* ENEA, Rome.

Figure 4.4 Expected savings by end-use sector



Sources: Government of Italy (2013), *National Energy Strategy*, Ministry of Economic Development; Government of Italy (2014), *National Energy Efficiency Action Plan*, Ministry of Economic Development.

ENERGY EFFICIENCY POLICIES BY SECTOR

INDUSTRY SECTOR AND COMMERCIAL SECTOR

White certificates

The tradable WC system, which began to operate in 2005, is one of the first market mechanisms for energy efficiency in Europe. It is a trading incentive scheme that requires electricity and natural gas distribution system operators (DSOs) with more than 50 000 customers ("obliged parties") to achieve yearly energy saving targets. They can do this either by implementing energy efficiency solutions themselves, or by buying certified savings from other (non-obliged) DSOs, energy service companies (ESCOs) and other entities that have an appointed energy manager or an ISO 50001-certified energy management system in place. Only savings achieved above the market average or above legislative requirements are taken into account (baseline) (IEA, 2014a). More specifically, savings are calculated by taking into account production volumes in industry and the use

of buildings, besides weather, building use, and other parameters that affect the energy consumption baseline. Furthermore, certificates are issued only for additional savings: savings are first evaluated as the difference between the *ex ante* and the *ex post* consumptions and then reduced if the *ex ante* level is below the baseline. The market baseline is defined with reference to the solutions available and sold in the market, not to the installed solutions. That is, additionality aims to account only the savings resulting from the availability of the WC scheme – excluding those that would have been obtained in any case because of technological improvement, mandatory standards, or market developments – thus theoretically ensuring that the incentive is both cost-effective and able to promote a real increase in energy efficiency.

The WC scheme has proved to be an effective means of expanding the market for energy efficiency and to achieve energy savings. The first phase of the programme, which ran from 2005 to 2012, cost EUR 172 million a year and led to energy savings of approximately 35 GWh per year. The cost of the programme was calculated to be EUR 0.005 for each kilowatt/hour (kWh) saved. The average price of a certificate was EUR 96.53 and over 23 million certificates were issued.

Decree 28/12/2012, which entered into force in January 2013, launched the 2013-16 phase of the WC scheme. This new phase introduces rewards for large industrial and infrastructure projects capable of generating savings of at least 35 000 GWh per year. ENEA estimates that phase two of the WC scheme will lead to energy efficiency investments valued at more than EUR 20 billion to 2016, at a cost of EUR 3 billion (ENEA, 2014).

Energy audits

Article 8 of Legislative Decree 102 of 4 July 2014 provides, in compliance with Article 8 of the EED, the requirement for large companies to perform an energy audit at sites located throughout the country by 5 December 2015 and every four years thereafter. In addition, Italy has extended this provision to enterprises with high consumption of energy, irrespective of their size. Companies that have adopted management systems according to ISO 50001 or EN ISO 14000 are exempted.

In order to increase the quality of services offered in the energy sector, it is expected that two years after the publication of the legislative decree, these audits will only be carried out by persons certified in accordance with UNI 11352, UNI 11339 or certified energy auditors in the industrial, tertiary and transport sectors.[3]

The law provides that, to test this obligation, ENEA establishes and maintains a computerised register of enterprises obliged to participate. It places controls to ensure compliance with the requirements of the audits by a random selection of an annual statistically significant percentage of all the energy audits performed. ENEA will control all the audits carried out by internal auditors.

In May 2015, the MSE launched a call for the selection and co-financing of programmes submitted by the Regions aimed at supporting energy audits and ISO 50001 certifications

3. The Italian National Unification Body (*Ente Nazionale Italiano di Unificazione*, UNI) is a private non-profit association that performs regulatory activities in Italy across industrial, commercial and service sectors, with the exception of electrical engineering and electronic competence of Italian Electrotechnical Committee (CEI). The UNI is recognised by the Italian State and by the European Union, and represents Italy at the International Standards Organization (ISO) and European Committee for Standardization (CEN).

in SMEs. For this purpose EUR 15 million each year has been allocated over the period 2015-20. A further EUR 15 million will be allocated by the Regions whose programmes have been selected. Funds will cover up to 50% of the cost of audits and certifications. The government expects 15 000 energy audits in SMEs annually that are expected to generate the same number of energy efficiency projects eligible under the WC scheme. To date, the Regions have provided positive feedback and data on actual outcomes and impacts will be available in 2017.

ESCO and qualification of energy manager experts

Article 12 of Legislative Decree 102 of 4 July 2014 concerns the availability at national level, of schemes for qualification, accreditation and certification of entities operating in the energy services sector.

For this purpose, Accredia has defined certification schemes and/or accreditation for compliance with technical standards regarding ESCOs, experts in energy management, energy management systems and energy audits.[4] These schemes are published by the Ministry of Economic Development and the Ministry for the Environment, Land and Sea.

In order to promote the widespread use of energy audits accessible to all end-users, it is also planned to update the technical rules on the execution of energy audits and for the voluntary certification of auditors in the residential, industrial, commercial and transport sectors.

In order to promote the improvement of quality and technical expertise in the energy services sector, it is provided that after 24 months from the entry into force of the legislative decree, participants in the WC mechanism will require certification according to the UNI CEI 11352 or UNI CEI 11339.

BUILDINGS SECTOR

Incentives

Energy efficiency tax rebate programme

The Energy Efficiency Tax Rebate Programme (55% tax reduction up to 2013, increased to 65% in 2014) provides credits to households for comprehensive or single retrofit energy efficiency measures (such as thermal insulation, installation of solar panels, and replacement of heating and air-conditioning systems or comprehensive refurbishments). Tax credits are applied over ten years, beginning with the completion of work. In order to apply for a tax credit, building owners must submit to ENEA an application that contains a description of the work performed, confirmation documents to prove payment, and performance certificates (online or via post) within 90 days of the work's completion.

It is an effective scheme for scaling up energy efficiency investments. Between 2007 and 2014, more than two million applications were approved, and about EUR 25 billion of investments were leveraged by households, at a cost of about EUR 14 billion in undiscounted foregone tax revenue (ENEA, 2015). In 2013 alone, more than 350 000 energy-efficient projects were implemented, which included

4. ACCREDIA is the Italian National Accreditation Body appointed by the State to perform accreditation activity.

2.5 million square metres (m^2) of window replacements and 1.3 million m^2 of rehabilitated solid surfaces. These measures led to primary energy savings of 1 585 GWh per year and 330 thousand tonnes of carbon dioxide ($ktCO_2$) per year avoided.

Of all the energy efficiency tax deduction measures, the most cost-effective was found to be comprehensive renovation (e.g. implementation of a package of several measures, including the building shell and the heating system).

In 2013, through Legislative Decree 90/2013, Italy increased the tax rebate from 55% to 65% for investments made between June 2013 and December 2014. The 65% tax rebate has been confirmed up to December 2015. According to the 2014 NEEAP, between 2014 and 2020, the tax rebate is expected to stimulate total private investment of about EUR 20 billion, resulting in about 0.9 Mtoe per year of final energy savings.

Table 4.3 Overview of key government-led energy efficiency investments, 2014

		Cost (EUR million)	Life (years)	Annual cost (EUR million per year)	Achieved saving (GWh per year)	Performance (EUR/kWh)
WCs		3 359	10	336	39 530	0.0085
55% tax deduction	**Overall renovation**	438	20	22	527	0.0415
	Insulation of opaque envelope and replacement of windows	6 457	20	323	3 894	0.0829
	Replacement of electric boilers with solar panels	866	20	43	599.3	0.0722
	Efficient heating systems	3 571	12	298	4 319	0.0689
	Multiple selection	769	20	38.45	574	0.067
		Average				0.068
Incentives for new cars and trucks		1.589	12	132.44	1.315	0.101

Source: ENEA (2015), *Energy Efficiency Annual Report 2013-2014*, ENEA, Rome.

Renewable energy for heating and cooling support scheme (thermal account)

Ministerial Decree of 28 December 2012 provides incentives of up to EUR 700 million per year for small-scale projects on production of thermal energy from renewables in the private sector. In addition, EUR 200 million has been allocated to the public sector, in particular for small-scale energy efficiency projects and for the production of thermal energy from renewables.

GSE is the body in charge of awarding incentives, implementing and managing the scheme. Public administrations are eligible to receive incentives for both energy efficiency and renewable energy projects, and private individuals are eligible only for renewables projects. Projects eligible include energy efficiency improvements in existing building

envelopes (thermal insulation of walls, roofs and floors, replacement of doors, windows and shutters, installation of solar screens); replacement of existing systems for winter heating with more efficient or renewable ones (condensing boilers or renewables such as biomass, solar thermal and heat pumps); and audits and energy certification associated with these projects.

Incentives paid in yearly instalments are intended to support part of investment costs (up to 40%) for a period ranging from two to five years, depending on the type of intervention realised. ESCOs are allowed to obtain incentives for these interventions operating through energy performance contracts.

Public administration

Renovation of central public administration buildings

Legislative Decree No. 102 of 4 July 2014, implementing Directive 2012/27 /EU, identifies requirements designed to ensure optimal co-ordination of interventions and measures for energy efficiency. The requirements aim at full implementation of the commitments made at EU level in terms of improving energy efficiency, reducing consumption of the national housing stock, and promoting compliance with the mandatory redevelopment of properties of the central public administration. In this regard, Article 5 of the decree provides incentives for the energy renovation of publicly owned property, for achieving the energy upgrading of at least 3% per year of useful air-conditioned indoor area or, alternatively, leading to energy savings accumulated in 2014-20 of at least 0.04 Mtoe.

It is provided that the MSE, in accordance with other administrations involved, draws up each year, as from 2014, a programme of measures to improve the energy performance of buildings of the central public administration. Up to EUR 350 million has been allocated for this purpose in the period between 2014 and 2020. A call for projects was already performed, which has led to the presentation of about 30 projects ready to be financed. A second call has just been issued and will expire on 15 July 2016.

Fund for energy efficiency in educational buildings (or Kyoto Fund)

The 2007 Finance Act (Article 1, paragraph 1110) established at the *Cassa Depositi e Prestiti* a revolving fund for the financing of measures to reduce GHG emissions, aimed at implementing the Kyoto Protocol. The total amount of the fund is about EUR 600 million, distributed in three cycles programming EUR 200 million each.

Article 9 of Legislative Decree 91/2014, converted into Law No. 116 of 11 August 2014, provides for urgent action for the energy efficiency of public buildings such as schools and universities as well as the High Level Music, Arts and Dance (AFAM) School. It allows the revolving fund, referred to in Article 1, paragraph 1110, of Law No. 296 of 27 December 2006 on the financing of measures to reduce GHG emissions. The provision is aimed at concentrating the remaining availability of the Kyoto Fund, amounting to about EUR 350 million, for interventions aimed at improving energy efficiency of school buildings and universities.

Access to finance is based on an energy audit before the intervention: the project must achieve a certain improvement in the energy efficiency of the building within in a maximum period of three years. The duration of the loans may not exceed 20 years, while

for energy efficiency measures which shall be limited to analysis, monitoring, audit, diagnosis, certification and design, the maximum duration of the loan is set at ten years.

Regulatory measures

The EU Energy Performance of Buildings Directive 2002/91/EC (EPBD) established minimum primary energy requirements for the shell of new buildings; promoted energy certification and the use of higher-performance installations; and introduced requirements for monitoring and for the integration of renewables. These elements are already present in Italian legislation, and have been made more effective by recent measures undertaken by government in order to transpose the updated EU legislation on energy performance of buildings (EU Directive 2012/31/UE). In particular, it is important to mention:

- Legislative Decree No. 192/2005 as modified by DL 63/2013, converted into law by Decree 90/2013, is the most important instrument for the definition of criteria and procedures for energy efficiency in buildings and near-zero energy buildings (NZEB). All prescriptions answer to a criterion of effectiveness in terms of cost.
- In accordance with Legislative Decree No. 192/2005, recently approved decrees include a decree to upgrade the methods for calculating the energy performance and to establish new minimum efficiency requirements for new buildings and those undergoing renovations; and a decree to update national guidelines for the energy certification and classification of buildings.
- A new regulation supplementing the current regulations on inspections of heating systems (Decree of the President of the Republic No. 74/2013).
- A further regulation defining the professional requirements and criteria for the accreditation of experts or agencies responsible for the energy certification of buildings with the purpose of improving the quality of service so as to guarantee the independence and impartiality of the work of certifiers (Decree of the President of the Republic No. 75/2013).
- All the above decrees and regulations on Energy Services and on renewables.

TRANSPORT SECTOR

Implementation of EU Regulation 443/2009/EC, which sets standards to frame the CO_2 emissions of new passenger cars, has led to a significant reduction in fuel consumption.[5] Furthermore, among EU member states Italy has one of the lowest vehicle average mass (the fifth-lowest) and engine power (second-lowest) value among those countries reporting engine power values (EEA, 2014).

On 15 June 2012 the Italian government enacted a legislative decree known as *Decreto Sviluppo* that, among others, includes provisions to promote the development of mobility through low-emission vehicles: Italy is already the EU country reporting the highest number of alternative fuel vehicles (AFVs), running mainly on liquefied petroleum gas (LPG) and natural gas vehicles. Within this context, regulations on incentives to purchase low-emission vehicles include: incentives for the purchase of

5. Regulation (EC) No 443/2009 of the European Parliament and of the Council of 23 April 2009 setting emission performance standards for new passenger cars as part of the Community's integrated approach to reduce CO_2 emissions from light-duty vehicles. The limit set by the regulation is 130 gCO_2/km. From 2020, this level is to be reduced to 95 gCO_2.

more environment-friendly two-, three- and four-wheel electric, hybrid, LPG, natural gas, biogas, biofuel and hydrogen. The regulations provide for substantial discounts for the purchase of AFVs.

Decreto Sviluppo also directed the Ministry of Infrastructures and Transport to produce a national plan for electric vehicle (EV) recharging infrastructure: annual plans that will guarantee a minimum level of service in the main cities; define standards and interoperability among energy utilities; and providers, and include incentives to install charging points at service stations. The plan provides a EUR 20 million budget for each year from 2013 to 2015 inclusive. All new (and restored) non-residential sites over 500 m^2 in size are also required to install EV charging points. All local laws must also be updated to make the installation of EV charging points a priority installation within public and private buildings. The Italian Regulatory Authority for Electricity, Gas and Water (AEEGSI) has developed special tariffs for EV charging.

Finally, the National Intelligent Transport System (ITS) Action Plan, adopted through Ministerial Decree of 12 February 2014, identifies national priorities until 2017. It analyses the state of the art of ITS deployment in Italy and identifies strategies and policies to be undertaken, for each of the priority areas included in the EU directive. It is currently under discussion between all stakeholders in order to identify measures and deploy the Action Plan.

OTHER CROSS-SECTOR POLICIES

Appliances

Requirements for energy labelling of household appliances are based on several directives adopted since 1992. The recast of the Energy Labelling Directive (2010/30/EU) expands the mandatory labelling requirement to cover commercial and industrial appliances and also energy-related appliances; product-specific labelling standards are set up under this directive. The recast Directive Establishing a Framework for Setting Ecodesign Requirements for Energy-related Products (Ecodesign, 2009/125/EC) aims to improve energy efficiency throughout a product's life cycle. It applies to products that use energy and to products that have an impact on energy use, such as building components. Product-specific standards are set by EU regulations based on the directive.

The Ecodesign Directive was adopted into the Italian legislation by means of Legislative Decree No. 15/2011. The aim of this decree is to increase the energy efficiency of electrical appliances while at the same time ensuring a high level of environmental protection. Monitoring functions are entrusted to the MSE (Article 17 lays down penalties).

Legislative Decree No 104 of 28 June 2012 transposed EU Directive 2010/30/EU on Labelling and standard product information related to the consumption of energy and other resources by energy-related products into Italian law. The aim of the regulation is to allow consumers to choose more efficient products: products must be labelled with detailed information on the energy consumption, the assigned energy class and a related fact sheet.

Energy performance contracting

An energy performance contract (EPC) is an arrangement in which a contracting partner (e.g. an ESCO) enters into an integrated contract with an end-user, together with a financing institution that provides a loan to design and implement energy efficiency

measures with a guaranteed level of performance. Repayment and profit is paid out of the resulting financial savings. EPC may allow the loan to remain on the balance sheet of the ESCO rather than on the building owner (a form of off-balance sheet financing).

The EPC model works well in specific market segments, such as services, industry and the public sector; it also works well for project sizes of more than USD 0.5 million given in part the transaction costs. EPCs have relatively high transaction costs and typically take several months to develop, involving complex contracts and funding from several sources. One way to overcome high transaction costs and mitigate risk is to aggregate contracts; a failure on one building, for example, may be balanced by better results on others (IEA, 2014a). The use of EPCs in Italy is expanding, largely in the public sector, and reached EUR 0.67 billion and up to 100 ESCOs by the end of 2013.

Energy managers

Law 308/82 established an obligation for all industrial enterprises with energy consumption over 10 000 toe per year to nominate an energy manager. Law 10 of 1991 extended the mandatory appointment of energy managers. The energy manager can be an employee of the company subject to the obligation or an external consultant. More precisely, with the objective of assuring that energy consumption is monitored and controlled and that energy efficiency measures are promoted and implemented, the law requires energy managers to:

- identify actions, interventions and procedures necessary to ensure the promotion of the rational use of energy
- ensure the preparation of energy balances also in accord with the economic parameters and the final energy uses
- prepare energy data to verify the measures implemented with the contribution of the state.

Covenant of Mayors

After the adoption in 2008 of the EU Climate and Energy Package, the European Commission launched the Covenant of Mayors (COM) to endorse and support the efforts deployed by local authorities in the implementation of sustainable energy policies.

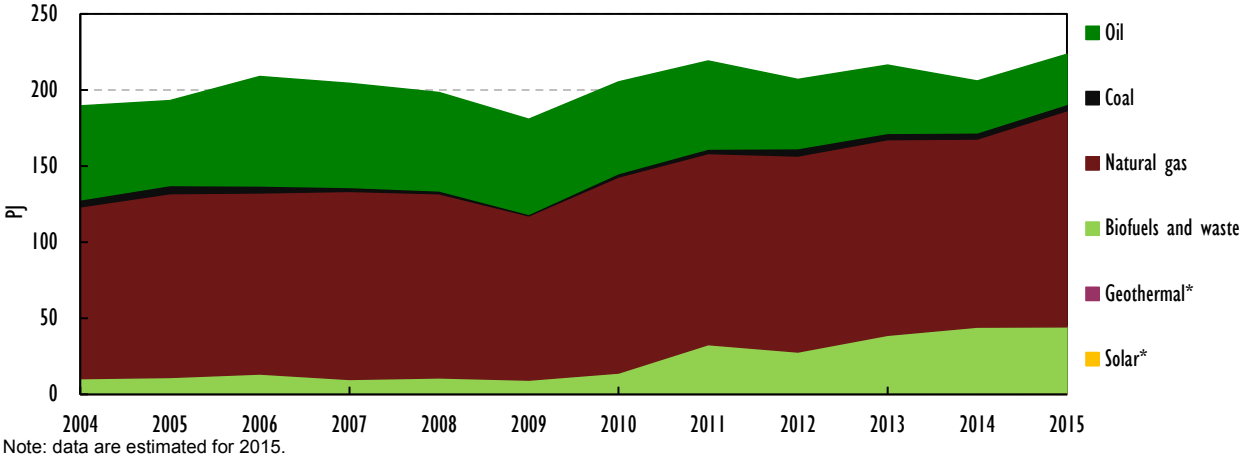
In June 2011, the Italian Covenant Platform was launched and promoted by the most important networks in Italy working on local climate policies and signatories of the COM. Since 2013, ENEA has been the Italian Territorial Co-ordinator of the Covenant.

DISTRICT HEATING

District heating is defined as heat produced at centralised heat production (such as combined heat and power plants, heat-only boilers, industrial waste heat) and transported via heat networks. Combined heat and power (CHP) generation (also known as co-generation) saves about 30% of the fuel compared with separate production of heat and power (IEA, 2004). District heating systems also provide opportunities to use local heat sources that would otherwise be wasted such as industrial waste heat, municipal waste or biomass. Such systems have emerged in many towns in the north of Italy over the past four decades although less than 10% of these systems use renewable energy sources (RES), which contributes 25% of the heat generated.

The development of district heating (DH) in the north of Italy commenced in the 1970s with the construction of networks in Modena (1971), Brescia (1972), Mantua (1972), Verona (1973) and Reggio Emilia (1979). In the 1980s and 1990s, other networks were developed, some of limited size and others part of specific residential developments. At present, 85% of the heating volume is concentrated in Lombardy (45%), Piedmont (27%) and Emilia Romagna (14%). In terms of cubic metre (m^3) per inhabitant the DH regions of Piedmont (16.7 m^3 per inhabitant), Trentino Alto Adige (16.5 m^3 per inhabitant), Lombardy and Valle d'Aosta (approximately 13 m^3 per inhabitant) and Emilia Romagna (approximately 13 m^3 per inhabitant) are most prominent. Between 2000 and 2011 the volumes connected increased at an average annual rate of 7.5%, from 110 million m^3 to 260 million m^3. The Italian Association of District Heating (AIRU) estimates that at the end of 2011 there were at least 200 DH networks in operation, roughly 90 of which were powered primarily or exclusively by biomass (excluding municipal waste). Approximately 5% of the population is served by DH networks. Most of these networks are small or medium-sized, with a connected volume of less than 5.0 million m^3. They use a variety of heat generation technologies, often combined. Biomass-fired networks are more numerous but generally smaller. In most cases, their economic sustainability is closely linked to the local availability of biomass. In the larger DH networks, natural gas co-generation is more common, followed by heat from the incineration of solid municipal waste. Alternative technologies complement one or both in Ferrara (geothermal) and Milan (heat pumps).

Figure 4.5 Heat generation by source (including DH), 2004-15

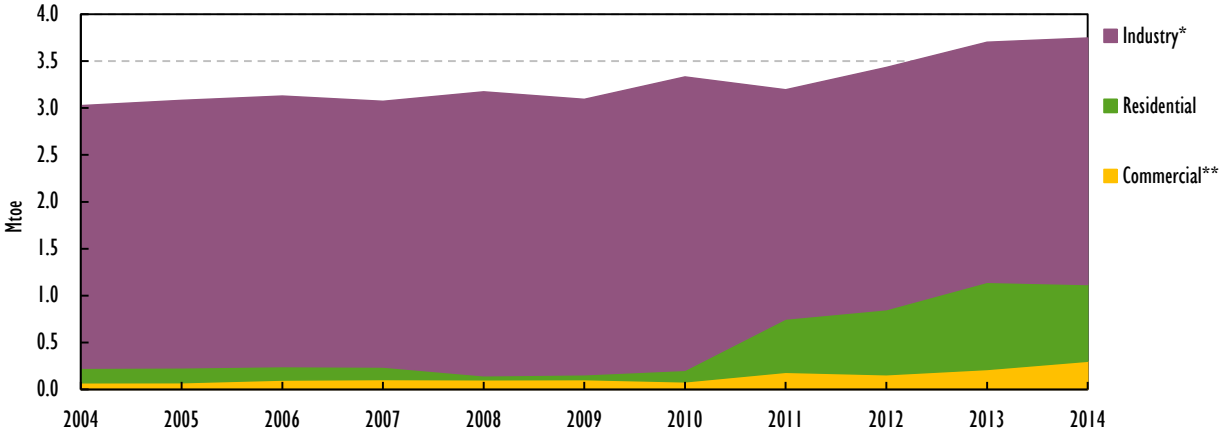


Note: data are estimated for 2015.
* Negligible. Source: IEA (2016), *Energy Balances of OECD Countries 2016*, www.iea.org/statistics/.

Approximately half of the heat produced in Italy comes from fossil fuel-fired co-generation plants (which account for only 30% of installed capacity). Energy from renewable sources and heat pumps, while representing only 10% of the available capacity, contributes with one-fifth of the heat generated. The remaining 25% of heat generated comes from integration, reserve and base boilers powered by fossil fuels (which constitute about 60% of installed capacity). Most of the operators are subsidiaries of the municipalities. Among the most significant are A2A S.p.A. and Iren S.p.A. (which both provide nearly half of the heating volume in Italy) and HERA S.p.A. The largest privately owned operators are EGEA S.p.A, SEI S.p.A (Kinexia group) and T.C.V.V.V. S.p.A. The industry is only moderately concentrated with the HHI value below 1 800 points.[6]

6. The Herfindahl–Hirschman Index (HHI) is calculated by squaring the market share of each firm competing in the market and

Figure 4.6 Heat consumption by sector, 2004-14



* *Industry* includes non-energy use.

** *Commercial* includes commercial and public services, agriculture, fishing and forestry.

Source: IEA (2016), *Energy Balances of OECD Countries 2016*, www.iea.org/statistics/.

DISTRICT HEATING TECHNOLOGY AND FUEL SOURCES

Most distribution systems and DH networks in Italy use indirect systems, in which the heat exchangers (equipment in which heat is transferred from the external network to the distribution system inside the building where the meters are installed) form the interface between the DH network and the internal network in the building to be heated. The indirect system, at the expense of higher upfront capital costs, allows the use of low-pressure components for the system user, simplifies maintenance and leak detection, making regulation and heat metering more efficient and simplifies the connection of buildings to the DH network.

The average cost of the heat distribution network, which must be recovered from the price of the service, depends both on the amount of heat supplied per linear metre of network and on the cost of pipeline infrastructure. Given the characteristics of the DH network (double insulated pipe to be laid in special trenches designed to contain thermal expansion), the per metre costs of construction and installation of DH systems are 1.5 to three times higher than those of natural gas networks of similar diameter.

THERMAL DENSITY AND NETWORK LOSSES

Network losses depend on technical factors related to the characteristics of the pipes used (such as insulation and friction), but more importantly on the distribution of the heat demand across the network, often called the heat density of the network. Heat density, together with the temperature difference between flow and return flow, is a key driver of distribution costs. In general, the cost of distribution, expressed in euros per unit of heat supplied to the user, decreases with increasing heat density of the network. Network losses in Italy are estimated to average 15%.

then summing the resulting numbers. Regulators generally consider markets in which the HHI is between 1 500 and 2 500 points to be moderately concentrated. Conversely, markets in which the HHI is in excess of 2 500 points are considered to be highly concentrated.

The measurement of the thermal density commonly used is the linear heat density of the network. This is defined as the amount of heat demanded per linear metre of the network and measured in MW of thermal capacity (MW_{th}) per metre per year: the higher the density, the more efficient the operation of the network.

Linear thermal density values around 2.5 MW_{th} per metre (MW_{th}/m) are regarded as economically feasible to operate a DH network in Italy. The large urban networks of Turin, Brescia and Milan are characterised by very high densities: 3.5 MW_{th}/m in Turin, 3.9 MW_{th}/m in Milan and 3.0 MW_{th}/m in Brescia (where the DH network is connected to lower heat density areas characterised by single-unit housing). Linear densities over 2.5 MW_{th}/m are also noted in mid-sized cities such as Mantua and Ferrara. Networks in smaller towns are on the other hand tend to be characterised by lower densities of between 1.5 MW_{th}/m and 2.0 MW_{th}/m. Networks in mountainous regions have very diverse values but are generally less than 2.0 MW_{th}/m. The economic feasibility of some of these networks is heavily dependent on capital grants and on incentives related to the renewable electricity produced).

THE COST OF HEAT

The fundamental factors underlying the cost of industrial heat are the cost of fuel needed to produce it and the efficiency of generation. Natural gas-fired boilers in networks surveyed in the *AIRU Yearbook 2001* had an average efficiency of 88.7%.[7] Biomass powered boilers had an average efficiency of 82.9%. Using the wholesale price of natural gas at the *punto di scambio virtuale* (PSV, virtual trading point on the natural gas network managed by Snam Rete Gas), AIRU estimated that the cost of an industrial MW_{th} provided to users and produced by a natural gas boiler had an average cost of about EUR 41.5/MW_{th} (or EUR 49.9/MW_{th} if losses of 15% are included). AIEL estimated that the average cost of the heat produced by industrial biomass boilers in 2011 was not less than (net of transportation costs and applicable taxes) about EUR 36.19/MW_{th} (EUR 51.74/MW_{th} if average network losses of 25% for this technology are included).[8]

Approximately half the heat supplied through DH networks in Italy is produced through co-generation, exploiting the heat produced by power generation that would otherwise be wasted. The production of heat causes a reduction in the efficiency of electricity production and thus the quantity of electricity produced adds to its cost. Moreover, the use of a co-generation plant in a DH network may result in a less than optimal electricity generation profile as the plant is run to meet times of high heat demand rather than in higher electricity prices. It is, therefore, sometimes more appropriate to attribute to co-generated heat a portion of the cost of fuel (and other costs) incurred by the DH network operator.

VERTICAL INTEGRATION IN DISTRICT HEATING

The DH network and the installation of heat generation are generally designed in an integrated manner by the same entity that will also manage sales of heat to users. The Italian system, therefore, tends to be vertically integrated, strengthened by the existence of exclusive concession agreements from the municipality. An exception to this rule is Mantua where the DH service sources heat from a number of entities other than the network operator.

7. Italian Urban Heating Association.

8. Italian Agro-forestry Energy Association.

A major DH network integration project is under way in the Turin area. This will create a network of a size comparable to that of Copenhagen, consisting of several interconnected networks, linked by a long and complex transport network, in which heat is supplied by plants operated by a number of different parties. Corporate unbundling already completed by the Iren group may encourage the creation, for the first time in Italy, of a wholesale market of heat that could evolve towards the Danish model, in order to better meet the heat needs of an interconnected system.

Box 4.1 DH and the EU EED

Article 14 of the European Energy Efficiency Directive (2012/27/EU) requires that member states perform an assessment of the potential for further deployment of co-generation and efficient district heating and cooling (DHC) systems by December 2015, as well as an analysis of policy strategies to be adopted by 2020 and 2030 to realise their potential. GSE published the Italian study in December 2015. This exercise required the development of national maps locating heating and cooling generation and demand points, as a basis for assessing cost-effective opportunities for these technologies to meet existing heating and cooling demands. This assessment includes:

- Heating and cooling sources, including electricity generation facilities with an annual generation over 20 gigawatt hours (GWh), waste incineration plants, and existing or planned DH systems and co-generation sites.
- Heating and cooling demand points, including industrial areas with an annual consumption over 20 GWh and municipalities with a minimum plot ratio of 0.3.*
- The directive also calls for the analysis of energy efficiency improvement potential in existing DHC systems and a cost-benefit analysis for new installations or substantial refurbishment projects, including:
- Thermal electricity plants or industrial facilities generating surplus heat (at a recoverable temperature level).
- New DHC systems or existing networks with a thermal input of more than 20 MW where a new generation facility is expected.

* Plot ratio is defined as the ratio of the building floor area to the land area in a given territory.

Source: IEA (2014b), *Linking Heat and Electricity Systems, Co-generation and District Heating and Cooling Solutions for a Clean Energy Future*, IEA/OECD, Paris.

REGULATIONS THAT PROMOTE CONNECTION TO DISTRICT HEATING NETWORKS

In Italy, public intervention in DH has historically evolved in two ways. On the one hand, environmental objectives and energy efficiency have encouraged the development of the sector, consistent with the development of EU policies. On the other hand, DH has always been subject to some form of regulation by municipalities, with the imposition of a series of obligations (such as prices) for the benefit of its users.

The development of DH systems in Italy was supported by the investment of private and public capital. Public investment came from the municipally owned companies that developed most of the networks and from the various environmental and energy saving incentives that support the networks.

State or regional legislation concerning energy efficiency in buildings has had an important impact on effective competition between heating systems, in so far as they effectively established a hierarchy between heating systems as a function of the efficiency target. Italian legislation relating to energy efficiency and the energy performance of buildings has given priority to DH systems compared to other heating systems (such as central or individual) using fossil fuels. This has placed the adoption of DH systems on the same level as production based on renewable sources for the purpose of increasing the energy efficiency of buildings.

National energy efficiency legislation requires that all new buildings separated by no more than one kilometre from a DH network be connected to that network. This requirement was reinforced by Legislative Decree 28/2011, which provides that the infrastructure for the networks distributing energy from renewable sources for heating and cooling be similar in all respects to the primary urbanisation infrastructure works. This means that the provision of such infrastructure will be required in new residential initiatives, as a requirement for granting a building permit.

Article 11 of Legislative Decree No. 28/2011 features (commencing in 2012 and for a share which will be gradually increased to 50% of the heating requirements of the building) a requirement for the integration of RES in the production of heat and cooling in new buildings and existing buildings undergoing major renovation. Breach of this obligation results in the denial of a building permit. This obligation does not apply if the building is connected to a DH network that covers the entire heat demand for space and water heating. In this way, the decree considers DH equivalent to the integration of RES in the thermal conditioning of buildings, even if the DH network is powered by a fossil fuel plant.

REGULATION OF DISTRICT HEATING

In the past, the development of DH in Italy took place within a context of *de facto* inclusion of this service among local public services (LPS), which led to the direct award of the service to municipal district heating companies, later transformed into joint stock companies. This inclusion did not occur, however, on the basis of a detailed classification of the service as an LPS; but rather from the fact that, since the distribution and sale of natural gas and the management of the network carried out by a municipal enterprise was considered an LPS, this qualification has therefore also been extended to DH.

In the past, therefore, relationships between the local authorities, the city and the DH service manager have been governed by conventions or service contracts with which the city awards the DH service exclusively within the municipal area, in exchange for a fee, for periods as long as 20 to 40 years. The risk is borne by the awardee, financed with the proceeds of the sale of the DH service. In no case has there been a competitive award of the DH service. These agreements have resulted in a more or less extensive DH regulation at the local level.

The instrument of the convention has been used less frequently in recent years, when municipalities have participated in the development of DH initiatives indirectly or directly. It has been achieved by using other legal instruments rather than that of a public concession. In mountain areas, it is not uncommon to find members of co-operatives or privately owned companies that manage DH networks, outside of concession schemes. Inside concessions, there are forms of regulation of both

connections (typically forecasts of non-discrimination and the obligation to connect, specifying the cases in which the user must pay the connection fees), and prices.

With regard to prices in gasified areas, the price of heat is calculated on the basis of avoided cost of heating with natural gas, including the costs of maintenance and management. This calculation is accompanied by an indexation mechanism that links the price to changes in the regulated gas price for domestic consumers. The price is sometimes the result of specific provisions of the conventions which provide for non-discrimination between DH users and users of natural gas for heating, or the indifference of users between the two heating systems. In the absence of conventions, the pricing of the service is explicitly left to the freedom of the operator. Managers of DH systems in mountain-area sometimes make explicit reference to the price of heating with oil as a benchmark to determine their own prices.

The agreements between the Italian utility company A2A and the municipalities of Milan and Sesto San Giovanni explicitly provide for non-discrimination between natural gas and DH users (Milan) or apply the equivalence criterion (Sesto) for the pricing of the two services. The agreements between the City of Alba (CN) and the private operator of the city's DH network (EGEA), including Metanalpi and the City of Sestriere, between TEA and the City of Mantua and between HERA and the municipality of Bologna contain a more detailed regulation on the determination of the price of the service, which is attached to natural gas in the case of Alba, Mantua and Bologna, and diesel in the case of Sestriere. The agreement between HERA and the Municipality of Ferrara explicitly states that the rates should allow the achievement of economic equilibrium, including recovery of investment and adequate profitability. The formulas for determining the price can be monomial (unit price per unit of heat consumed) or binomial (composed in part of committed power and in part of heat consumption).

As for connections, the conventions always provide obligations of non-discrimination in access, sometimes weighted by the allocation of costs of non-standard connections between the user and the DH operator. In general, the connection fee covers all costs of connection if the user is within a given distance from the primary distribution network. Beyond that distance, there is a cost increase in proportion to the distance.

The Italian Urban Heating Association (AIRU) has developed a Code of Business Conduct of District Heating (the code) that may be voluntarily adopted by member companies. The code is viewed as an instrument of protection for customers who decide to enter into a contract for the supply of heat and any related services with a DH network. The code, which was first published in 2012 and updated twice since, defines the following:

- general rules of transparency and fairness, prices and behaviour of sales staff
- information and documents regarding the conclusion of the contract
- the essential terms of the contract
- quality charter or services
- rights to reconsider
- changes to the contract proposed by the company.

The transposition of the EED (Legislative Decree 102/14), in light of the results of antitrust enquiry, has enshrined the political understanding of "light regulation" of the DH sector. By July 2016, the Regulatory Authority for Electricity, Gas and Water (AEEGSI),

in addition to exercising its powers of control, inspection and sanction, in order to promote development and competition and based on guidelines of the MSE, will determine:

- standards of continuity, quality and safety
- criteria for the determination of tariffs for connection of utilities and the procedures for the exercise of the right to disconnect
- the publication of prices for the supply of heat, connection and disconnection, auxiliary equipment, for the purpose of cost-benefit analysis on the spread of DH
- terms of reference for the connection to the DH networks and district cooling, in order to facilitate the integration of new generation units and heat recovery of useful heat available locally
- tariffs for heat where there is an obligation to connect to the DH network, imposed by municipalities or regions.

The new rules will apply gradually also to the networks already in operation, while preserving existing investments and competition in the sector.

PRICES AND SUBSIDIES

Over time, AGCM (the Italian Competition Authority) received numerous complaints related to the DH sector, regarding both the price level (freely set by the various operators) and the constraints relating to the choice of whether or not to connect to the district heating network and of how the service is assigned. Following these complaints, in December 2011, the Authority opened a formal enquiry into the sector and auditioned numerous stakeholders. The enquiry was closed in 2014. It emerged that the average price of DH in a sample survey was found to be equal to about EUR 97/MW_{th}, inclusive of value-added tax (VAT) and net of discounts to customers; which appears to be lower than the recorded average in Denmark (EUR 117/MW_{th}), but higher than the prices in Finland and Sweden (respectively EUR 67/MW_{th} and EUR 80/MW_{th} approximately). In all the countries surveyed, however, the DH is clearly the least expensive heating system, a conclusion that does not seem to be applicable to Italy, perhaps because of the prevalence of natural gas in the fuel mix, compared to the widespread use of waste-to-heat in other countries.

The profit margins (both on the sales of electricity and heat, and on heat management only) appear on average less than 20% and therefore not overly excessive. This seems to indicate that at least part of the difference in price between DH and natural gas heating could be explained by the need to cover the higher costs that characterise DH networks. The analysis of heat suppliers' margins also demonstrates how the profitability of minor DH networks, but also of a large network such as in Turin, is strongly influenced by the existence of incentives for co-generated electricity. These incentives are in fact essential to ensure the profitability of different DH networks in mountain areas.

A preliminary analysis of the rates of return on invested capital confirms the importance of incentives: without them, only three networks in the sample have a return of more than 8%, which is defined by the energy regulator (AEEGSI) as the weighted average cost of capital (WACC) for operators of gas distribution networks. When including these incentives, six networks out of 21 produce a yield of more than 8%. These results suggest that the prices of DH, however high, do not indicate a situation of systematic over-

exploitation of *ex post* market power by the DH operators. This appears to be the result of local regulation (which imposes constraints on pricing policies), and the effect of competition between heating systems (notably in mountain areas).

ASSESSMENT

ENERGY EFFICIENCY

Over the period since 2008, Italy has continued to make progress in implementing energy efficiency polices. Most notably, the National Energy Strategy published in 2013 has made energy efficiency a national priority and the country aims to exceed the environmental and decarbonisation targets established by the European Union's 2020 Climate and Energy Package. ENEA has been designated as the national energy efficiency monitoring agency and has undertaken, and published, a number of comprehensive evaluations of the cost-effectiveness of energy efficiency policies. This includes an analysis of the effectiveness of the incentive schemes implemented. Italy has also developed and implemented an energy efficiency action plan in line with the requirements of the relevant EU Directive 2012/27/EU and has updated this plan a number of times.

Final energy consumption by sector remains broadly in line with other industrialised economies, and the transport sector is the largest user of energy (about 30%) followed by industry and households. What marks Italy as different from some of its economic competitors is the nature of its primary energy sources, the importance of natural gas and the low share of coal in electricity supply, alongside some of the highest energy costs in IEA Europe. The Strategy places energy efficiency among its top priorities, sets out relatively robust objectives and identifies specific support measures alongside mechanisms to overcome barriers to the adoption of energy efficiency technologies. The government attempts to clearly define the tools that will allow the acceleration of efficiency improvements such as WCs, minimum standards, certification methods and the role of public administration. The energy efficiency measures contained in the Strategy, if implemented, should allow Italy to outperform its EU energy efficiency targets (20%) and deliver a reduction in primary energy consumption from 209 Mtoe to 158 Mtoe, a saving of 24% by 2020. It is difficult to attribute the reduction of primary energy consumption as several factors, such as the economic crisis and fast growing PV production, have to be taken into account.

Italy uses a variety of regulatory measures and economic instruments to promote energy efficiency, including tax incentives and an innovated trading mechanism, the WCs scheme. These measures are not cumulative and have contributed to energy savings above the intermediate target set by the NEEAP. The different schemes aim at a wide range of policy goals such as lower GHG emissions, reduced energy import dependence and the development of a market for energy efficiency products and services. Both the WCs and the 55% tax incentive have fostered the development of sound methodologies for monitoring and certifying energy savings, but also the production and diffusion of a wealth of data and information, with benefits (avoided energy costs) surpassing the costs borne by consumers.

The WC scheme is based on energy saving obligations imposed on electricity and gas distributors to achieve annual targets of primary energy savings. The trading element is a central part of the system as it allows savings to occur where they are economically most effective. Furthermore, the scheme is governed by a strong additionality criterion: only savings achieved above the market average or above legislative requirements are taken

into account (baseline). The definition of that baseline is crucial to the value and attractiveness of the different energy savings. In addition, the scheme has supported the emergence of a thriving ESCO sector notably in the industrial regions of the north.

While Italy has invested much capital in renewable energies, the energy efficiency sector has not received the same level of support. Few incentives went into the buildings sector, where economic value could be generated and where "non-action" has a long-term impact as the buildings built today will stay for many years. Large subsidies (up to 65% fiscal benefits) are foreseen for the refurbishment of buildings and the replacement of household appliances. These provide fixed target levels of energy efficiency. The challenge for government is to provide sufficient fiscal support to build and maintain a robust energy efficiency industry that can gradually sustain itself. This will allow the phasing out of direct government spending towards a viable self-sustaining market while continuing to improve energy efficiency outcomes.

The effectiveness of the current incentive mechanisms would also benefit from more complete and consistent implementation of the certification of buildings' energy performance, which is currently uneven across regions. Nonetheless, the sector could be further boosted if a mechanism to help SMEs finance the high upfront costs of energy efficiency investments could be developed. Additional financing mechanisms should also be put together to support advice for trained independent energy efficiency counsellors to SMEs and proposals for energy- and cost-saving measures. There are a number of such mechanisms in other markets, most notably in Germany.

Household energy consumption per dwelling in Italy is among the lowest in Europe and has continued to decrease (EEA, 2015). Improved efficiency in electricity use has been the result of greater application of energy performance certification of buildings across the country and lower household energy consumption for heating and cooling. National and regional governments are jointly responsible for technical standards and building regulations relating to energy. As a consequence, there are two levels of standards and regulations: a national level that establishes the national minimum energy performance requirements and a regional or local level that may be more stringent. The Ministry of Economic Development alongside the Ministry for the Environment and local governments are responsible for monitoring implementation and reporting to Parliament. Some Regions have defined a clear reference system for the registration of the energy performance certificates while others have yet to implement it: by the end of 2012, 11 Regions and autonomous Provinces out of 20 had enacted local transposition of the EU Energy Performance of Buildings Directive (EPBD). The northern Regions account for 92% of the total of EPCs issued, while Lombardy accounts for more than half the total. A single national monitoring system could help harmonise and reinforce implementation of the standards, with a view to achieving further energy savings and being fully compliant with the EPBD.

Few government initiatives, beyond EU requirements, are being planned or implemented to expand the energy efficiency market in the transport sector. The sector in Italy accounts for 32% of TFC and demands increased attention from policy makers given the large dependence on imported oil supplies. While Italy has had some policy successes, such as fiscal support for the large fleet of alternative fuel vehicles and plans to expand the fleet of gas-fuelled vehicles, greater effort is required. Potential policies to enhance the transport efficiency market are diverse, and could include road tolls and congestion charging, scaled-up investments in public infrastructure and tax incentives to encourage the purchase of more efficient vehicles and technologies. Development of an

integrated transport strategy should be a priority and its implementation should be consistent with the Strategy (see Chapter 3).

The Italian energy efficiency market will grow as the government puts in place the energy efficiency activities set out in the Strategy alongside a range of enabling measures. The government has committed to include a number of enabling measures enhancing the ESCO model by introducing classification criteria; developing and disseminating innovative contract models for financing via third parties; and setting up dedicated guarantee funds or special revolving funds for larger projects, with possible participation of public financial institutions. The government also plans to step up inspection procedures and introduce heavier penalties to ensure compliance with the regulatory provisions and standards. Improving energy efficiency awareness has been identified as an important area for action, and the government is launching an extensive communication campaign in close collaboration with regional governments and business associations. Finally, promoting energy audits for the service and industrial sectors (particularly for SMEs) and introducing energy efficiency training courses to strengthen the collaboration between the national agency ENEA and companies will likely go a long way towards expanding the energy efficiency market in Italy in the years to come (OECD, 2013).

DISTRICT HEATING

DH networks supply heat for low- and medium-temperature applications, such as space and water heating in residential and commercial buildings. Efficient DH (and cooling) networks provide clear environmental benefits as a result of their enhanced conversion of energy and use of waste heat and renewable energies. Parts of Italy have developed such systems and provide heating to a small proportion of the population.

The regulatory model that has emerged to date is the result of the history of the technology and its development, in other words of local arrangements with the industry or voluntary codes of practice developed by the industry. Unlike the other utilities such as electricity, natural gas and water, there is currently no place for DH in the Strategy nor is there a single national regulatory regime overseen by the regulatory authority AEEGSI. The present market structure and legal frameworks have limitations that prevent the networks from meeting the increasing flexibility needs of complex and highly integrated energy systems such as the interaction between DH systems and the natural gas and electricity systems.

A national energy policy that integrates district heating alongside market regulations can help the development and sustainability of co-generation technologies and efficient DH networks. Market conditions should ensure transparent and fair fuel prices and reflect the real cost of electricity and heat generation to promote the efficient use of energy. For example, cross-subsidies between heat and electricity markets should be avoided since they can result in artificially imbalanced energy prices. By promoting the most efficient use of low-carbon and renewables, energy policies can also help to provide a twofold contribution: meeting climate targets by using renewable sources, while achieving higher levels of energy efficiency in the conversion process to final energy. Such a national DH policy is starting to emerge as a result of the CompetitionAauthority's enquiry and the mandate to AEEGSI to set a "light" regulatory framework.

The European EED required every EU member state, including Italy, to complete an assessment of the potential for further deployment of co-generation and efficient DHC systems by December 2015, as well as an analysis of policy strategies to be adopted by

2020 and 2030 to realise their potential. This assessment has been completed by Italy and its outcome can be utilised to form the cornerstone of a national policy for DH and an opportunity to reform the regulatory regime. The result of the analysis indicates that over an extra 1% of total final energy consumption in Italy could be supplied though these means. DH systems can also play a role in an integrated energy system by providing means to balance a greater share of variable renewable energy sources. National energy policy should promote the most efficient use of low-carbon and RES through effective co-ordination and complementarity of energy efficiency and renewable energy policies.

RECOMMENDATIONS

The government of Italy should:

Energy efficiency

- *Define and monitor sector- and instrument-specific targets of primary energy savings (e.g. lower GHG emissions, reduced energy import dependence, development of a market for energy efficiency products and services, financing mechanisms, reinforcement of the transmission grids and interconnections, electricity tariffs, etc.).*
- *Develop, in co-operation with the banking sector and consistent with the National Energy Efficiency Fund, new programmes for financing long-term investment and to stimulate the mobilisation of private resources in economic efficiency measures and establish an effective guarantee fund.*
- *Develop an integrated transport strategy as a priority and ensure that its implementation remains consistent with the National Energy Strategy.*
- *Strengthen the energy efficiency measures for new and existing public and private buildings, given the significant untapped potential in this sector.*
- *Harmonise and rationalise existing incentive schemes (and new ones) and direct resources towards the most cost-effective energy efficiency projects and technologies.*

District heating

- *Develop a comprehensive national policy for the DH sector which includes clear objectives and responsibilities alongside policy integration and co-ordination in the areas of DH, renewable energy, natural gas and energy efficiency.*
- *Ensure that municipal planning takes into account the assessment of the DH sector (as required by the Energy Efficiency Directive) and that it includes comprehensive mapping of the distribution and condition of DH plants and pipelines, including assessment of the availability of local renewables.*
- *Change over time to a national regulatory system for DH based on existing municipal models and integrating elements to existing codes of practice.*

References

EEA (European Environment Agency) (2015), *Progress on Energy Efficiency in Europe*, Copenhagen www.eea.europa.eu/data-and-maps/indicators/progress-on-energy-efficiency-in-europe-2/assessment (accessed 1 April 2015).

EEA (2014), *Monitoring CO_2 emissions from passenger cars and vans in 2013*, Copenhagen.

ENEA (2015), *Rapporto Annuale Efficienza Energetica 2013-2014*, Italian National Agency for New Technologies, Energy and Sustainable Economic Development, Rome www.enea.it/en/publications/enea-english-edition.

ENEA (2014), *Rapporto Annuale Efficienza Energetica - RAEE 2012*, Italian National Agency for New Technologies, Energy and Sustainable Economic Development, Rome www.enea.it/en/publications/enea-english-edition.

IEA (International Energy Agency) (2016), *Energy Balance of OECD Countries 2016*, www.iea.org/statistics/, OECD/IEA, Paris.

IEA (2014a), *Energy Efficiency Market Report 2014*, OECD/IEA, Paris.

IEA (2014b), *Linking Heat and Electricity Systems, Co-generation and District Heating and Cooling Solutions for a Clean Energy Future*, IEA/OECD, Paris.

IEA (2004), *Coming in from the Cold: Improving District Heating Policy in Transition Economies*, IEA/OECD, Paris.

MSE (2014), *Italian Energy Efficiency Action Plan*, Ministry of Economic Development.

OECD (2013), *OECD Environmental Performance Reviews: Italy 2013*, OECD Publishing, Paris.

PART II
SECTOR ANALYSIS

5. RENEWABLE ENERGY

Key data (2015 estimated)

Share of renewable energy: 18.2% of TPES and 40.2% of electricity generation (IEA average: 10% of TPES and 23.5% of electricity generation)

Biofuels and waste: 9.7% of TPES and 7.8% of electricity generation

Geothermal: 3.6% of TPES and 2.2% of electricity generation

Hydro: 2.5% of TPES and 15.6% of electricity generation

Solar: 1.6% of TPES and 9.3% of electricity generation

Wind: 0.8% of TPES and 5.2% of electricity generation

OVERVIEW

Renewable energy sources (RES) have been deployed rapidly in recent years; outpacing government targets in particular in the case of solar photovoltaics (PV). As a result, the total share of renewable energy has more than doubled from 7.9% in total primary energy supply (TPES) in 2005 to 18.2% in 2015. The use of RES has grown in all the sectors (heating and cooling, electricity and transport).

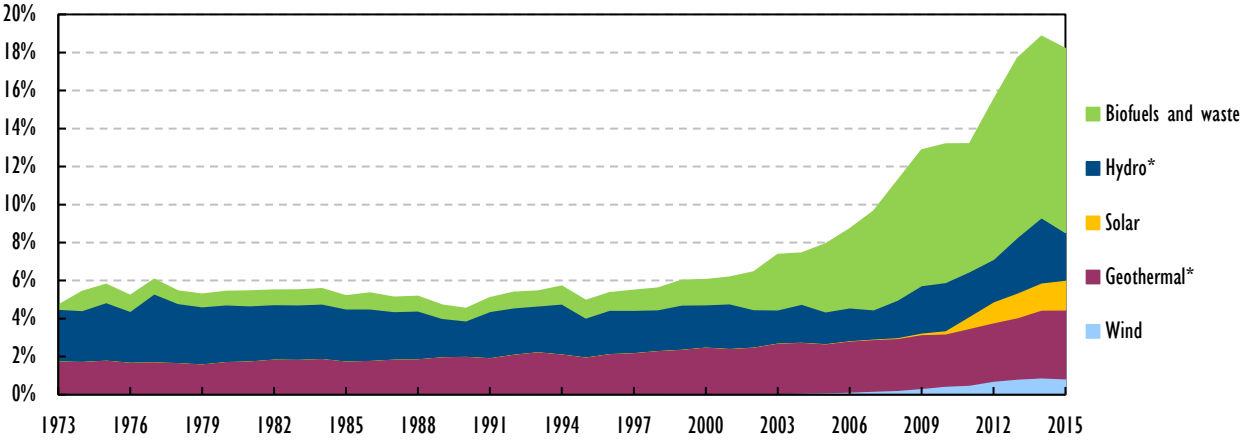
RES were supported with a range of different schemes over recent years. These have shown varying degrees of effectiveness in terms of stimulating deployment while containing costs. As a result, a comprehensive review of support schemes was implemented in early 2013. The overall framework has now been harmonised across electricity, heating and cooling, as well as transport. However, as a consequence of the large cost legacy of past deployment, support for RES has been capped and it remains unclear how deployment momentum can be sustained.

SUPPLY AND DEMAND

Italy's 18.2% share of renewables in TPES is made up of biofuels and waste (9.7%), geothermal (3.6%), hydro (2.5%), solar (1.6%) and wind (0.8%).

Renewable energy as a share of TPES has increased from 7.9% in 2005 thanks to significant developments in solar, wind, and biofuels and waste (Figure 5.1). Solar power has increased on average by 63.7% per year from 2005 to 2015, while wind power grew by 21.6% per year in average. Both have increased their share of TPES from negligible levels in 2005. Biofuels and waste were up by 11.1% per year over the same period, overtaking geothermal as the largest source of renewable energy in Italy since 2003. Geothermal energy grew by 1.1% per year in average in the last decade, increasing its share of TPES from 2.6% in 2005 to 3.6% in 2015. Hydropower as a share of TPES has varied around 1.5-3% with a 3.4% peak in 2014 (largest share since 1977) and down to 2.5% in 2015.

Figure 5.1 Renewable energy as a percentage of TPES, 1973-2015



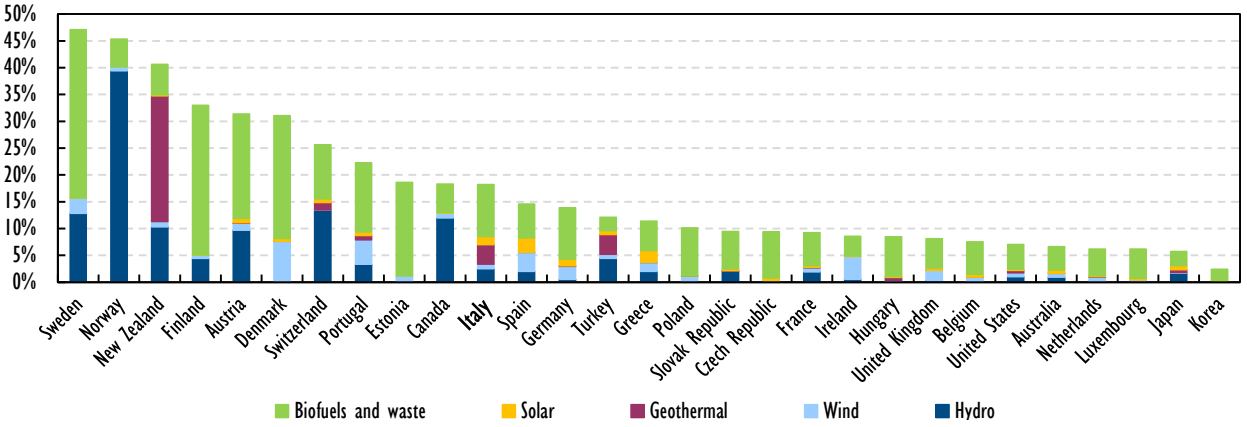
Note: data are estimated for 2015.

Source: IEA (2016), *Energy Balances of OECD Countries 2016*, www.iea.org/statistics/.

Electricity from renewable sources amounted to 112.8 terawatt hours (TWh) in 2015, or 40.2% of total generation. Renewables in electricity generation are made up of hydro (15.6%), solar (9.3%), wind (5.2%), biofuels and waste (7.8%) and geothermal (2.2%).

The share of renewables in generation has increased from 17.2% in 2005, primarily thanks to developments in solar and wind power, and biofuels and waste. The share of solar, wind, and biofuels and waste has increased from 0.4%, 0.8%, and 2.1%, respectively. The shares of hydro and geothermal have increased more moderately from 12.2% and 1.8% respectively. Italy is ranked eleventh-highest among IEA member countries with regard to the share of renewables in TPES and tenth-highest for electricity generation (Figures 5.2 and 5.3). Italy's share of solar power in TPES is third-highest among IEA countries, behind Spain and Greece. Its share of solar in electricity, however, is the highest. Geothermal share in TPES and generation is the third-highest, behind New Zealand and Turkey.

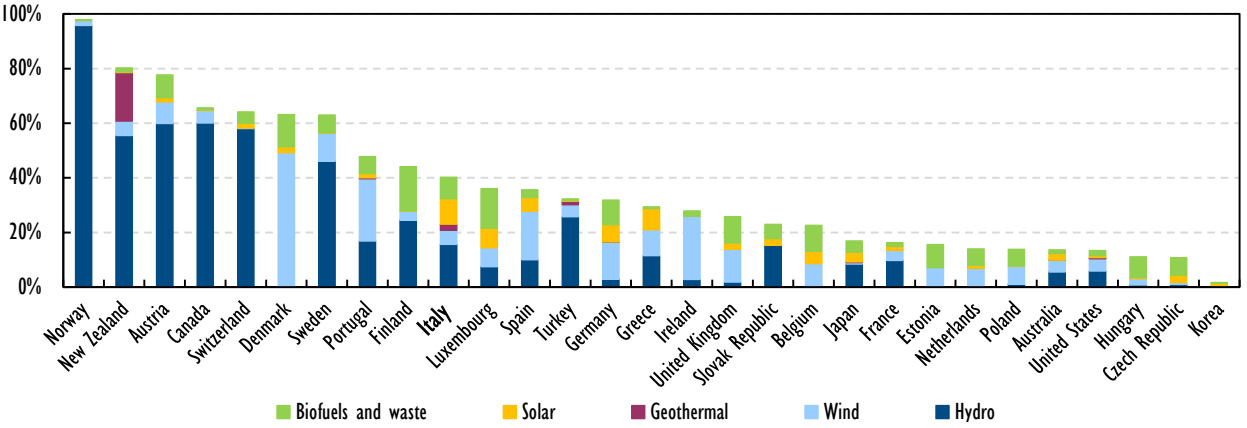
Figure 5.2 Renewable energy as a percentage of TPES in Italy and IEA member countries, 2015



Note: data are estimated.

Source: IEA (2016), *Energy Balances of OECD Countries 2016*, www.iea.org/statistics/.

Figure 5.3 Electricity generation from renewable sources as a percentage of all generation in Italy and IEA member countries, 2015



Note: data are estimated.

Source: IEA (2016), *Energy Balances of OECD Countries 2016*, OECD/IEA, Paris.

POLICY AND INSTITUTIONAL FRAMEWORK

INSTITUTIONS

The main responsibility for general energy policy lies with the **Ministry of Economic Development** (**MSE**) while the **Ministry for the Environment, Land and Sea** (**MATTM**) is responsible for co-ordinating climate change policies. Furthermore, the latter body, in co-ordination with the MSE, is responsible for the promotion and the development of renewable energy and for energy efficiency. The **Ministry of Agricultural, Food and Forestry Policies** (**MIPAAF**) deals with the development and co-ordination of policy guidelines in the fields of agriculture and forestry at the national, European and international levels. Therefore, it plays a significant role in the bioenergy sector. **The Regulatory Authority for Electricity, Gas and Water** (**AEEGSI**) has a number of responsibilities regarding renewable energy, such as ensuring fair grid access conditions or allocating support to face renewable energy costs to different consumer groups.

Gestore Servizi Energetici (**GSE**) promotes the development of RES and energy efficiency, manages payments of economic incentives, forecasts and aggregates the production of renewable energy power plants. This also includes the sale of renewable power on the electricity market and supporting policy makers with analysis. GSE is organised as a private company with a sole shareholder, the **Ministry of the Economy and Finance** (**MEF**, *Ministero dell'Economia e delle Finanze*), which exercises its shareholder rights together with the MSE that is responsible for operational guidelines.

The National Agency for New Technologies, Energy and Sustainable Economic Development (**ENEA**) is a public body supervised by the Ministry of Economic Development in co-operation with other ministries. Its purposes are research activity, technological innovation and the provision of advanced services in the energy and sustainable economic development sector. The Agency's main research issues are energy efficiency, renewable energy, nuclear energy, climate and the environment, safety and health, new technologies.

Terna is responsible for high-voltage electricity transmission and dispatching throughout the national territory. As GSE, Terna was established as a result of the liberalisation of the electricity market in 1999.

The responsibility for energy policy is shared between government and the Regions. Legislative Decree No 112/1998 made the Regions responsible for the administrative duties relating to energy, including renewable sources, electricity, oil and gas, which were not reserved for the state or assigned to local authorities. Under Constitutional Law No 3/2001, the state has legislative power within the renewable energy sector, while the Regions have administrative power.

OVERVIEW OF RENEWABLE ENERGY POLICY

Directive 2009/28/EC established a common framework for the use of energy from renewable sources in order to limit greenhouse gas GHG emissions and to promote cleaner transport. To this end, national action plans must be defined, as are procedures for the use of biofuels alongside a renewable energy forecast in advance of the action plan.

According to Directive 2009/28/EC, 17% of Italy's final energy consumption must be supplied by renewable sources by 2020.[1] In June 2010, in compliance with the directive, Italy submitted its National Renewable Energy Action Plan (NREAP) to the European Commission. The plan identified sectoral targets and measures for achieving them.

In 2013, Italy approved the National Energy Strategy (NES, hereafter the Strategy). The document identifies the main objectives that the Italian energy sector aims to achieve by 2020. A major role is reserved for energy efficiency but renewable energies (RE) also have a prominent role, notably for heating and cooling. The Strategy raises the 2020 target for renewable energy in final energy consumption from 17% (EU target) to 19% or 20%. The target of 10% for renewable energy in transport has been confirmed by the Strategy.

ELECTRICITY FROM RENEWABLE SOURCES

Between 2009 and 2012, the growth of RES in the electricity sector has been supported by three different support mechanisms: a feed-in tariff and a premium scheme (*conto energia*) for solar photovoltaic (PV) installations, a green certificate scheme for all RES other than PV, and a feed-in tariff scheme for all RES other than PV and with a capacity up to 1.0 megawatt (MW), 200 kilowatts (kW) for wind.

In 2013, support schemes were changed in two ways. First, a new support scheme (*conto termico*) was introduced in the heat sector, with a price-based mechanism: costs are recovered via a levy on gas. Secondly, the green certificates scheme was replaced by a sliding feed-in premium/feed-in-tariff scheme with different access procedures depending on the size of the installation. Large-scale plants are awarded contracts under an auction process. In addition to the premium system, tax credits induce deployment in heat and electricity.

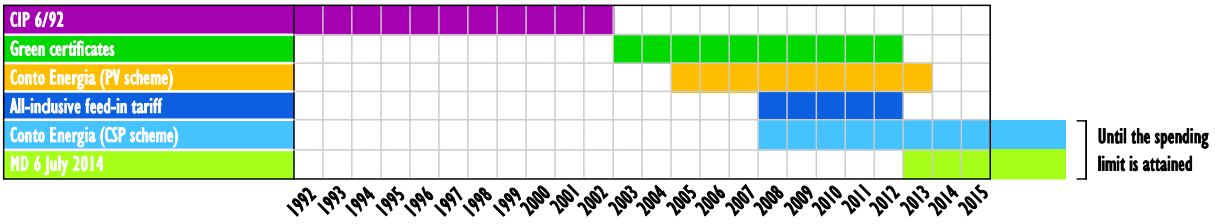
The cost of RES support in the electricity system is recovered via a surcharge on consumer bills (the A3 charge). The committed level of funds for the A3 surcharge are capped at EUR 12.5 billion per year, split further into EUR 6.7 billion for PV and

1. Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the Promotion of the Use of Energy from Renewable Sources, and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC.

EUR 5.8 billion for other non-PV technologies. The maximum cost of EUR 5.8 billion for other technologies is likely to be reached in 2015.

The policy framework for electricity from RES has evolved significantly over the period since the last in-depth review. Different types of performance-based incentives, i.e. support paid per unit of electricity produced from renewable sources (RES-E), including green certificates or feed-in tariffs, have been in place in Italy over the past years (Figure 5.4).

Figure 5.4 Overview of RES-E support systems, 1992-2015



Notes: The periods shown in the figure refer to the possibility to access the mechanisms. They do not refer to the duration of the incentive.

CIP 6/92: a precursor to Green Certifiicates; CSP: Concentrated solar power; MD; Ministerial Decree.

Sources: GSE (2014), "Italian experience in deploying renewable energy", presentation at the Res4Med workshop, 16 September 2014, Rabat.

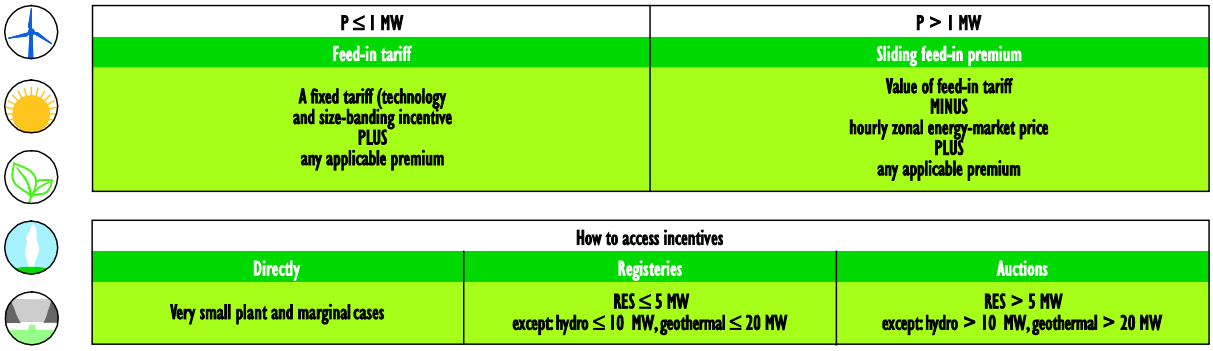
The schemes have led to substantial deployment, notably for solar PV, where deployment has far exceeded initial government targets. This has translated into significant support costs.

Most of these schemes expired during 2014. Those remaining in force are a feed-in tariff and feed-in premium system for other than solar energy (Ministerial Decree of 6 July 2012) and a support scheme for solar thermal electricity. Support payments under these schemes are only granted up to the point where the annual spending caps of EUR 5.8 billion per year is reached. This figure includes the indicative annual cost of existing installations receiving support under schemes that have been closed to new plants. By 31 July 2015, EUR 5.73 million had been committed (GSE, 2015), thus limited resources remain for new initiatives (GSE, 2015). In 2015, access to RES incentives is restricted to small plants (below 50-100 kW, technology-dependent) and to initiatives that, although not yet in operation, had previously obtained the right to apply for incentives (registries and auction, see below). Finally, it should be noted that, from a mid-term perspective, a number of old plants (chiefly hydro and wind) are approaching the end of their induced term, and will therefore contribute to a reduction in costs.

Ministerial Decree of 6 July 2012

This decree introduced a support mechanism to replace all other types of support for non-solar RES-E. For each technology, there is a feed-in tariff for small installations and a sliding-scale feed-in premium system for larger installations. Moreover, there are different rules for accessing the incentives. Small-scale generators can access the incentives directly, medium-sized plants need to be registered before incentives are granted, and large-scale plants compete for incentives in an auction process (Figure 5.5). For plants that need to be registered, there is an annual capacity quota to access the system.

Figure 5.5 Overview of the RES-E support system following the introduction of Ministerial Decree of 6 July 2012



Source: GSE (2014), "Italian experience in deploying renewable energy", presentation at the Res4Med workshop, 16 September 2014, Rabat.

Support levels are determined administratively for small and medium-sized installations. For auctions, the base tariff forms an upper limit for support, and auction participants can offer tariff reductions in the range between 2% and 30%. Base remuneration levels are indicated in Table 5.1.

Table 5.1 Support levels under Ministerial Decree of 6 July 2012

Source	Typology	Power	Conventional useful life-time of plants	Base tariff
		kW	years	EUR/MWh
Wind	Onshore	1<P≤20	20	291
		20<P≤200	20	268
		200<P≤1000	20	149
		1 000<P≤5 000	20	135
		P>5 000	20	127
	Offshore*	1<P≤5 000	25	176
		P>5 000	25	165
Hydraulics	Flowing water (including plants in aqueduct)	1<P≤20	20	257
		20<P≤500	20	219
		500<P≤1 000	20	155
		1000<P≤10 000	25	129
		P>10 000	30	119
	Basin or tank	1<P≤10 000	25	101
		P>10 000	30	96
Ocean (including tidal and wave energy)		1<P≤5 000	15	300
		P>5 000	20	194
Geothermal		1<P≤1 000	20	135
		1000<P≤20 000	25	99
		P>20 000	25	85

Table 5.1 Support levels under Ministerial Decree of 6 July 2012 (continued)

Landfill gas		1<P≤1 000	20	99
		1000<P≤20 000	20	94
		P>20 000	20	90
Residual gas and water treatment processes		1<P≤1 000	20	111
		1000<P≤5 000	20	88
		P>5 000	20	85
Biogas	**a) Products of biological origin**	1<P≤300	20	180
		300<P≤600	20	160
		600<P≤1 000	20	140
		1000<P≤5 000	20	104
		P>5 000	20	91
	b) By-products of biological origin from wastes, not from recycling other than that referred to in point c) below	1<P≤300	20	236
		300<P≤600	20	206
		600<P≤1 000	20	178
		1000<P≤5 000	20	125
		P>5 000	20	101
	c) Waste for which the biodegradable fraction is determined at a flat rate	1<P≤1 000	20	216
		1000<P≤5 000	20	109
		P>5 000	20	85
Biomass	**a) Products of biological origin**	1<P≤300	20	229
		300<P≤1 000	20	180
		1000<P≤5 000	20	133
		P>5 000	20	122
	b) By-products of biological origin from wastes, not from recycling other than that referred to in point c) above	1<P≤300	20	257
		300<P≤1000	20	209
		1000<P≤5 000	20	161
		P>5 000	20	145
		1<P≤5 000	20	174
		P>5 000	20	125
Sustainable bioliquids		1<P≤5000	20	121
		P>5000	20	110

* For offshore wind farms whose managers do not appeal to provisions of Article 25, paragraph 3, and realise at their own cost the connection to the electricity grid, they receive a premium equal to EUR 40/MWh.

Source: MSE, IDR country submission.

Green certificates scheme

The green certificates (GCs) mechanism was available for new plants between 1999 and late 2012. The scheme is based on legislation which requires producers and importers of non-renewable electricity to inject a minimum quota of renewable electricity into the

power system every year. Eligible technologies receive a different number of certificates per megawatt/hour of electricity generated (banding). Banding is frequently used in such systems to avoid excessive rents to producers from low-cost sources. Solar PV generation was eligible under the scheme until 2008. Certificates are granted for 15 years. When first issuing GCs, GSE opens an ownership account in the name of the producer where the GCs are deposited. GSE tracks the movements of GCs via a dedicated information system. Holders of ownership accounts may access the system after obtaining an appropriate identification code from GSE.

Table 5.2 Green certificates annual mandatory quota, 2010-15

Reference year	Mandatory quota	Compliance year
2010	6.50%	2011
2011	6.80%	2012
2012	7.55%	2013
2013	5.03%	2014
2014	2.52%	2015
2015	0.00%	2016

Source: MSE, IDR country submission.

The number of GCs introduced each year is calculated by multiplying the amount of electricity generated and/or imported, subject to the obligation and exceeding 100 GWh, by the mandatory quota for the reference year.

Since 2006, the quota obligation has been surpassed. This outcome is associated with a fall of certificate prices to very low levels. In response, GSE acts as buyer of last resort at an administratively determined floor price. As this system has been discontinued, the quota obligation will be scaled down according to the exit of eligible generation after 15 years of participation in the system. The certificate system was complemented by a feed-in tariff system for small-scale installations (less than 1.0 MW of capacity), excluding solar PV. This system was closed to new plants at the end of 2012.

Solar PV : the *conto energia*

Italy offered very generous feed-in tariffs to PV installations between 2005 and 2011. The original 2005 capacity target for PV of 100 MW was reached in nine days. It was increased to 500 MW the following year and entirely removed for the second phase of the support scheme (*secondo conto energia*) which started in 2007.

Downward adjustments to the tariff under the third phase (*terzo conto energia*) in 2010 did not significantly slow down the market. Tariff reform in mid-2011 (*quarto conto energia*) introduced lower support levels, subject to regular decreases over time and an annual cap to control support costs. The announcement of reform led to an unprecedented rush of investors to register their installations under the much more generous *secondo conto energia*. This happened as a result of a legal loophole that was introduced by Parliament, which remained open until June 2011. Installed

capacities more than tripled in that year and reached about 13 GW by the end of 2011.[2] The targeted volume for 2020 had been 8.0 GW.

In an effort to contain costs, the fifth and final *conto energia*, introduced by Ministerial Decree 6 July 2012 included provisions to cap annual support payments to solar PV at EUR 6.7 billion annually. This cap was reached in June 2013 and the system has been discontinued.

Table 5.3 All-inclusive feed-in tariff rates

Source	All-inclusive feed-in rate (EUR/kWh)
Wind (P < 200 kW)	0.3
Geothermal	0.2
Waves and tides	0.34
Hydro (other than the one indicated in the previous point)	0.22
Biomass, biogases and bioliquids complying with Regulation (EC) No 73/2009	0.28
Landfill gas, gas for sewage treatment plant, biogases and bioliquids complying with Regulation (EC) No 73/2009	0.18

Sources: GSE; MSE, IDR country submission.

All-inclusive feed-in tariff

The all-inclusive feed-in tariff (tariffa omnicomprensiva), an alternative to the GCs scheme, is a scheme applicable to RES-E plants (excluding solar), which have a nominal real power of less than 1.0 MW (200 kW for onshore wind plants). The tariff is granted over a period of 15 years, during which its rate remains fixed and based on the amount of electricity fed into the grid, for all plants commissioned by 31 December 2012. To benefit from this form of support, producers must first ask GSE to qualify their plants as RES-E.

Tax incentives and net metering scheme

RES-E producers can make use of net metering service (*scambio sul posto*) if their plant's capacity is between 20 kW and 500 kW. Strictly speaking, the system does not work by subtracting self-consumption from the electricity bill. GSE pays a contribution to the customer based on injections and withdrawals of electricity in a given calendar year and on their respective market values. Payments are made up to the point where generated electricity matches consumption on an annual basis. Production surpluses can be carried over to subsequent years. This system has facilitated the deployment of small-scale PV plants after the end of the *conto energia*. Net metering is not compatible with the simplified purchase resale arrangements (*ritiro dedicato*) and with the all-inclusive feed-in tariff (*tariffa omnicomprensiva*).

In order to reduce the upfront cost of PV systems for customers, there are also tax credits in place. In 2015, this tax credit corresponds to 50% of the solar PV system costs. As from 2016, the tax credit is foreseen to become a structural measure at a rate of 36% of the solar PV system costs that is tax deductible. Tax incentives are also available for renewable heat (see section below).

2. This decree, known as *Salva Alcoa*, allowed 3.5 GW of installations to benefit from these exceptional conditions.

Table 5.4 Total annual support costs of different RES-E support schemes

Indicative annual cumulative cost of incentives for electric RES (Updated 28/02/2015)	
Mechanism	**Annual indicative cost (EUR million)**
GCs	3 152
All-inclusive feed-in tariff	1 731
CIP 6/92 (A precursor to GCs)	208
Registries and auctions Ministerial Decree 6/7/2012	492
Plants in operation Ministerial Decree 6/7/2012	136
Concentrated solar plants	1
Feed-in scheme for photovoltaic plants	6 700
Total	**12 421**

Source: MSE, IDR country submission.

Fiscal incentives

Solar thermal energy plants, highly-efficient heat pumps, low-enthalpy geothermal systems and biomass heat generators are supported by a tax credit mechanism for energy savings in the buildings sector. This is a voluntary scheme, which permits the possibility to subtract from income tax, whether personal income tax (IRPEF) or corporate income tax (IRES), a percentage (55% until 6 June 2013 and 65% until 31 December 2015) of the costs incurred for specific energy efficiency upgrading interventions on existing buildings. The deductions must be spread over ten years.

Box 5.1 Geothermal electricity in Italy

While the use of geothermal hot springs has been known since ancient times, active geothermal exploration for industrial purposes started at the beginning of the 19th century in Italy. The country has a long history of geothermal electricity production and it remains an important source of renewable electricity, representing about 2% of electricity production in 2014 (Terna, 2015). Total installed geothermal capacity at the start of 2014 was 875.5 MW, which represents approximately more than half of installed geothermal capacity in OECD Europe.

All geothermal plants in operation are located in Tuscany, concentrated in the Larderello/Travale and Mount Amiata areas. All of the plants are owned and operated by Enel Green Power. There are approximately 304 production wells in operation alongside 62 reinjection wells and 125 wells used for reserve or field control. Of these, 96 wells have depths greater than 3.0 km (IEA, 2014). Enel Green Power has stated that it remains strongly focused on geothermal development in Tuscany, with several new projects planned, such as a new 40-MW plant in Bagnore, and exploration in the new leases surrounding the Larderello and Mount Amiata areas. These are aimed at identifying an exploitable geothermal fluid with temperature suitable for a binary power plant.

Box 5.1 Geothermal electricity in Italy (continued)

New zones have been opened to geothermal research in Tuscany and other Regions, targeting fluids suitable for electricity. The industry has argued that existing incentive mechanisms are not enough for sustaining a significant investment in the geothermal sector, even if the resource in Italy is much more generous than in other countries (IEA, 2014). Combined with the ongoing public concerns related to seismic risks in Italy, the prospects of significant expansion of geothermal capacity in Italy appear limited.

Tackling the cost legacy of renewable energy support schemes

The technologically imbalanced, and only partially controlled, increase in RES-E generation has led to a legacy of significant support costs. Despite recent reductions in renewable energy costs, consumers will need to pay this legacy for many years to come. For example, the rapid increase of solar PV at very high levels of financial support has meant significant costs of EUR 6.7 billion annually. This corresponds to more than half the costs for renewable energy support, while solar PV generation only covers approximately one-third of financially supported RES-E output.

In July 2014, total support for renewable electricity paid for through electricity surcharges reached its peak (EUR 12.5 billion). This surcharge is spread over electricity bills and varies according to tension levels, connection capacities and monthly consumption rates. The surcharge rate related to renewables for a typical small or medium-sized enterprise connected at medium voltage and a rate of consumption within 4.0 GWh per month was about EUR 0.06/kWh. This value has grown steadily over the years: it was less than one eurocent in 2008.

The causes underlying the strong growth of the renewable surcharge have included: generous incentive levels, the significant growth of installed renewable electricity capacity (especially between 2010 and 2012), strong production levels thanks to efficient renewable energy management systems and a robust grid capacity whose expansion was able to keep up with the increasing production capacity. Levels of production curtailment, while above the European average in the past, have decreased and are converging with the rest of Europe. Moreover, it should be noted that the Italian law compels the regulatory authority AEEGSI to immediately pass on the increased cost for cross-subsidising renewables to final customers, without ever slowing the rate of increase. No tariff deficits were accumulated and therefore no liabilities with energy producers were incurred.

In late 2014, the government revised incentives in the PV sector with the aim of improving the sustainability of electricity bills, boosting the competitiveness of the manufacturing industry and avoiding new peaks in support costs. It targeted savings of about EUR 600 million per year.

A scheme was established in October 2014 offering owners of installations above 200 kW the opportunity to choose between four different schemes:

- Extend the duration of the remaining induced period from 20 to 24 years in exchange for a proportionally lower per unit incentive payment.
- Maintain the original remaining induced lifespan of the installation but with a lower per unit incentive payment for the first half of the remaining period and an increased per unit payment for the second half.

- Sell off the net present value of the cash flow to GSE or another financial institution, which will be identified by means of a tendering procedure. These institutions may then bundle them and seek long-term refinancing of the financial commitments on capital markets. The tender will be awarded to those institutions offering the highest net present value to operators. This option, once operational, will be available to all renewable energy installations availing of incentive schemes (all sources and all sizes).
- A cut to the current levels of incentives in order to compel operators to choose between the first three schemes.

Options one to three share a common feature: the total amount of revenue receivable, although distributed differently in time, remains the same for operators. Option one has the additional system benefit of reflecting the increased technical lifespan of PV installations. Once operational, option three will be available also to operators that have chosen other options in the past. Operators have challenged this government decision in court and a final court decision on this matter remains outstanding.

In 2015, it is estimated that the reduction of the overall burden will be about EUR 400 million, a figure set to rise to EUR 600 million once the financial refinancing option becomes operational. Notwithstanding the temporary uncertainty caused by the announcement of the new system and its implementation, the PV sector in Italy remains healthy with 424 MW of new capacity installed in 2014, of which about 330 MW was built without access to any incentive scheme.

ADMINISTRATIVE AND PLANNING PROCEDURES

In order to simplify the regulatory and non-regulatory barriers and improve the administrative procedures supporting the development of renewable sources, Italy implemented a series of new measures. Legislative Decree No. 28/2011, which transposed Directive 2009/28/EC, provided for the partial review of the general framework of authorisations for renewable energy plants. Three procedures are provided by current regulations for the authorisation of renewable energy plants:

- A **single authorisation** (AU) is a procedure introduced by Legislative Decree 387/2003, which transposed Directive 2001/77/EC, for the authorisation of plants generating electricity from renewable sources and connected infrastructure works. It is required for power plants above a certain thresholds. It is issued at the end of a single procedure, and constitutes the title to construct and operate the plant. Where necessary, it also acts as a variation to the town planning programme. Legislative Decree No 28/2011 reduced the maximum duration of the procedure from 180 days to 90 days, net of the timescales provided for production of an environmental impact assessment where necessary. Competence for the issue of the single authorisation is vested in the Regions or Provinces delegated by the Regions.
- A **simplified authorisation procedure** (PAS) has been introduced by Legislative Decree No. 28/2011 to replace the declaration of commencement of activities (DIA). The PAS can be used for the production of renewable energy plants below the pre-established power thresholds (above which the AU is required) and for some types of thermal energy plants using renewable sources. The PAS must be submitted to the municipality at least 30 days before commencing the works, accompanied by a detailed report, signed by a qualified project designer, and by the appropriate project plans, attesting also the compatibility of the project with town planning

programmes and current building regulations, as well as compliance with the safety and health-hygiene regulations. The PAS presents a tacit assent mechanism: 30 days after the submission of the PAS, in the absence of a response or notification from the municipality, it is possible to commence works.

- A notice of building activity (CAEL) is the requirement provided to simplify the authorisation procedure of some types of small plants for the production of electricity or heat from renewable sources and which can be assimilated to unrestricted building activities. Communication of the commencement of works must be sent to the municipality, accompanied by a detailed report signed by a qualified project designer. It is not necessary to wait 30 days before commencing the works.

Furthermore, Legislative Decree No. 28/2011 also empowers the Regions to further extend the applicability of PAS systems for the production of electricity up to 1.0 MW, and the applicability of CAEL, for systems up to 50 kW of photovoltaic or of any power on buildings. Some regions have made use of these faculties.

In order to ensure the provision of information and improve transparency, Legislative Decree No. 28/2011 also provided for the establishment of a national web portal, which includes a variety of information related to renewable energy and energy efficiency, including administrative procedures to be followed for the construction of renewable energy plants. GSE, which is responsible for implementing this portal, publishes an annual report on the authorisation procedures in force at the regional and provincial levels. National guidelines for the authorisation of RES plants were also provided by the Ministerial Decree. These monitor the effectiveness and efficiency of the authorisation procedures at regional and provincial levels in order to identify good practices and improvement actions.

GRID ACCESS AND CONNECTIONS

The Italian regulations establish that grid operators must treat applications for connection and construction of connections of new RES plants (or high-efficiency co-generation plants) as a priority. Furthermore, grid operators must satisfy defined performance standards within the timescale set out in the Unified Text for Active Connections (TICA). The TICA aims to introduce swifter connection procedures, more transparency in the communications between grid operators and project developers, and introduce provisions concerning the requests of connection in areas (or lines) where the capacity of the grid is tight.3 Should the network operator fail to meet the obligations the Italian Electricity and Gas Authority (AEEGSI), may start a replacement procedure.

The Italian transmission system operator Terna and the distribution companies that have at least a primary substation, must define and publish on their websites atlases related to networks in high- to very high-voltage and primary substations at medium- to high-voltage to provide up-to-date qualitative information in relation to the available network capacity and the identification of the critical lines and critical areas. TICA also provides predefined and easier payment terms for connecting renewables to the low- and medium-voltage networks, compared to those applied to larger thermal power plants.

Regulations also provide developers with the right to construct their own connections where works do not involve interventions on the existing electricity grid. The grid

3. AEEGSI Deliberation ARG/elt 125/10.

operator may permit the renewable power plant owner to perform interventions on the existing network, without prejudice to safety requirements and safeguarding continuity of the electricity service. Regarding grid access and market integration, RE plants have the right to priority dispatch subject to the security of the electricity system.

Since 2007, remuneration has been provided to RE generators for curtailment by Terna to ensure security of the electrical system in order to safeguard investments made in the renewable sources sector.

INTEGRATION OF VARIABLE RENEWABLES

For a large economy, Italy has the world's highest share of PV generation, which provided 8.8% of electricity produced in 2014. In addition, wind generation accounted for 5.4% of electricity production in the same year (Terna, 2015).

The Italian TSO, Terna, has invested in upgrading the network, specifically to accommodate wind power, which is concentrated in the south of Italy. PV capacities are more evenly spread throughout the country and have been absorbed with less implication for the transmission grid. Challenges on the distribution grid involve overvoltage situations and 75% of all substations in Italy have reverse power flows during at least 1% of the year. This is a remarkably high share, considering that the power grid was not initially conceived with power flowing in this direction in mind. Curtailment levels are low, 1.5% of all wind generation and no PV generation had to be curtailed in 2013. This illustrates that the grid has been able to absorb current deployment levels.

Looking ahead, the design of the intraday and balancing markets may need to be revised, so as to shift trading closer to real time and remunerate the provision of system services and to operate reserves in a transparent and efficient manner.

Moreover, a large number of smaller PV systems connected to the distribution system are not visible to the system operator and cannot be controlled directly. In order to mitigate this possible risk for system security, the visibility and controllability of a sufficient number of variable renewable energy plants need to be ensured.

HEATING AND COOLING

SUPPORT SCHEME FOR RENEWABLE HEATING AND COOLING (*CONTO TERMICO*)

The *conto termico*, which was implemented by Ministerial Decree of 28 December 2013, bundles together incentives for renewable heating and cooling as well as for energy efficiency improvement. The scheme targets the replacement of old equipment with renewable energy devices and in some cases the installation of such devices in new buildings (biomass boilers, heaters and fireplaces; solar thermal systems, including for cooling). The scheme also covers heat pumps, energy efficiency improvements and in some cases supports energy auditing and certification. The scheme is open to private and public entities. The latter are eligible for a broader range of support under the scheme, including large-scale renewable energy installations, because they cannot make use of tax breaks.

The support covers all those measures which are additional to the requirements set by building codes and permitting requirements. Support is granted for periods ranging from two to five years, depending on the type of intervention. Support levels are calculated on expected energy production (factoring in equipment size and climate zone) rather

than metered production as in the case of electricity. This has the advantage of remunerating according to achieved output while avoiding complications associated with metering actual thermal output. Premium levels vary depending additional factors such as, for example, the GHG impact of different bioenergy technologies. This leads to a differentiated categorisation of support levels (Table 4.3 in the previous chapter).

Access to incentives is organised in three different ways. Direct access is possible up to 60 days of completing an intervention. Public bodies can use a second access route, permitting to secure funds before interventions start by using a cost estimate. Replacement interventions on heat pumps or bioenergy of a size between 500 kW and 1.0 MW can access support by means of a registry. Total annual support payments are capped at EUR 200 million for public administrations and EUR 700 million for privately owned entities.

TRANSPORT

In the transport sector, the share of RES (in accordance with the transport target definition of EU Renewable Energy Directive) reached 5.8% in 2012 (3.7% in 2009). The main source is biodiesel blended into the traditional fuel. In the field of biofuels, the main support scheme is the blending quota obligation for fuel distributors.

Italy has a blending requirement for biofuels that increases annually: the 2020 target is a share of 10% of energy content from biofuels. The obligation is met via blending an appropriate amount of biofuels or by purchasing biofuel certificates, which represent the blending of 10 gigacalories (Gcal) or 41.84 gigajoules (GJ) of biofuels.

All the biofuels released for consumption in Italy must comply with the sustainability criteria stated by RES Directive 2009/28/EC and Directive 2009/29/EC.[4] They must be certified by specific certification bodies according to the National Certification Scheme (Ministerial Decree 23 January 2012) or according to voluntary schemes approved by the EU Commission or according to bilateral or multilateral agreements with third countries.

Until mid-2014, there was a special incentive for biofuels produced from raw materials coming from EU countries and processed in the European Union. This preferential treatment was achieved by granting one certificate per 8.0 Gcal (33.47 GJ) of energy, rather than per 10 Gcal (41.84 GJ) as for standard fuels, but has since been discontinued.

Since 2013, an incentive is in place for biofuels produced from wastes, residues, cellulosic and ligno-cellulosic material which are eligible to receive twice the number of certificates (double counting measure).

In October 2014, the new decree for biofuels established the trajectory from 2015 to 2022 for the biofuel quota obligation. This decree introduces the concept of "advanced biofuels": biofuels produced from materials such as biomass fraction of wastes and residues (apart from unused cooking oils and animal fats category one and two), animal manure, sewage sludge, bagasse, grape marcs, wine lees, nut shells, non-food cellulosic materials. Biomethane obtained from those materials is also considered advanced biofuel. A mandatory sub-target of advanced biofuels is also

4. Directive 2009/29/EC of the European Parliament and of the Council of 23 April 2009 amending Directive 2003/87/EC so as to improve and extend the GHG allowance trading scheme of the European Community.

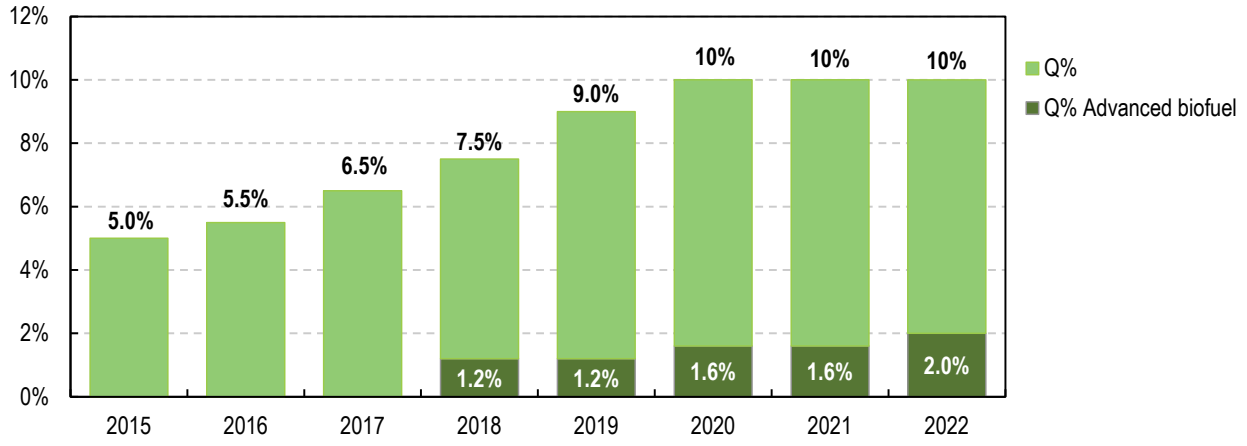
introduced as a means to promote advanced biofuels (including biomethane from waste and residues) in addition to double counting.

Italy is the first country in Europe to explicitly promote advanced biofuels with a comprehensive regulatory framework by anticipating the provisions of an EU proposal to amending current legislation on biofuels. That will amend the current legislation on biofuels in the EU Renewable Energy Directive and in the EU Fuel Quality Directive.[5,6,7] The adoption of ambitious new generation biofuel targets will help demonstrate the impact of the directive and is offering a regulatory framework designed to stimulate long-term investment.

BIOMETHANE

Biomethane used for transport is supported by the issue of biofuel certificates. It is produced from particular materials (wastes, residues, etc.) listed in Article 4 of Ministerial Decree of 5 December 2013 and receives two certificates for every 10 Gcal (41.84 GJ) produced. A producer selling biomethane directly in a specially built filling station will receive a premium of 50% of the total number of certificates for ten years.

Figure 5.6 Advanced biofuels in the biofuel quota



Source: MSE, IDR country submission.

ASSESSMENT

Italy has experienced impressive growth in the renewable energy sector since the last review. This progress has propelled Italy to the global forefront of countries developing renewable energies. The IEA welcomes and commends this development. The National Energy Strategy established targets which go beyond the EU 2020 goals and is strongly

5. Proposal for a Directive of the European Parliament and of the Council.

6. Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC.

7. Directive 2009/30/EC of the European Parliament and of the Council of 23 April 2009 amending Directive 98/70/EC as regards the specification of petrol, diesel and gasoil and introducing a mechanism to monitor and reduce greenhouse gas emissions and amending Council Directive 1999/32/EC as regards the specification of fuel used by inland waterway vessels and repealing Directive 93/12/EEC.

focused on the heat sector. Reaching its 2020 targets will require continued focus on developing the RE sector while containing costs to consumers.

Containing costs for electricity consumers is a priority for the Italian government. Three main areas appear relevant in this regard. First, increasing focus on cost-effective RE potential in the heat sector. This is important given the frequent neglect of this important sector by previous governments. In the heating sector, the adoption of a comprehensive strategy for renewable heating and cooling, combined with measures to increase energy efficiency is a commendable step. This underlines the country's continued leading role in the deployment of renewable energy technologies. Secondly, it has fostered PV deployment by mean of tax credits and net metering. Thirdly, additional measures to stretch the payment of costs under the A3 surcharge, for example by stretching payment periods at reduced incentive levels for existing installations.

In late 2014, the Italian government pressured owners of existing PV installations to choose from a number of options: extend the incentive payment periods, cut payments in the short term and increase them afterwards, or sell off the net present value of receivable payments on the financial market. Arguably, no (or only very few) solar PV projects have been rendered uneconomic by these measures. Nevertheless, the pending changes to the support scheme are bound to change the remuneration structure of existing installations. As such, these measures have created uncertainty, undermining investor confidence and arguably increasing the cost of capital for future investments.

Alternative approaches to save costs could (or should) be considered, such as long-term refinancing of financial commitments on capital markets or other measures like broadening the base on which costs for RE incentives are recovered, and need to be implemented quickly to avoid undermining investor confidence. Thanks to a dramatic reduction in costs, fostering PV via the combination of tax credits and net metering has allowed for continued deployment of the technology. Deployment should be monitored closely, however, to ensure that its patterns maximise the value of PV resources from the perspective of the overall power system.

RE support levels in Italy differ depending on the technology, the size of the RE installation and usage pattern. Support levels appear high compared to other European countries and tariff degressions are programmed at a fixed annual level. The cost of capital plays a crucial role in determining the cost of RE generation, and Italy's relatively high cost of capital may be partially responsible for higher prices.

The level of competition in the auctioning component of the support systems is very low but it may be argued that it is growing. In the first land-based wind auction in 2012, offers reached 356 MW, short of the target level of 500 MW. While the situation improved in the following year (1.0 GW of offers for 500 MW of awarded contracts), the auction cleared only 10% below the maximum price. In the third auction procedure (August 2014), however, not only was the bidding capacity (1.3 GW) more than three times the available capacity, but the bid reduction was also very high, in the order of 26% to 30%.

The threshold of auctions is set at 5.0 MW regardless of the technology and this is the main cause for the absence of certain technologies in the auctions. Starting in 2017, the threshold will be lowered, consistent with the EU policy framework, to 1.0 MW and it is expected that this will bring more, if not all, technologies into the auctions.

Policies, however, will need to increasingly focus on bringing down deployment costs towards international benchmarks. In this sense, the move towards competitive awarding of support for large installations is commendable. Most recent experiences with the outcome of auctions will be important in fine-tuning the system.

Containing costs for electricity consumers is a priority for the Italian government. This has been the main driver for capping cumulative support costs. While this has been an effective means to contain uncontrolled cost escalation, it remains unclear what strategic direction policy making will take with the imminent expiration of economic support for a large part of renewable electricity technologies.

Italy has adopted an advanced regulatory framework on new generation biofuels. This framework anticipates the European pursuit of avoiding indirect land-use change that would negate the greenhouse gas savings that result from increased use of biofuels. The size of the country's oil sector makes this effort a test bed for the effects on both the upper and the lower parts of the supply chain that should be carefully monitored.

RECOMMENDATIONS

The government of Italy should:

- *Strengthen the policy environment for renewables by building on Italy's leadership in several renewable energy sectors developed over the past decades in order to transform Italy into one of the first major IEA economies with a high penetration of renewable energy across all sectors.*
- *Avoid recalibrating the remuneration structure for renewable energy in any way that undermines investor confidence and increases the cost of renewables development over the long term.*
- *Maximise competition in the auctioning system by, for example, adjusting the amount of procured capacity as a function of offered prices.*
- *Regularly update support levels in light of cost developments and deployment levels rather than at fixed percentage reductions per year.*
- *Emphasise cost-effectiveness in the deployment of renewable energy in the heating sector and closely monitor the impact of the associated surcharge on gas prices.*
- *As part of the reform of retail electricity tariffs, encourage photovoltaics deployment in a way that minimises total system costs.*
- *Reform wholesale electricity market operations in view of rising shares of variable generation proactively, and ensure that a sufficient share of photovoltaic generation is visible and controllable.*
- *Continue developing the market for advanced biofuels with a specific focus on biomethane and carefully monitor the effects of the newly introduced policies on the biofuel supply chain.*

References

GSE (Gestore Servizi Energetici) (2015), "Costo Indicativo Cumulato Annuo Degli Incentivi" (Yearly indicative cumulative cost of incentives granted for non-photovoltaic RES-E plant), www.gse.it/it/Documents/Il%20contatore%20degli%20oneri%20delle%20fonti%20rinnovabili.pdf, accessed 11 April 2015.

GSE (2014), "Italian experience in deploying renewable energy", presentation at the Res4Med workshop, 16 September 2014, Rabat, www.res4med.org/uploads/focus/Rabat_16-09-2014-BENEDETTI.pdf.

IEA (International Energy Agency) (2016), *Energy Balances of OECD Countries 2016*, www.iea.org/statistics/, OECD/IEA, Paris.

IEA (2014), *IEA Geothermal: Italy Country Report 2013*, IEA Geothermal Implementing Agreement, IEA/OECD.

Terna (2015), *Provisional Data on Operation 2014 of the Italian Power System*, Terna Rete Italia, Rome.

6. ELECTRICITY

Key data (2015 estimated)

Total electricity generation: 280.7 TWh, -5.4% since 2005

Electricity generation mix: natural gas 38.3%, coal 16.6%, hydro 15.6%, solar 9.3%, biofuels and waste 7.8%, wind 5.2%, oil 4.8%, geothermal 2.2%

Installed capacity (2014): 117.7 GW

Peak load (2014): 51.6 GW

Electricity consumption (2014): industry 38.8%, commercial and other services 32.2%, residential 22.1%, transport 3.6%, other energy 3.3%

OVERVIEW

Italy is the fourth-largest electricity market in IEA Europe. Since the last in-depth review the country has continued to make progress in terms of market liberalisation and infrastructure development. The country has integrated large volumes of variable renewable energy albeit at a cost. A competitive wholesale market has developed and prices generally converging throughout Italy and falling more in line with wholesale prices throughout Europe. Nonetheless, greater reforms are necessary in the retail market if the full benefits of reform are to be passed to consumers.

SUPPLY AND DEMAND

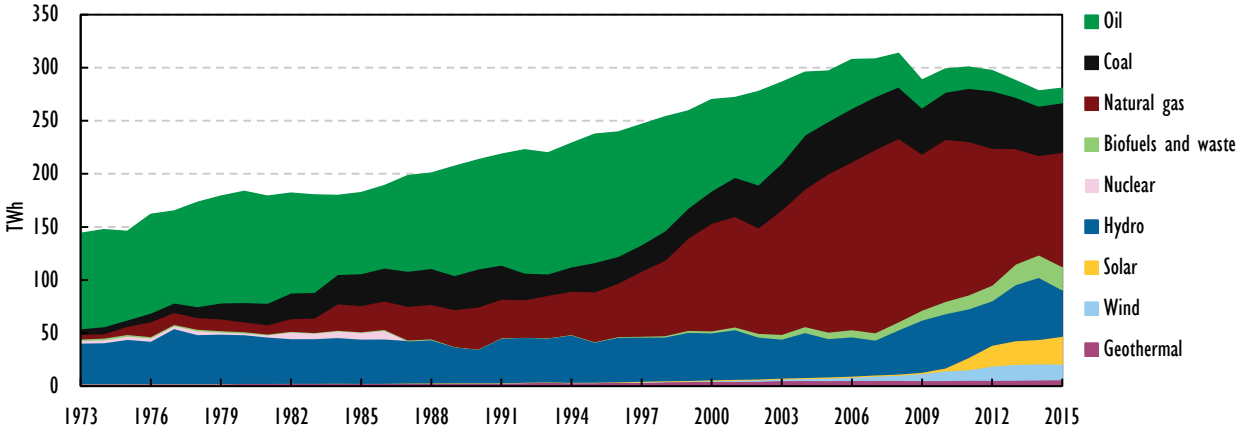
ELECTRICITY GENERATION

Electricity generation in Italy peaked at 313.5 TWh in 2008 before a sharp decline of 8% during the economic recession in 2009. During 2010 and 2011, generation recovered by 4.2% before falling again by 6.6% during 2012-15 (Figure 6.1). Natural gas accounted for 38.3% of Italy's electricity mix in 2015, followed by coal (16.6%) and hydro (15.6%). Oil accounted for 4.8% of the total, with the total fossil fuels share at 59.8%. Non-hydro renewables represented 24.6% of generation, including solar (9.3%), biofuels and waste (7.8%), wind (5.2%) and geothermal (2.2%).

The electricity mix has evolved since 2005. In that year, natural gas, coal and oil represented 82.8% of total generation, including 50.3% gas, 16.6% coal and 15.9% oil. Renewables, composed of hydro (12.2%), biofuels and waste (2.1%), geothermal (1.8%), wind (0.8%) and solar (0.4%), accounted for the remainder. Over the last ten years, solar, wind, and biofuels and waste have boomed, growing by 2 182%, 526% and 256%, respectively. Solar energy has experienced the highest level of growth since 2010 as a result of the lower costs of systems, coupled with favourable government incentives. Hydro power grew by 21.7% over the same ten-year period while the use of oil, natural gas and coal contracted by 71.3%, 27.9% and 5.5%,

respectively. Oil use in electricity has been declining since the mid-1990s while natural gas use peaked in 2008 and has fallen by 37.7% in the seven years to 2015.

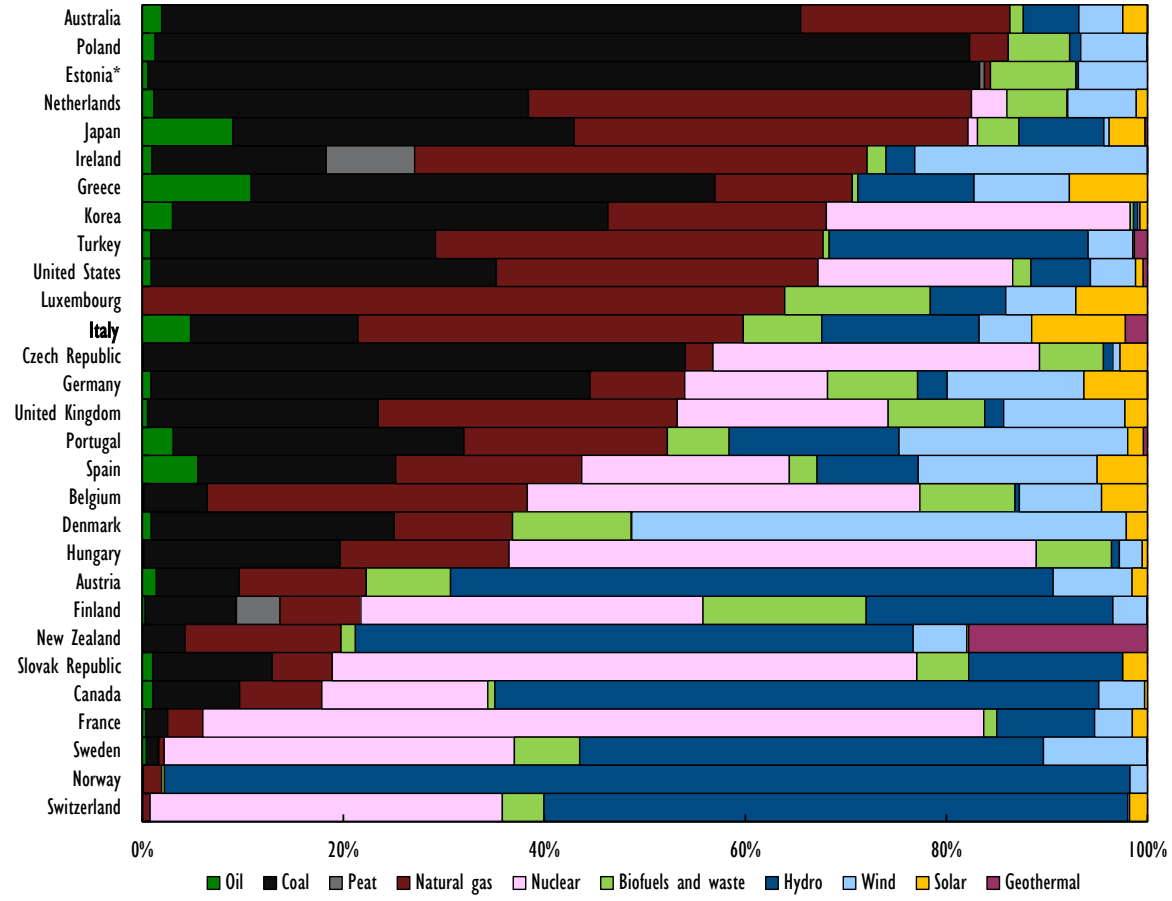
Figure 6.1 Electricity generation by source, 1973-2015



Note: data are estimated for 2015

Source: IEA (2016a), Energy Balances of OECD Countries 2016, www.iea.org/statistics/.

Figure 6.2 Electricity generation by source in IEA member countries, 2015



* Estonia's coal represents oil shale. Note: data are estimated

Source: IEA (2016a), Energy Balances of OECD Countries 2016, www.iea.org/statistics/.

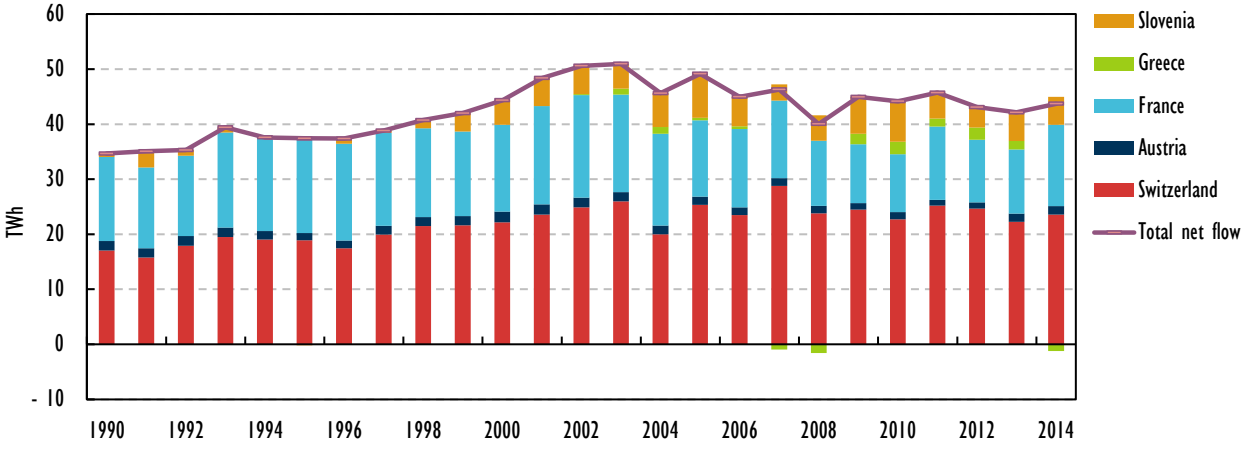
In comparison with other IEA member countries, Italy's share of fossil fuels in electricity generation ranked twelfth-highest in 2015 or near a median level (Figure 6.2). Oil and natural gas shares are the forth- and sixth-highest, respectively. Italy has the highest share of solar in electricity generation, while the geothermal share is third-highest.

IMPORT AND EXPORT

Italy is an electricity net importer with net imports of 46.4 TWh in 2015 or around 15% of electricity consumption. Imports were 50.8 TWh while Italy exported 4.5 TWh of electricity. Net imports were approximately 9% lower in 2015 compared to a peak of 51 TWh in 2003.

In 2014, approximately 54% of net imports were from Switzerland, with the remainder from France (33.8%), Slovenia (11.6%), Austria (3.4%), and a net export to Greece (-2.8%) (Figure 6.3). Trade with Greece began in 2002 and has ranged from net imports of 2.3 TWh to net exports of 1.6 TWh. Following commissioning of a new interconnection, trade with Malta began in April 2015.

Figure 6.3 Net electricity imports to and exports from Italy, by country, 1990-2014

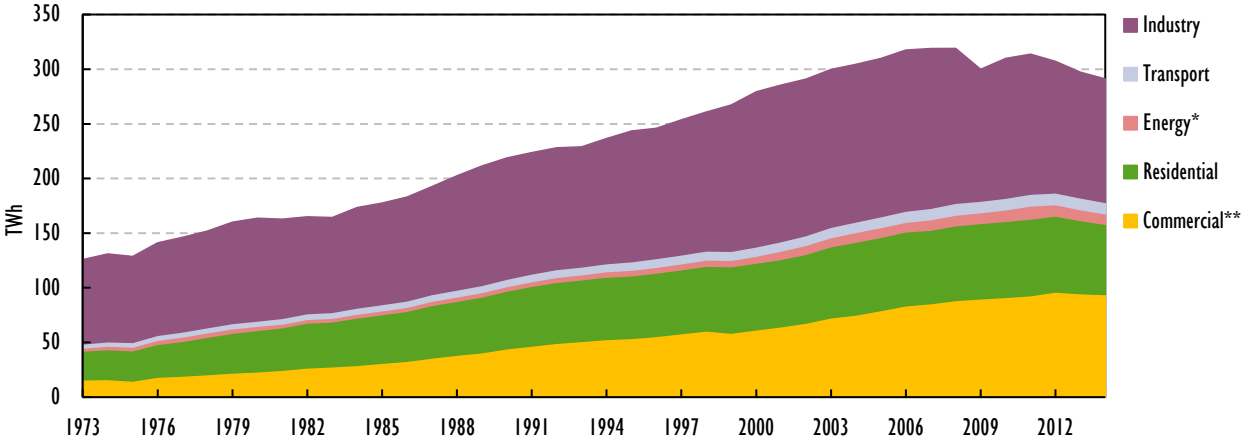


Source: IEA (2016b), *Electricity Information 2016*, www.iea.org/statistics/.

ELECTRICITY CONSUMPTION

Industry is the largest consuming sector in Italy, accounting for 38.8% of demand in 2014. The commercial and other sectors accounted for 32.2% of demand in 2014, up by 24.9% compared to 2004. The residential sector experienced a decrease in electricity demand with 3.5% over the ten years, and consumed 22.1% of total demand. The transport sector increased its demand with 9.0% compared to 2004, and consumed 3.6% of the total electricity demand. Electricity use in the energy sector was 3.3% of total consumption in 2003.

Figure 6.4 Electricity consumption by sector, 1973-2014



* *Energy* includes energy own-use and the transformation sector.

** *Commercial* includes commercial and public services, agriculture, fishing and forestry.

Source: IEA (2016b), *Electricity Information 2016*, www.iea.org/statistics/.

INSTITUTIONS

The **Ministry of Economic Development** (**MSE**, *Ministero dello Sviluppo Economico*) is responsible for leading policy development in a number of sectors, including economic development and cohesion, energy and mineral resources, telecommunications, internationalisation and business incentives.

The Regulatory Authority for Electricity Gas and Water (**AEEGSI**, *Autorità per l'Energia Elettrica, il Gas e il Sistema Idrico*) is an independent regulatory body established under Law 481 of November 1995 to regulate and oversee the electricity and natural gas sectors. As the liberalisation process evolved, AEEGSI progressively assumed new responsibilities in the energy sector. Furthermore, substantial new oversight and regulatory duties were attributed to the AEEGSI in the water services (Law 214 of November 2011) and district heating sector (Legislative Decree 102, July 2014). In 2015, following the implementation of the EU Remit Regulation, new duties related to the surveillance and enforcement of wholesale energy markets were also attributed to AEEGSI. Its regulatory powers include the setting of tariffs and the definition of service quality standards, and the technical and economic conditions governing access and interconnections to the networks. The Authority enjoys a high degree of autonomy from the government and is funded by means of annual contributions paid by the service providers.

The Competition Authority (**AGCM**, *Autorità Garante della Concorrenza e del Mercato*) is the independent competition body, which was established by Law No. 287 of 1990. The AGCM enforces rules against anticompetitive agreements among undertakings, abuses of dominant position as well as mergers and acquisitions, joint ventures) which may create or strengthen dominant positions detrimental to competition. The AGCM has undertaken a number of investigations in the electricity and natural gas sectors in the past five years.

Gestore dei Sistemi Energetici (**GSE**) is the state-owned company which promotes and supports renewable energy sources in Italy. In particular, GSE works to foster sustainable development by providing support for renewable electricity generation and by taking actions to build awareness of environmentally efficient energy uses. The sole shareholder of GSE is the Ministry of Economy and Finance (MEF), which exercises its

rights in consultation with GSE. GSE manages support schemes for renewable energy sources (RES) at central level, taking into account the different technologies of the plants and the level of maturity of the related markets.

GSE is also the parent company of three subsidiaries: *Acquirente Unico, Gestore dei Mercati Energetici*, and *Ricerca sul Sistema Energetico* (RSE), which are active in research in the electricity and energy sectors and in projects of strategic interest.

Gestore dei Mercati Energetici (**GME**) is a company established by GSE for the purpose of organising and economically managing the electricity market in a neutral, transparent, objective manner. It works to foster competition between or among producers, as well as economically managing an adequate availability of reserve capacity. GME is also responsible for managing the reading of green certificates and of energy efficiency certificates (white certificates).

Acquirente Unico (**AU**) is a subsidiary of GSE. It is vested by law with the mission of procuring continuous, secure, efficient and reasonably priced electricity supply for households and small businesses. AU buys electricity in the market on the most favourable terms available and resells it, in accordance with directions given by AEEGSI, to distributors or retailers active in the standard offer market (*mercato di maggior tutela*) for supply to small consumers who choose not to switch to the competitive market.

MARKET STRUCTURE

GENERATION

Italy has fully unbundled transmission and generation ownership. Italy had 118 gigawatts (GW) of installed capacity in 2014, of which nearly 23 GW is steam generation and 40 GW is combined-cycle gas turbines. Hydroelectric power and solar PV make up the bulk of the renewable generation at nearly 22 GW and 19 GW, respectively, while installed capacity of onshore wind is close to 9 GW (IEA, 2016b). Actual capacity available to serve peak load is smaller, at 69 GW. This is still significantly above Italy's peak load, however, which in 2015 was 56.8 GW, giving a reserve margin of 28%. Moreover, this figure excludes import capacity.

Slow growth in net demand as a result of a combination of low economic activity, energy efficiency programmes, and the increase in renewable capacity has also contributed to this relative surplus of generation. Despite the relative abundance of domestic capacity, Italy continues to import significant quantities of power – approximately 15% of its total consumption, the largest share in the European Union – because lower-cost imported electricity is able to compete with domestic supply in Italy's wholesale electricity market.

Though natural gas is the largest single source of generation in Italy, its relative share has been declining in recent years in favour of increased solar and wind power generation. In fact, in 2014, total production from thermoelectric plants (natural gas, coal and oil) declined by 11% from 2013, with natural gas production falling by 14% and coal production by 4%. Production from renewables, on the other hand, has increased, even if at a slower pace than in previous years, rising by 8% between 2013 and 2014. Of that, hydroelectric power increased the most, by 11%, followed by biomass (9%), geothermal (5%), solar PV (3%), and wind (2%). Solar PV in particular has played a role in the continued displacement of oil-fired generation, which makes up 5% of total output, compared to 40% in 1998 (AEEGSI, 2014).

The role of natural gas generation in the Italian power mix has changed over time as the amount of solar PV and wind in the system has increased, which has in turn changed the

shape of demand in certain parts of the country by reducing peak load on sunny days. Afternoon peaks have on many days been replaced by periods of low or negative net demand, followed by a period of rapidly increasing load. The relative flexibility of natural gas generation means it is well suited to serving load under such conditions.

In terms of installed capacity, Enel is by far the largest owner of generation, with 31% of the market share, while the second-largest, Edison, has only 5.2%. Enel also remains the largest power producer in Italy, at 25% of total generation in 2013, though its share of production has fallen in recent years. ENIi is the second-largest producer at 8.5%, followed by Edison at 6%. A2A Energia, ERG and Iren Mercato each contribute 3.1% of generation (or, collectively, 9.3% of total generation). Put another way, Enel produces more electricity than the next five largest companies combined (AEEGSI, 2014).

Italy has very low levels of renewables curtailment (1.5% for wind and 0% for solar PV), though this could change if the increase in penetration of variable renewables outpaces developments in the transmission and distribution system. Over the past year, Italy has made changes to dispatch operations intended at increasing system efficiency, including the introduction of a mechanism to better measure and more generally enhance the performance of frequency regulation.

In order to maintain sufficient system adequacy, the MSE has been instructed, via the 2014 budget law, to introduce a capacity system intended to remunerate flexible generation. A Ministerial Decree dated 30 June 2014 further outlined the new capacity mechanism's requirements; system adequacy will be measured taking into account *i)* grid and cross-border interconnection capacity, *ii)* active demand-side management, *iii)* the contribution of distributed generation. The new system, still under discussion, is set to enter into force in 2017.

WHOLESALE MARKETS

The Italian spot electricity market consists of a day-ahead market and an intraday market. Both markets are managed by the electricity market operator (GME). There is also an ancillary services market where the transmission system operator, Terna, acts as the central counterpart. In addition, GME operates a forward electricity market (MTE). In 2014, there were 223 registered participants in the spot markets, an increase of 23 from 2012, but only 23 operators participate in the MTE, a slight decrease from 25 the previous year (GME, 2014).

In addition, suppliers may enter into bilateral contracts, which must be registered in the Piattaforma conti energia (PCE), or Energy Accounts Platform. In 2013, there were 287 registered participants on the PCE, an increase from 259 in 2012 (GME, 2014).

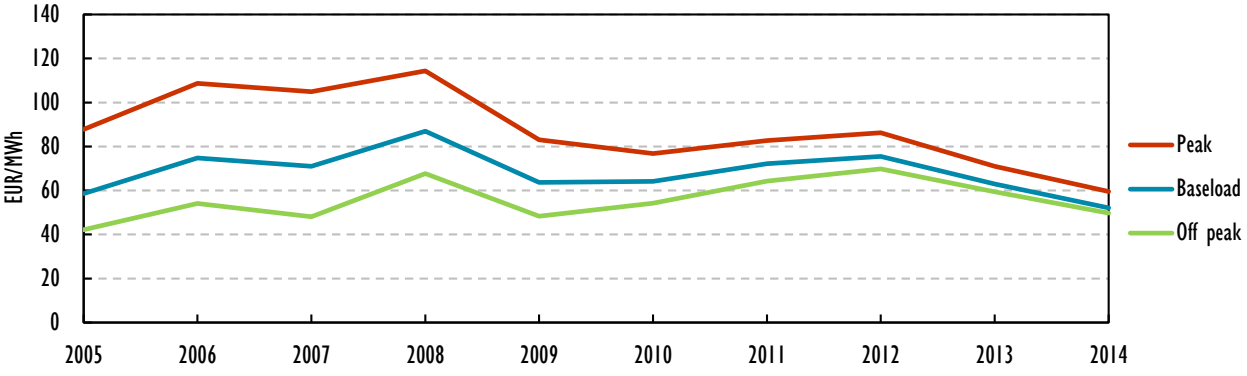
The spot market exchange is the largest clearinghouse for delivered electricity, accounting for 42% of electricity supply in 2013, or 121.2 TWh. Approximately 28%, or 82.3 TWh, of electricity supplied was cleared through the PCE, and 12% (35.4 TWh) was bought on foreign power exchanges. The remainder (17%, or 50.2 TWh) was supplied by GSE, a publicly owned company that is responsible for developing renewable generating resources and energy efficiency. The Italian government is currently in the process of unbundling GSE's operational role from its accounting role, in order to increase its independence (AEEGSI, 2014).

Wholesale prices in Italy are calculated for six main geographic zones and four "poles of limited production", consisting of generating units, whose interconnection capacity

with the grid is smaller than their installed capacity.[1] In addition, these zonal prices are aggregated into a single, hourly national single price (PUN, *prezzo unico nazionale*), which is simply the average zonal price weighted by total purchases. From 2005 to 2013, the PUN ranged from a minimum of EUR 58.9/MWh (2005) to a maximum of EUR 87/MWh. In 2014 the average annual PUN dropped by 17% to EUR 52.1/MWh, with a minor increase to EUR 52.3/MWh in 2015. Peak prices in 2014 averaged EUR 59.2/MWh, while off-peak prices averaged EUR 49.7/MWh. Peak prices in particular have seen significant declines since 2008, when they reached a high of EUR 114.4/MWh (GME, 2015).

A the same time, the share of conventional thermal power plants (gas, coal and oil) in power generation has followed a decreasing trend , falling from 80% at the beginning of 2012 to 54% by July–August 2014. This fall has been offset by an increasing share of renewable sources, largely solar energy, which reached 13% (a record high) of the generated power in August 2014. At the same time, as a result of rain in the Alps during the summer, the share of hydro was more than 25% in July–August. Nonetheless, while the higher share of renewables and lower gas prices helped to bring down wholesale power prices in Italy, however, the market carried a price premium of EUR 15.0/MWh to EUR 20.0/MWh compared to Central and Western Europe, providing opportunities for these countries to export electricity to Italy (EC, 2014). It is also worth noting the recent shift away from over-the-counter, or bilateral, trades on the Energy Accounts Platform (PCE), in favour of exchange trades. This fact was reflected in the fact that Platform prices increased as prices on the day-ahead market fell.

Figure 6.5 Convergence of peak, off-peak and baseload prices, 2005-14



Source: GME (2015), *Annual Report 2014*, *Gestore dei Mercati Energetici*, Rome.

The number of participants and volumes traded on the various wholesale markets has been increasing since 2011 and, as a consequence, total liquidity has been improving. Despite the net decline in sales, the liquidity of the day-ahead market reached a record 72% in 2013, an increase from 60% in 2012. This was mainly the result of an increase in non-institutional participation. In fact, the increase in liquidity would have been higher if not for the decrease in volume of trades by AU, the single buyer.

The increase in the day-ahead market liquidity stands in contrast to the intraday market, which saw a 7% decline in participation between 2012 and 2013. The intraday market is

1. Central northern Italy, central southern Italy, northern Italy, southern Italy, Sicilia, and Sardinia.

actually articulated in five sessions (MI1, MI2, MI3, MI4, MI5), with MI1 clearing first and MI5 clearing last, closest to the real-time market.

The forward market has recently seen an increase in trade volumes. Forward markets offer market participants an opportunity to hedge against price volatility, and it is likely that this market will become more important in the future.

RETAIL MARKETS

Italy has three retail markets: the safeguarded market; the enhanced protection market; and the open market. The safeguarded market (last resort service) is aimed at all final customers who do not qualify for the enhanced protection market and who may temporarily find themselves without an electricity supplier. There are approximately 93 000 consumers served by two companies selected through public auction held, every three years, by AU S.p.A (a state-owned company). This category has been steadily shrinking as more consumers move to the open market.

Customers must actively choose to move to the open market. Those who do not are served by the enhanced protection market. In total, 136 suppliers provided enhanced protection service, though the vast majority of consumers (85%) are served by Enel Servizio Elettrico. The next three largest providers are Acea Energia (4.3%), A2A Energia (3.7%) and Iren Mercato (1.3%), with the remaining 132 providers collectively serving less than 5% of the standard offer market. As of December 2013, there were 22 million households and 4 million small and medium-sized enterprises in the enhanced protection market.

At the centre of the enhanced protection market is the single buyer AU, which has a legislative mandate to ensure adequate service to the “enhanced protection” market, or those consumers who have not chosen to switch to an alternative supplier. AU purchases electricity on the wholesale market and sells it to standard offer retailers, who in turn resell it at a regulated rate.

Though there has been some form of open, or free, market in Italy for more than a decade, the introduction of retail competition was completed in 2007. The free market has the largest number, 336, of retail providers. The number of resellers has been continuously growing and between 2012 and 2013 alone it increased by 50 participants.

Here again, Enel is the largest retailer. Though its relative market share is significantly lower than in the enhanced protection market, Enel still serves 35% of the free retail market, a percentage that is significantly higher than any other competitor. Indeed, this 35% figure is misleadingly low, as it includes all customer classes. Within the domestic, or residential, category, Enel supplies 76% of delivered electricity. It is also the largest provider in the non-residential, low-voltage category, serving 43% of load. Enel has dropped out of first place, however, in the medium- and high-voltage categories, in favour of Edison and Green Network Luce and Gas, respectively. Nevertheless, Enel’s dominance of both the enhanced protection and free domestic markets puts it in a unique position.

Between 2007 and 2013, the rate of customers switching from enhanced protection service to the free market exceeded the rate of those switching from the free market by approximately ten-to-one, suggesting that the free market has been successful in providing competitive pricing or additional value to consumers. As a result, the

enhanced protection market has been steadily shrinking, though it still represents 23% of total electricity consumption.[2]

While switching between market categories has worked well, switching between retail providers has been more problematic. Data-sharing requirements have been minimal, and thus the time and work required to switch providers can be extensive. Italy is working to improve this by requiring that AU implement an Integrated Information System (IIS), which is intended to act as a common platform for tracking and managing all retail customers. AU also acts in a common customer support role, tracking and responding to retail consumers' complaints.

TRANSMISSION AND DISTRIBUTION

Terna was established as the national transmission system operator (TSO) in 2005, when it was fully unbundled from Enel. It manages the largest high-voltage network in Europe, with more than 63 500 km of transmission lines. Terna has sole responsibility for the transmission system, while the distribution networks are controlled by Enel and various other market participants. As Italy's only TSO, Terna owns the entire high-voltage network and is the single buyer for generation dispatching services.

Italy's transmission grid is interconnected to the wider European transmission system by means of 25 high-voltage interconnectors comprising four with France, 12 with Switzerland, two with Austria, two with Slovenia, two DC connections and one sub-sea cable with Corsica, one DC sub-sea cable with Greece and one alternating current (AC) sub-sea cable with Malta.

Over the past five years Terna has significantly upgraded the transmission network with the explicit goal of reducing congestion. In particular, two needs were identified: the significant transmission constraints between northern and southern Italy, and the lack of connectivity to the two main islands, Sicily and Sardinia. Historically, northern Italy had relatively low electricity prices, while southern Italy and the islands had higher prices. In 2014, transmission improvements between north and south and to Sardinia brought prices in those regions far more in alignment, allowing consumers across Italy to benefit from the general reduction in wholesale prices. Prices in Sicily remain higher, though a new interconnection connecting the island to the mainland has been approved as part of Terna's most recent development plan. In addition, grid improvements have reversed the general flow of electricity from its historical north-south direction, to a south–north flow.

Rules on transmission tariffs were determined in 2011 for a four-year period. Tariff rules were approved for that period with an assumed capital investment need of EUR 9.8 billion, of which EUR 9.6 billion was for transmission services and EUR 0.2 billion for dispatching services,; the approved weighted average cost of capital (WACC) was 7.4%, an increase from 6.9% over the previous period. Italy has an incentive tariff system in place whereby Terna will receive additional return on specific development investments. Furthermore, there is an additional incentive for strategic investments based on the timeliness of projects completion. The most recent tariff also includes a new incentive aimed at encouraging the deployment of storage solutions, pilot projects, as part of the transmission network.

2. This figure includes customers who self-supply – for a total of approximately 25 TWh. If those customers are excluded, the proportion of customers in the enhanced protection market is 25%.

Figure 6.6 Map of Italy's electricity infrastructure

This map is without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries, and to the name of any territory, city or area.

Italy has the second-largest low-voltage network in Europe, after France, with 852 835 km of lines, and the third-longest medium-voltage network, after France and Germany, with 387 730 km; 37.2% of Italy's low-voltage cables are underground, a relatively low figure compared to the European average of 55%. There are 139 distribution operators, of which Enel Distribuzione is the largest.

The distribution tariff has three components: a fixed fee, a charge for energy consumed, and a "demand" component. The demand component is set according to the customers' peak consumption – with higher charges for customers with higher peak usage. For historical reasons, standard household electricity contracts have a 3.0 kW rating; other commonly used ratings are 1.5 kW, 4.5 kW and 6.0 kW, while rating above these values are the exception. Similarly, standard non-household electricity supply contracts come at different power ratings. DSOs manage supply contract ratings through smart meters with distance-controlled circuit breaker ratings, on the basis of contracts notified to the DSO by suppliers. Smart meters restrict the maximum amount of power that flows to any given household customer, according to their tariff class. Before the advent of smart meters in the early 2000s, a change in the supply contract rating implied the physical replacement of the electromechanical meter with a different circuit breaker rating.

Italy has "decoupled" the tariff that consumers pay for service from the tariffs that distribution companies earn for providing that service. In practice, this means that distribution companies are remunerated on the basis of a reference tariff that is calculated according to a common methodology, but that is different for each distribution company (reflecting the different cost structure of each company). Prices are capped, so that there is a ceiling on the amount of operating costs that can be recovered through the tariff.

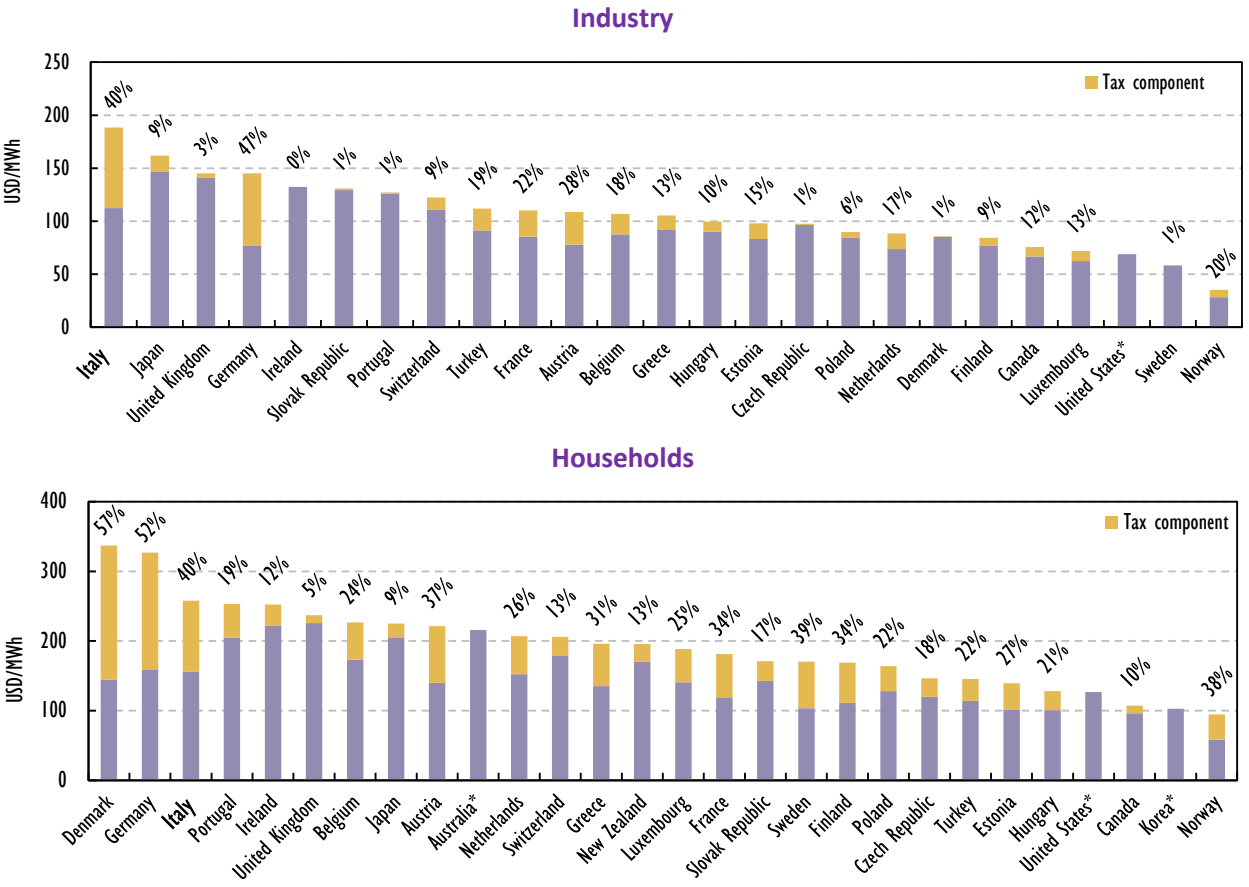
Retail rates for industrial consumers are the highest in Europe and the third-highest in Europe for households. This is because of the relatively large portion of the retail rate devoted to taxes and other fixed fees, in particular as they are applied to the retail tariff.

The retail tariff contains four components: the energy cost (which comes from the wholesale market), distribution network costs, taxes, and "general burdens". For residential customers, the general burdens component consists of six parts: A2, which covers the cost of nuclear decommissioning; A3, which covers the cost of incentives for renewables; A4, a special rate specifically to support the reduced tariff paid by Ferrovie dello Stato, the national railroad; A5, which supports research conducted to improve the electricity system; AS, which covers the cost of additional benefits for consumers who undergo economic or physical hardships; and AE, which covers the cost of the reduced rates given to high-consuming manufacturing companies.

PRICES

Declines in natural gas prices and electricity demand alongside a rise in renewable energy generation have led to lower wholesale prices, and the network component has also decreased over recent years. While the portion devoted to taxes has remained fairly stable, the A3 component has increased recently in line with the rising cost of renewables support programmes. From the beginning of 2011 to the middle of 2013, the A3 component of the tariff increased by nearly 150%, from EUR 01.47/kWh to 03.64/kWh.

Figure 6.7 Electricity prices in IEA member countries, 2015

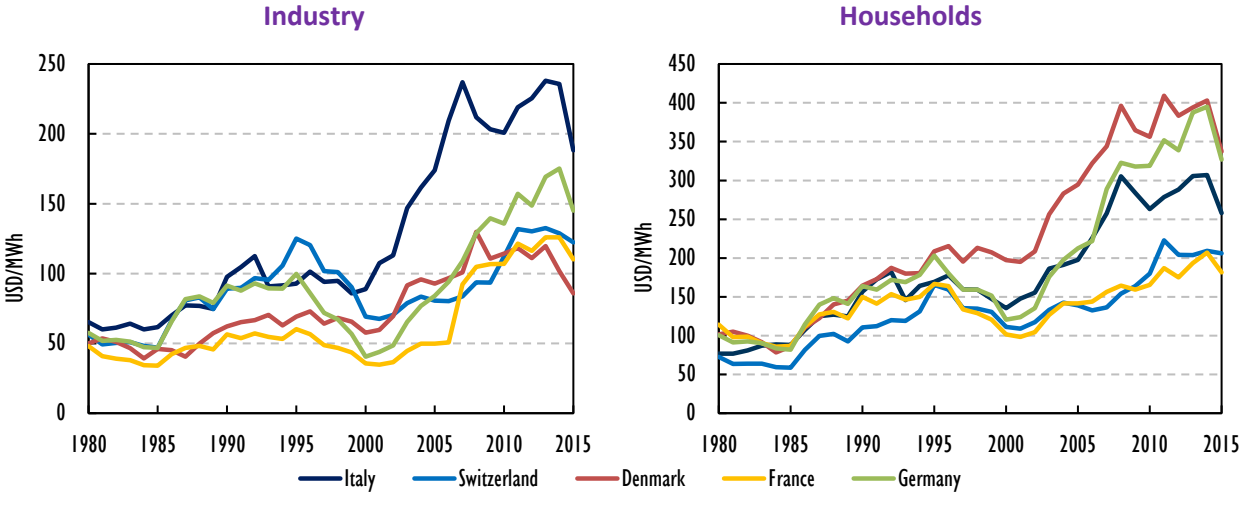


* Tax information not available.

Note: industry data are not available for Australia, Estonia, Korea, New Zealand and Spain. Household data are not available for Estonia and Spain.

Source: IEA (2016c), *Energy Prices and Taxes 2016*, Q3, www.iea.org/statistics/.

Figure 6.8 Electricity prices in Italy and in other selected IEA member countries, 1980-2015



Source: IEA (2016c), *Energy Prices and Taxes 2016*, www.iea.org/statistics/.

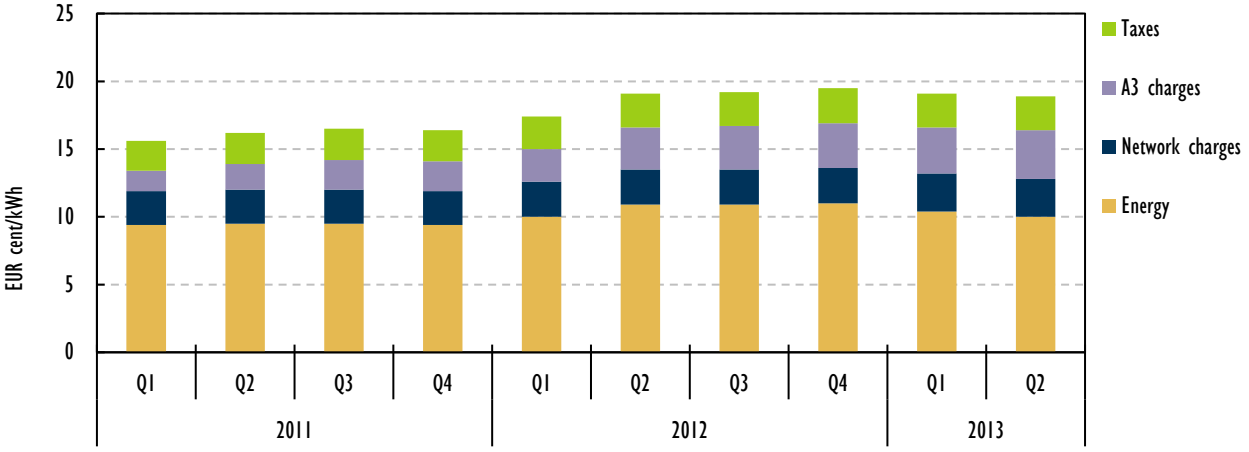
Table 6.1 Retail tariff components of general burdens by household consumer group

Peak consumption	Annual consumption	Rate						
		A2	A3	A4	A5	AS	AE	Total
< 3 kW	<= 1 800 kWh	0.216	3.077	0.051	0.017	0.007	0.233	3.601
	> 1 800 kWh <= 2 640 kWh	0.327	4.619	0.075	0.025	0.007	0.35	5.403
	> 2 640 kWh	0.478	6.692	0.108	0.037	0.007	0.506	7.828
>= 3 kW	<= 1 800 kWh	0.478	6.692	0.108	0.037	0.007	0.506	7.828
	> 1 800 kWh <= 2 640 kWh	0.478	6.692	0.108	0.037	0.007	0.506	7.828
	> 2 640 kWh	0.478	6.692	0.108	0.037	0.007	0.506	7.828

Source: AEEGSI (2015), www.autorita.energia.it/allegati/dati_documenti/prezzi///675-14tab1_5.xls, last accessed on 19 January 2016.

The largest single driver of the A3 rate is the cost of solar PV support, making up more than 55% of the total cost of A3 in 2013. In 2014, in order to make electricity more affordable for consumers, notably small enterprises, the government adopted specific provisions to reduce its cost. These included extending the incentive period and a reduction of the remuneration for renewables producers.

Figure 6.9 Evolution of retail tariff components over time, 2011-13



Source: MSE, country submission.

The intent of the progressive tariff system – referred to as inclining block rates – is to provide an incentive to use electricity more efficiently. This works well for energy efficiency measures that, for example, replace high-consuming appliances with low-consuming ones. This sort of tariff structure can create disincentives, however, for energy efficiency measures that involve fuel switching. For this reason, the regulator is testing an explicit incentive in the tariff for consumers who use heat pumps for their heating system. Lastly, Legislative Decree No. 102/2014 implementing the Directive 2012/27/EC on Energy Efficiency, provided for a gradual removal of the progressive tariff system with regard to domestic consumers.

Box 6.1 *Acquirente Unico*

AU is a subsidiary of *Gestore dei Servizi Elettrici*. It is vested by law with the mission of procuring continuous, secure, efficient and reasonably priced electricity supply for households and small businesses. AU buys electricity in the market at the most favourable terms and resells it, at prices that allow to meet its costs, to distributors or retailers of the standard offer market (*mercato di maggior tutela*) for supply to small consumers who did not switch to the open market.

Since the full opening-up of the electricity market on 1 July 2007, AU has been purchasing electricity to cover the requirements of the standard offer market, i.e. household and small business consumers (connected at low voltage, with less than 50 employees and a yearly turnover not exceeding EUR 10 million) who did not choose a new provider in the open market. It also manages an energy consumers' help desk and holds public bidding procedures to select providers of last resort.

The manner in which AU procures electricity is specified in the Decree of the Minister of Productive Activities of 19 December 2003. Under the decree, AU may:

- Make over-the-counter contracts (off the power exchange) for a volume not exceeding 25% of the overall yearly forecast demand of the captive market.
- Participate in procedures for the allocation of transmission capacity in order to import electricity from abroad and, on the basis of its allocated capacity, make contracts with foreign suppliers.
- Procure electricity on the electricity market in order to cover the remaining requirements, after making financial contracts to hedge the risk of price volatility.

AU also holds bidding procedures to identify providers of the last resort service (*servizio di salvaguardia*). This service is rendered to all final customers who do not qualify for the standard offer market and who may temporarily find themselves without an electricity supplier.

SMART METERS AND GRIDS

Italy has deployed smart grid extensively with nearly 32 million smart meters installed in homes and businesses throughout the country. These smart meters include a wide variety of technologies and can be put to many uses, including remote metering, outage monitoring, fraud detection, retail-provider switching, electric vehicle charging, and variable renewables integration.

Enel Distribuzione, the second-largest distribution company in Europe, which has a total market share of 85%, has led the deployment of smart grids. Smart grid technologies have also been deployed at transmission level by Terna to help manage energy flows, help with real-time system optimisation, perform real-time system monitoring, and predict variable renewable generation. Terna also includes storage in its definition of smart grid technologies, which it uses to ease transmission constraints.

The main driver of smart grid deployment at the distribution level has been improved service and cost reductions. Between 2001 and 2013, Enel estimates that service quality – as measured by the number of minutes of interruption per year – has improved by 65%, while the operation and maintenance expenditures have declined by 40%, from EUR 80 to EUR 51 per customer. As a result of these and other efficiency improvements, the component of retail tariffs allocated to distribution costs declined by 35% over that same period.

The smart grid infrastructure is also a key component of the common customer management platform under development (IIS). The creation of an independent database system requires data to be collected on a constant basis and in a consistent fashion. It also requires that smart grid data be made available to third parties, which may give rise to opportunities for privacy violations, fraud, and other abuses.

REGIONAL INTERCONNECTIONS AND MARKET COUPLING

Italy's transmission grid is interconnected to the wider European transmission system by means of 25 high-voltage interconnectors. In addition, the development of two high-voltage direct current (HVDC) lines connecting Italy to Montenegro has been approved as part of the most recent transmission development plan. The majority of Italy's imports have historically come from Switzerland, totalling nearly 25 000 GWh in 2012, and France, with more than 12 000 GWh. Imports from Slovenia in 2012 neared 4 000 GWh. Imports from Austria in 2012 were slightly above 1 000 GWh.

Starting in January 2011, Italy and Slovenia coupled their day-ahead wholesale markets. Under market coupling, the two countries agreed to a common methodology for determining prices, with calculations performed simultaneously in both countries using a common dataset.

While originally adopted on a temporary basis, the project was deemed successful and made permanent as of 2014. Allocation of the daily transmission capacity between the two countries is now done entirely through market coupling. This has brought significant measurable benefits, including rationalising flows between the two countries such that electricity moves from the lower-price to the higher-price region. In 2012 and 2013, prices between the two regions converged for 20% and 12% of the time, respectively.

In February 2015, following a successful period of testing during the previous month, market coupling at the Italian borders was successfully launched. As of this time, the electricity markets in three of the five countries bordering Italy, namely France, Austria and Slovenia, were coupled by means of the synchronisation of respective power exchanges and the co-ordination of their respective TSOs. On the remaining two borders (Italy-Switzerland and Italy-Greece), the process will commence later in 2015.

TRANSMISSION PLANNING AND FORECASTING

Terna is responsible for the National Electricity Transmission Grid Development Plan, which lays out expected grid investments over a ten-year period. The plan is developed through a five-stage process: definition of system targets; analysis of mid- and long-term scenarios; establishment of development needs; determination of specific grid needs; and final plan development. Terna's plan for 2015 provides for capital expenditure, totalling EUR 6.7 billion, of which EUR 5.1 billion is to be spent in the following ten years.

The plan contains proposals for significant reductions of transmission congestion, approximately 5 000 MW of new interconnection capacity and the integration of around 5 500 MW of renewable electricity.

System targets are defined to ensure sufficient security of supply and quality of service. Targets for congestion reduction are also set, and the plan must in general maximise renewable generation and minimise environmental impact. Mid- and long-term scenarios focus on load growth and the integration of new generating units, as well as any expected regulatory requirements. On the basis of these forecasts, critical infrastructure needs are identified, as well as opportunities to reduce system constraints and improve interconnections with other countries.

The grid development plan itself sets out a mix of new transmission projects and improvements to the existing grid. Opportunities for smart grid deployment and network rearrangements are also identified. Finally, Terna will develop a specific set of projects with associated cost-benefit analyses. These projects are then submitted for approval by the appropriate regulatory bodies.

The most recent development plan includes EUR 5.1 billion of expenditures on system improvements and new transmission lines over the next ten years. Some of these transmission projects will extend outside Italy, including new HVDC connections with France and Montenegro. Most of the projects, however, are focused on reducing transmission constraints within Italy and improving connectivity between mainland Italy and some of its islands.

From the current ten-year plan, approved projects include the two interconnections mentioned above, a 150 kV submarine cable connecting the Islands of Campania to the mainland, a new high-voltage connection between Sicily and Calabria, and grid upgrades for four metropolitan regions (Turin, Milan, Naples and Palermo). Also approved was a trial of a battery system intended to reduce transmission constraints between Campania and Puglia.

The European Union has mandated the European Network of Transmission System Operators for Electricity (ENTSO-E) with the delivery of a biennial ten-year network development plan (TYNDP), the first pilot of which was released in 2010. The purpose of the TYNDP is to identify gaps in infrastructure from a broader European perspective and to inform decision makers in EU member states and other stakeholders about projects with a network-wide impact. The TYNDP builds on national and regional investment plans. ENTSO-E has formed six regional groups to identify and address network investment and development challenges reflecting regional particularities and needs. Italy forms part of two groups: the Continental Central South (CCS) Regional Group, which also includes Austria, France, Germany, Slovenia and Switzerland, and the Continental South East (CSE) Regional Group, which includes Greece, Hungary, Romania, Slovenia and the Balkans.[3] The TYNDP 2014 identifies about 100 locations on the European grid where bottlenecks exist or may develop in the future, if reinforcement solutions are not implemented. Furthermore, ENTSO-E has identified the northern borders of Italy and the boundary between Italy and Greece and the Balkans area as transmission bottlenecks. Internal bottlenecks with respect to market integration are also observed within Italy.

To help create an integrated EU energy market, the European Commission has drawn up a list of 248 projects of common interest (PCIs). These projects may benefit from

3. Albania, Bosnia-Herzegovina, Bulgaria, the Former Yugoslav Republic of Macedonia, Montenegro and Serbia.

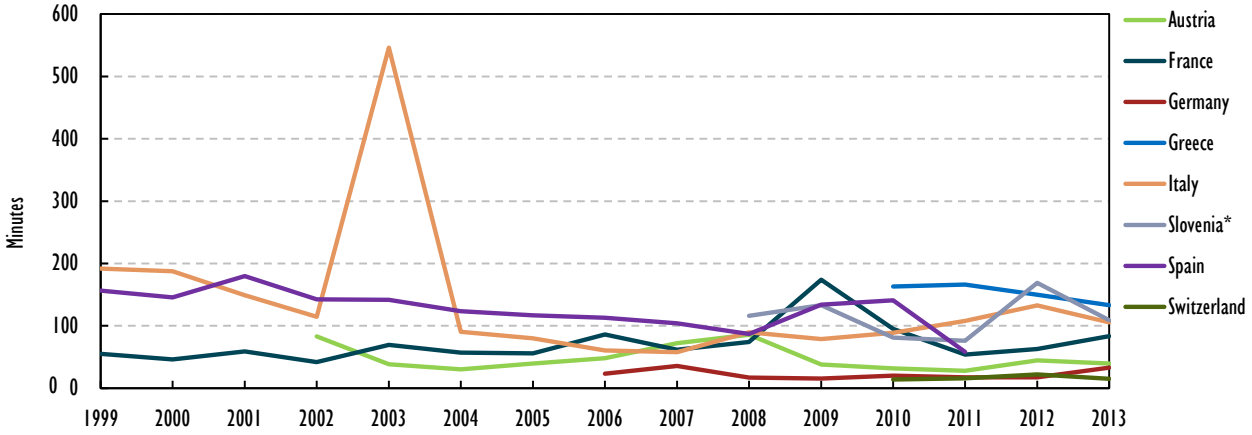
accelerated licensing procedures, improved regulatory conditions, and access to financial support totalling EUR 5.85 billion from the Connecting Europe Facility (CEF) between 2014 and 2020. The TYNDP has been stated as the sole basis for the selection of PCIs. Among others, the CCS-TYNDP identifies Italy-France interconnection, three Italy-Austria interconnections, the interconnection between Italy and the Balkans area, two Italy-Switzerland interconnections, Austria-Germany interconnection and two Italy-Slovenia interconnections as PCIs. The CSE-TYNDP identifies investments at France-Italy (one project), Austria-Italy (three projects), Italy-Montenegro (one project), Italy-Switzerland (two projects), and Italy-Slovenia (two projects) as PCIs.

ELECTRICITY SECURITY

OUTAGE RATES

In 2013, Italy was ranked thirteenth out of 26 EU countries in terms of average length of outages. Approximately 60% of the outages are in the medium-voltage network, while 35% are in the low-voltage network. Compared to neighbouring countries and other countries in Central Europe, outages in Italy tend to last longer (see Figure 6.10). In addition, the trend in recent years has been towards longer outages. While the average outage rate in 2013 was in line with the average rate of the previous five years, this is because 2013 was the first year in that period when outage lengths declined.

Figure 6.10 Unplanned System Average Interruption Duration Index (SAIDI), length of outages in selected countries, 1999-2013



* Slovenia uses an alternative indicator instead of SAIDI, which is more representative of the average interruption time on medium-voltage networks because interruptions originating from low-voltage networks are not taken into account.

Source: CEER (2015), *CEER Benchmarking Report 5.2 on the Continuity of Electricity Supply Data Update*, Council of European Energy Regulators, Brussels.

POWER SYSTEM OPERATION AND SECURITY TRENDS

Terna has primary operational responsibility for electricity emergency response. The operating standards that the TSO is obliged to meet under the Grid Code – which is in turn guided by ENTSO-E (see below) – cover a range of key issues including: appreciation of the system state; control room backup; over/under-frequency load shedding; restoration plans; and black start units.

Terna manages the National Control Centre, which co-ordinates operations through eight regional control centres and three switching centres. The control system acquires continuously comprehensive real-time data relating to the state of the electricity system and implements any corrective measures needed to maintain reliable and secure electricity services. Each Regional Control Centre is responsible for real-time system operation within its own territory.

The essential duties of the system operator are performed in three phases:

- The *planning phase* is the formulation of operational plans developed on the basis of day-ahead electricity demand forecasts and available generating capacity at national level. The short-term weekly and daily forecasts, developed on the basis of medium-term forecasts and day-ahead bids, and offers from the wholesale spot market, allow the determination of the production levels, configuration of grid functioning and calculation of contingency reserve requirements.
- In the *real-time control phase*, the system operators manage the production of active and reactive power and determine power flow limits and the generation margin for the network. The system operators also prepare to intervene to control any emergencies and to facilitate timely restoration of services following an outage.
- In the *operation analysis phase*, the TSO analyses the functioning of the system, so as to inform preparations for the next system operating cycle.

The electricity distribution networks also have an important role in electricity emergency response planning. DSOs are required to support the TSO where a network crisis occurs.

The growing proportion of variable renewables in the electricity mix means that real-time information sharing, robust communications and co-ordination of real-time power system management between the TSO and DSOs have become more important. Arguably, Italy is moving towards an electricity system in which the distribution networks, as a result of the growing number of distributed generation power plants connected to the network, need to progressively move from being passive to active players in the system. This means that DSOs need to become increasingly capable of exchanging signals with load distributors and generators as well as with the TSO, in order to maintain voltage and current standards, adequate performance in case of relevant incidents and, in general, the security of the Italian power system.

EMERGENCY MANAGEMENT AND RESTORATION PLANNING

The nature and volume of emergency and other resources available to the TSO and other responsible parties to manage emergency events are set out in the Italian Grid Code. Chapter 10 of the code, known as the Defence Plan, is designed to deal with multiple contingencies which can lead to a system cascading effect or emergency/interruption conditions in order to avoid the partial or total collapse of the system.

Under ENTSO-E standards, control room functions must be backed up in a separate location so that the system can withstand any damage to the main installations.[4] In accordance with the Grid Code, Italy has backup control centres in case of any damage to the switching centres, the National Control Centre, and the Regional Control Centres.

4. ENTSO-E, the European Network of Transmission System Operators, represents 41 electricity transmission system operators (TSOs) from 34 countries across Europe. The network was established and given legal mandates by the EU's Third Legislative Package for the Internal Energy Market in 2009, which aims at further liberalising the gas and electricity markets in the European Union.

All control centres are equipped with uninterruptible power supplies supported by a dedicated backup electricity generator, and testing occurs once a year. Furthermore, in accordance with the Grid Code and ENTSO-E standards, all gas-fired power plants and hydroelectric power plants in Italy are required to have black start capacity, and to self-test this capacity at least twice per year. The list of black start plants and load rejection capabilities is updated regularly.

The Defence Plan vests authority for co-ordinating the restoration of service with the TSO. Prioritisation is afforded to the fastest possible restart of thermal power plant units by means of predefined corridors (or re-energisation corridors), which are energised by "black start" units or islanded areas of the system still in operation. In the case of separation between Italy and the rest of the European electricity network, system restoration can be supported by top-down re-energisation via interconnectors (or connections between neighbouring systems) in accordance with bilateral or trilateral agreements. DSOs are responsible for ensuring the prompt availability of the load required for balancing and of ballast load (the utilities loads that are connected to the power restoration lines during the first phases of return to service).

In June 2010, Terna, the French TSO *Réseau de Transport d'Électricité* (RTE), and the Swiss TSO *Swissgrid,* agreed a joint operational trilateral procedure in order to co-ordinate the restoration of the Italian system using interconnectors. The procedure identifies co-ordinated actions in case of islanded operations and/or blackouts (including inter-TSO diagnosis, information exchange and co-operation) and preselected re-energisation paths involving the interconnectors (two paths from France and five paths from Switzerland). Restoration plans are updated when necessary (e.g. to implement lessons learned from tests, or following the decommissioning of power plants or corridors previously included in the re-energisation path).

SYSTEM STATE

The "system state" (e.g. normal, alert, emergency and blackout) is continuously assessed and monitored by the TSO, which carries out system security analysis during all operational phases.

The system state itself is determined through voltage monitoring at the main nodes, online AC load flow and automated security analysis. Analysis of different scenarios, for example, is performed by using dynamic security assessment (DSA) software, which provides a dynamic security assessment on the basis of a set of predefined critical exceptional contingencies (e.g. disconnection from the continental EU power system, internal network separation on sections of critical infrastructure, busbar faults, and cascading events).

Assessment of the system state regarding the northern grid interconnections with continental Europe is managed jointly with the neighbouring TSOs – Swissgrid, RTE, APG, the Slovenian Electricity System Operator (ELES) and the Hellenic transmission system operator ADMIE. Inter-TSO agreements have been signed with all TSOs to which the Italian grid is directly linked through the northern interconnectors, and these include pre-prepared remedial actions to enhance system security, including a mutual emergency assistance service (MEAS). Terna also participated with regional TSOs in the development of the Pentalateral Energy Forum, founded in 2005 to promote collaboration on cross-border exchange of electricity, which enables operators to curtail electricity imports or exports and implement control programmes to support system

security at the Italian northern interconnections. Each TSO in the pentalateral region is allowed to trigger the procedure in the event of a grid security violation once all internal and non-costly remedial actions have been implemented.

Together with RTE (France), Elia (Belgium), 50Hz (Denmark) and National Grid (United Kingdom), Terna is also a member of CORESO – a regional service provider which supports member TSOs with security assessments. The purpose of CORESO is to enhance operational security and enable better co-ordination among TSOs in terms of interconnected operations and implementation of co-ordinated remedial actions across the regional power system.

FREQUENCY CONTROL AND LOAD SHEDDING

In the event of under- or over-frequency situations, Terna's National Control Centre can activate special-purpose tertiary reserves to recover the nominal frequency. The Centre's communications with power plants for the purpose of rebalancing generation is performed by a SISCOM (*sistema comandi*) tool which manages the automatic generator control function. In an emergency, it is also possible to send advance warning by telephone. Deployment of formal defence plans such as load shedding may also be used to manage exceptional circumstances.

Under ENTSO-E standards, in order to prepare for the possibility of a major frequency drop, automatic load shedding functions must be installed to prevent a further frequency drop and the collapse of the system. Automatic load shedding protocols are likely to be the main tools available to the TSO to quickly manage a crisis in real time.

In accordance with Grid Code requirements, Italy's TSO has prepared an Emergency Plan for the Security of the Electricity System (*Piano di Emergenza per la Sicurezza del Servizio Elettrico,* or PESSE). The plan establishes protocols for automatically interrupting power supplies to domestic and other non-industrial users and – during off-peak hours – for industrial users without contracts containing an interruption clause.

ASSESSMENT

Since the last in-depth review, Italy has continued to make progress in terms of market liberalisation and infrastructure development. This can be seen in the number of retailers competing in the electricity market and the general trend of customers moving out of the regulated and into the free market, and in the reductions in congestion, in particular in mainland Italy. The regulator AEEGSI remains independent and well-functioning. Terna, the independent system operator, has also demonstrated its capacity for designing appropriate long-term development plans and for maintaining system stability. Institutions that were relatively young at the time of the last in-depth review are now maturing, and it is clear they are well suited for their respective roles.

Significant progress has been made in the wholesale market, with prices generally converging throughout Italy and falling more in line with wholesale prices throughout Europe. One exception is Sicily, where prices remain significantly above the rest of Italy. Transmission improvements currently under way between Sicily and mainland Italy are likely to resolve this concern. Prices in the wholesale market are calculated zonally: there are six zones (four on mainland Italy, plus Sicily and

Sardinia) and four "poles of limited production", consisting of generating units whose interconnection capacity with the grid is smaller than their installed capacity. It may be that, as existing transmission constraints are reduced, more or different zones should be created, so that price signals can more accurately reflect remaining system constraints. Moving to nodal pricing may also lead to system improvements, in particular given the high share of variable renewables.

A significant portion of wholesale market purchases comes from AU or the single buyer. Italy is the only European country to use the single buyer model (CSA, 2013). AU, charged with meeting the electricity needs of the regulated retail market, does not serve customers directly, but rather purchases the required quantities of electricity in the wholesale market. This is then resold by retail companies serving the regulated sector at a reference price which can be compared to the price retailers acting in the free market. Because AU purchases its power from the wholesale market, it is in practice competing with retailers. While its relative share of purchases in the wholesale market has been declining, the presence of such a large single buyer in a market raises concerns about overall competitiveness. The Italian regulator is currently working on a review of the current regulation in order to overcome these concerns, and a legislative proposal to exclude households and small enterprises from the regulated retail market is currently under discussion.

Enel remains the largest single supplier of electricity although its market share has been falling albeit relatively slowly. The relatively high liquidity and price performance of the wholesale market suggests that market power abuse is inexistent or is at least not significant. Nonetheless, the relative share of Enel in the power mix should be examined more carefully, in particular with a view to determine how often its plants are setting the marginal price. Enel Distribuzione is also the largest distribution company. Enel, the parent company, serves 85% of the regulated market and 76% of the domestic free market. While Enel's generation and distribution assets are held under completely separate business units, its continued dominance in both these sectors is a cause for concern, and should be examined more carefully.

Despite the progress in the wholesale market, the absence of an independent market monitor is notable. A market monitor is empowered to observe wholesale market bids in real time, to determine whether market rules are being violated, and often to mitigate bids that it deems to be unreflective of underlying market dynamics. It also delivers annual reports describing market conditions and making recommendations for improvements to market rules. In Italy, these responsibilities lie with GME, the power exchange. Markets in the European Union, the United States and elsewhere, however, have established separate market monitors in order to ensure that the monitoring function is performed in an unbiased and transparent fashion. Market monitors do not set market rules and are distinct from competition authorities and sector regulators in that they have no power to mitigate price distortions and market participants' leading position. Rather, they serve to augment and strengthen the roles of these other institutions by offering fair, objective advice on how to improve market conditions, and to ensure that market abuses, should they occur, can be remedied. Often the mere existence of a market monitor is enough to prevent abuses of market power, and it can be an important element in the development of efficient retail markets, by ensuring that wholesale prices accurately reflect marginal costs. Italy could strengthen the existing market

monitoring role by making it external to, and therefore independent of, GME. This has been done in U.S. markets such as the PJM Interconnection. Separating the market monitor role from the day-to-day operations of the market itself would help to ensure that the electricity market functions in the public interest.

While natural gas remains the largest single source of generation in Italy, its relative share has fallen increasingly in favour of solar PV and wind. Italy has been very successful in integrating large shares of variable renewable generation while also maintaining a stable power system, and without significant negative impacts on the wholesale market. The high penetration of solar PV has changed the shape of the load curve on many days, reducing peak demand and increasing the need for fast-ramping generation.

The rapid increase of solar PV in the recent past challenges the efficiency of intraday and balancing markets in their current form. Bidding blocks on the intraday market remain hourly and gate closure takes place at least five hours before real time. This leaves a large balancing burden on resources in the balancing markets, which tend to come at higher cost. In addition, the pricing structure of balancing markets (pay-as-bid pricing, non-remuneration of critical services) may thwart efficient outcomes. This could be addressed via the introduction of new market products. In consideration of the changed needs of the electricity system resulting from the increase of intermittent renewable energy generation, at the end of 2012 the Italian regulator began a public consultation process in order to define possible future changes of the ancillary services and balancing market. In the first document, the regulator asked Terna to develop a study aimed at describing the actual needs of the electricity system. In response Terna proposed flexible performances of the plants, for example: reduction of the minimum time necessary to start production, increase of the speed of the balancing service. Furthermore, Terna proposed that plants using renewables, with power over 10 MW participate to the ancillary services and balancing market. We look forward to the completion of this process.

Italy has a significant overcapacity of generation relative to peak load and is the largest importer of electricity in Europe. Imports have increased steadily since the last review, creating stress on the existing interconnections. Terna plans to resolve this by adding between 3 000 and 5 000 MW of new capacity on the northern border, as well as a new 1 000 MW interconnection to the Balkans via Montenegro. Italy has also improved electricity flows with Slovenia through market coupling. These imports make economic sense, as power from neighbouring countries is often cheaper than domestic natural gas-fired generation. The combination of overcapacity, low-cost imports, and the general fall in demand as a result of low or declining economic activity has reduced the profitability of the generating sector, in particular by depressing peak prices. There is some concern that generating capacity will retire as a result, potentially lessening system security and reducing the amount of flexible generation. While overall system security is not in any immediate danger, the need for flexible generation is real and Italy is right to focus on this concern. To address the problem, Italy is considering the introduction of a capacity mechanism. The stated goal is to remunerate capacity and encourage flexibility without increasing retail rates. Capacity mechanisms being considered elsewhere in Europe are focused on meeting peak demand needs, and so remunerate all generation based on their availability. Italy does not have a deficit of available capacity, but is seeing relative reductions in its flexible capacity – specifically, the reduction of

natural gas-fired generation, while the amount of generation from coal remains fairly constant. For this reason, if Italy is to introduce some kind of capacity mechanism, it should consider carefully how the capacity product itself is designed, so as to ensure that it promotes the type of generation that is most valuable from a system perspective. While discussions around the capacity market design are ongoing, it is notable that the current design proposal includes a mechanism that will encourage investment in flexible capacity. Ideally, such incentives should be designed to be as technology-neutral as possible.

Creating such a mechanism without raising the cost to consumers will be difficult, as in practice these costs must be borne by one or the other user in the market. Any additional cost to consumers could perhaps be offset by reductions in taxes or in the "general burdens" portion of the tariff. Such reductions are necessary, however, as Italy's retail tariffs are among the highest in Europe. For industrial users, tariffs are the highest in Europe by a large margin, a factor that impacts on the relative competitiveness of Italian industries. Recent reductions in wholesale prices have brought prices down somewhat, but further reductions are unlikely unless natural gas prices fall further. Any additional reductions in retail rates, therefore, will have to come from the fixed portion.

The largest single contributor to the "general burdens" component is the cost of supporting the feed-in-tariff. The move to reduce this by replacing existing incentives with lower payments extended over longer periods of time will be helpful, but probably insufficient. Italy should refine the tariff system further, so that more of the cost for these subsidies falls on the shoulders of those who benefit the most from them.

Despite the unbundling of grid ownership and operation in retail supply and distribution, the establishment of a fully functional retail market remains incomplete. According to Eurostat, retail rates averaged EUR 26.4 per 100 kWh over 2014, giving Italy the sixth-highest retail prices in the European Union.[5] There are three main barriers that have blocked progress in the past: the complexity of retail rates, continued heavy-handed regulatory measures (standard rates and single buyer procurement), and the persistent dominance of Enel, the incumbent. All these factors form a systemic challenge that calls for an integrated solution.

Italy's electricity retail tariffs cover a very broad range of charges and are presented in a complex form. To identify potential retail offers, consumers must estimate both their capacity needs and annual usage, and then select from a range of options with limited information beyond price. It is often the case that the so-called *servizio di maggior tutela*, or protected service, is the cheapest option. Apart from the differentiation according to connection capacity and consumption, the tariff spread is a result of a complex allocation arrangement of system charges. In particular the A3 surcharge to cover renewables incentive costs amounts to approximately EUR 12.5 billion per year, and makes up nearly 85% of the total system charges for a typical household user. The charge may be as high as EUR 0.06322/kWh for a small commercial consumer and as low as EUR 0.02907/kWh for a household. Large industry pays approximately EUR 0.04863/kWh, a charge that declines as overall usage increases. In summary, SMEs currently bear 38% of A3 surcharge costs while

5.http://ec.europa.eu/eurostat/documents/2995521/6849826/8-27052015-AP-EN.pdf/4f9f295f-bb31-4962-a7a9-b6c4365a5deb.

only consuming 25% of the electricity. The complexity in tariff design is hampering switching of supplier and the current design may overburden SMEs and act as a disincentive to certain efficiency measures such as heat pumps. Notably, Legislative Decree No. 102/2014 requires the regulator to examine ways in which to simplify the tariff structure.

AEEGSI calculates standard tariffs for the protection regime which are regularly adjusted to take account of changing spot market prices and pass them through to final consumers. Italian households and small businesses are eligible for this tariff, which must be included in the portfolio of all offered tariffs by each supplier. The AU is the single buyer in charge of purchasing electricity for these consumers. The standard tariff system was originally conceived in 2007 as a market power mitigation measure, given the dominant position that Enel held on both the generation and supply sides at that time. While Enel's market power on wholesale energy markets seems to have declined, it has persisted in the retail sector. Enel owns 85% of the distribution grid, and 34.9% of the retail market. The second-largest retailer, Edison, has 7.3% of the market.

Missing from the retail sector is a strong consumer advocate. While a number of organisations in Italy do play this role, consumers are better served when they are represented by a single organisation that has a strong mandate to represent consumer interests in all matters related to utilities, for example retail tariffs. In many jurisdictions, the consumer advocate is situated within a state agency, while in others it may be an NGO funded by consumers. It is important that the consumer advocate has no other role in the market, so that it may be viewed as a super-parties broker by both consumers and other market participants. The retail tariff structure is complicated, though efforts by the regulator to simplify the tariff will hopefully help to resolve this. Retail consumers must choose a retail tariff based on their estimated peak use, and then may be charged different rates depending on their annual usage. Such a system may reduce peak use, but leads to little load reductions in total as households and businesses simply shift their consumption to other hours. One alternative is to move to time-of-use pricing, charging higher rates during hours of relative scarcity. Higher on-peak rates could be offset with lower off-peak rates, so that average consumers would see little impact on their total bill.

The tariff system may also discourage the use of energy efficiency measures that involve fuel switching towards electricity, for example the use of heat pumps for heating. The regulator is considering the introduction of a special tariff to encourage heat-pump use. While the intent of such a change is commendable, adding more details to an already complex tariff system should be done cautiously, as it may lead to unintended consequences. Instead, Italy should seek to take advantage of its smart grid infrastructure. Italy has installed smart meters in nearly 32 million homes, which have helped to significantly reduce the costs for distribution companies and improve overall system stability. Consumers, however, are unable to take full advantage of these meters, as they lack the ability to see and control their own electricity use. Increased awareness of consumption could encourage energy efficiency without having to rely on relatively opaque and confusing tariffs.

RECOMMENDATIONS

The government of Italy should:

- *Strengthen current market monitoring activities and make recommendations on market rules in order to ensure that the market operates in a fair and open fashion.*
- *Examine mechanisms to simplify the retail tariff structure and introduce measures to put downward pressure on prices, for example by offsetting or completely replacing the A3 component of the retail bill with an economy-wide carbon tax.*
- *Allow consumers to take advantage of existing smart grid infrastructure to provide them with greater control over their electricity consumption and costs, and encourage active demand participation.*
- *Ensure that additional interconnections are managed in such a way as to maintain overall system stability.*

References

AEEGSI (2014), *Annual Report to the International Agency for the Cooperation of National Energy Regulators and the European Commission on the Regulatory Activities and the Fulfilment of Duties of the Italian Regulatory Authority for Electricity, Gas and Water*, Autorità per l'Energia Elettrica, il Gas e il Sistema Idrico, Milan, Italy.

CEER (2015), *CEER Benchmarking Report 5.2 on the Continuity of Electricity Supply Data Update*, Council of European Energy Regulators, Brussels, Belgium.

CSA (Castalia Strategic Advisors) (2013), *International Experience with Single Buyer Models for Electricity*, Wellington, New Zealand.

EC (European Commission) (2014), *Quarterly Report on European Electricity Markets, Volume 7,* Directorate-General for Energy), Market Observatory for Energy, Brussels, Belgium.

GME (Gestore del Mercato Elettrico) (2015), *Annual Report 2014*, Rome, Italy.

IEA (International Energy Agency) (2016a), *Energy Balances of OECD Countries*, 2016, www.iea.org/statistics/, OECD/IEA, Paris.

IEA (2016b), *Electricity Information 2016*, www.iea.org/statistics/, OECD/IEA, Paris.

IEA (2016c), *Energy Prices and Taxes 2016*, Q3, www.iea.org/statistics/, OECD/IEA, Paris.

7. NATURAL GAS

Key data (2015 estimated)

Natural gas production: 6.8 bcm, -43.9% since 2005

Net imports: 61.0 bcm, -20.8% since 2005

Share of natural gas: 36.7% of TPES and 38.3% of electricity generation

Consumption by sector (2014): 61.9 bcm (power generation 35.2%, residential 29.9%, industry 17.9%, commercial and public services, including agriculture and fishing 12.1%, other energy industries 2.9%, transport 2.1%)

OVERVIEW

Italy's natural gas market is the third-largest in Europe. Over the past six years the country has invested significantly in new infrastructure but is now experiencing a period of falling demand as the economic crisis continues to hurt and demand for gas-fired power is offset by the growth in electricity generated from renewable sources and energy efficiency. Furthermore, despite the implementation of many new measures to facilitate the emergence of a competitive gas market, end-user prices remain high by European standards while wholesale prices appear to be converging with other markets.

SUPPLY AND DEMAND

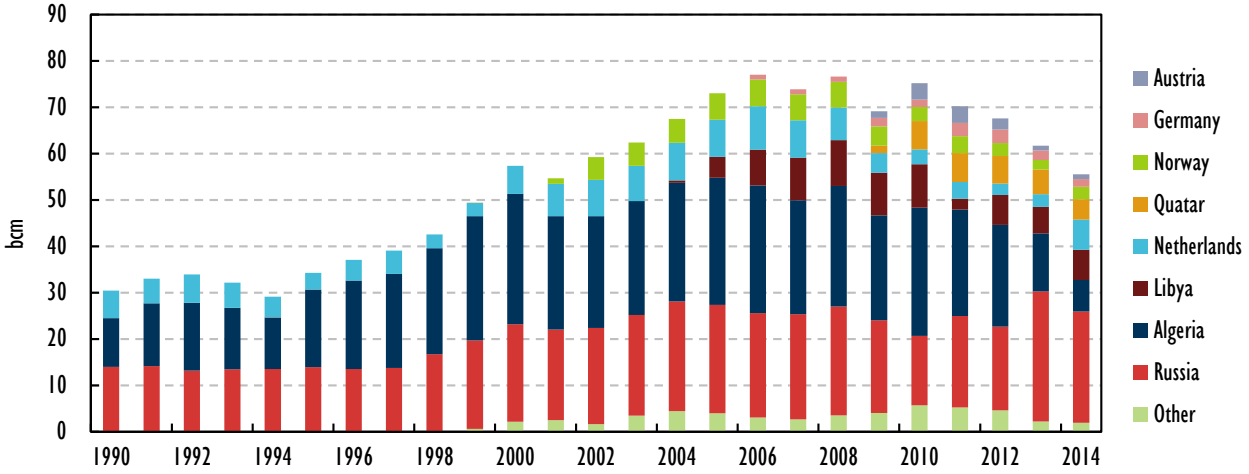
SUPPLY

Natural gas is the largest fuel in Italy's energy sector, representing 36.7% of total primary energy supply (TPES) and 38.3% of electricity generation in 2015. Natural gas supply was 67.5 billion cubic metres (bcm) in 2015, equivalent to 55.3 million tonnes of oil-equivalent (Mtoe). The supply of natural gas increased by 9.1% in 2015 from the year before, but was 21.7% lower than a peak of 86.3 bcm in 2005.

Italy produced 6.8 bcm of natural gas in 2015, or 10% of domestic supply. Production peaked in 1994 and has been falling since, as resources depleted; it was 56.1% lower in 2015 than in 2005. At present, there are 719 active gas well assigned to 26 concessions.

Natural gas imports totalled 55.8 bcm in 2014 while 0.2 bcm was exported (Figure 7.1). Imports originated from Russia (43.1%), Algeria (12.2%), Libya (11.7%), Netherlands (11.7%), Qatar (7.9%) and others. Imports from Libya, Qatar, Germany, Austria and Croatia all started in 2003. Previously, imports originated mainly from Russia, Algeria, the Netherlands and Norway. Since 2004, imports from Algeria, Norway, and the Netherlands have declined by 73.6%, 48.6%, and 19.1% respectively, while imports from Russia have increased by 1.7%. Exports were to Switzerland (41.4%), Slovenia (29.5%), and Austria (29.1%). Italy has diversified its natural gas imports over the same period.

Figure 7.1 Natural gas net imports by country of origin, 1990-2014



Source: IEA (2016), *Natural Gas Information 2016*, www.iea.org/statistics/.

Box 7.1 The future of Italy's gas supplies

While Italy has access to multiple gas supply sources, the supply mix is heavily dependent on Russian. In the future, the reliability of North African imports – which have traditionally been the main diversification option to Russian gas – remains questionable. While ENI has strongly reduced its imports of Algerian gas in recent years owing to the sharp reduction in domestic demand, it is unclear to what extent Algeria could ramp up exports to levels seen early in this decade. There has been limited new investment in the Algerian upstream sector while fast growing demand may limit the availability of gas for export. ENI, Enel and Edison hold commercial gas supply contracts with Algeria (Sonatrach) and these will expire in 2019. Commercial gas transit contracts with Tunisia will also expire in 2019. Signing new supply contracts in the context of reduced internal demand and an ever-increasing share of hub-linked prices in Europe might also prove challenging.

During March to September 2011, gas supply from Libya came to a complete halt because of war, then slowly resumed in October and returned to full capacity in late 2013. Deliveries from Libya are directly linked to the precarious political situation in the country, which continues cause concern. An increase in production and exports beyond current average levels is unlikely.

Increased imports from Russia have offset reduced deliveries from North Africa in the recent past. ENIi, Italy's largest importer of gas from Russia, has long-term contracts terminating in 2035 and this gas is currently supplied by pipeline via Ukraine and Slovakia. In winter months, imports from Russia cover well over 40% of total imports. Repeated cuts in supply, caused by commercial and political disputes between Russia and Ukraine in 2006 and 2009 have given rise to concerns regarding the reliability of future Russian gas deliveries transiting Ukraine, given the deepening of the political crisis between the two countries.

Box 7.1 The future of Italy's gas supplies **(continued)**

In more recent winters, Ukraine has proven to be a reliable transit route for transportation of Russian gas to European markets but future interruptions during the winter season cannot be ruled out. In response, Italy has implemented further gas security measures and built new import infrastructures (Italy now has a total import capacity of 15 bcm/year of LNG supply and over 16 bcm of storage capacity, including strategic storage). In the medium term, LNG markets are likely to offer increasing opportunities to source spot cargoes as a result of oversupplied LNG markets and the emergence of more flexible LNG volumes as new facilities in the US are commissioned. Gazprom had been developing the South Stream project, and following its cancellation at the end of 2014, the Turkish Stream project was initiated in order to supply gas to Italy via a new route bypassing Ukraine. Realisation of the Turkish Stream project is uncertain and it remains unclear if, and how, Russian gas could be supplied to Italy via the planned Nord Stream expansion. Under these circumstances, it is likely that Ukraine and Slovakia will remain key transit countries for Russian gas supplied to Italy.

While uncertainties surround most traditional suppliers, one new source of supply for Italy and for the rest of Europe is being developed in the Caspian area. The "Southern Gas Corridor" project, starting in the Shah Deniz 2 offshore field in the Caspian Sea, which crosses Azerbaijan, Georgia, Turkey, Greece and Albania and lands in Italy via the Trans-Adriatic Pipeline (TAP) is set to be opened in 2020. It will transport 10 bcm of gas per year, of which 8.8 bcm is destined for Italy. The Italian government gave its final approval to the project in May 2015. While this latest project is a welcome development, the new quantities of gas available through the Southern Gas Corridor will be limited. There is potential for doubling the capacity of the TAP pipeline to 20 bcm/year and expanding supplies via the TANAP pipeline through Turkey if more Caspian gas becomes available. The gas supply potential from this region beyond Shah Deniz 2 may be greater, especially from other offshore fields in Azerbaijan, Turkmenistan, Iran or northern Iraq, but will require strong political engagement, co-operation among all interested stakeholders, in particular Georgia, Azerbaijan, Turkmenistan and Turkey, as supply or transit countries and viable commercial agreements materialise.

Last but not least, the export potential for offshore gas in the eastern Mediterranean is unconfirmed; however, major finds have been made, beyond Israel, recently offshore Egypt by ENI and further exploration activities are is underway.

Overall, the most secure option to diversify gas supplies in the medium term appears to be the development of LNG trade with key partner countries.

DEMAND

The power generation sector is the main consumer of natural gas with 35.2% of inland consumption in 2014 . Demand from other sectors was: residential 29.9%, industry 17.9%, commercial and other services 12.1%, other energy industries and energy own-use 2.9% and transport 2.1% (Figure 7.2).

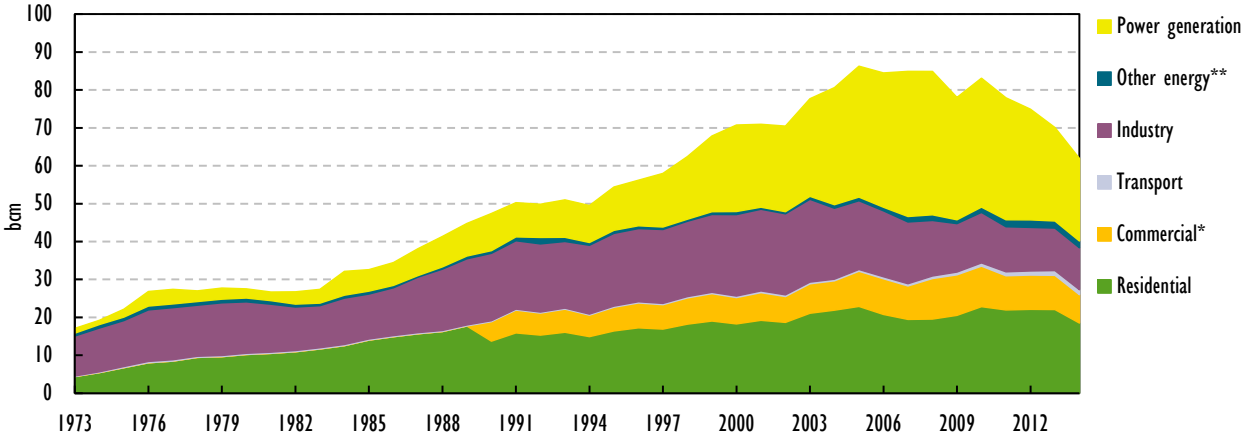
Following the economic downturn and changes to the underlying structure of the sector, industry demand decreased sharply over the past decade with its share in total consumption falling from 23.2% in 2004 to 17.9% in 2014. Demand in the power generation sector has also declined sharply from a top level of 38.3bcm in 2007 to

21.8bcm in 2014. The power generation's share in total natural gas consumption has also decreased from the highest share in 2007 (45.1%) to the 35.2% value in 2014.

The only sector that has shown continuous growth in the last decade is the transport sector, which has increased their demand for natural gas by over 200% since 2004., The absolute values, however, are small with a 2.1% share of total demand, up from 0.5% in 2004.

Household consumption fell in 2014 compared to previous year (17 %), and is back at a level similar to consumption during 1998-2002. The commercial and public services (including agriculture) also showed a decline in natural gas consumption in 2014 (7.5%), which brings it down to a level similar to 2004.

Figure 7.2 Natural gas supply by sector, 1973-2014



Note: methodology for residential and commercial consumption changed in 1999.

* *Commercial* includes commercial and public services, agriculture/fishing and forestry.

** *Other* includes other energy industries and energy own-use.

Source: IEA (2016), *Natural Gas Information 2016*, www.iea.org/statistics/.

NATURAL GAS TRADE

Italy imports natural gas from five pipeline entry points (Tarvisio, Gries Pass, Gorizia, Mazara del Vallo and Gela) and three LNG regasification terminals (GNL Italia in Liguria, Adriatic LNG off the coast of Veneto, and Offshore LNG Toscana (OLT) off the coast of Tuscany). Construction of the TAP pipeline, a 10 bcm per year pipeline, which will bring gas from the Shah Deniz field in Azerbaijan to Europe, is expected to commence by May 2016. The government has been strongly supportive of this project, which will open up a new Southern Gas Corridor to Europe. The first gas sales to the European Union via TAP are scheduled for 2020. Italy also plans closer links with the more liquid northern European markets, and the transmission system operator (TSO) is working to reverse the flow of the Gries Pass and Tarvisio pipelines that are expected to become fully operational at the end of 2018.

The role of long-term import contracts still remains very important for the Italian gas supply system, where about 90% of demand is covered by imports. In the most recent outlook by the Regulatory Authority for Electricity, Gas and Water (AEEGSI), published in its *2015 Annual Report*, almost one-third of active contracts have a contractual period of over 15 years. But this figure has strongly decreased over the years. The residual contractual periods for active gas supply contracts are shown in Table 7.1.

In 2014, long-term supply contracts over 20 years are decreasing compared to previous years. The contractual framework is slowly changing: more than 60% of current contracts will expire in the next ten years. The number of contracts with residual duration of less than one year and between one and five years is increasing.

Table 7.1 Residual contractual periods to supply gas to Italy

Remaining contractual period of gas supply contracts (in volumes)	Up to one year	Over one year, less than five years	Over five years, less than ten years	Over ten years, less than 15 years	Over 15 years, less than 20 years	Over 20 years
2005	5.%	7%	15%	50%	19%	4%
2008	4.%	4%	8%	20%	17%	47%
2011	12.%	11%	28%	17%	7%	25%
2014	14.9%	13.3%	34.8%	4.8%	8.7%	23.7%

Source: AEEGSI (2014), Annual Report to the International Agency for the Cooperation of National Energy Regulators and to the European Commission on the Regulatory Activities and the Fulfilment of Duties of the Italian Regulatory Authority for Electricity, Gas and Water, Regulatory Authority for Electricity, Gas and Water, Milan.

INFRASTRUCTURE

TRANSMISSION

Gas transmission activities in Italy are carried out by Snam Rete Gas S.p.A., Società Gasdotti Italia S.p.A., Edison Stoccaggio S.p.A. and a small number of companies operating at regional or local level. Snam Rete Gas, an investor-owned company, owns and operates approximately 95% of the natural gas transmission network (around 32 306 km of pipeline). In January 2012, the company changed its name from Snam Rete Gas to Snam and conferred the transmission, dispatching, remote control and gas metering businesses to a new company Snam Rete Gas.

Snam became a corporate entity, the owner of four operating companies that focus on the management and development of their respective businesses, while the new transmission company was configured as an independent transmission operator, as defined in Italy's enforcement of the Third Energy Package of the European Union. In May 2012, Italy's Presidency of the Council of Ministers approved a decree defining the methods and terms of Snam's ownership unbundling from ENIi. According to the decree, ENIi had to sell at least a 25.1% stake in the business to Cassa Depositi e Prestiti (CDP), a largely state-owned savings bank. In October 2012, CDP completed the closing of the acquisition of 30% minus one share of the voting capital of Snam held by ENIi. Consequently to the sale, Snam is no longer subject to the control, management and co-ordination of ENIi and operates independently. Snam also fully controls GNL Italia regasification terminal.

In 2013, following the conclusion of the process to unbundle Snam Rete Gas from its parent ENIi, AEEGSI certified it as an ownership-unbundled TSO. The operator certification procedure was carried out in order to verify the operator's compliance with the provisions of the ownership unbundling model provided for by Directive 2009/73/EC and Legislative Decree No. 93 of 1 June 2001 for its transposition into national law. Also in 2013, following receipt of the opinion issued by the European

Commission pursuant to Article 3 of Regulation (EC) 715/2009, the Authority proceeded with the certification of two other major companies: Società Gasdotti Italia and Infrastrutture Trasporto Gas (Edison-EDF).

Interconnections

There are five natural gas pipelines (Transmed, Greenstream, TAG, TENP/Transitgas, Italy-Slovenia) with five pipeline entry points for importing natural gas into Italy. The combined natural gas import capacity of the five pipeline entry points is 298.6 million cubic metres/day (mcm/d) or around 109 billion cubic metres/year (bcm/yr). Utilisation rates were relatively low in 2014: the interconnector with the highest utilisation rate in 2014 was Tarvisio with 67% utilisation; the lowest was Gorizia with 0%.

Two pipeline entry points (Tarvisio and Passo Gries) account for almost 60% of Italy's gas imports. Italy's biggest entry point is the TAG pipeline interconnection through Tarvisio in the northeast of the country, which in 2014 delivered 26.1 bcm of natural gas (maximum capacity of 107 mcm/d), equivalent to 47.2% of total gas imports to Italy. The TMPC interconnection to Tunisia through Mazara del Vallo has fallen into second place, in terms of volume delivered, in favour of the Passo Gries interconnection with northern European markets. In 2014, the Passo Gries interconnection delivered 11.4 bcm or 20.6% of total gas imports to Italy.

All of Italy's northern natural gas pipeline interconnectors have reverse flow capacity: Tarvisio with 18 mcm/d reverse flow capacity from Italy to Austria; Gorizia with 2 mcm/d reverse flow capacity into Italy from Slovenia; and Gries Pass with 5 mcm/d reverse flow capacity back into northern Europe via Switzerland from Italy. In 2018, following the conclusion of the work to strengthen reverse flows, the overall capacity available to exit the Italian system towards northern and central European markets will be 40 mcm/d.

Table 7.2 Transmission entry and exit points

Cross-border entry points of LNG	**Firm transmission capacity winter 2013-14 [mcm/d]**	**Utilisation rate 2014**
Mazara del Vallo	99	18.7%
Gela	31.6	56.4%
Tarvisio	107	66.9%
Gorizia	2.0	0.01%
Passo Gries	59	53.1%
Panigaglia	13	0.56%
Livorno	15	0.005%
Cavarzere	26.4	46.37%
Cross-border exit points	**Firm transmission capacity winter 2013-14 [mcm/d]**	**Utilisation rate 2014**
Bizzarone	1.2	3.36%
Repubblica di San Marino	0.5	3.89%
Tarvisio	18	0.08%
Gorizia	4.4	0.56%
Passo Gries	5.0	0%

Sources: MSE, IDR country submission.

Access

At the beginning of each gas year, users can book capacity for gas transmission on the Snam Rete Gas network, on a firm and/or interruptible basis for up to five gas years. In order to be entitled to book capacity at import entry points, users must be owners of an import contract, i.e. a natural gas purchase contract with delivery at the same import entry point. Multi-annual natural gas imports must be authorised by the Ministry of Economic Development (MSE). Spot contracts do not need ministerial authorisation.

Each month after the beginning of the gas year, and for a maximum duration equal to the remainder of the same gas year, if capacity is available, shippers may request an increase of transmission capacity at the existing points.

Trading is allowed, at entry/exit and redelivery points, between users that comply with the requirements necessary to access the transmission service. All capacity trades must start on the first day of the month and for a minimum duration of one calendar month with the exception of import entry points where capacity trades are allowed for a minimum of one day, effective on any day of the gas year.

The transfer of transmission capacity is allowed for the needed capacity to supply gas at the corresponding redelivery point of the national network until the end of the gas year. The transfer of capacity to a redelivery point, belonging to the national network may run from any day of the gas year, starts from the second day after the result of the transaction and continues until the last day of the gas year.

Investments

Since 2008, the European Union has strengthened its framework for cross-border infrastructure development both within the regulatory market framework of the Third Energy Package and within the framework for trans-European networks for energy (TEN-E). Within ENTSO-G (for gas), TSOs co-operate on the development of EU-wide grid planning, by means of EU-wide ten-year network development plans (TYNDP), regional investment plans and national TYNDPs.[1] In March 2015, ENTSO-G published the fourth edition of the EU-wide TYNDP (TYNDP 2015) covering the 2015-35 period.

Furthermore, TYNDP 2015 plays a central role in the selection process of projects of common interest (PCIs). These have been defined as projects that help create an integrated EU energy market. The European Commission has drawn up a list of 248 PCIs. These projects may benefit from accelerated licensing procedures, improved regulatory conditions, and access to financial support totalling EUR 5.85 billion from the Connecting Europe Facility (CEF) between 2014 and 2020. Among the projects selected as PCIs are the TAP, the Interconnector Turkey-Greece-Italy (ITGI) and the GALSI and Cyréné pipelines. A project to develop reverse flows at the Passo Gries interconnection between Italy and Switzerland is also included.

1. The role of ENTSO-G (the European Network of Transmission System Operators for Gas) is to facilitate and enhance co-operation between national gas transmission system operators (TSOs) across Europe in order to ensure the development of a pan-European transmission system in line with European Union energy goals.

Figure 7.3 Map of Italy's natural gas infrastructure

This map is without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries, and to the name of any territory, city or area.

Decree No. 65, dated 27 February 2013, of the MSE, defined a mechanism for assessing and monitoring the development plan of gas transmission systems. Pursuant to the decree, grid operators must communicate their plans to states, the regulatory Authority and the MSE. Each year, grid operators submit their TYNDP to the AEEGSI and to the Ministry of Economic Development, with the effective measures to guarantee the system adequacy and the security of supplies. It also takes into account the economic effectiveness of the investment and environmental protection concerns. Following receipt of the plan, the AEEGSI submits it for public consultation in an open and transparent manner and publishes the outcome of the consultation.

The MSE assesses whether the TYNDP is consistent with the National Energy Strategy (NES, hereafter the Strategy) referred to in Article 3, whether the infrastructure programmes correspond to international agreements signed by the Italian government and to the need to guarantee, in the medium and long term, security of supply. The AEEGSI examines whether the TYNDP meets all investment needs identified during the consultation process and whether it is coherent with the non-binding EU-wide TYNDP (EC Regulation 715/2009).[2] The AEEGSI consults ACER (Agency for the Cooperation of Energy Regulators) whenever doubts emerge on the consistency with the EU-wide TYNDP. The AEEGSI may require the TSO to amend its ten-year network development plan.

The AEEGSI monitors the implementation of the TYNDP. Should there be evidence that the grid operator did not realise an investment which, on the basis of the plan, should have been realised, the AEEGSI can oblige the operator to realise the investment within a defined period of time. In case of non-compliance with the measures issued following the monitoring activity, AEEGSI can impose sanctions (AEEGSI, 2014).

EU Gas Regulation (EC) 715/2009 requires European TSOs to publish Gas Regional Investment Plans (GRIPs) on a biennial basis. After an analysis of transmission system interconnections and operation, as well as infrastructure development needs, the ENTSO-G and TSOs agreed on six regional groups, in some cases overlapping, to develop the first GRIPS. Italy participates in two of these groupings: the South-North Corridor and the Southern Corridor.

The Snam Rete Gas network development plan for the 2015-18 period for the Italian domestic market amounts to investments of EUR 5.1 billion, of which EUR 1.3 billion to be spent in 2015. These investments are aimed not only at enhancing security of supply and flexibility of the system, but also at supporting gas flows towards the European markets, in the broader perspective of an effective interconnection with the continental networks. Regarding transmission, representing approximately EUR 3.1 billion, the main elements of the 2015-18 strategic plan include:

- development of infrastructure in the Po Valley, with the aim of increasing transport capacity in the north of the country, while at the same time making physical export to northern Europe possible
- increasing liquidity in domestic and European markets, by making new integrated services, among other things, available to shippers
- investing in the Italian domestic network to increase flexibility and interconnections with the regional network.

2. Regulation (EC)715/2009 of the European Parliament and of the Council of 13 July 2009 on conditions for access to the natural gas transmission networks and repealing Regulation (EC)1775/2005.

The 2015-18 strategic plan envisages an extension of the gas network by about 1 000 km and an increase of the installed capacity of the compression stations of around 130 MW. Beyond the plan period, investments for a further EUR 1.7 billion are also expected, aimed at completing development projects mainly oriented to create new entry capacity from the south of Italy. Snam will also invest in the two GRIPs, South-North and East-West, and has acquired stakes in both TAG and Transitgas. Snam is also assessing the opportunity to acquire a possible 20% stake in the TAP pipeline.

Authorisation for new pipelines

Authorisations to build new transmission pipelines are issued by MSE for the National Transport Network (NTN) and by the regions for Regional Transport Networks (RTN). Authorisation is granted by MSE only for infrastructure included in the NTN by a unified procedure, including environmental impact assessment and a declaration of public interest. All Snam Rete Gas pipelines allow reverse flow; flow direction depends in part on the entry/exit point utilisation chosen by the users; the time needed for the reversion of the flow is due to fixed technical timing.

N-1 Compliance

Italy's natural gas supply infrastructure is N-1 compliant. A natural gas network can be considered N-1 secure when it is capable of maintaining normal operations (i.e. reliable delivery of natural gas to consumers) in the event of a single credible contingency event, such as the unplanned loss of its single largest pipeline, interconnector or LNG terminal.

Italy's N-1 compliance score for 2014-15 is 108.1%, up from 106.1% in 2012-13. The N-1 estimate for 2014-15 is calculated on the basis of an estimated maximum daily peak demand of 490.7 mcm/d and a diversified range of supply sources (328.6 mcm/d pipeline import capacity; 52.8 mcm/d LNG import capacity; and a 242.5 mcm/d peak draw-down rate from natural gas storage facilities).

DISTRIBUTION

The natural gas distribution sector operates under service concessions granted by local authorities, and distribution company revenues are subject to regulation. Only one network operator is allowed to distribute natural gas in each concession area for the duration of the concession. The distribution companies operate from delivery points on the gas transmission network to final customer redelivery points. There were 222 gas distributors in 2013, of which the first ten operators had more than 65% of the market in terms of gas delivered to final consumers. In the coming years, the number of gas distributors will be reduced; this is a consequence of the sector reform programme, launched in 2007, that divided the Italian territory into 177 distribution basins and a corresponding number of concessions, which will be auctioned. The first tenders for distribution concessions will be launched by the end of 2015.

In 2014, the distribution company with the greatest market share was Italgas S.p.A (owned by the Snam Group) with a market share of 24.7% and approximately 52 600 km of network and 5.9 million active delivery points. The second- and third-largest operators are 2i Rete Gas S.p.A and HERA with a respective market share of 16.6% and 8.9%.

Box 7.2 Auctions for the acquisition of basin concessions for the management of gas distribution service

***Gas distribution market summary*:**

- 250 000 km of pipelines
- 222 operators
- 24 million delivery points and 29 bcm of gas delivered
- Total regulatory asset base (RAB) value of EUR 15 billion
- 12-year concessions
- Weighted average cost of capital 7.6% distribution, 8.0% metering activity.

Participation requirements

Economic and financial capacity: average of annual turnover during the previous three years of at least 50% of the annual value of services or financial guarantees of at least 50% of the annual value of services.

Technical capacity and management capacity: ownership of concessions for a total number of customers representing 50% of the customers or ownership of concession facilities (electricity/hydro) and ability to manage systems (available facilities, equipment and personnel); quality certification UNI ISO 9001; experience in operating in accordance with the security requirement cases of exclusion: bankruptcy, insolvency procedures, conviction of criminal charges; no participation in temporary associations or consortia.

Award criteria : percentage on total score awarded to tenders

Economic conditions 28%: (13%: discount to customers on maximum tariffs set by AEEGSI; 5%: discount on service fees + additional length of gas grid per customer; 5%: share of tariff offered to basin municipalities; 5%: additional investments in energy efficiency.)

Safety and quality conditions 27%: 22%: safety beyond the minimum standards set by AEEGSI; 5%: quality beyond the minimum standards set by AEEGSI.

Grid development plan 45%: extension of the grid, replacement of pipelines, decompression stations, etc.

Expected benefits of the reform

- Tender criteria fixed by ministerial decree represent a guarantee of uniformity and transparency; the reform provides general benefits for stakeholders and for the whole distribution system in terms of efficiency and scale economy profits.
- Benefits for municipalities: annual fee (up to 5% of distribution revenue value, VRD); investments on distribution network (development plan); investments in energy efficiency inside basin); decrease of tender costs (one bid for basin, guidelines for determination of residual value).

Benefits for operators: increase of transparency and certainty.

Benefits for customers: increase in efficiency, safety and quality of the service; in the mid-term tariffs decrease.

Source: MSE.

Smart metering

Smart metering in gas distribution started in 2008 and deployment was slow in the early years. In 2014, however, the number of deployed smart meters increased to 524 000 from 286 000 in 2013. While the number of smart meters is low in absolute terms, gas deliveries through smart meters have reached over 41% of total deliveries on distribution systems (12 187 bcm). It is expected that the current level of deployment of smart meters will continue for several years, with prioritised targeting of highest consuming delivery points.

LIQUEFIED NATURAL GAS

Italy also has three operational LNG regasification terminals with a combined import capacity of 54.4 mcm/d, and combined annual regasification capacity of 15.5 bcm. These terminals are: the Adriatic (Cavarzere) offshore LNG terminal near Rovigo; the Panigaglia terminal in Liguria; and the Livorno offshore terminal in Tuscany.

The Adriatic (Cavarzere) LNG terminal has a 26.4 mcm/d send-out capacity, and an annual regasification capacity of 8 bcm (equivalent of almost 10% of Italy's annual gas consumption). The terminal's storage capacity is 250 000 cubic metres (m^3) and the minimum permitted LNG tanker payload is 65 000 m^3.

The Panigaglia LNG terminal (owned by GNL Italia) has a 13 mcm/d send-out capacity, and an annual regasification capacity of 3.75 bcm. Its storage capacity is 100 000 m^3. The terminal can receive tankers with payloads ranging from 25 000 to 70 000 m^3.

The Livorno LNG terminal (owned by OLT) has a 15 mcm/d import capacity, and an annual regasification capacity of 3.75 bcm. The terminal's storage capacity is 155 000 m^3. It can receive tankers with payloads up to 165 000 m^3.

Other new terminals have been authorised, but the likelihood of them being built is unlikely under present market conditions:

- Porto Empedocle (Enel) onshore terminal in Catania, Sicily, with an initial nominal throughput equivalent to 8.0 bcm/year of natural gas (third-party access exemption in place)
- Falconara Marittima (API Nova Energia) a 4.0 bcm/year floating offshore terminal located north of Ancona, in Marche (third-party access [TPA] exemption under evaluation)
- Gioia Tauro (Med Gas LNG) 12 bcm/year onshore regasification terminal located near Gioia Tauro in Calabria, southern Italy (application for TPA exemption under evaluation).

There is a one-stop-shop procedure for authorisation. An application is sent to MSE and the environmental impact assessment (EIA) is sent to the Ministry for the Environment and made available for public consultation. MSE calls a first meeting of the joint conference (*conferenza dei servizi*) inviting all central and local administrations involved to discuss the project and to gather their preliminary advice. When the EIA is completed, and the Ministry for the Environment has confirmed the environmental compliance of the project, MSE convenes the concluding meeting of the joint conference to issue the final decision. If the State's administration in which the project is to be implemented opposes the project, notwithstanding possible compensation measures, MSE can submit the final decision to the Council of Ministers that can override the negative advice of the state, allowing MSE to grant the authorisation to build the infrastructure. This is true for both pipelines and LNG terminals.

Box 7.3 LNG peak shaving

LNG can play different roles as a short-term response measure and in long-lasting emergency situations. Taking into account difficulties in receiving LNG cargoes in the short term, only *ex ante* measures could be adopted in favour of the LNG system for short-term response measures. Such measures could be an agreement between shippers and producers for a cargo diversion in case of need or an enhanced use of the LNG storage tanks as "peak shavers" even if only for peak performance disruptions. Italy has implemented this last measure:

- LNG tanks of the regasification terminals are filled up at the beginning of the winter season by a market operator, selected through an auction mechanism, with regard to the share of the regasification capacity that has not been already booked by the LNG terminal users.
- The market operator receives a differential (determined by auction) that covers its losses resulting from bringing LNG to the Italian market instead of selling it in other international markets.
- If no emergency occurs, LNG will be held in the tanks until 1 April and then given back to the market operator who then sells it to the Italian market.
- In case of emergency, the LNG will be regasified and sold on the virtual trading price *punto di scambio virtuale*) at market price by the TSO, and the regasified LNG is returned to the shipper on 1 April by the TSO buying it at the VTP on a daily basis.

The system provides the benefits from full-load functionality being present continuously and being able to respond quickly to emergencies and having a better flexibility of cargo discharges.

LNG could also play an important role for long-lasting emergency situations where gas price in the affected market increases and can attract new LNG supplies. A co-ordinated joint purchase of LNG flexibility options in case of emergency could be a tool to be implemented, provided it is compliant with EU competition rules.

STORAGE

Storage activities are based on licences issued by the MSE for a period of 20 years, with a possibility of maximum one renewal of ten years.

Priority for the use of storage is given to natural gas producers in fields located in Italian territory, within certain limits, to allow them the same degree of modulation available to importers using flexibility of their import contracts.

Authorisation for imports of gas produced from non-EU countries and with a duration of more than one year is conditional, *inter alia*, on availability of a 10% flexibility of daily average quantity in their supply that can be reached by means of seasonal modulations and by using storage or a mixed portfolio of supply contracts

At present, storage facilities are managed by Stoccaggi Gas Italia (Stogit), the legally unbundled storage company of ENIi, and by Edison Stoccaggio, the legally unbundled storage company of Edison. Stogit is 100% owned by Snam, and Edison Stoccaggio is 100% owned by Edison.

For the storage contractual period (1 April to 31 March) 2014/15 Italy's natural gas storage capacity was around 16.02 bcm, of which 4.62 bcm was reserved as strategic storage in accordance with the Ministerial Decree of 29 March 2012. In January of each year, MSE

can vary the amount of strategic storage to take into account the level of risk in the gas system for the following winter season. The maximum nominal peak draw-down rate from the natural gas storage system during the same period was 238.6 mcm/d.

Italy has developed a fully regulated storage system that provides the market for storage capacities as a possible tool to fulfil the supply standards obligation of natural gas retailers. All the capacity for modulation of commercial storage (11.4 bcm) is offered to EU gas market players by the storage undertakings. This is done every year at the end of the winter season, by means of an auction mechanism. Two products are offered: a seasonal product (that has a withdrawal profile during the winter season, designed for the needs of household customers) and a product with a flat withdrawal profile (more attractive for industrial customers). Both products are further distinguished by different injection procedures: a product that allows injection of a discrete amount of gas in one month (the month which the auction refers to) and another product that allows the injection of gas volumes throughout the injection period starting from the month the auction refers to. The auction system gives an accurate price signal to the market for the value of modulation storage capacity. The storage system operators enjoy a regulated compensation mechanism, established by the regulator AEEGSI, to balance their regulated revenues if the auction revenues do not cover the regulated tariff.

Strategic storage is a last resort resource. This service is assured by a quantity of gas permanently stored in the storage system (currently 4.6 bcm, stored in the same fields as those used for modulation storage) and is not dependent on the modulation storage cycle. The strategic gas volume stored is not picked up by the market every year because it is composed of gas from the residual original reserves of the gas fields (never produced) and of some gas injected in depleted fields by the former monopolist. Strategic storage has, therefore, become a service provided to the system by the storage system operators that, thanks to market opening and to the unbundling provisions, inherited such capacities.

Moreover, strategic storage does not increase the price of the commodity and it improves overall gas system performance, particularly because it ensures a better peak withdrawal response for the modulation storage. Finally, the strategic storage is used only when all modulation storage, injected by the gas undertakings, has been totally withdrawn, that is to say in an emergency situation, when no other gas is available on the market, with the aim to ensure as long as possible the supply for protected customers (as happened in 2009).

After withdrawing strategic gas, the users are required to reinject it. Prices for withdrawal and injection of strategic storage are regulated by AEEGSI. Only the ministry can authorise the use of this strategic storage as a non-market measure, according to EU regulations. The cost paid by the gas market players for this last resource device to supply gas to protected customers is about EUR 0.001 per cubic metre per year; therefore it does not affect price differential between Italian *punto di scambio virtuale* (PSV, virtual trading point) and other EU markets where gas is cheaper. The actual spread between PSV and northern EU trading hubs (about EUR 0.02/kWh) depends on transport charges in place between northern hubs in more liquid markets linked to gas-producing countries, and the Italian market, which is very dependent on gas imports by means of take-or-pay contracts still linked to oil-indexed price formulas.

Strategic storage in Italy could also result in a benefit for neighbouring countries in case of a severe emergency situation. This is because Italy could supply gas to its protected customers thus making gas imports from other sources available for other countries facing a gas shortage.

The use of strategic storage is conceptually similar to the stockholding obligation of crude and oil products established at EU and IEA levels. As storage is developed in depleted gas fields, which remain the property of the state, the MSE has competence in strategic supply and infrastructure and in granting and monitoring concessions; it allocates underground depleted gas fields to companies as concessions. The needs for new storage fields and capacity are planned by the government under the National Energy Strategy. In 2014, there were 15 storage concessions in Italy, with ten storage facilities, eight of which are operated by Stogit and two by Edison Stoccaggio.

The natural gas storage sector is fully regulated and the allocation procedures and tariffs are defined by the AEEGSI. Under the conditions established by MSE and AEEGSI, the storage companies offer storage services to shippers and final customers who take part in an auction-based allocation system. These auctions define capacity costs and are considered by the AEEGSI to define tariffs for the next injection and withdrawal periods. Storage operators publish technically available storage capacities every year in February.

Table 7.3 Natural gas storage facilities

Location	Working gas [mcm]	Maximum peak performance [mcm/d]
Brugherio	330	8.0
Cellino	118	0.8
Collalto	440	2.8
Cortemaggiore	960	15
Fiume Treste	4 005	66
Minerbio	3 078	57
Ripalta	1 686	12
Sabbioncello	939	20
Sergnano	2 244	55.5
Settala	1 820	37.5
Total	15 620	274.6

Sources: MSE, country submission.

Table 7.4 Natural gas storage facilities under construction

Location	Authorisation	Working gas (mcm)	Max peak performance (mcm/d)	Operational date
San Potito e Cotignola	2009	915	7.2	2014-15
Bordolano	2001	1 200	20	2015-16
Cornegliano	2011	1 300	27	2015-16

Sources: MSE, country submission.

Each year, the amount of strategic storage is set by a MSE notice. Strategic storage must be at least sufficient to cover the equivalent of a 50% disruption of peak capacity at the main national entry point for a period of 60 days. It is determined on the basis of imports through the system's major entry points. All natural gas imports from outside the European Union are included in this calculation.

The long authorisation process, which includes EIA requirements, has become a barrier to the creation of new storage capacity. Access to storage facilities is based on regulated TPA, and tariffs are published by the national regulatory authority. The tariffs include a commodity charge, a strategic storage fee, and charges for volume, injection and withdrawal capacity.

The Italian government, in the National Energy Strategy, planned the development of new storage capacity (about 75 mcm/d of additional peak supply capacity and about 5.0 bcm of storage capacity). As a result of a fall in demand in recent years, the process to develop this capacity stopped: additional capacity reached 2.6 bcm in 2014. Nonetheless, this development allowed the system to be secure in case of emergency situations such as the one that occurred in February 2012. Furthermore, this storage capacity, together with possible further commercial storage capacity, will help to increase the liquidity and competitiveness of the market, representing also a potential for modulation of export flows.

Licensing of storage facilities is overseen by the Ministry of Economic Development (MSE), which evaluates all applications with the advice of an expert committee. Following MSE examination, the Ministry of the Environment and Protection of Land and Sea (MATTM) evaluates the environmental report and delivers the EIA.

After a positive outcome of the EIA (if it is the case), MSE calls for a joint services conference between MATTM, regional governments, municipalities and other ministries (if involved). After 180 days the conference has to grant a decision. If this decision is positive, the project is approved and the storage licence is authorised.

MARKET STRUCTURE AND OVERSIGHT

MARKET OVERSIGHT

The Italian Regulatory Authority for Electricity, Gas and Water (AEEGSI) is the independent body that regulates, controls and monitors the electricity and gas markets in Italy.

Its mission includes defining and maintaining a reliable and transparent tariff system, reconciling operators' economic goals with general social objectives. It provides an advisory and reporting service to the government, and formulates observations and recommendations concerning issues in the regulated sectors of electricity and gas.

The Italian Competition Authority (AGCM) is also active in the energy sector. It has taken a number of actions to promote competition in the natural gas sector. In October 2014, AGCM and the regulator AEEGSI signed a memorandum-of-understanding to strengthen consumer protection, with particular reference to unfair commercial practices in the regulated sectors.

MARKET STRUCTURE

The natural gas industry in Italy consists of production, transport (transmission and distribution) system operators, natural gas storage companies, LNG regasification facilities, and the retail market and trading. All TSOs' activities are regulated by AEEGSI,

including storage, LNG regasification and distribution activities. An exemption from the regulate regime may be granted to new infrastructure projects at the request of their promoters. The dominant company in the natural gas transmission sector is Snam Rete Gas with a 32 245 km transmission pipeline network, corresponding to 94% of total pipelines operating in Italy (the longest network in Europe).

There are five gas storage operators in Italy but the dominant company in the sector is Stogit (owned by Snam Group). Stogit has a 96% market share in Italy and has the most storage capacity of any gas storage company in Europe.

With regard to the LNG regasification sector, there are three significant players, two on the Tyrrhenian coast and one on the Adriatic with an overall technical send-out capacity of 15.5 bcm per year.

WHOLESALE MARKET AND TRADING

PUNTO DI SCAMBIO VIRTUALE

The main trading platform in the wholesale market in Italy is the PSV, which is managed by Snam Rete Gas. It enables gas capacities and quantities to be traded on the basis of over-the-counter contracts. In 2014, 150 parties conducted trades, sales and purchases of gas on the PSV; around one-third of them (48) were traders, insofar as they were not users of the transmission system (AEEGSI, 2014). Volumes traded on the PSV have increased more than fivefold since 2008.

Table 7.5 PSV transactions and volumes, 2008-14

Year	Energy (GJ)	MWh	Volumes (mcm)	No. of transactions	No. of users
2008	625 461 777	173 739 383	16 416	92 211	69
2009	938 119 312	260 588 699	24 622	105 077	96
2010	1 724 930 722	479 147 423	45 274	147 253	106
2011	2 308 444 838	641 234 677	60 589	206 307	120
2012	2 589 148 035	719 207 788	67 957	212 932	131
2013	2 631 211 092	730 891 970	69 061	208 043	112
2014	3 201 522 083	889 311 690	84 030	226 269	150

Sources: Snam and MSE.

GAS EXCHANGE

In 2007, Decree Law No. 7 of 31 January 2007, converted into law by Law No. 40 of 2 April 2007, established the obligation for holders of concessions for natural gas exploitation to sell the quotas of gas produced in Italy owed to the state and for importers to offer a quota of gas imported on the regulated capacity market (AEEGSI, 2014).

A MSE decree of 18 March 2010 established a trading platform for quotas of imported gas, called “P-GAS”. Specifically, the decree ruled that, with effect from 10 May 2010, quotas of imported gas which importers are obliged to sell should be offered by

importers exclusively via the new trading platform (in the so-called "import segment"), but that further offers of volumes of gas may be admitted to the platform for sale by parties other than those to whom the obligations imposed by Decree Law No. 7/07 apply. Parties authorised to operate on the PSV may operate on the P-GAS platform. The products traded are contracts with delivery periods of one month or one thermal year. The role of *Gestore Mercati Energetici S.p.A.* (GME) is to manage the platform and not to act as a central counterpart: guarantees, invoicing and payments are managed directly by the operators that sell the gas. Obligatory sales of import quotas are traded on the P-GAS platform on a continuous basis.

As of 10 August 2010, in addition to trading of imported gas quotas, royalty gas lots produced in Italy and owed to the state are traded in the segment of the P-GAS platform dedicated to the sale of royalty gas lots. Here, too, the GME is not a central counterpart and operates exclusively as the organiser and manager of the platform. However, trading takes place by means of a competitive bidding method.

In May 2012, an additional segment of the P-GAS platform, called "the segment referred to in Legislative Decree No. 130/10", was established, in reference to the legislative decree aimed at implementing measures to make the natural gas market more competitive, including infrastructure and storage upgrades. Legislative Decree No. 130/10 was instituted in place of the so-called "antitrust ceilings", now expired, with the purpose of introducing new incentives to foster competition in the wholesale market by developing storage capacity.

Specifically, the decree makes provision for investors to request that *Gestore dei Servizi Energetici* (GSE), while the new storage capacity is gradually brought online and in any case for a period of not more than five years, allows them to deliver gas during the summer period and to have it redelivered during the winter up to a maximum quantity corresponding to the quotas of the new storage capacity not yet online and allocated to them according to the procedures set out in Article 7 of the same decree.

In order to increase the liquidity of the wholesale natural gas market, the decree obliges parties which make use of the inducing measures just described, to offer for sale, in the trading systems organised by the GME, the quantities of natural gas for which they have requested redelivery in the winter period.

In March 2012, the regulatory Authority approved the proposals received from GME and GSE regarding how participating investors could fulfil their obligation to offer quantities of gas made available by the matched virtual storage facility, in relation to the aforementioned quotas, and making provision for them to be alternatively or cumulatively offered on the following platforms:

- The platform for offers to sell natural gas (P-GAS), through the creation of a specific segment called "the segment referred to in Legislative Decree No. 130/10".
- Gas spot markets (MGP-GAS).
- P-GAS is the natural gas trading platform where the gas quotas of parties subject to the obligations of Article 11 of Law Decree 7/07 are bid and where investors participating in virtual gas storage may fulfil their obligation to bid the gas quantities made available by the virtual storage operators associated with them. To trade on the P-GAS, operators must be authorised to carry out transactions at the PSV.

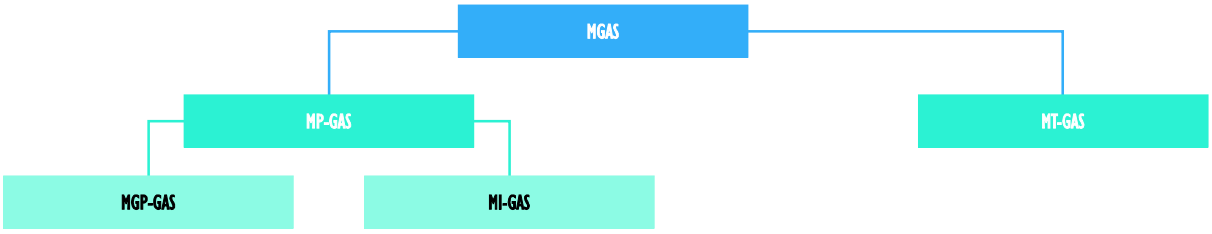
A fully-fledged natural gas spot market, with GME acting as central counterpart, was launched, finally, in December 2010, with the establishment of M-GAS. On this market, operators that have been authorised to carry out transactions on the PSV can purchase and sell quantities of natural gas on the spot market. Initially it was structured in two parts:

- MGP-GAS (the day-ahead gas market) in which trading was continuous, with a closing auction. Trading was organised in respect of the calendar gas day following the day on which the auction trading session ends.
- MI-GAS (the intraday gas market), in which trading was continuous. The trading opened after the closing of the MGP-GAS and closed on the gas day to which bids/offers refer with trading of gas in respect of the same gas day. Trading is continuous.

In this regard, with its Decree of 9 August 2013, the MSE set the launch date for the forward gas market managed by GME (MT-GAS) at 2 September 2013, in implementation of the provisions set out in Article 32, paragraph 2, of Legislative Decree No. 93 of 1 June 2011. The market, which took its place alongside the existing spot markets, operates on the continuous trading mechanism with a large number of trade books, each one for every kind of tradable product and referring to different delivery periods, where bids to buy and offers to sell are selected.

With regard to the operation of the MT-GAS platform since its launch on 2 September 2013, to date trades take place in the various types of tradable products – thermal year and calendar year, six-month, three-month, month, and balance-of-month (BOM), which is a product that includes the days of the current month that have not yet been delivered.

Figure 7.4 Structure of MGAS in 2015



Sources: MSE, country submission.

In 2015, the MGAS consisted of:

- A day-ahead gas market (MGP-GAS). The MGP-GAS takes place under the continuous trading mechanism. Gas demand bids and supply offers, in respect of the calendar gas day following the day on which the session ends, are selected.
- An intraday gas market (MI-GAS). The MI-GAS takes place under the continuous-trading mechanism. Gas demand bids and supply offers, in respect of the gas day on which the session ends, are selected.
- A forward gas market (MT-GAS). The MT-GAS takes place under the continuous trading mechanism. Gas demand bids and supply offers are selected from as many order books as the types of tradable contracts for the different delivery periods. The types of tradable products may be yearly/thermal year, yearly/calendar year, half-yearly, quarterly, monthly and balance-of-month.

The gas market design was completed with the PB-GAS platform, managed by GME on behalf of Snam Rete Gas, through which users of the transmission service can offer, buy and sell available resources. Users are responsible for balancing the gas resources that they need to cover expected system imbalances. In PB-GAS G+1, the participation of the holders of storage capacity is compulsory. At present, the PB-GAS consists of the following segments:

- G-1 segment, where balancing users that have acquired the status of PB-GAS participants may enter gas demand bids and supply offers. On this segment, Snam Rete Gas may – as balance responsible entity and in compliance with AEEGSI's Decision ARG/gas 45/11 – procure the gas resources needed to cover the expected system imbalance.[3] It does this by submitting a single demand bid or a single supply offer in each session. For the purposes of the operation of the G-1 segment, one or more zones are defined where to place the offer points, using one or more types of the flexible resources that Snam Rete Gas has admitted to trading on this segment and, in respect of which, Snam Rete Gas itself may define, where necessary, the corresponding utilisation limits;
- G+1 segment, where authorised users (users of the storage service, except for transmission companies and users of the strategic storage service only) who have acquired the status of PB-GAS participants offer daily – for purchase and sale – the storage resources that they hold.[4] In the G+1 segment, Snam Rete Gas, as balance responsible entity, offers – for purchase or sale – a volume of gas corresponding to the overall imbalance of the system, with a view to procuring the resources offered by the participants and that are needed to keep the gas system balanced.

In 2014, the G+1 segment proved to play a dominant and central role on gas markets. The platform strengthened the good signals that it had launched in 2011 in terms of active participants (77) and overall volumes traded (39 TWh). This performance was favoured by two factors*: i)* the need of participants to minimise the imbalance risk, by using the PB-GAS as a spot gas trading venue; and *ii)* the presence of Snam, which sells or buys daily the surplus volume or the deficit volume recorded in the system on the previous gas day. This said, it is worth stressing that the highest increases were observed in the volumes matched, independently of balancing requirements, rather than in the volumes offered by the balance responsible entity (28 TWh, -20%).

The platform also confirmed the reliability of its price signals, whose reduction to EUR 23.61 MWh (-15% compared to 2013) proved their alignment with the PSV and strengthened their convergence onto the values of the main European markets.

Table 7.6 PB-Gas, G+1 segment, 2011 to 2014

Year	Volumes (GJ)	Volumes (MWh)	No. Operators
2011	6 161 666	1 711 575	59
2012	125 731 644	34 925 458	74
2013	146 998 165	40 382 824	73
2014	128 903 444	38 584 290	77

Sources: MSE, country submission.

3. Pursuant to AEEGSI's Decisions ARG/gas 45/11, 446/2013/R/GAS, 520/2013/R/GAS, 552/2013/R/GAS, as well as 485/2014/R/GAS.

4. Referred to in Art. 1, para. 1 k) of AEEGSI's Decision ARG/gas 45/11.

While there is an oversupply of gas in Italy, there is a persistent lack of liquidity at the hub. This is attributable to a number of reasons: the difficulty in accessing capacity in the main pipelines into Italy, such as Transitgas and TAG, as well as the complexity of most of the rules governing the gas market such as the balancing rules. Nonetheless, the government has introduced a number of measures to improve the market landscape and these measures seem to be having a positive impact.

Box 7.4 Losses resulting from limited integration of national gas markets

The Agency for the Cooperation of National Energy Regulators assessed prospective gross welfare losses across the European Union – losses resulting from limited integration of national gas markets – by contrasting the estimated price deviation of EU member states' gas wholesale markets with the baseline reference price of the Netherlands (a Dutch market price built on the North European gas exchange, TTF). This provided an estimate of the potential savings that could be achieved if all wholesale markets had at least similar competition and liquidity levels, and hence comparable prices as the TTF. This initial exercise does not take into account demand-supply constraints or other factors such as transportation costs, necessary investment costs or import capacity availability, all factors that could affect the potential level of price convergence. On an EU-aggregated basis, the potential annual gas wholesale gross welfare losses due to the current lack of market integration amounted to EUR 7 billion in 2013 (a decrease of EUR 4 billion compared to 2012).

On a country-by-country basis, the highest aggregated potential losses were observed in Italy and France (EUR 2.8 billion in the case of Italy). This is likely to be driven by the fact that their supplies are, relative to the Netherlands, still more reliant on higher-priced existing long-term contracts and because their hubs continue to show lower forward product liquidity. On the basis of absolute values, the results of the ACER/CEER assessment indicate that Italy (and France) stands to gain the most if price convergence with adjacent zones increase. In recent years, Italy has achieved increased price convergence with other northwestern European hubs, and the implementation of auctions for cross-border capacity with Austria can be expected to increase price convergence further in the coming years, thereby realising some of the potential welfare gains.

Source: ACER/CEER (2014), *Annual Report on the Results of Monitoring the Internal Electricity and Natural Gas Markets in 2013*, Agency for the Cooperation of Energy Regulators and the Council of European Energy Regulators, Ljubljana/Brussels.

NATURAL GAS USE IN THE TRANSPORT SECTOR

LNG has cleaner exhaust emissions and higher energy efficiency than oil. LNG could be used as a replacement for heavy oil fuel in sea-borne transportation and for diesel in inland-water transportation. Onshore LNG bunker facilities for vessels are already in place in some EU countries. In road transportation LNG could also replace gasoil/diesel as it would offer the same advantages, especially for truck fleets. LNG refuelling stations are well developed in the United Kingdom and the Netherlands as well as in Spain, Portugal, Sweden, Belgium and Italy (ENTSO-G, 2015).

Compressed natural gas (CNG) for road transportation (mainly light-duty vehicles) is currently the most mature market in Europe with more than 1.0 million vehicles adapted to this technology and around 3 000 filling stations. Natural gas-fuelled

vehicles have been present in the Italian market since the 1930s, when retrofitting of cars, converting them for the use of natural gas, in combination with a relatively well developed refuelling infrastructure, started spreading. The market expanded further in the 1990s, when small and medium-sized vehicle models became available as CNG conversions. This market is supported by the evolution of a relatively well developed refuelling infrastructure complemented by a series of fiscal incentives and other government subsidies.

By June 2014, there were approximately 1.14 million natural gas-fired vehicles in the European Union, of which 885 000 (or 77% of the EU total) were registered in Italy (NGVA, 2014). The Italian fleet can be broken down further into 880 000 light-duty vehicles, 2 300 buses and 3 000 trucks. According to data published by NGVA Europe, natural gas-powered vehicles now have a market share of approximately 2.1% of the Italian vehicle fleet in 2014, one of the highest in the OECD area.

From 2008 to 2010, subsidies for gas-powered vehicles supported the conversion of existing vehicles as well as the purchase of new purpose-built gas-powered vehicles. Over this period, the number of gas-powered vehicles increased by 68% and the number of CNG stations almost doubled. Subsidies were reduced in 2010 and resulted in a slow-down in sales and the uneven distribution of refuelling stations across the country (NGVA, 2014).

At the end of 2014, there are approximately 1 040 (32% of the EU total) natural gas refuelling stations of which approximately 990 are open to the public (NGVA, 2014). There are only eight liquefied-compressed natural gas (L-CNG) filling stations which are often supplied via tanker trucks with LNG from other countries, mainly Spain. Italy hosts one LNG refuelling station, which was opened in April 2014 as part of the European LNG Blue Corridors project. The purpose of this project is to establish LNG as an alternative fuel for medium- and long-distance transport: first as a complementary fuel and later as an adequate substitute for diesel. It is the only supply point in Italy for refuelling LNG-powered heavy-duty vehicles.

CNG and LNG are favourably taxed compared to traditional fuels, especially gasoline on which the tax is among the highest in the European Union. Driving with CNG therefore allows for substantial cost savings in Italy: 64% compared to gasoline and 57% compared to diesel.

EUROPEAN DIRECTIVE ON THE DEPLOYMENT OF ALTERNATIVE FUELS INFRASTRUCTURE

The current lack of infrastructure hampers the wider use of gas (CNG and LNG) as a fuel across Europe and has justified the final Directive 2014/94/EU on the deployment of alternative fuels infrastructure adopted on the 29 September 2014 by the European Parliament and the Council (ENTSO-G). Member states must set and make public their targets and present their national policy frameworks by end-2016. In addition to targets for electric vehicles and hydrogen-powered vehicles, the rules contain targets for LNG and CNG. To support the development of LNG for road transport, member states have to ensure a sufficient number of publicly accessible refuelling points, with common standards, on the Trans-European Network for Transport (TEN-T) core network, ideally every 400 km, to be built by end-2025. The directive also requires a minimum coverage to ensure accessibility of LNG in main maritime and inland ports. The same requirement applies to CNG vehicles, both in urban and suburban areas as well as on the TEN-T core network, ideally every 150 km, to be built by end-2025.

In addition, the directive requires that clear information be given to consumers about the fuels that can be used in a vehicle, using standardised labelling in vehicle manuals, at dealerships and on the recharging and refuelling points. It also aims at providing clear information to users to compare alternative fuel prices with conventional fuel prices. Member states must also ensure that information about the geographical location of publicly accessible recharging and refuelling points is made available in an open and non-discriminatory manner.

The European Union is also looking at LNG as maritime transport fuel. The European Commission, as part of the TEN-T projects, has recently co-financed the Northern Adriatic Ports Association (NAPA) for the creation of a master plan that will assess the potential of LNG as a marine fuel in the harbours of the northern Adriatic. The project, the first of its kind in the Mediterranean, will be completed in December 2015. Italy is also developing activities to increase the use of LNG as fuel for maritime use (even for the Italian Navy fleet) and land transport, and is carrying out the techno-economic analysis to evaluate the feasibility of a national plan on the use of LNG in transport (Italian Presidency of the Council, 2014).

THE STRATEGIC NATIONAL PLAN FOR THE USE OF LNG IN TRANSPORT IN ITALY

In order to foster and consolidate the use of LNG in the transport sector, the Italian government is developing a strategy for the realisation of more storage centres and LNG refuelling stations throughout the country. The goal is to reduce the environmental impact of diesel engines and reduce maintenance costs. For this reasons, MSE is developing a National Strategic Plan (NSP) for the use of LNG in Italy, the aim of which is to foster greater usage of LNG in the country. The NSP will bring the national strategy into line with the EU directive to encourage the use of alternative transport modes to the traditional gasoline- and diesel-powered vehicles and also consistent with the EU 2030 Climate and Energy Framework.

Moreover, in coming years, increasingly stricter ship emission limits will enter into force in many specific areas and worldwide; according to the revised Sulphur Directive, SOx limits (maximum sulphur content in marine fuels) have to be 0.5% by 2020 in EU waters (and 0.1% in EU ports).[5] The Italian government has pledged, in Parliament, to take steps for the construction of storage facilities and redistribution, as well as rules for the implementation of the distributors of LNG to read, throughout the country. A key goal of the strategy is to reduce the environmental impact of diesel engines in transportation by sea and road, to reduce heavy management costs for all users of diesel engines and to develop the use of LNG.

Owing to the intrinsic feature of LNG systems and logistics, the strategy aims to spread the usage of LNG to the whole national territory, and can be functional for supplying natural gas to areas not yet reached by the national network (such as the main island Sardinia or mountainous regions).

To support the development of the strategy, the government established a National Co-ordination Group (NCG), which has prepared a comprehensive document. This document considers regulatory, technical and economic perspectives; safety and social

5. Directive 2013/33/EU of the European Parliament and of the Council of 26 June 2013 laying down standards for the reception of applicants for international protection.

impact of the use of LNG mainly in the transport sector (shipping and heavy-duty road transport) but also in industry.

The NCG is divided into four sub-groups, overseen by ministerial representatives: *i)* authorisations, *ii)* supply and storage, *iii)* social acceptability and dissemination, and *iv)* safe storage and distribution. Three further sectoral sub-groups focus on the use of LNG in the maritime sector, in land-based transport, and other uses such as CNG.

The gas industry estimates that in 2030 at least 10% of total traditional fuels can be replaced with LNG, with a chance to reach 20% of the total energy demand in transport; these figures are conditioned by upholding the favourable fiscal regime for methane as a fuel, by the development of an adequate distribution network and the availability of more competitive means of transport and others conditions.

The share of LNG in heavy-duty road transport could reach a share of 10% to 30% of the current market and in shipping at least 20% (with progressive penetration of LNG in bunkering for point-to-point routes and in ferries) and 10% to 20% of current industrial off-grid usages. The strategy was published for public consultation in June 2015; it is expected to be finalised in 2016.

EMERGENCY PREPAREDNESS

EMERGENCY RESPONSE POLICY

Italy's natural gas emergency response policy provides for mandatory security measures in the national gas system and aims at reducing price fluctuation, increasing supply security, co-ordinating the storage system, and reducing the vulnerability of the gas system.

Natural gas emergency response policies in Italy are underpinned by Regulation 994/2010/EC, in which the different crisis levels and the variety of actions to address them are described. The MSE updated its legislation regarding specific emergency procedures in April 2013, with the adoption of the Preventive Action Plan and the Emergency Plan, as provided for by European regulation.[6] The update establishes the roles of the players involved, the system monitoring procedures, and the measures to be taken by the ministry in the event of a crisis.

In an emergency, the MSE would convene the Technical Gas System Emergency and Monitoring Committee to decide on and adopt the most appropriate available measures. In the absence of an emergency, the committee meets several times a year to monitor issues of natural gas security of supply and develop hypothetical crisis scenarios and measures to intervene in such scenarios should they arise. The committee, totalling around 20 people, is chaired by the Director-General of the Direction-General for Security of Supply and Energy Infrastructures (DGSAIE, MSE). It is also composed of a delegation from the national regulatory authority, the main natural gas TSO, the natural gas underground storage operators, the operators of LNG regasification terminals, the electricity TSO and other relevant stakeholders and experts.

6. A new emergency plan will be published shortly.

Emergency response measures

In accordance with European Regulation 994/2010/EC, there are three natural gas crisis levels: Early Warning, Alert, and Emergency. During the first two levels, the available natural gas emergency response measures are market-based, but if the situation deteriorates to the Emergency crisis level, non-market measures are also available.

Market measures include: increasing import contracts or stipulating spot contracts; triggering interruptible commercial gas supply contracts; and fuel switching through the use of alternative backup fuels in industrial plants. Non-market measures include: actions to increase gas availability in the network, compulsory reduction of gas withdrawal by industrial customers; defining new temperature or schedule thresholds for the domestic heating sector; request for activation of co-operation and solidarity measures by other EU member states; and the use of LNG storage as peak-shaving devices.

The February 2012 "cold snap"

A critical situation or crisis was registered with regard to Italian natural gas supplies from 5 to 12 February 2012, largely the result of adverse weather conditions (Europe experienced extremely cold weather for a prolonged period – the coldest in Italy since 1965).

During this period, the natural gas import flow was reduced by approximately 60 mcm/d. Incidences of reduced flow included: reduced import volumes through the entry point at Tarvisio as a result of very high gas consumption in Eastern Europe and Ukraine; the LNG terminal at Rovigo virtually ceased operations following very severe weather conditions in the Adriatic Sea; there was a lack of spot cargoes available for the Panigaglia LNG terminal; and import flows from the entry point at Gela were reduced.

The situation was exacerbated by the fact that the utilisation factor of one import pipeline had been reduced for a period of more than 20 days (not consecutive) during the three months immediately preceding the crisis. The situation was also exacerbated by the fact that the natural gas storage system was not fully optimised because of the unavailability of the Ripalta storage field.

The crisis highlighted a weakness in Italy's market-based balancing system, whereby it was unable to send sufficiently strong price signals to motivate natural gas shippers to boost import levels. Specifically, the balancing system did not react to the lack of storage withdrawal capacity – instead it focused only on total gas volumes in storage. The administration has since taken steps to prevent a recurrence of this situation by making changes to the natural gas market so as to allow pricing to better reflect actual supply and demand.

In November 2013 the Italian administration implemented a new day-ahead balancing system where the TSO is responsible for checking that all shippers have determined the total amount of gas due into entry points and out exit points to ensure adequate supply. If sufficient gas has not been nominated by 7pm each day, the TSO will now open a new session in which it can make offers at the entry points to buy gas on the spot market at any price to balance the system. Any additional costs are to be met by shippers and passed through to customers.

More successful during the cold snap, the curtailment of consumption for industrial and remote controlled customers was implemented by TSOs with daily surveys.

The evaluation of the events of February 2012 and the consequent "lessons learned" were taken into consideration with regard to the choice of crisis levels and related mechanisms defined in the Emergency Plan. The necessary adoption, on a short- to medium-term basis, additional measures for reducing risks was also introduced.

During 2012, the maximum nominal peak draw-down rate from the natural gas storage system was 278 mcm/d. The administration estimates that peak demand in exceptional weather conditions is about 480 mcm/d, leaving a reserve margin of about 50 mcm/d for five days. This particularly applies towards the end of the thermal winter, when delivery capacity from storage is low. Italy's maximum withdrawal capacity can theoretically cover about 58% of peak winter demand (assuming perfect interconnectivity).

Drawing on the lessons learned from the February 2012 cold snap, the National Energy Strategy sets two targets with the aim to increase security in case of a supply emergency.

Peak-shaving devices

To complement the country's conventional natural gas storage capacity, a Ministerial Decree of 18 October 2013 allowed for the exploitation of underutilised LNG terminal storage as a peak-shaving device to help the gas system handle future daily peak supply performance problems. The potential savings resulting from this measure – first made available during winter 2013/14 – are 5 mcm/d for a maximum of three days for each of the country's three LNG terminals.

For the 2013/14 winter season, because of a lack of LNG cargo availability, this emergency measure was made available using LNG storage (50 000 m^3) remaining from an operational test conducted by OLT.

Fuel switching

A Ministerial Decree passed in September 2013 implemented new fuel switching mechanisms for power generation. The new measures provide for switching from combined-cycle gas turbines (CCGTs) to oil-fired power plants. The potential savings from using this measure equate to 13 mcm/d, for a maximum of four weeks. A similar measure was used in 2012, but the updated procedures work in a more flexible and cost-effective way.

Switching from gas to oil is very expensive in environmental terms, because the oil-fired plants are old and highly polluting, and in terms of direct cost, because of high maintenance and fuel storage replenishment costs. Options for fuel switching outside the transformation sector are limited, however, as only 0.5% of the industrial load can operate on fuels other than gas. Furthermore, large industrial facilities are not required to have alternative fuels available. This measure was not activated in winter 2014/15 and has been abandoned because of its low cost-benefit ratio.

Demand-side measures

The Italian natural gas system foresees demand curtailing in its emergency plan. This kind of measure can be diversified to be active on several categories of end-customers, depending on the crisis level attained.

The first category that can be affected by demand curtail are (sorted by crisis situation order) the commercial end-customers, then the industrial, and finally gas-fired power plants. Gas-fired power plants, as already mentioned can switch to oil. Another demand-side measure that can be implemented from the consists in the definition of

new temperature and/or schedule thresholds for the domestic heating sector (for serious emergency situations only)

It is useful to understand that as long as the crisis reaches the first levels of warning, the measures that should be used are market-based; but as soon as the situation worsens into an emergency-level crisis, non-market-based measures are allowed to quickly restore normality.

RETAIL MARKET AND PRICES

Legislative Decree No. 164 of 23 May 2000 started the process of liberalisation of the natural gas market and all end-users have been able to purchase natural gas from the supplier of their choice since 1 January 2003. Customers who have not chosen an offer on the open market and/or did not change their supplier remain part of the protected market. In this case, the regulator AEEGSI determines the economic and contractual conditions for the supply and the quality of service. The large majority of household customers have chosen to remain in the protected market and thereby benefit from a form of regulated tariff while the free market continues to supply larger users of gas.

Natural gas prices in Italy remain stubbornly high despite the best efforts of government over the past six years. According to the most recent dataset published by the European Commission, retail gas prices for households, including taxes, are the third-highest in the European Union, behind Sweden and Denmark. When taxes are excluded, Italian households pay the fifth-highest retail prices (EC, 2014). The situation is more positive for industrial consumers, perhaps reflective of changes in the wholesale market: prices including taxes are below the EU average. Nonetheless, there are significant variations between the prices paid by industrial consumers with different levels of annual consumption.

The number of retailers active in the market increased from 313 operators in 2012 to 339 in 2014. This number has been increasing in recent years, despite that fact that the market has not expanded since 2006 (AEEGSI, 2014). The six largest retailers ranked by market share in 2014 were; ENIi (24.6%), Edison (11.3%), Enel (9.9%), GDF Suez (3%), Shell Energy Italia (3%) and Iren (3.8%). In 2014, the level of concentration in the retail market was slightly lower than in 2012, but it remains relatively high.

ASSESSMENT

With consumption of 61 bcm in 2014, Italy is the third-largest natural gas market in Europe behind Germany and the United Kingdom. There have been a number of significant improvements in natural gas infrastructure in the period since the previous in-depth review, in terms of both pipeline capacity and competition rules. Snam Rete Gas has been ownership-unbundled in conformity with the EU Third Package and a 51% majority stake is held by CDP, the Italian public (credit) bank. Problems with lengthy authorisation processes appear to have eased over the period since 2009. The government has introduced a fast-track application procedure for PCIs. Strategic projects nominated in the Strategy, when facing unreasonable obstacles at regional level, are being authorised to make use of the overriding administrative powers of the Council of Ministers. Nonetheless, some problems remain such as, for example, the role of Regions in authorisation procedures, which have to give their administrative approval for a project, having *de facto* veto powers over projects of national interest.

In the years to 2010, demand for gas grew rapidly, largely driven by the power sector, but consumption has fallen during the past five years. This fall in demand has happened for a number of reasons, including the economic crisis which led to a fall in demand in the industrial sector, the rising share of renewables in electricity production, and enhanced energy efficiency. Notably, the growth in renewable energy production is having a severe impact on the power sector and a growing number of generators are moth-balling gas-fired capacity (for example, Enel removed six gas-fired units totalling 1.3 GW of capacity from the market in 2014).

Italy imported 56 bcm (88%) of its natural gas demand in 2014 and its imports are relatively well diversified. The two main import sources are Russia and northern Europe (Norway, the United Kingdom, the Netherlands), which accounted for 60% of imports in 2014. Other important import sources are Algeria (12.2%), Libya (11.7%) and Qatar (8%). In 2014, imports from North Africa decreased while imports from Russia picked up (amounting to 43% of total gas imports in 2014). The reasons for this are both commercial and political: there were a number of revisions to the volumes agreed in existing supply contracts with a number of Italian importers (ENIi, Edison and Enel), but also partly by the background of socio-political instability in the North African region, which caused several interruptions to gas (and oil) flows to Italy (AEEGSI, 2014). Italy also meets approximately 12% of natural gas demand by domestic production that has progressively declined (from 12 bcm in 2005 to 6.8 bcm in 2014) similar to the decline in total consumption. LNG imports peaked at 9.0 bcm in 2011 and have declined to half that volume in 2014, because of a decline in demand for natural gas in the power generation sector.

There is only one further international pipeline authorised with entry points into Italy: the TAP (bringing gas from the Caspian Sea). The other planned pipelines transporting gas from Algeria via Sardinia to mainland Italy (GALSI) and from Greece (IGI) are unlikely to progress as the GALSI project has not been finalised owing to the lack of commercial agreements to supply new Algerian gas to Italy, and the IGI project has been rescheduled to find alternatives to supplies from Azerbaijan. The remaining 11% of imports are delivered in LNG cargoes. There are three LNG terminals operational (that deliver under 10% of imported natural gas) and three more authorised for construction. Italy's Livorno LNG regasification terminal commenced commercial operations in December 2013. The other planned terminals are currently delaying the beginning of construction activities because of the uncertain economic viability.

Italy has one of the largest storage capacities in Europe: 16.43 bcm (11 storage facilities), of which 4.6 bcm are reserved as strategic storage. The storage facilities, all in depleted gas fields, are the property of the state, for which concessions are granted to operators. Gas storage infrastructure plays an important role in the gas market and is fully regulated.

The NES foresees the development of Italy as a Southern European gas hub: importing LNG and pipeline gas and exporting it to its northern and eastern neighbours. Accordingly, when planning gas infrastructure, Italy is not only looking at domestic demand but at regional integration as well (e.g. three authorised LNG terminals, the enhancement of reverse flow capacity and new pipelines such as TAP). While the IEA supports Italy in its efforts as regards regional integration of the Italian gas market, the development of a gas hub should be second to the establishment of a fully functioning wholesale gas market in Italy.

Within the Strategy, in 2013 the need to increase import capacity of LNG has been evaluated and defined as a total volume ranging from 8 bcm/yr to 16 bcm/yr, depending on the final selection of the route of supply of the Shah Deniz 2 consortium. The Italian market having been selected as the final destination of the TAP project, the need of new regasification capacity in the Italian market actually amounts to 8 bcm/yr. The reason to increase the level of regasification capacity in Italy is linked not only to security of supply requirements (to face possible disruption from other entry points), but also to reduce market power of existing external suppliers. Increasing regasification capacity to 23 bcm/yr (from 15 bcm/yr in 2015) will establish a guarantee that no possible agreement among external suppliers could result in a pivotal role in determining gas prices in the Italian market, because an increase would lead to additional import of LNG to balance gas prices. If energy, gas in particular, can be used as a mean of political coercion, as stated in the 2014 Rome G7 declaration, LNG regasification overcapacity can represent a tool to counterbalance this risk. For this reason, in order to incite operators to build another LNG regasification terminal, a guarantee factor has been introduced to assure investors that, once the LNG terminal has been built, the remuneration of the asset is guaranteed by the system, even if it is not used at full capacity. A similar procedure can also be applied to gas storage, to encourage new investment for additional peak withdrawal capacity from new or existing storage fields.

The impact of the guarantee factor of an LNG terminal is very low with respect to the risk avoided and to the contribution of gas price convergence among the Italian *punto di scambio virtuale* and other EU hubs: even a EUR 0.02/m^3 difference (multiplied by 62 bcm) in hub prices is much larger that the possible impact of the guarantee factor spread over transport tariffs.

There is some evidence of a possible overinvestment in pipeline capacity: given the insecure supply and demand situation (with political conflicts in Ukraine and Libya possibly impacting imports via certain pipelines), this should be monitored more carefully. There is a trade-off between the additional costs to the consumer of new network capacity and the security of supply benefit of such infrastructure. Snam Rete Gas's investment programme for 2014-2017 foresees a EUR 3.6 billion capital spending. The first TYNDP according to EU rules was submitted by Snam Rete Gas to the government, the regulator and the Regions in May 2014. There are two priority projects: the first one in the north of Italy, to create flexibility in the Po Valley region, in particular via physical reverse flow capacity of 40 mcm/day, and the second one, the Adriatic line reinforcing the capacity for south-to-north transport infrastructure, also allowing for future additional imports from the so-called Southern Gas Corridor (e.g. TAP).

There are 222 gas distribution operators despite some consolidation in the sector to enhance efficiency. MSE is managing, and implementing, a deep reform programme of the sector. The reform will open the sector to competition and transparency, and will deliver greater efficiency and more benefits for final customers. The distribution networks will be allocated following a series of public auctions. The concession will be priced at a fixed value, published within the bid, and determined according to the industrial residual value. This value will be calculated by means of guidelines issued in May 2014. MSE also established auction criteria and requirements for participation. The implementation of the reform and the guiding role of the ministry have been slowed down in the past by the resistance of the municipalities that grant concessions and their preference not to delegate their powers to the contracting body. Furthermore, the existing distribution system operators have shown resistance in moving to the new competitive system.

The Strategy focuses on four main goals, one of which is the delivery of significant reduction in energy costs by bringing prices and costs in line with European levels by 2020. The development of a competitive and efficient gas market is a key element in this regard and, if Italy succeeds, it will enable the country to recover some of its competitiveness and strengthen its energy security profile. Despite progress in recent years, natural gas prices remain high in comparison with other EU countries but this differential is falling. Among the reasons for persistently high prices are the structure of gas import contracts and the lack of liquidity in the wholesale market. More should be done to arrest this situation. There are a number of long-term contracts (just under a third of active contracts have more than 15 years remaining) which are take-or-pay or linked to an indexed oil price; some of these have been renegotiated, mainly for the gas volumes to be delivered according the take-or-pay clause, but many remain operational. Wholesale spot prices have recently begun to converge with those on North European exchanges, notwithstanding the lack of comparative liquidity, and industrial consumers and the power sector are purchasing gas on prices and terms similar to those on other EU hubs. This decrease of gas prices is driven by the current oversupply situation in Italy and the global development of the natural gas markets (shale gas) and also by changes to some of the import contracts. As a consequence, importers are obliged to sell take-or-pay gas at prices lower than the price they pay to the external supply sources (for example Norway, Algeria, Russia). Some purchasers have entered into international arbitration with source countries in an effort to modify the gas pricing formulas of their supply contracts which tend to depend on an oil-based formula unrelated to wholesale gas prices in the EU market.

Furthermore, most import and export pipeline capacity is secured under long-term contracts, which can have the effect of preventing other parties from using the capacity, even when it is available. These constraints, however, are likely to end when Italy implements the new European Union Network Code on Capacity Allocation Mechanisms later in 2015.[7]

At the PSV, transactions are conducted by means of bilateral over-the-counter contracts and AEEGSI has worked on the development of a gas exchange since 2009. GME has launched wholesale market and balancing platforms which operate separately. The wholesale exchange platform lacks liquidity and the reasons for this are not entirely clear: they may well be structural. The domestic market is highly concentrated: ENIi retains a large market share for imported gas (44.6% in 2012) and is also the most important domestic producer of natural gas. The second-biggest player on the gas import market, Edison, had a share of 19.2% in 2012. Previous antitrust ceilings established by decree, which limited the market share of ENIi, have expired since 2011, following which ENIi increased its market share by approximately 5%. Market participants have expressed concerns that the prices at a gas exchange would be set by one dominant player and have argued that this prevents them from entering the market (first-mover problem). GME is looking at several measures to increase liquidity in the gas trading market, including a minimum trading volume for the largest market participants, the introduction of a market-maker obligation established by law for three years for the most important importers, and a guarantee mechanism to create liquidity. The IEA strongly encourages these efforts.

7. Commission Regulation (EU) No. 984/2013 of 14 October 2013 establishing a Network Code on Capacity Allocation Mechanisms in Gas Transmission Systems and supplementing Regulation (EC) No. 715/2009 of the European Parliament and of the Council.

The retail market design remains dysfunctional. There are recommended tariffs set by the regulatory authority, which every retail seller has to offer in his portfolio. The calculation of these tariffs has recently been changed by the regulator: it is now based on the wholesale price at the TTF (the North European gas exchange), plus a transport charge. The regulator considers a recommended (regulated) tariff necessary until a market is developed. The recommended tariff, which is sometimes below that of the free market, constitutes a significant barrier to entry. The rate of consumers switching supplier is still very low, around 5%; consumers have no incentive to leave the recommended tariff. A further concern in the retail market is a lack of transparency and access to data. These concerns should be addressed and the market as structured provides a strong cross-subsidy from consumers to large gas utilities.

RECOMMENDATIONS

The government of Italy should:

- *Continue to promote the development of a competitive gas market by introducing rules to increase liquidity, such as consolidating balancing and wholesale exchanges, and facilitate the entry of new suppliers.*
- *Encourage efficient investments in infrastructure by enhancing physical reverse flow capacity and diversifying import sources and routes, with a view to integrating Italy into regional markets and further strengthening security of supply. This should include streamlined and transparent authorisation procedures of nationally relevant critical infrastructure.*
- *Review the necessity of certain infrastructure developments in light of the National Energy Strategy (foreseeing the doubling of electrification until 2050) and expected demand and ensure consistency between Italy's gas hub ambition and the other parts of the Strategy.*
- *Manage the effects of the gas distribution system reform, aiming at attaining high levels of competitiveness as well as increased benefits for the final consumers in terms of efficiency and tariffs. Competitiveness in the gas distribution system facilitates competition in the retail market.*
- *Support the development of a competitive retail market by revising the retail market design so that new suppliers can enter the market by offering market-based retail tariffs that will allow for the phasing out of administered retail prices. Consumers should be encouraged to switch suppliers.*

References

ACER/CEER (2014), *Annual Report on the Results of Monitoring the Internal Electricity and Natural Gas Markets in 2013*, Agency for the Cooperation of Energy Regulators and the Council of European Energy Regulators, Ljubljana/Brussels.

AEEGSI (2014), *Annual Report to the International Agency for the Cooperation of National Energy Regulators and to the European Commission on the Regulatory Activities and the Fulfilment of Duties of the Italian Regulatory Authority for Electricity, Gas and Water,* the Italian Regulatory Authority for Electricity, Gas and Water, Milan.

EC (European Commission) (2014), *Quarterly Report Energy on European Gas Markets, volume six and volume seven*, European Commission, Directorate-General for Energy, Market Observatory for Energy, Brussels.

ENTSO-G (2015), *Ten-year Network Development Plan 2015*, European Network of Transmission System Operators for Gas, Brussels.

IEA (International Energy Agency) (2016), *Natural Gas Information 2016*, OECD/IEA, Paris.

Italian Presidency of the Council of the European Union (2014), *Building a Euro-Mediterranean Energy Bridge, the Strategic Importance of Euromed Gas and Electricity Networks in the Context of Energy Security,* Session One: Towards a Mediterranean Gas Hub, Issue Paper: Liquefied Natural Gas: an Alternative Fuel for Transport, Rome.

NGVA (2014), *European NGV Shares in Total European Market,* Natural (and bio) Gas Vehicle Association Europe, Brussels. *(www.ngvaeurope.eu/european-ngv-statistics)*, last accessed 1 March 2015.

8. OIL

Key data (2015 estimated)

Crude oil production: 5.4 Mt, -11.1% since 2005

Crude oil net import: 61.8 Mt, -30.1% since 2005

Oil products net exports: 15.1 Mt

Share of oil: 34.2% of TPES and 4.8% of electricity generation

Consumption by sector (2014): 51,6 Mtoe (transport 63,5%, industry 16,5%, power generation 7,8%, commercial and other services, including agriculture and fishing 5.2%, residential 4,2%, other energy industries and energy own-use 2,8%)

OVERVIEW

While oil maintains its position as one of the largest energy component in primary energy supply, its share has been falling over the past decade. The transport sector is the largest consumer and Italy has adopted measures to reduce consumption in road transport. While the country produces some oil, it represents a small share of consumption.

SUPPLY AND DEMAND

SUPPLY

Italy's oil supply totalled 51.6 million tonnes of oil-equivalent (Mtoe) in 2015 or 34.2% of total primary energy supply (TPES), with a second-largest share in the energy mix after natural gas. Oil supply reached a peak of 91.1 Mtoe in 1995 and has been falling consistently since, down by 35.7% from 2005 to 2015.

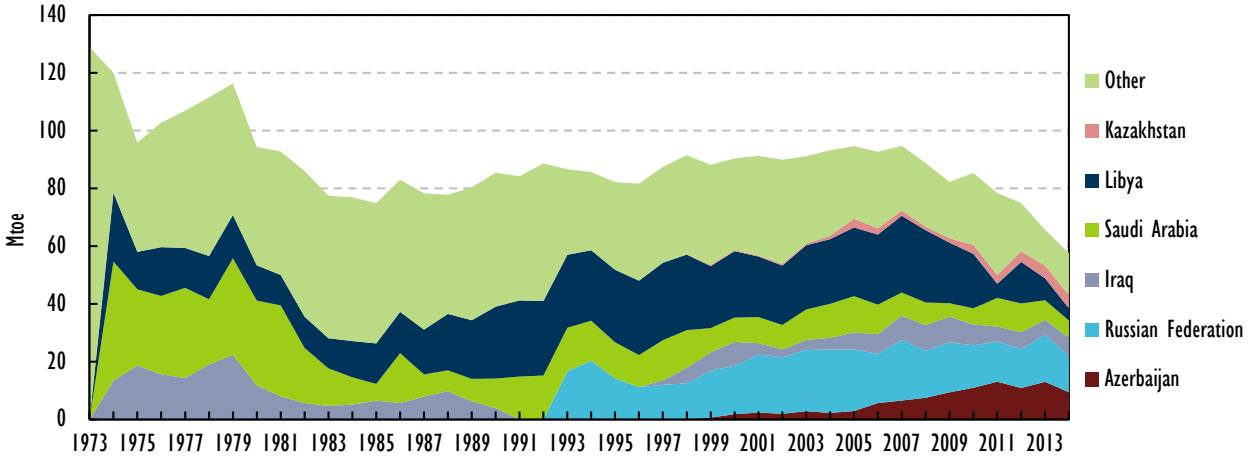
Crude oil and refinery feed stocks

Italy relies on imported crude oil as indigenous production accounts for approximately 8% of domestic demand. Crude oil production was 5.4 million tonnes (Mt) in 2015, a level which is 11.1% lower than in 2005. Oil production has averaged 5.5 Mt during the ten-year period. Italy also produced 0.4 Mt of refinery feedstocks in 2015.

Crude oil imports were 62.5 Mt in 2015 with 6.1 Mt of refinery feedstocks imports. Imports were 40% lower in 2015 than in 2005, which was a peak of 89.3 Mt. Imports have had a declining trend since, but increased by 16% from 2014 to 2015. Refinery feed stocks imports were moderately volatile over the past decade with average imports of 6.6 Mt during 2005-15.

Crude oil and refinery feedstocks imports originated mainly from Russia (21.0%), Azerbaijan (15.7%), Iraq (10.6%), Saudi Arabia (9.8%), Kazakhstan (7.6%) and other countries (Figure 8.1). Over the past decade, imports from Azerbaijan and Kazakhstan have increased by 318% and 293%, respectively, while imports from Russia, Libya and Saudi Arabia declined by 43%, 81% and 50%, in that order.

Figure 8.1 Crude oil (including refinery feedstock) imports by source, 1973-2014



Notes: With the break-up of the Soviet Union, reporting methodology for Russian Federation, Azerbaijan, Kazakhstan and other former republics changed in 1992.

Source: IEA (2016a), *Oil Information 2016*, www.iea.org/statistics/.

Oil products

Domestic refinery output was 73.2 Mt in 2015, made up of gas and diesel oil (44.4%), motor gasoline (23.1%), fuel oil (10.1%) and others. Italy's refinery output reached a peak of 101.6 Mt in 2005 and has been declining since, but recovered somewhat in 2015. Output was 27.3% lower in 2015 compared to 2005.

Italy is a net exporter of oil products with net exports of 15.1 Mt in 2015. It exported 26.7 Mt and imported 11.5 Mt during 2015. Over the ten years since 2005, imports of oil products have declined by 14.5% in response to falling demand while exports were 4.1% lower because of falling production.

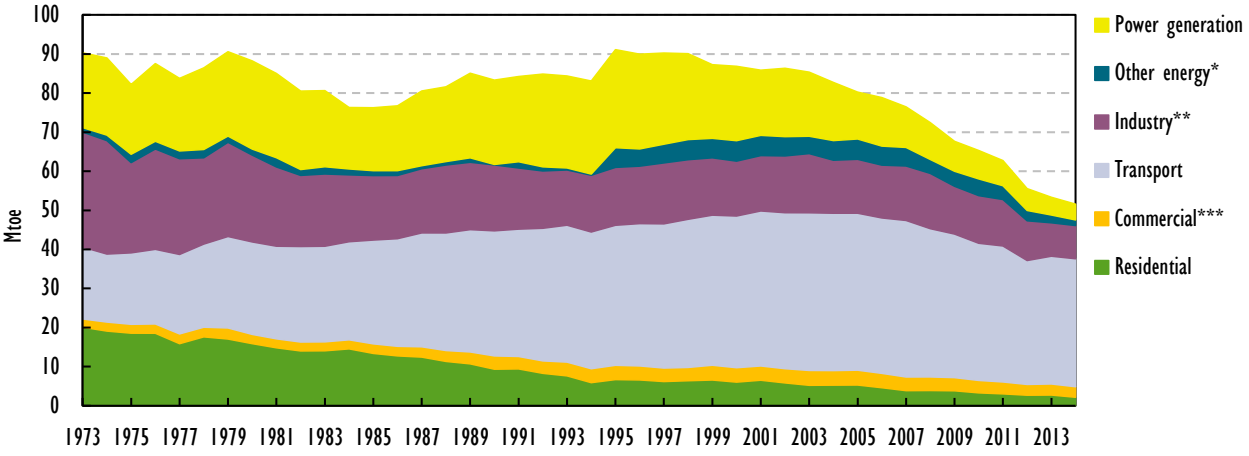
Oil products exports were destined for a large number of countries in 2014, mainly in Europe, with no dominant export market. Imports originated mainly from the United States (22.5%), Algeria (12.3%), Egypt (7.7%), Spain (6.6%), India (6.2%), Russia (6%) and others, with import sources changing year-to-year.

DEMAND

The transport sector consumed 63.5% of Italy's oil supply in 2014. Industry accounted for 16.5% of consumption while 7.8% was consumed in the power generation sector. Commercial and public services (including agriculture and fishing) and the residential sector represented 5.2% and 4.2% of demand, respectively, while other energy industries (including refining, energy own-use and losses) accounted for 2.8% (Figure 8.2).

Over the ten years to 2014, oil demand has declined by 37.6%, largely driven by a decline in use in the power sector and heavy industry as well as the residential sector as gas displaced oil for space heating. Demand in power generation and other energy industries were 72.8% and 71.4% lower, in that order, while residential, industrial, commercial, and transport demand contracted by 58.9%, 37.3%, 27.7% and 18.7%, respectively. The breakdown of oil consumption by product (excluding crude oil consumption) is represented in Figure 8.3.

Figure 8.2 Oil supply by sector, 1973-2014



Notes: TPES by consuming sector.

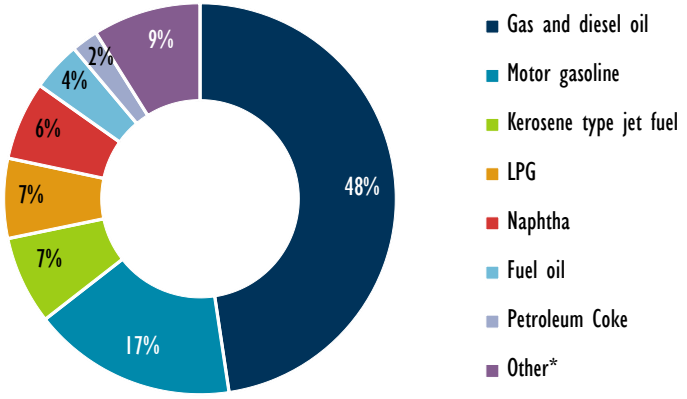
* *Other* transformations include refineries and energy own-use.

** *Industry* includes non-energy use.

*** *Commercial* includes commercial and public services, agriculture/fishing and forestry.

Source: IEA (2016b), *Energy Balances of OECD Countries 2016*, www.iea.org/statistics/.

Figure 8.3 Oil consumption by product, 2015



Note: LPG = liquefied petroleum gas.

* *Other* includes refinery gas, other kerosene, lubricants, paraffin waxes, white spirit, aviation gasoline and other non-specified oil products.

Source: IEA (2016a), *Oil Information 2016*, www.iea.org/statistics/.

DOMESTIC OIL PRODUCTION

Domestic production of crude oil and other hydrocarbons declined from 6.1 Mt in 2005 to 5.4 Mt in 2015. Italy's total domestic oil production met 8.1% of domestic demand in 2015, a level that is expected to improve marginally, to meet 12% of domestic demand by 2018.

The leading producing region is Basilicata which, in 2013, contributed 72% of total crude oil production and 17% of natural gas output. The National Energy Strategy (NES, hereafter the Strategy) estimates Italy's total oil and gas reserves at approximately 700 Mtoe, including proven, probable and possible reserves, and sets a target of EUR 15 billion of investment in order to double the portion of demand

satisfied by domestic resources by 2020. Notably, about EUR 3.5 billion has been earmarked for two planned projects in Basilicata:

- Modernisation and upgrading of the Centro Olio Val d'Agri field, a joint-venture between ENIi and Shell, where production is projected to reach 104 thousand barrels/day (kb/d) in the medium term.
- Launching production from the Tempa Rossa field (Total 50%, Mitsui 25% and Shell 25%), will require an investment of EUR 1.6 billion, of which EUR 600 million has already been spent. Operations are expected to start at the beginning of 2016 (Unione Petrolifera, 2014).

In addition to Basilicata, four other zones offer a high development potential: the Po Valley, the Upper Adriatic, the Abruzzo region and the Strait of Sicily. Investment in the sector has, however, been limited by a legislative framework and decision-making processes that have slowed down or even halted many initiatives over the last ten years. Waiting times for permits can be up to ten times the legally envisaged timescales, at both the exploration and the production stages, and are much longer than worldwide averages. In recent years waiting times for permits have lengthened even further. Two problem areas stand out:

The complexity and long timescales of the authorisation system: for example, in Italy exploration and production can only go ahead once two or three different permits (case-based) have been received. In some European countries (for example Norway or the United Kingdom), a single permit is granted for each zone identified and evaluated in advance by the competent authorities. The recent draft European directive on this subject removes the distinction between licences for exploration and licences for production, which it deems run counter to practice. In Italy, the licensing procedure includes State-Regions agreements, without a deadline for the latter to express an opinion. In all the other producer countries, licensing decisions are taken at the central level. It should be noted that the marked slow-down in exploration and production in Italy occurred after 1999, when constitutional reforms changing the roles of central and regional governments in the decision-making process were introduced.

Restrictions on offshore activity: offshore activity is heavily influenced by the prohibitions introduced by Legislative Decree 128/2010. This decree banned offshore activities in many areas and resulted in the cancellation of projects worth EUR 3.5 billion. No other European country has adopted similar laws. Norway, for example, has no generalised ban although certain areas (the Lofoten Islands, for example) are "off-limits" for environmental reasons. Such reasons are in any case taken into consideration in Italy by the legislation to defend protected areas, to which the government intends to devote the utmost attention.

MARKET STRUCTURE

The Italian oil market is fully liberalised and decisions regarding imports, exports, trade and pricing are determined by the market. The government intervenes only to protect competition and avoid abuse of dominant market positions. Furthermore, companies proposing to set up new refineries and oil product storage facilities require authorisation from the Ministry of Economic Development (MSE).

Former state oil company ENIi has a dominant position in the Italian upstream oil and natural gas sector, but a number of private sector companies (both domestic and foreign) have also established a significant presence.

In the downstream sector, distribution is principally undertaken by the integrated oil companies. ENIi has the largest retail market share in Italy, with a 31.2% market share in 2012 (up 0.7% from 2011). The company operates 4 780 service stations in Italy under the ENIi and Agip brands. In addition, independent, "white pump" and supermarket pumps collectively account for around half the country's retail market.

SUPPLY INFRASTRUCTURE

REFINING

There were 12 major refineries operating in Italy as of 1 January 2014. Of these, nine are located along the coast and are supplied by sea, while the remaining three are situated in the Po Valley, in the north of Italy, and are supplied by pipelines from Genoa and Vado Ligure. The Italian refining industry includes a mix of refineries, ranging from very large and complex export refineries on the islands of Sardinia and Sicily to some simple and small refineries. Those that are less competitive by their technical configuration are mostly located near large areas of consumption and they derive a competitive advantage from their location.

In 2013, installed refining capacity was 99 Mt compared with total refining activities of around 71 Mt, a drop of 12%. The utilisation rate was 72%, which falls to 66% if calculated on the basis of domestic consumption alone and it is unlikely to improve in the short term. Refining, in terms of both volumes of crude oil and foreign semi-finished products, has never been at such low levels (Unione Petrolifera, 2014). On 1 January 2014 available refining capacity was 98.1 Mt which will fall to 91.3 Mt following planned plant conversions.

On 1 January 2014, the desulphurisation capacity of the refining system, i.e. plants able to produce fuel qualities in compliance with the specifications for low sulphur, was 46.1 Mt, 6% below what it was in 2012 before the downsizing of plant capacities. In 2013, refining margins resumed their decline, especially during the second part of the year, cancelling the effects of the brief recovery in 2012 and remaining at non-profitable levels: all refining processes lost an average margin of around USD 2.0/barrel with highly negative values for the less complex operations (Unione Petrolifera, 2014).

Low plant utilisation rates, together with shrinking margins, have contributed to worsening problems of economic sustainability, leading to the closure of the Raffineria di Roma and the IES Refinery in Mantua at the beginning of 2014, and the conversion of the Refinery of Marghera into a biorefinery. Between 2011 and 2014, four refineries (Cremona, Rome, Marghera and Mantua) were closed or turned into logistical hubs, while others reduced or temporarily suspended their operations. Utilisation rates have continued to decline despite these refinery closures, a modest rise in Italian product exports, and the fact that substantial investments have been made in recent years to adapt refineries to the declining share of heavy fuel oil in the electricity sector and the growing share of cleaner fuels in the transport sector.

Analysis of the refinery margin data, combined with the expected additional operating costs, suggests that only five out of the current 12 operating refineries in Italy would have a positive operating result in the long term. In terms of refining capacity, it can be expected that around 60% of current operating capacity would close, with only 40% of current capacity continuing to operate. This 40%, although retaining a positive operating result, would most likely generate only a low return on investment, and so would also be at risk of closure (IHS, 2014). In the Strategy, the government has made restructuring the refining sector and the fuel distribution network a priority.

PIPELINES

Italy has two major international crude oil pipelines. The first is the Central European Line (CEL) from Genoa, with a 1 million barrels/day (mb/d) capacity, which supplies inland refineries in northern Italy and the Collombey refinery in Switzerland. The second is the Trans-Alpine Pipeline (TAL) from Trieste (850 kb/d capacity), which supplies Germany, Austria and the Czech Republic. Most refineries in Italy are located along the Mediterranean coast; therefore, the country has relatively few domestic crude oil pipelines.

The domestic pipeline network (for both crude and products) is largely concentrated in northern Italy. As of end-2012 the network was 4 920 km-long, with total annual crude and product transport capacity of 132 million cubic metres (mcm). The average utilisation rate of the domestic pipeline network is relatively low, with 84 mcm transported in 2011 (an utilisation rate of around 64%). Notably, there is no connection between the eastern and western halves of the northern pipeline network, reducing its potential flexibility during an oil supply disruption.

PORTS

Italy has 16 crude oil tanker ports; four of which – Taranto, Milazzo, Falconara (Ancona) and Augusta (Santa Panagia) – can receive cargo ships of up to 300 000 dead weight tonnes. In 2013, around 101.3 Mt of crude oil was imported into Italy through these ports, down from 106 Mt in 2012 and 118 Mt in 2011 (Unione Petrolifera, 2014).

STORAGE CAPACITY

There are approximately 704 industrial and commercial oil storage depots in Italy: these have a total storage capacity of around 26 mcm. More than 50% of this storage capacity is located within four regions in the north of the country. Storage capacity is roughly divided into one-third crude and two-thirds finished products.

FUEL DISTRIBUTION

The Strategy has made restructuring the fuel distribution network a priority. The government has indicated that the sector is to be modernised to make it more efficient and more competitive, and to improve service levels for consumers.[1]

1. For natural gas as a fuel please see Chapter 7.

Figure 8.4 Map of Italy's oil infrastructure

This map is without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries, and to the name of any territory, city or area.

The fuel distribution sector in Italy suffers from major structural problems, which are evident when compared with the structure of the sector in other major European countries. The distribution network is extremely fragmented, with high numbers of filling stations (22 400, about double the number in comparable countries). Of these, 52% were owned by the main oil companies, 37% were dealer-owned and 9.8% were owned by other parties such as independent operators and large supermarkets). These stations are limited in size on average (in terms of litres delivered/sold and square metres per sales point); they are old, and poorly diversified in non-oil products (which account for only 3% of revenues, compared to over 30% in other markets). The market has not been helped by a decline in sales over the last three years.

For service stations owned by oil companies, the segment has thus far been characterised by the predominance of the commodate model (gratuitous loan). This form of concession is tied to a sole supply contract for fuel from the oil company, which decides on recommended prices and discount policies. Elsewhere in Europe, on the other hand, the agency model is more widespread. The sustainability of the Italian system has been undermined by falling margins and demand, with strong trade union tensions and rigidities in the sector, thus hindering rationalisation.

INITIATIVES TO STRENGTHEN THE COMPETITIVENESS OF THE FUEL MARKET

Initiatives have been introduced since 2012 to increase the competitiveness of the fuel market sector and influence price levels by enhancing consumer protection and increasing price transparency and quality of the service provided are being introduced. A number of measures were introduced by means of a Decree Law. Many of these are designed to promote a higher degree of liberalisation in the sector. They include:

- increased use of cost-effective self-service facilities
- the removal of many constraints related to the sale and availability of non-oil products and services
- improved communication and transparency of fuel prices to users
- steps to eliminate the “sole supplier” constraint and allow retailers to obtain supplies directly on the wholesale market
- some regional laws in Italy envisage an obligation for new service stations to also supply liquefied petroleum gas (LPG) or vehicle-quality methane
- the arrangements for electronic payments are being reviewed with the aim to extending this type of payment.

As regards rationalising the fuel network and contractual arrangements, the following steps are envisaged:

- the implementation of measures for the closure of service stations defined as “incompatible” and measures to encourage rationalisation measures to eliminate network inefficiencies by introducing grants for incompatible service stations
- the introduction of new types of contract to regulate relations between oil companies, independent operators and “tied” operators
- the possibility for sales point owners and operators to redeem their facility, for example by setting up consortia or other forms of affiliation, in order to increase the number of independent operators and “white pumps” (fully independent filling stations that draw all their supplies from the wholesale markets)

- incentives to encourage the wider use of automotive methane, which is peculiar to the Italian network (about 1 000 filling stations, albeit concentrated in certain regions and hardly present at all on the motorways)
- further to the provisions of the Liberalisation Decree, a fuel wholesale market will be set up as part of the implementation of the recently adopted Minimum Stocks Directive: a "fuel exchange" from where independent owner/managers and operators and can also obtain their supplies.

Box 8.1 Collection and treatment of waste oils in Italy

Re-refining describes the process where collected waste oil is transformed into a lubricant base with similar qualitative characteristics to those of oils produced directly from processing crude oil. Re-refining has a high yield: from 100 kg of waste oil it is possible to get 65 kg of base oil and 20 kg to 25 kg of diesel oil and bitumen. Approximately 30% of the lubricant base oil market in Italy is made up of regenerated base oils.

There are four active lubricant re-refining plants in Italy, with a combined nameplate capacity of about 260 thousand tonnes/year (kt/yr). The Waste Oil Directive is adopted in Italian law as DPR 691/82, under which a non-profit consortium (*Consorzio Obbligatorio degli Oli Usati* [COOU]) was established. The consortium is responsible for the collection, selection, quality control and appropriate disposal of used oils – by re-refining, combustion or incineration.

In the past, regenerated base oils were subject to a lower excise. To comply with EU rules, the tax break was eliminated. Where the market value of regenerated base oil is insufficient to cover the costs of the treatment, COOU acts to support the work of regeneration. Recently COOU has further adapted its operating procedures with a collection network and regeneration companies that deal freely in the market, keeping COOU in control of the system and ensuring the collection and processing of waste oils in case the latter should not be intermediated in the market.

The Italian system has granted collection and regeneration rates way above the European average, close to 100% of theoretically recoverable waste oils, with significant environmental benefits.

Sources: COOU; UNEP (2012), *Compendium of Recycling and Destruction Technologies for Waste Oils,* UNEP, Japan.

EMERGENCY PREPAREDNESS

EMERGENCY RESPONSE POLICY

Responsibilities for energy policy are shared between Italy's central government and regional authorities. Within central government, the MSE has lead responsibility for energy policy and for maintaining an operational *Handbook for the Management of Energy Emergencies.*

The latest version of the *Handbook*, last updated in 2014, emphasises the following measures in the event of an oil supply disruption: voluntary demand restraint campaigns (public appeals to reduce energy consumption); reduced heating levels and hours;

driving restrictions and stock draw-down. As the share of oil in the electricity generation mix has fallen to near-negligible levels, fuel switching away from oil to other sources in electricity generation is no longer an option. The new Italian Central Stockholding Agency, OCSIT, is responsible for updating the *Handbook*.

NATIONAL EMERGENCY STRATEGY ORGANISATION

Within the MSE, the Oil Office of the Security of Supply and Energy Infrastructure Directorate (DGSAIE) in the Department of Energy functions as the permanent body of the National Emergency Strategy Organisation (NESO). This permanent body is distinct from the full NESO body, the Conference of Services, which is only convened during an emergency.

The Conference of Services, in addition to DGSAIE officials, includes representatives from several other relevant ministries: the Ministry of Foreign Affairs, the Ministry of the Interior and its Department for the Civil Defence, the Ministry of Transport, the Ministry of Defence, the Ministry for the Environment, the Ministry of Health and the Ministry for Communications. The Conference of Services also includes representatives from the oil industry and industry associations, and also from OCSIT. It is chaired by a representative of the MSE.

Within the DGSAIE, a staff of three persons is tasked with the calculation, reporting and control of emergency stocks held in Italy.

LEGISLATION

Law No. 249/2012 establishes the legal basis for oil emergency response policy in Italy, including compulsory stockholding obligations on industry and on OCSIT. The law transposes EC Directive 2009/119/EC regarding compulsory stocks of oil and/or oil products. It includes a new obligation to maintain stocks for individual products rather than stocking entire categories of products, introduces significant limitations on keeping stocks abroad, and requires the setting up of an Italian central stockholding entity [OCSIT] for state-owned product stocks, known as “specific stocks”.

STOCKHOLDING REGIME

As of end-2013, all stocks held in Italy are industry stocks, with oil industry operators subject to a compulsory stockholding obligation. Italian legislation, in compliance with European Union (EU) Council Directive 2009/119/EC of 14 September 2009, requires that total compulsory stocks for the country as a whole must correspond to not less than 90 days of average daily net imports or 61 days of average daily inland consumption, whichever of the two quantities is greater.

The stockholding obligation is distributed proportionally among the various oil companies on the basis of product amounts delivered for inland consumption in the previous calendar year. There are approximately 234 companies with stockholding obligations in Italy. Individual stockholding commitments of one company may be transferred to another through lease or storage rental agreements. Around half of the companies with stockholding obligations, especially smaller companies that do not have storage facilities, utilise the option to transfer their stockholding commitments to another company.

Secondary storage holders (small products depots authorised by the local prefecture) are not required to hold stocks. They collectively can, however, stock 5% to 10% of respective gross tank capacity. As these depots are distributed widely across the country, these additional non-compulsory stocks ensure broad product availability in an emergency.

Italian law stipulates that one-third (30 days) of compulsory stocks must consist of products from four key categories (gasoline, diesel, fuel oil and jet fuel). These are known as "specific stocks" and cannot be substituted with crude oil or other oil products. Obligated companies are free to determine the make-up of the remainder of their obligated stock. Compulsory and commercial stocks can be, and often are, commingled.

The required volumes of crude oil and "specific" product stocks are determined annually with a decree from the Minister of Economic Development. The annual decree is adopted at the beginning of each year and published in the Official Gazette of the Italian Republic and on the MSE website. Obligated companies are required to adjust their stock levels (if necessary) to comply with the new compulsory stock levels by 1 April each year.

In limited circumstances, biofuels may also count towards Italy's compulsory stock totals. To be included in the country's oil stock calculations, they must have already been blended with petroleum products or, in the case of stand-alone biofuel stocks, there has to be certification guaranteeing that the biofuels are intended for blending with petroleum products, and that they are to be used in transport. Biofuel components are limited to a maximum proportion of 25% in the case of diesel and 10% in the case of gasoline.

ITALIAN CENTRAL STOCKHOLDING AGENCY

Since 1 July 2014, the Italian Central Stockholding Agency (OCSIT) has begun to progressively assume responsibility for an increasing proportion of the country's stockholding obligation from industry. New oil stockholding rules have been established with the passage of Law No. 249/2012, which transposes the EU Council Directive 2009/119/EC regarding oil stockholding obligations. Under the new law, the government established OCSIT. *Acquirente Unico S.p.A*, a state-owned company under the control of MSE, was to be responsible for the establishment and operation of the new agency.

The main purpose of OCSIT is to hold and manage "specific" oil product stocks within Italy and to organise and provide a service for the storage and transport of oil stocks for emergency and commercial purposes. In order to "contribute to national oil stocks optimisation," OSCIT is also required to:

- assist all economic operators to fulfil their stockholding obligations by using a transparent, market-based approach
- to improve data flows and operational management using an information system
- work with the MSE to prepare all the necessary arrangements for energy security audits conducted by the European Commission
- monitor emergency preparedness levels.

With regard to oil stockholding, OCSIT is responsible for the operational management of "specific" product stocks. This includes the purchase, storage, maintenance and, when necessary, sale of those stocks. The build-up of OCSIT stocks will be a relatively gradual process. The initial target is to hold 0.11 Mt (one day) of

finished products starting on 1 April 2014, and from there to gradually increase this amount over 10-year timeframe until the organisation holds 100% of the country's obligated specific stocks (3.34 Mt or 30 days).

As OCSIT's stock levels increase, the compulsory stockholding obligation of Italy's oil industry will be progressively reduced at a rate proportional to the rate of the stock build. This means that from 1 April 2014, when the agency's stock levels reach the equivalent of one day of specific product stocks, the Italian oil industry's obligation will be correspondingly reduced by one day. In other words, it will only be required to hold 29 days of specific stocks (or 89 days of stocks in total) – with OCSIT holding the other one day.

OCSIT will operate as a not-for-profit entity, with all operating, administrative and debt servicing costs to be met with fees paid by industry operators. Purchases of oil products are to be systematically carried out by a tendering process. Most oil industry players will be invited to participate in this process. All stocks will be commingled and consist only of gasoline, gasoil, heating oil and jet fuel. OCSIT can only sell stocks when formally requested to do so by the government.

OCSIT's responsibilities also include the acquisition of the necessary oil product storage capacity. The government's preferred method in the short and medium term is for OCSIT to rent storage capacity in order to minimise acquisition costs. All 30 days of specific stocks are to be held in Italy, but there are otherwise no geographical or localisation constraints on where stocks are to be held. The agency is required to conduct regular testing of the quantity and quality of its stocks.

The same EU Council decree also requires *Gestore dei Mercati Energetici* S.p.A (GME) to set up, organise and operate a marketplace for the matching between supply and demand for oil logistics of mineral oils; to set up, organise and manage a market for the matching between supply and demand of liquid oil products for vehicle use, also in co-ordination with the platform for the offer of logistics.

BILATERAL STOCKS AND TICKETS

For security of supply reasons, Italian law requires that specific stocks should be held exclusively on the national territory. One exception to this rule is that specific stocks of kerosene-type jet fuel may be held in other EU member states during a transitional period up to 2017. Obligated stocks other than specific product stocks can be held in other EU member states within the following limits for each obligated company: 100% of oil-equivalent up to 30 thousand tonnes of crude oil-equivalent (ktcoe); and up to 70% of oil exceeding 30 ktcoe until end-2014 – with the maximum amount to be progressively reduced until it reaches 20% of oil exceeding 30 ktcoe in 2017.

Decree 22/2001 sets out guidelines for intergovernmental agreements on stockholding with other EU member states, in order to facilitate the coverage of stock obligations for companies. Italy has bilateral agreements with Malta, Hungary, the Netherlands, Slovenia and Spain. In addition, the country has memoranda-of-understanding with Denmark and the United Kingdom, and a joint declaration-of-intent with Germany that replaced the two old bilateral agreements. Most stocks held in other countries under bilateral agreements are in the form of tickets. As of end-December 2014, around 18.7 million barrels of compulsory stocks were held in other countries, accounting for around 20 days of net imports. As of end-2014, there also around 1.4 million barrels of stocks held on the Italian national territory on behalf of other countries.

COMPLIANCE WITH THE IEA 90-DAY STOCKHOLDING OBLIGATION

Italy consistently meets its 90-day IEA obligation, and generally holds storage well in excess of the obligated amount. Italy's 90-day stockholding obligation was 11.5 million tonnes of crude oil-equivalent (Mtcoe), and the actual amount of stock held as of end-December 2014 was 15.7 Mtcoe. The amount of stock held in excess of the 90-day obligation was therefore 4.2 Mtcoe or 33 IEA days.

Decision-making and responding to a call for collective action

During an oil supply disruption the MSE would convene the Conference of Services. The Conference would meet within 24 hours and decide what measures should be taken and communicate these to the Minister of Economic Development. In the event of an IEA collective action, the minister has the authority to require industry (and OCSIT) to release stocks to meet the country's international obligations.

A decision to use emergency reserves during an IEA collective action would be announced in a ministerial decree authorising companies to reduce their mandatory stocks by a certain amount, and to make these stocks available to the market. This decree would include an indication of each company's share of stock draw-down.

The time required between a government decision to release stocks and the physical delivery of those stocks commences is estimated to be less than 24 hours.

Financing and monitoring

Companies are obliged to report on a daily basis to the MSE the exact location, quality and quantity of stocks. In collaboration with the Revenue Guard Corps and the Customs Agency, the ministry monitors each company's compliance with the decree obligations.

The standard sanction for breaching stock obligations is a fine of EUR 6.50 per day and per tonne by which the company falls short of its prescribed minimum for that specific location. In addition, the penalty for a company that fails to report the quantity of products supplied for domestic consumption the previous year (or that partially omits such information) is subject to a fine of EUR 10 000 to EUR 25 000. The penalty for late provision of this information is a fine of EUR 2 000 to EUR 5 000. No financial support is given to oil companies for holding stocks.

OIL DEMAND RESTRAINT AND OTHER OIL EMERGENCY RESPONSE MEASURES

Oil demand restraint policy and measures

Once activated by the Minister for Economic Development, the Conference of Services (the full NESO body) has the legal authority to decide upon demand restraint measures and implement them through its operational structures. Government demand restraint policy is determined by the 2014 Italian Handbook for the Management of Energy Emergencies.

The specific measures to be considered by the Conference of Services include: appeals to the public for voluntary measures to limit consumption; a reduction in domestic heating; and possible driving restrictions. During a crisis, monitoring activities may be intensified, including increased frequency of reporting stock levels and product deliveries to the

market. Industry participants are also required to submit forecasts of anticipated sales on a regional basis. The regional prefectures will become responsible for monitoring deliveries to vital sectors and assuring initial data verification of regional reporting. Demand restraint measures can also be tightened in the event of a crisis becoming more severe. For example, regional shortages of oil products could be addressed through a compulsory redistribution of supplies, subject to approval by the MSE.

The government has indicated that a driving ban is the measure likely to be prioritised if it resorted to demand restraint measures. Italy has significant experience in imposing odd/even licence plate schemes, mainly to reduce air pollution in metropolitan areas during the winter. On an average day of application, this measure can reduce by 10% to 15% the normal consumption of gasoline and diesel for transportation. As the use of oil for heating is diminishing over time, the scope for oil savings through demand restraint measures on domestic heating is declining.

In order to verify the effectiveness of the available suite of demand restraint measures, OCSIT has been asked to conduct a new demand restraint study by the end of 2014.

Other oil emergency response measures

Fuel switching: Around a third of oil-fired electricity generation plants can switch to natural gas in the event of an emergency. However, the potential of this emergency response measure is rapidly declining as the share of oil in thermoelectric plants is shrinking.

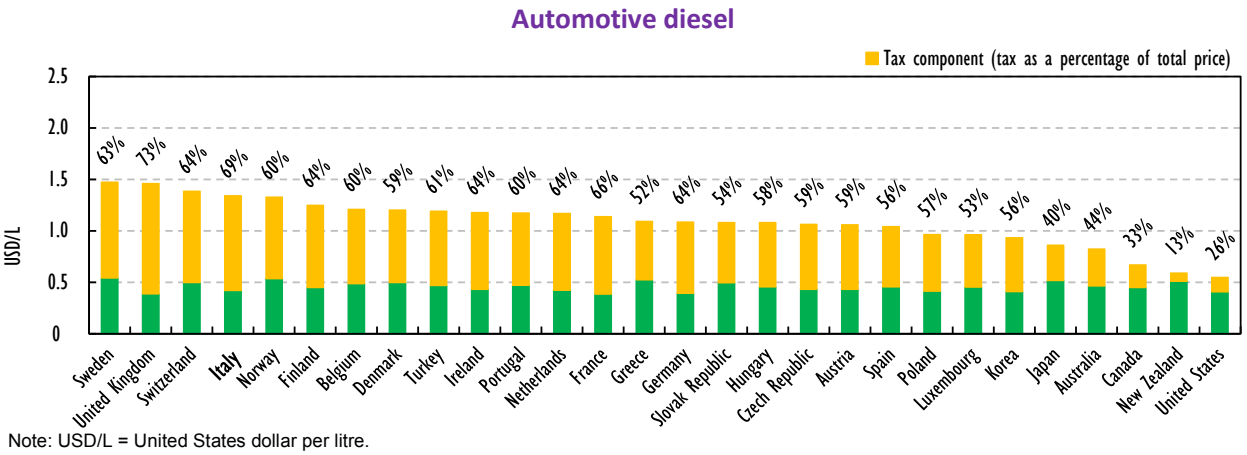
Surge production: The scope for surge production of crude oil is very limited as active fields operate at or close to their maximum capacity.

Relaxation of product specifications: The Italian government has no plans to relax oil product specifications for the purpose of boosting domestic refinery output in the event of an oil supply emergency. This is because it considers that such measures could create practical problems regarding the segregation of oil products intended for export to countries that have not implemented similar measures. In the government's view, the relaxation of product specifications is a last resort measure requiring consensus among all EU member states before it can be considered.

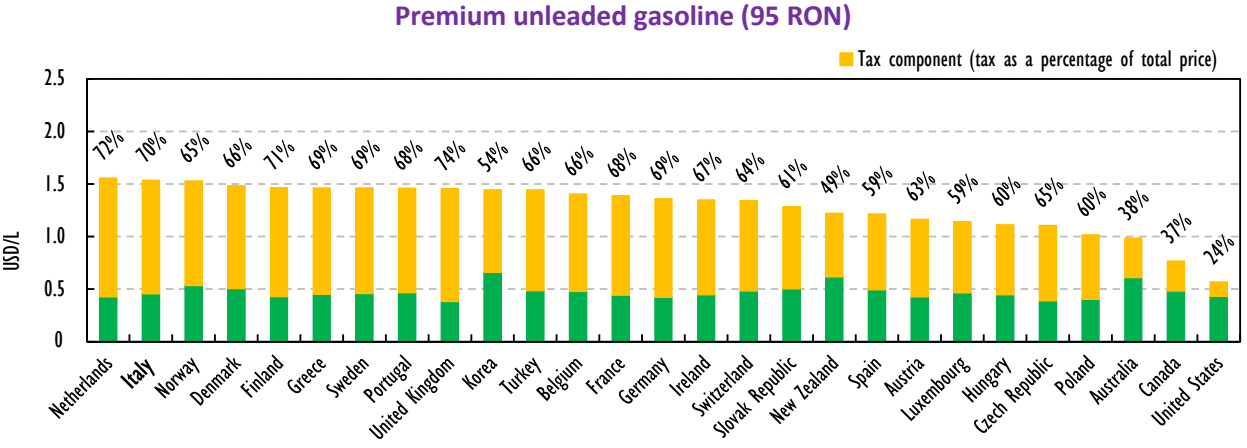
PRICES

The Italian oil market is not subject to any form of price regulation. Nonetheless, fuels sold for use in a motor vehicle are subject to an excise tax. In 2012, the excise tax on gasoline was increased to EUR cents 70.42 per litre, and the excise tax on diesel fuel was increased to EUR 0.5932 per litre. In addition, the tax on LPG used as fuel was set at EUR 0.2677 per kilogram, and on natural gas for vehicles the excise was set at EUR 0.0331 per cubic metre. The legal basis for the excise tax rate levels set in 2012 was the Decree "*Salva Italia*".

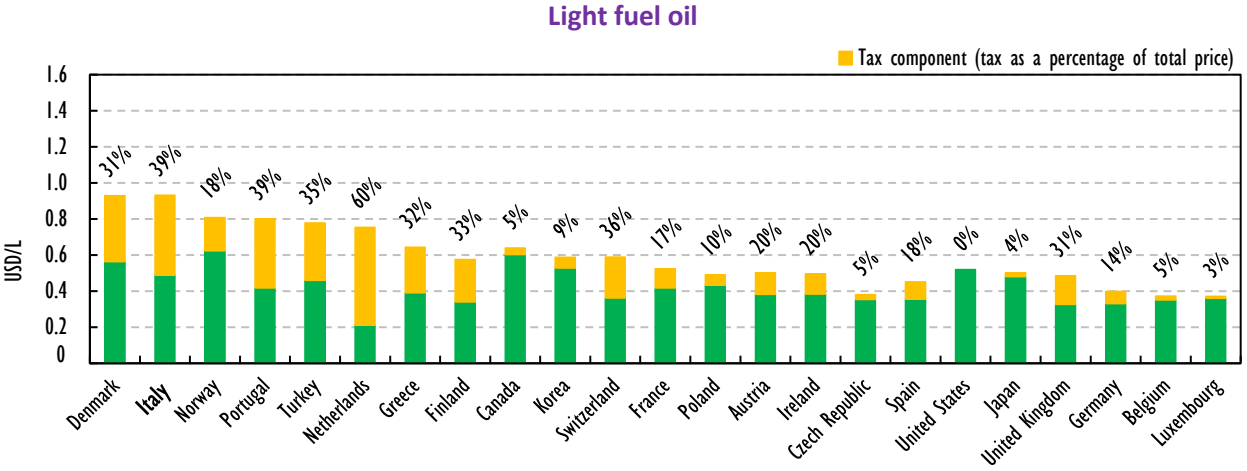
Figure 8.5 Fuel prices in IEA member countries, first quarter 2016



Note: USD/L = United States dollar per litre.



Notes: RON = research octane number. Data are not available for Japan.



Note: data not available for Australia, Greece, Hungary, New Zealand, the Slovak Republic and Sweden.

Source: IEA (2016c), *Energy Prices and Taxes 2016*, Q1, www.iea.org/statistics/.

Box 8.2 Italian Fuel Price Observatory

Since 16 September 2013, a law has been in place that requires fuel retailers at all service stations on the road network to communicate their prices for all types of fuels (petrol, gasoil, LPG and methane) to the MSE for the purpose of publishing them on a special website (https://carburanti.mise.gov.it).[2] The website also offers information on what non-oil services, such as food and beverages, ATMs, etc., which may be available at service stations. Retailers are required to communicate any price increase at least once a week. By the start of 2014, there were 17 000 sales points officially registered out of an estimated total of 22 400.

Source: *Unione Petrolifera*.

ASSESSMENT

Oil remains a significant source of energy although its share in TPES is declining: 45% in 2004, 40% in 2009 and 35% in 2014. This decline in oil use has been driven by a number of factors: such as the switch from oil to natural gas and renewables in the power sector, declining industrial output and greater use of natural gas for space heating Italy's limited domestic production met only 8% of domestic demand in 2015 (5.4 of 67 Mt). According to the IEA medium-term forecast to 2018, however, domestic oil production will increase slowly reaching 135.6 kb/d and oil consumption will decline slightly to 1.1 mb/d, thereby improving the share of domestic production marginally, to about 12%.

Oil demand in Italy is increasingly concentrated in the transport sector. The progressive dieselisation of the vehicle fleet has significantly altered the demand structure. Diesel accounted for 41% of oil products consumption in 2014, which was an increase from 27% of total oil consumption in 2004, while the share of gasoline declined from 18% to 16% during the same period. Italy is highly dependent on oil imports to complement limited domestic production. Import sources are well diversified and Russia, Azerbaijan, Iraq, Saudi Arabia, Kazakhstan, and Libya account for around 72% of crude oil imports.

In the power sector, the long-term shift from oil to natural gas has reduced the share of oil in the electricity generation mix from 51% in 1995, to 16% in 2005 and 5% in 2015. Older oil-fired plants are used only to guarantee fuel switching during a possible gas system crisis. The shift from oil-fired electricity plants to natural gas-fired electricity plants renders an emergency response system for natural gas indispensable. To that purpose, an emergency plan is being implemented, together with the other EU member states. Italy seems to be well prepared for this situation.

The Italian refining industry provides significantly more production than domestic demand, with the exception of jet fuel. According to a recent analysis prepared for the Italian government, only 40% of current refining capacity is likely to continue to operate in the long term (IHS, 2014). Overall, more than 32 Mt have been lost in the last decade, equivalent to more than six average-sized refineries and considerably more than the 17.9 Mt lost in the five years 1980-85 during the second oil shock. In the meantime, despite the closure of several facilities, declining demand is leading to an ongoing problem of overcapacity in the refining system (Unione Petrolifera, 2014). Italy is not alone in this regard and has successfully raised EU-level awareness on this topic and has significantly contributed to the

2. The Development Law (Law No. 99/09 art. 51) and related implementation measures (Ministerial Decree of 15 October 2010 and Ministerial Decree of 17 January 2013).

launch of the EU Refining Forum; countries throughout the European Union are experiencing the restructuring of refining capacity, a process that is set to continue in the coming years.

The EU refinery sector is challenged by falling oil demand and chemical production, declining local crude production and shrinking export markets for gasoline. Refineries are closing throughout Europe and further restructuring is expected. The impacts of restructuring are different across the European Union, with some member states successfully emerging from the restructuring thanks to process innovation, access to cheap feedstock and global commodity markets. In 2013, the European Commission started to run a so-called "fitness check" of the EU refining industry, in close co-operation with industry and across the EU institutions. The purposes of the fitness check was to assess the combined impact of all EU policies, the costs and benefits with regard to the impact on the cost of refineries and the oil product market, as well as the impact on the competitiveness of the European refining sector. The fitness check has acknowledged that on average 25% of the decrease in European refinery margins is attributable to compliance with EU legislation. The decrease in Italian refinery margins has been significantly higher. The government should bring excise duties for diesel and gasoline closer to each other and help mitigate the imbalance of demand for these fuels.

A further negative impact on refining margins is to be expected from the coming into effect of the Industrial Emissions Directive (2010/75/EU) in 2016. Though the environmental benefits of the new directive must not be underestimated given the energy security implications of the potential loss of Italy's refining capacity, there is a need for a right balance between environmental protection and the continued functioning of the refining activity in Italy. This balance could be attained through the full use of the flexibilities already present in the European legislation, including the application of the "refinery bubble" concept (instead of setting individual emission limits for multi-fuel-firing combustion plants within a single refinery).

There should be greater political will in the member states to adopt important energy taxation measures with a view to ensure greater levels of oil supply security (IEA, 2014). Furthermore, experience in IEA member countries shows that where the refining industry has invested in energy efficiency and process innovation, and where it is well integrated with the petrochemical sector, it can remain competitive.

Italy's fuel distribution sector is also undergoing major structural reform in order to meet the government's principal objectives of enhanced security of supply, increased competitiveness and greater quality of service. Compared to other major European countries, Italy's distribution network is fragmented, with 22 400 filling stations, about double the number of comparable size countries. They are limited in size on average (in terms of sales) and poorly diversified in non-oil products which account for only 3% of their revenues, compared to over 30% in other countries. The situation is exacerbated by the fall in sales over the last three years, aggravated by a slump in demand as a result of the economic crisis and higher taxes on fuels, bringing with it low profitability for service station owners alongside relatively high unit prices for consumers. In 2014, the Italian government, with the enactment of the Liberalisation Decree Law, introduced a new initiative to promote a higher degree of liberalisation: increased use of self-service arrangements, removal of constraints on non-oil products and services, improved communication and transparency of fuel prices to consumers, and eliminating the "sole supplier" constraint and obligation of supplying LPG. MSE has also introduced changes to the Rationalization Fund for the fuel distribution network to support the closure of inefficient and loss-making filling stations.

Italy fulfils its minimum oil stockholding requirements to the IEA by placing stockholding obligations on industry. Companies are obliged to report on a daily basis to the MSE the exact location, product type and quantity of stocks. A company's non-compliance with its obligations can result in substantial financial penalties. In an emergency, oil operators can be granted permission to draw on stocks.

In 2012, new rules were established following the introduction of Law No. 249/2012 to manage stocks of crude oil and petroleum products in Italy. The purpose of this law was to transpose EU Council Directive 2009/119/EC, which obliges member states to stock minimum amounts of crude oil and petroleum products, so as to guarantee the availability of oil stocks and the safeguard of energy supply. In order to meet these requirements, the government created the Italian Central Stockholding Agency (OCSIT), a state-owned entity overseen by the MSE. The main purpose of OCSIT is to hold and manage state-owned product stocks known as "specific stocks" within the Italian territory, and to organise and provide a service for the storage and transport of oil stocks for emergency and commercial purposes.

Since 1 July 2014, OCSIT has begun to progressively assume responsibility for an increasing proportion of the country's stockholding obligation from industry. The initial target is to hold 0.11 Mt (one day) of finished products, and to gradually increase this amount over a ten-year timeframe until the organisation holds 100% of Italy's obligated specific stocks of 3.34 Mt or 30 days of imports. In addition, OCSIT is responsible for updating the *Handbook for the Management of Energy Emergencies*.

The Italian oil market is fully liberalised with decisions regarding imports, exports, trade and pricing determined by industry participants. The government intervenes only to protect competition and avoid abuse of dominant market position. Also, companies are required to obtain authorisation from the MSE when they propose to set up new refineries and oil product storage facilities.

In the past, mobilising investment in hydrocarbon production projects has been problematic because of the complexity of the authorisation system and long delays inherent in the permitting of new projects alongside restrictions on offshore activity. In this sense, it is notable that the Strategy clearly sets out two initiatives to address these challenges: to enact legislation/regulations that guarantee compliance with the highest international safety and environmental protection standards; and simplify the bureaucratic procedures in issuing permits; and, to support the industrial sector to develop technology hubs and make the date and technology information available. In order to achieve the goal of sustainable production of hydrocarbons, a detailed roadmap to guide the process, complemented by regular monitoring, will also be necessary to ensure that the initiative remains on track.

RECOMMENDATIONS

The government of Italy should:

- *Assess the quantitative impact of demand restraint measures contained in the 2014 Handbook for the Management of Energy Emergencies.*
- *Limit the further impact of the Industrial Emissions Directive on the refining sector by making full use of the existing flexibility mechanisms in EU legislation.*

- *Develop the monitoring process of the Strategy through detailed roadmaps with measurable milestones for the sustainable production of hydrocarbons in Italy, especially simplifying the permit issuing procedures in line with new European standards.*
- *Consolidate and reduce the number of fuel supply stations in a competitive manner and ensure that market reduction is driven by efficiency and implanting changes to the Rationalization Fund for the fuel distribution network that facilitate the closure of inefficient loss-making outlets.*

References

IEA (International Energy Agency) (2016a), *Oil Information, 2016*, www.iea.org/statistics/, OECD/IEA, Paris.

IEA (2016b), *Energy Balances of OECD Countries, 2016,* www.iea.org/statistics/, OECD/IEA, Paris.

IEA (2016c), *Energy Prices and Taxes, 2016*, Q1, www.iea.org/statistics/, OECD/IEA, Paris.

IEA (2014), *Energy Policies of IEA Countries: European Union 2014 Review*, OECD/IEA, Paris.

IHS (2014) (Extract from) *IHS Report for Unione Petrolifera: An Assessment of the Contribution of the Italian Refining Sector to the Italian Economy and the Impact of Legislation on its Future*, IHS, London.

Unione Petrolifera (2014), *Annual Report 2014*, Unione Petrolifera, Rome.

UNEP (United Nations Environment Programme) (2012), *Compendium of Recycling and Destruction Technologies for Waste Oils*, UNEP, Japan.

9. COAL

Key data (2015 estimated)

Production: negligible

Hard coal imports: 19.2 Mt, -20.5% since 2005

Share of coal: 8.2% of TPES and 16.6% of electricity generation

Inland consumption (2014): power generation 80.4%, industry 12.7%, coke ovens and other transformations 7.0%

OVERVIEW

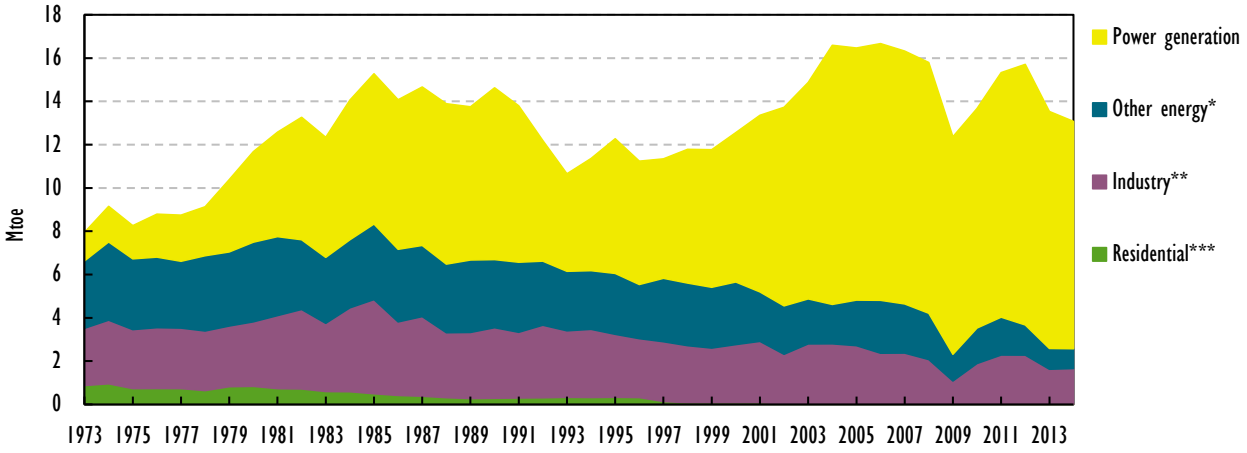
Coal accounted for 8% of total primary energy supply (TPES) and 17% of electricity supply in 2014. Over the long term, coal use is expected to decline as older, less efficient power plants are shut down and the electricity sector shifts towards even more natural gas and renewable energy.

SUPPLY AND DEMAND

SUPPLY

Total coal supply was 12.4 million tonnes of oil-equivalent (Mtoe) or 19.1 million tonnes (Mt) in 2015, which is 2.5% lower than in 2014. Italy's coal supply was on a steady rise from the mid-1990s to the peak of 16.7 Mtoe in 2006. During 2009 and 2010, supply declined by 25% in total, and a drop in the industry sector of almost 50% in one year (2009). Consumption recovered in the following two years before declining again since 2013 (Figure 9.1).

Figure 9.1 Coal supply by sector, 1973-2014



Note: TPES by consuming sector.

* *Other transformations* include coke ovens, other refining and energy own-use.

** *Industry* includes non-energy use.

*** *Residential* use ceased in 2013.

Source: IEA (2016), *Energy Balances of OECD Countries* www.iea.org/statistics/.

Italy relies on imported hard coal as domestic production is negligible (73 kilotonnes of hard coal in 2015, compared to over 19 000 kilotonnes that was imported). The country does not produce or import brown coal. Hard coal imports in 2014 were mainly from the United States (26.8%), Russian Federation (hereafter "Russia") (20.6%) and Indonesia (17.0%) with the remainder from Colombia, South Africa, Spain, Canada, Australia, Kazakhstan, Venezuela, Ukraine and Croatia. Imports from Spain started in 2006, from Kazakhstan in 2013 and from Croatia in 2014, while the other countries have been exporting coal to Italy for decades.

The only known coal source in Italy is located in the Sulcis Iglesiente basin, in southwest Sardinia. In August 2013, the region of Sardinia in collaboration with the Ministry of Economic Development (MSE), ENEA and Sotacarbo granted EUR 60 million towards a new initiative, the "Integrated Sulcis Project". This aim of this initiative is to develop a cluster of innovative combustion technologies (in particular oxy-combustion) integrated with enhanced coalbed methane recovery (ECBM) with carbon capture and storage (CCS) technologies to exploit the seams of non-extractable coal, by recovering the methane contained in it (CIAB, 2014).

DEMAND

Coal is mainly used in electricity generation and industry. The latter also primarily consumes coal in autonomous power generation plants. Electricity generation accounted for 80.4% of coal consumption in 2014 while 12.7% went to industry. Coke ovens, other energy industries and energy own-use accounted for 7.0% of coal consumption in 2014 (Figure 9.1). The residential sector consumed negligible levels in 2012 and ceased consumption in 2013, after decades of falling demand.

The power generation sector was the driving force behind growing coal use up to 2004, with its consumption increasing by 74% from 2000 to 2004. Since then, the demand from the sector has been relatively stable between 10 kt to -12 kt. Coal use in industry almost halved in 2008-2009, but has recovered some and grew by 54% 2009-2014. Coal demand in coke ovens also dropped dramatically in 2009 and has since fallen further to a level 50% below 2004 in 2014.

COAL AND THE POWER SECTOR

Compared to the other major economies of Europe, the share of coal in Italy's electricity generation mix is relatively low, at 16.7%. There are 13 coal-fired generating plants in Italy representing approximately 7 800 megawatts (MW) of generating capacity. Enel retains the largest share of coal-fired capacity with 5 545 MW or 70%. In 2014, however, it announced that it is considering phasing out 23 obsolete thermal power plants, some of which are coal-fired, in the near term.

Further plans to develop more coal-fired capacity have run into difficulties. Earlier in 2014, Enel announced its decision to abandon plans to convert the 2.6 gigawatts (GW) fuel oil plant in Porto Tolle, mothballed in 2009, into Italy's first coal-fired plant with CCS technology. This project is considered cancelled owing to delays in project delivery after the decision of the Italian State Council to annul the environmental permit for the Porto Tolle power plant and the difficulties in achieving closure for the financial structure of the project (GCCSI, 2014). Enel is instead considering converting the plant into a smaller biomass unit.

In 2013, plans to develop the Saline Ioniche Plant, containing two units of 660 MW owned by Repower/SEI – which previously obtained an authorisation for two high-efficiency coal-fired units (1 320 MW) – were stalled following the withdrawal of Swiss-owned Repower from the project. This greenfield project located in the Calabria region was to replace an older industrial facility. Original plans contained proposals for the installation of CO_2 post-combustion amine capture and compression units.

CARBON CAPTURE AND STORAGE

Carbon capture and storage (CCS) is a family of technologies and techniques that enable the capture of carbon dioxide (CO_2) from fuel combustion or industrial processes, the transport of CO_2 via ships or pipelines, and its storage underground, in depleted oil and gas fields and deep saline formations. CCS can have a unique and vital role to play in the global transition to a sustainable low-carbon economy, in both power generation and industry.

The European Commission's proposal for a 2030 Climate and Energy Policy Framework acknowledges the role of CCS in reaching the EU's long-term emissions reduction goal. The main piece of regulation for CCS across Europe is the EU CCS Directive on Geological Storage of Carbon Dioxide (Directive 2009/31/EC), which came into force on 25 June 2009. This is an enabling directive, which means it does not require CCS to be developed, but if a European Union (EU) member state or company chooses to develop a CCS project, then the provisions of this directive must be followed. The process of transposing process of the EU CO_2 Storage Directive in Italy has been completed and the Directive is law in the Italian legal framework (Legislative Decree 14 September 2011, No. 162). Italy implemented the legislative decree by means of a number of implementation decrees.

In 2011, Enel inaugurated a CCS pilot project at its Federico II power plant in Brindisi. The development of the capture project was part of a combined Enel and ENIi project aimed at testing the first integrated Italian pilot. The pilot treated 10 000 cubic metres (m^3) per hour of emissions from the coal-fired plant, separating out 2.5 metric tonnes of CO_2 per hour, up to a maximum of 8 000 metric tonnes per year. There are plans to permanently store underground, in depleted natural gas fields, the CO_2 released by the Brindisi power plant but current market conditions are thwarting investment in that direction.

ASSESSMENT

While coal use in Italy is relatively small compared to other major European countries, coal use is projected to contribute to electricity production well into the medium term. The cancellation of the project at the Porto Tolle plant and the decision not to continue the Brindisi pilot leaves Italy without any major CCS-related activities. These projects could have made an important contribution to European knowledge about the viability of the entire CCS chain and a significant contribution to Italy's carbon abatement efforts. If coal use were to increase, however, it would need to be accompanied by CCS.

The National Energy Strategy (NES) recognises that renewable energy and energy efficiency will play a substantial role in meeting Italy's long-term energy goals and mitigating GHG emissions. There is also a major role for CCS: the IEA's *Energy Technology Perspectives* projects that CCS can contribute 14% of total CO_2 emission reductions required in 2050 but also highlights that CCS development and demonstration have been slower than expected (IEA, 2014).

CCS deployment requires strong policy action, as present market conditions are insufficient and current CO_2 pricing mechanisms have failed to provide adequate incentives to drive it. Governments need to put in place incentive policies that support not only demonstration projects but also wider deployment (IEA, 2013). The NES notes the development of projects on CCS as an area of priority interest within the context of Italy's participation in the European programmes. Italy should take steps to recover its profile and leadership in international efforts to promote and implement CCS and commit funding to the implementation of projects, both in Italy and elsewhere, and advance their construction.

RECOMMENDATION

The government of Italy should:

- ☐ *Retain domestic CCS research and development capacity, according to the European SET-Plan recommendation including participation in the construction of full-scale demonstration facilities.*

References

CIAB (Coal Industry Advisory Board) (2014), *International Coal Policy Developments in 2014*, CIAB/IEA, Paris.

GCCSI (Global Carbon Capture and Storage Institute) (2014), *The Global Status of CCS 2014*, GCSSI, 2014.

IEA (International Energy Agency) (2016), *Energy Balances of OECD Countries 2016*, www.iea.org/statistics/, OECD/IEA, Paris.

IEA (2014), *Energy Technology Perspectives 2014: Harnessing Electricity's Potential*, OECD/IEA, Paris.

IEA (2013), *Redrawing the Energy-Climate Map*, OECD/IEA, Paris.

10. ENERGY TECHNOLOGY RESEARCH, DEVELOPMENT AND DEMONSTRATION

Key data (2013)

Government energy RD&D spending: EUR 529 million

Share of GDP: 0.33 units of GDP per USD 1 000 (IEA median*: 0.35)

RDD&D per capita: EUR 8.7

* Median of 23 IEA member countries for which data are available.

OVERVIEW

The Italian economy has struggled over the past decade and there is an urgent need to restore its international competitiveness, recover from the recession and establish the basis for long-term growth. The National Energy Strategy (NES, hereafter the Strategy) recognises that the energy sector has a fundamental role to play in the growth of the economy. Developing a more competitive and sustainable energy market is therefore one of the most significant challenges for Italy's future. Accordingly, the Strategy aims to pave the way for wider and more effective participation of industry and of the country's public and private research centres in future research and development (R&D) programmes. Smarter investment in energy-related research activities will contribute to further improving the energy and resource efficiency of the economy and to creating new sources of growth.

INSTITUTIONS

The principal ministries involved in funding energy R&D are the **Ministry of Education, Universities and Research** (**MIUR**), the **Ministry of Economic Development** (**MSE**), and the **Ministry for the Environment, Land and Water** (**MATTM**).

The public R&D institutions which carry out energy-related research are **the National Agency for New Technologies, Energy and Sustainable Economic Development** (**ENEA**), the **National Research Council** (**CNR**) and **Research on Energy Systems** (**RSE**). These institutions are directly involved in implementing the National Electric System Research programme dedicated to developing technologies of interest to the electricity sector.

KEY POLICIES

Italian energy-related research activities at national level are co-ordinated by public institutions. In 2001, constitutional amendments provided the basis for this framework for sharing regulatory competences, which include energy, between the State and the Regions.

The high level political governance of R&D activities is overseen by two bodies: the Council of Ministers and the Inter-Ministry Committee for Economic Planning (CIPE). By approving the periodic National Research Programme (PNR), the principal national cross-sector R&D policy document, CIPE allocates financial resources to public research agencies. A PNR is prepared every three years and is updated annually. The PNR is the key mechanism in the planning and direction of national R&D activities. It defines the objectives and modes of implementation of specific interventions in priority areas, disciplinary sectors, involved parties, projects which qualify for funding, etc. Its goal is to ensure the co-ordination of research with other national policies, bringing Italian research into alignment with the EU strategic vision and creating the conditions necessary for a progressive integration of public and private research.

The 2010-13 PNR dealt with several thematic priorities for national research policy, among them energy and environment. In January 2014, the 2014-20 PNR, which was prepared by the MIUR, was introduced following extensive consultation with stakeholders, including ministries, regional governments, the scientific community, the Confederation of Italian Industries, the Science Academy and the labour unions. The new PNR included the secure, clean and efficient energy; smart, green and integrated transport and climate action; resource efficiency and raw materials, among the 11 challenges facing the research community. MIUR commits EUR 900 million each year to support implementation of the measures included in the programme.

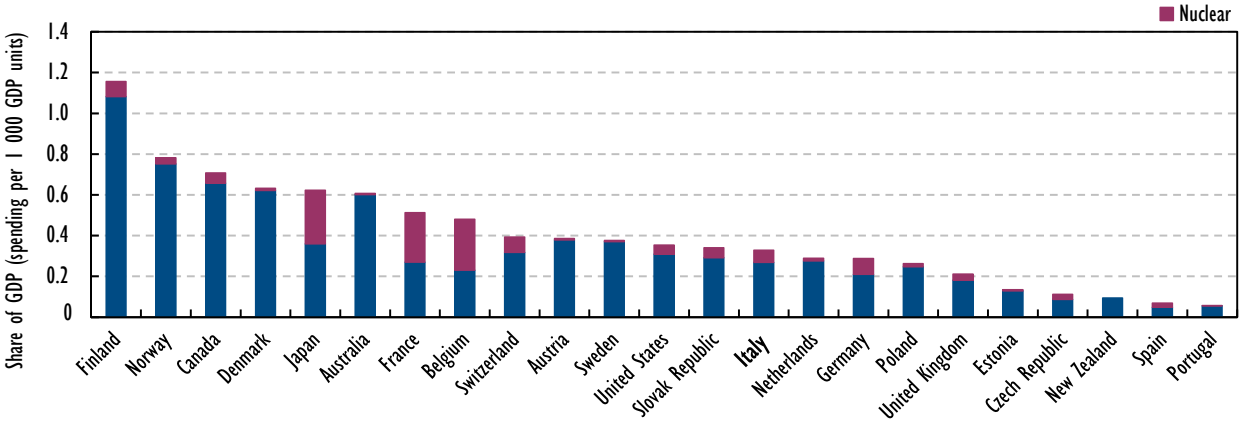
ENERGY RESEARCH PRIORITIES AND FUNDING

FUNDING

The level of resources devoted to research and innovation, both private and public, is increasing in Italy. The main contribution comes from public institutions at both national and regional levels. Following a period of decline in the first half of the 2000s, public funding for energy-related R&D increased, reflecting the renewed priority attached to this sector. Funding declined again at the end of the decade, however, as a result of an overall cut in public spending. The government energy R&D budget allocated to energy efficiency and renewable energy technologies grew steadily during the decade, with the exception of the last few years. These have become the dominant energy research areas, accounting for about half the total government energy R&D budget in 2010 (up from 17% in 2000). This is reflected by the growing number of patent applications in these fields. Public funding for nuclear research grew at the end of the decade, in line with the government's decision to begin using nuclear energy again, a decision which was over-ruled by a 2011 popular referendum. In 2010, nuclear research attracted one-third of government energy R&D funding (OECD, 2013).

In 2013, the funding of research, development and demonstration (RD&D) on public energy amounted to around EUR 529 million. The budget structure has changed in recent years, with a marked shift towards energy efficiency and renewable energy (13.8% and 21.5% of the total budget, respectively), while nuclear R&D has lost ground (18.2% in 2013 compared to 40.7% in 2000). Transport research is also funded through the general research framework and through programmes dedicated to transport.

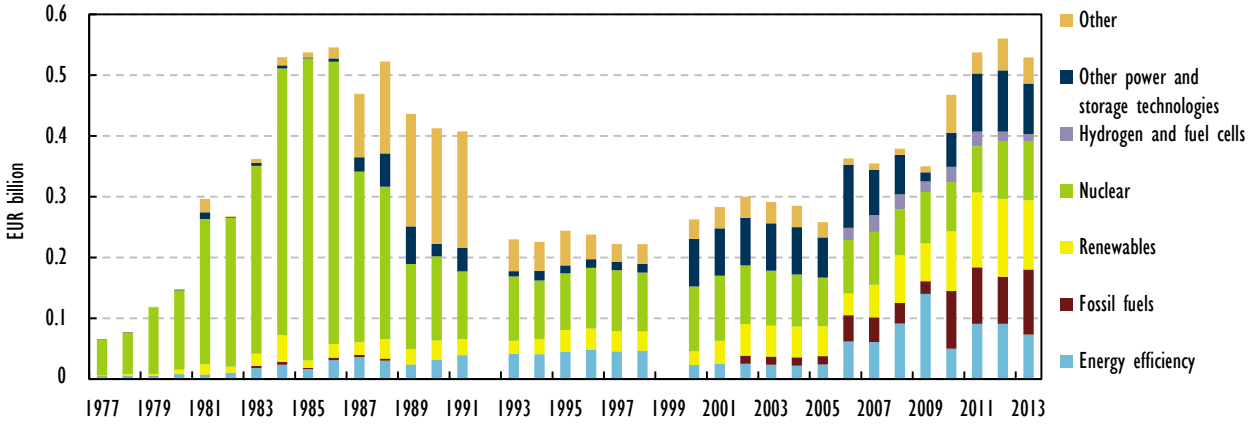
Figure 10.1 Government energy RDD&D spending as a ratio of GDP in IEA member countries, 2013



Notes: RDD&D includes demonstration. Data are not available for Greece, Hungary, Ireland, Korea, Luxembourg and Turkey.

Source: IEA (2015), "RD&D Budget", IEA Energy Technology RD&D Statistics (database), www.iea.org/statistics/.

Figure 10.2 Government energy RDD&D spending, 1977-2013



Note: data are not available for 1992 and 1999.

Source: IEA (2015), "RD&D Budget", *IEA Energy Technology RD&D Statistics* (database), www.iea.org/statistics/.

NATIONAL ENERGY STRATEGY

The Strategy highlights the fact that most indicators reveal that research and innovation in the energy sector is not at the required level. There is a strong dependence on foreign technology, and a growing trade deficit, especially in high technology products and for the production of clean energy, that has grown more pronounced in recent years. The Strategy is explicit in that compared to its European peers, the Italian research and innovation system is inadequate. In addition to limited public resources, the sector faces a number of other problems:

- low private sector participation in R&D investment in the energy sector notably the lower level of engagement from the private sector
- the high degree of fragmentation among the parties and the areas of research involved, which sometimes translates into overlaps or an inability to "act as a system" around major initiatives and/or hubs of excellence

- the lack of clear guidelines on energy research priorities for the country on which to concentrate resources, and the absence of a single co-ordination "control room" for the sector to facilitate collaboration and the more effective allocation of available resources
- the need to revise and adapt the energy sector to new demands. The Strategy recognises the strategic need to anticipate, the need for know-how, and the need to drive the effects of new policies.

Accordingly, one of the aims of the Strategy is to pave the way for wider and more effective participation of industry and the country's public and private research centres in future R&D programmes. On this basis, the Strategy proposes a series of new measures:

- Greater support for R&D promoted by private sector stakeholders: Tax relief recently introduced is a first step and the Kyoto Revolving Fund is another important element. These measures will be complemented with two other instruments, both financed from electricity and gas tariff revenues: the Fund for System Research in the Electricity Sector (endowed with about EUR 60 million per year) and the *Fondo per la Crescita Sostenibile* (Fund for Sustainable Growth), launched in late 2013, endowed with EUR 300 million, directed small and medium-sized enterprises (SMEs) towards Italy's structurally weak southern regions, for projects aimed at deploying technologies and business processes that minimise environmental impact.
- Increase the amount of resources available under competitive access conditions to create partnerships between both universities and research establishments and private sector companies.
- Ensure that Italy's technological innovation activities are closely co-ordinated with the EU Strategic Energy Technology Plan (SET). In coming years, EU R&D resources will increasingly be allocated to the priority projects identified under the SET-Plan, as already happened for the Seventh EU Framework Programme for Research and Innovation. Within this context, therefore, Italy considers the following areas to be of priority interest:
  - research in innovative renewable technologies
  - research in smart grids and in storage systems
  - research in energy efficiency materials and solutions, and related technology transfer
  - the development of CCS projects
  - research aimed at the exploitation of indigenous energy resources, notably hydrocarbons and marine energy
  - over the longer-term perspective, the development of international collaborations in the field of safety and studies on fusion and on generation IV nuclear fission reactors.
- Reorganisation of ENEA is planned. Its aim is to focus ENEA's activities and organisational structure on priority research fields identified in the Strategy, and to rationalise potential overlaps with other public agencies. A census of national competences in the energy research sector is also planned, as a preliminary step in establishing more precise priorities and properly calibrating the incentives applied to specific branches of technology.

Fiscal support: Tax credits and the patent box

A tax credit regime offers a 25% incremental-based tax credit, with a more generous rate of 50% if the R&D project is conducted in collaboration with universities and public research institutions, or by innovative start-ups, and this to cover expenditures related to highly qualified R&D staff. The R&D tax credit can be used to offset tax and social contributions liabilities, which means that even loss-making firms could benefit from the incentives. This is important to avoid favouring firms in a profit-making position at the expense of firms making losses as is often the case for young dynamic firms.

A patent box allows businesses to benefit from lower effective tax rates (13.75% as of 2017) on profits derived from intellectual assets (copyrights; patents; trademarks which are functionally equivalent to patents and know-how exploited through licences with the aim of encouraging the location of intellectual assets currently held abroad, avoiding their relocation and more generally supporting investment in R&D) (OECD, 2015).

Kyoto Revolving Fund

In March 2012, the Italian government launched its Kyoto Revolving Fund, which amounted to EUR 600 million for the reduction of GHG emissions. This mechanism will allow private companies and public institutions to receive subsidised loans to be invested in projects for renewable energy, energy efficiency and forest management. The national savings bank, *Cassa Depositi e Prestiti*, manages the fund, which was divided into three annual instalments of EUR 200 million.

MONITORING AND EVALUATION

Italy supports, and considers as a priority, building a resilient Energy Union, which was launched in 2014 under the Italian Semester Presidency, fully in line with the European 2030 Climate and Energy Policy Framework. The five dimensions of the Energy Union identified by the European Commission will be the priorities of the European energy policy for the incoming years (security and solidarity; a fully integrated internal energy market; energy efficiency; decarbonisation; research, innovation and competitiveness).

The Italian government has called for an integrated roadmap of the SET-Plan as an "umbrella" for developing strengthened partnerships to face the technological challenges posed by climate change and energy transition. Research and innovation in the energy sector in particular should be set according to a holistic approach. In this respect, the objectives of research and innovation must be oriented not only on individual technologies but also on their mutual integration at a higher level.

In this perspective, Italy supports the need to have an inventory of R&D activities. At the same time, having tried several times to make it happen at the national level, the Italian government noted the difficulty of the challenge and the barriers placed by the research players, especially private, often unwilling to make information about their research available to third parties.

Monitoring of priorities is essential to define and possibly revise policies to support research and innovation. Italy is actively co-operating at the European level in the Strategic Energy Technologies Information System (SETIS), which offers an integrated approach to the exchange of data and information on low-carbon energy technologies and innovation

across member states and energy sectors.[1] This information can be used to support the effective strategic planning, monitoring and assessment of the RDD&D activities.

The parameters to be monitored must be well calibrated, avoiding complex procedures and difficult to understand by research operators, whose collaboration is essential. It is also necessary to identify homogeneous criteria that allow it to evaluate with a reasonable approximation the impact of the policies initiated by the SET-Plan in terms of cost-reduction technologies and/or performance improvement of products and/or processes.

KEY PROGRAMMES

National Electric System Research

This programme develops research projects of general interest to the Italian electricity system, focusing on applied research and a system-oriented approach. The activities are aimed at innovating and improving the performance of the system in terms of economics, safety and the environment. The programme's coverage ranges from system governance to R&D and deployment of renewable technologies, electric transmission and end-use. It is financed through a specific component of the end-user electricity price which is determined annually by the electricity regulator (AEEGSI) and currently amounts to about EUR 0.015 per kilowatt-hour (kW/h).

The resources allocated by the three-year plans (2006-08, 2009-11 and 2012-14) amount to approximately EUR 600 million. In January 2013, the 2012-14 three-year plan provided support of EUR 221 million to ENEA, CNR and RSE, the leading research agencies involved.

Industria 2015

The general objective of *Industria 2015* is to help the Italian industrial system to strengthen its competitiveness through technological innovation. The programme has two specific objectives: to develop industrial activities in the field of high technology and to upgrade and strengthen SMEs through research and technical development, reduction of costs, promotion of investments, and increases in size.

The programme has identified five strategic areas including energy efficiency and sustainable mobility. In energy efficiency, the programme contains three elements: industrial investments in renewable energy sources; investments for upgrading existing industrial divisions and manufactured products that have a low environmental impact and are capable of saving energy; and industrial investments for innovating manufacturing processes in order to reduce the use of energy. In sustainable mobility, the programme supports projects that have a significant impact on the eco-compatibility of surface transport systems: reducing the level of congestion of surface transport, inter-modality and logistics network; sustainable urban mobility; and safety and security of people and goods in surface transport.

Industria 2015 has two sources of public funding: the Fund for Competitiveness and Development and the Fund for Corporate Finance. The total amount of funding made available for the relevant projects is summarised in Table 10.1.

1. https://setis.ec.europa.eu/.

Table 10.1 Funding for energy-related projects under Industria 2015 programme (by 31 May 2014)

Strategic areas	Approved projects	Projects under way	Granted subsidies (EUR million)	Paid subsidies (EUR million)
Energy efficiency	37	29	253.6	38.0
Sustainable mobility	29	27	204.8	24.2
Total	66	56	458.4	62.2

Sources: MSE; IDR country submission.

Technological districts

The innovation system in Italy is built around technological districts. Support for early stage companies is concentrated on certain regions mainly in the north and centre of Italy and also in large cities such as Milan, Rome, Torino, Trieste, Bologna and Venice. This support is strongly linked with the activities of universities and industrial hubs. The National Energy Technology District (DiTNE) in Brindisi, aims to support development in the fields of renewable and fossil energy sources by means of scientific excellence and technological research, by strengthening the research infrastructure and boosting technology transfer. These R&D activities are locally supported by research institutions such as ASI (Italian Space Agency), CNR, ENEA, INFN (National Institute of Nuclear Physics), INGV (National Institute of Geophysics and Volcanology) and OGS (National Institute of Oceanography and Experimental Geophysics).

ENEA plays a specific role in promoting competitiveness of SMEs in new energy technologies. It helps SMEs in overcoming the so-called "Valley of Death" phase between the formation of a new business idea and entering the market. ENEA's support consists of sharing knowledge, applied research results and laboratories in projects by SMEs.

Scientific parks in technological districts cluster knowledge institutes and businesses and tend to focus on a specific theme. For example, the environment park in Torino combines technology and eco-efficiency, and features areas such as green buildings, biomass and hydropower. The city of Torino is an industrial cluster that also hosts a number of incubators that help start-ups in clean-tech sectors.

Large industrial corporations such as Enel, ENIi, Fiat and Ansaldo Energia engage with innovations by connecting start-ups with relevant advisors, set up incubator programmes such as Enel Labs and match up with innovative SMEs.

National operational programme for research and competitiveness 2007-13

This programme was co-financed by the European Regional Development Fund (ERDF). Its management and evaluation are the responsibility of MIUR as the managing authority and MISE was involved as an intermediate body. The priority research areas were: distributed generation, co-generation, solar power, waste, biofuels, geothermal power, electro-chemistry, rational use of energy and emissions reductions. The programme budget in the energy sector for the period 2007-13 was EUR 200 million.

Interregional operational programme : Renewable energies and energy savings 2007-13

This programme implemented the National Strategic Framework 2007-2013 in the energy sector. Its aim was to increase the production of energy from renewable sources and to improve energy efficiency as well as promoting local development opportunities in the convergence regions (Campania, Puglia, Calabria and Sicily). The total national contribution to the Operational Programme was EUR 800 million, 50% of which was dedicated to renewables projects.

Programme for promoting smart grids by distribution companies

AEEGSI introduced specific provisions in the regulation governing the procedures, costs and timing for the connection of renewable energy systems to the grid (Unified Text for Active Connections – TICA). Improvements were introduced to facilitate better access to the feed-in tariff mechanism. In this context, AEEGSI began to support activities by granting funding to pilot projects aimed at developing smart grid solutions. These projects supported schemes related to the smart management of the power network and the integration of electric vehicles. Enel and other distributors are very active in this field.

PROJECTS AND RESEARCH AREAS

Concentrated solar energy technologies

Since 2001, ENEA has been active in research and demonstration of concentrated solar energy technologies. Several innovations have been introduced in parabolic trough technology: thermal storage by means of molten salt, which has extended the temperature range up to 550 degrees centigrade, a new heat-collecting element and a new tracking system. The solar collector assembly test loop (PCS) sited in the ENEA Research Centre in Rome has allowed researchers to analyse the behaviour of the process components with molten salt as heat-transfer fluid, to verify the instrumentation, control system and operating procedures, and to test the optical and thermal efficiency of the new solar collector.

Building on the outcome of this project, ENEA has also developed the Archimede Project. In September 2003, ENEA and Enel, the electricity utility, agreed to test the feasibility of integrating a solar plant into a combined-cycle gas turbine power plant. A joint working group produced a design document on which all the critical aspects of the system were evaluated. These activities were performed from 2007 to 2009 and a prototype was commissioned in 2010 and is now operated by Enel.

Photovoltaics

ENEA and CESI RICERCA are active in research in photovoltaics (PV) with the support, in some cases, of universities and of the National Research Council. ENIi is also active in the production and marketing of solar cells, panels and photovoltaic systems and, in partnership with the Australian company Pacific Solar, is committed to developing a new generation of silicon cells and thin films aimed at cutting production costs and contributing to the market growth.

Bioenergy

The Italian National Program on Renewable Energy from Biomass, promoted by the Ministry of Agricultural and Forestry Policy, is seeking to displace up to 10 million tonnes of oil-equivalent (Mtoe) of fossil fuels with biomass sourced from agriculture, forestry, livestock sectors and related industries.

Hydrogen

The Hydrogen Park Consortium in Venice, supported by the Venice Industrial Union, aims to develop hydrogen as a viable fuel and demonstrates its use in a high-density residential and industrial area. The Civitavecchia Hydrogen Pole in the Lazio region, funded by the Seventh Framework Programme, is researching the viability of a new system of sustainable mobility for the future. The Zero Regio project in Lombardy, in partnership with Rhine-Main in Germany, focuses on the development and demonstration of hydrogen infrastructure for passenger cars and is co-financed by the European Commission in the Sixth Framework Programme.

Nuclear fission

A three-year R&D programme on New Nuclear Fission, funded by MSE within the framework of the Fund for Research on the Electrical System, focuses on participation in international initiatives such as International Near-Term Deployment (INTD) and Generation IV nuclear systems

Nuclear fusion

Fusion activities are performed and planned by the Italian Fusion Association (ENEA-CNR-Consorzio RFX) have been defined according to strategies, which are oriented to realise fusion as an energy source.

Energy efficiency

Italy remains active in the European initiatives and training programmes for monitoring, promoting and increasing energy efficiency across sectors. Examples of Italian participation include the European TRAINER project (energy efficiency in railways), ENERLIN (residential lighting initiative), Green Labels (greener procurement), ODYSEE-MURE (indicators in EU-15 and Norway).

ENEA also plays an important role in supporting those technologies aimed at increasing the efficiency of energy production and use. These activities range from research to technological innovation and advanced services. These are provided through the implementation of advanced technologies targeted especially on energy and industry, sustainable use of fossil fuels, final energy use and development of robots for a wide range of industrial applications.

PRIVATE SECTOR PARTICIPATION

In Italy, the share of business enterprise expenditure on R&D has been among the lowest among OECD countries (OECD, 2015). Across all sectors, involvement of the private sector remains limited, with the business sector carrying out only about half of R&D and financing 44% of it, well below the OECD average (OECD, 2013). The involvement of the

private sector is monitored by means of an annual survey conducted by the National Statistics Institute (ISTAT) on R&D. Twenty energy-related R&D themes are surveyed. Current levels of surveyed private sector energy R&D spending are in the range EUR 200 million to EUR 300 million per year. Non-surveyed R&D spending is estimated at significantly higher levels.

INTERNATIONAL COLLABORATION

Italy is engaged in a number of international initiatives including bilateral agreements for environmental co-operation in Latin America, the Mediterranean basin, the Balkan region, Central and East Asia, People's Republic of China, India, Iraq, Thailand and the United States. Bilateral engagements with the United States include the United States–Italy Programme for Science and Technology Co-operation on Climate Change, and the United States Department of Energy-MISE Bilateral Agreement in the field of energy R&D (nuclear energy and clean coal technologies).

Italy is an active participant in a number of multilateral partnerships, including the Carbon Sequestration Leadership Forum, the International Partnership on Hydrogen Economy, Methane-to-Market, the Global Bioenergy Partnership (Italian initiative in the G8 Gleneagles Summit) and the International Smart Grids Action Network (ISGAN).

Italy participates in 20 IEA Implementing Agreements as contracting party and as sponsor through ENIi–Tecnologie (the Corporate Technology Company of ENIi) to the IEA programme on greenhouse gas R&D.

Co-ordination of the participation to the International Thermonuclear Experimental Reactor is done through the Association EURATOM–ENEA. Italy is also a participant in EURATOM, in the European Commission Framework Programmes, in the Technology Platforms and in ERA-NETS, and in a number of European Technology Platforms.

ASSESSMENT

Italy has made some progress despite the decline in funding for this sector over the period since the previous in-depth review was published in 2009. Recent measures in the sector have concentrated on balancing a series of budget cuts and streamlining research funds. The overall framework remains oriented towards direct grants and loans, but a shift of some of this direct financing towards encouraging demand-driven innovation in key research areas is being initiated as non-competitive funds are phased out. Integration with European R&D and Horizon 2020 is under way and funding programmes are being simplified. The focus of current policy is moving towards support for new R&D-oriented companies, large collaborative programmes and, more recently, demand-driven innovation.

Innovative SMEs are now financed by means of grants and loans provided by public agencies at regional level. Most regions also support SMEs by taking shares in specific investment companies for local development. At national level, *Invitalia* (the Agency for the Attraction of Investment and Development of Enterprises) has been mandated by the national government to increase the competitiveness of the country, and the south in particular, by supporting the development of strategic innovative sectors. Market development is also supported through networks such as the Italy Clean-tech Network, the *Corrente* network and the Italian Trade Agency, which help Italian companies exploit markets elsewhere.

In order to achieve the objectives set out in the Strategy, the possibilities provided by effective research, development and innovation policy should be fully exploited. The Strategy has the potential of filling the gap with clear energy technology policy guidelines that can catalyse the interest and resources of the scientific and industrial communities.

The main funding sources include the new Italian National Programme for Research, which however lacks a specific part dedicated to energy research, the Kyoto Revolving Fund, the Fund for System Research in the Electricity Sector and the Fund for Sustainable Growth. Overall, the level of resources devoted to research and innovation, both private and public, is significantly lower in Italy than in other EU countries. Nonetheless, Italy ranks second in Europe after Germany in terms of presence of innovative SMEs. This is partly compensated as Italian entities have achieved significant results in obtaining research and demonstration grants in the energy part of the EU framework programmes for research and technological development (RTD).

A small part of the public funding for energy R&D is financed through a specific component of the end-user electricity price. In particular, specific projects with the leading public R&D institutions are 100% financed with such resources. In a context of high electricity prices, this calls for a stringent evaluation of the cost-effectiveness of the use of these resources and the obtained results.

Italy can count on excellent research resources in areas such as renewable energy (for example concentrated solar power) and system integration (for example on smart grids and on the storage experimental project). In terms of priority areas of development, Italy aims to align itself with the EU's SET-Plan. The articulation of clear national energy technology policy goals and priorities can however be strengthened.

There is currently a segmentation of energy research, development and innovation measures, and funding instruments entrusted to various ministries, agencies, both at central and regional levels. Considering the limited resources available, Italy will need to focus on making public investment in this area as effective as possible, avoiding duplication. To this end, a stronger co-ordinating role for the ministry responsible for energy policy is recommended.

Innovation is promoted through various programmes at national level, such as the National Technology Clusters, and through grants and loans provided to innovative SMEs by public agencies at regional level. The lack of a stronger presence of seed capital is however still an important barrier to the commercialisation of innovative developments.

Italy is very active in international energy R&D co-operation. It participates in 20 IEA Implementing Agreements, in some in a leading role. The review team applauds this commitment.

RECOMMENDATIONS

The government of Italy should:

- *Define, on the basis of the NES, and through a multi-stakeholder involvement process, a policy with clear priorities for energy technology research, development and innovation.*
- *Enhance the co-ordinating role of the ministry responsible for energy policy in the field of research, development and innovation in energy technologies.*

- *Overcome the fragmentation typical of the incentive system: the alignment with the Strategic Energy Technology Plan and Horizon 2020 priorities can represent an opportunity to streamline operations.*
- *Pursue the convergence of technological innovation activities at national and regional levels on the priorities of the above-mentioned plan, reinforcing the conditions of system and organisation to improve the score of the Italian participation in the Community research programmes.*
- *Develop public-private partnerships to ensure economies of scale and adequate cash flows for financing demonstration projects.*

References

IEA (2015), "RD&D Budget", IEA Energy Technology RD&D Statistics (database), www.iea.org/statistics/.

OECD (2015), *OECD Economic Surveys: Italy 2015*, OECD Publishing, Paris.

OECD (2013), *OECD Environmental Performance Reviews: Italy 2013*, OECD Publishing, Paris.

PART III
ANNEXES

ANNEX A: ORGANISATION OF THE REVIEW

REVIEW CRITERIA

The Shared Goals, which were adopted by the IEA Ministers at their 4 June 1993 meeting in Paris, provide the evaluation criteria for the in-depth reviews conducted by the IEA. The Shared Goals are presented in Annex C.

REVIEW TEAM

The in-depth review team visited Rome between 16 June and 20 June 2014. During the visit, the review team met with government officials, representatives from ministries and government agencies, market participants, non-governmental organisations, consumers groups and other organisations and stakeholders. This report was drafted on the basis of the information obtained in these meetings, the Italian government response to the IEA energy policy questionnaire and information from many other sources. The team is grateful for the co-operation and hospitality of the many people it met during the visit. Thanks to their openness and willingness to share information the review visit was highly productive.

In particular, the team wishes to express its gratitude to Mr. Gilberto Dialuce, General Director for Security Supplies and Energy Infrastructure, his management team and support staff of the Ministry of Economic Development, notably Mr. Sebastiano Del Monte, Mr. Giovanni Perrella, Mr Wolfgang D'Innocenzo and Mr. Massimiliano Umile for their input and support throughout the visit. The team is also grateful to Enel Distribuzione for hosting the field trip and providing the examiners with a detailed overview of their control room activities.

The author is particularly thankful to the Mr. Wolfgang D'Innocenzo for organising the team visit. Mr. D'Innocenzo was also the key point of contact throughout the process and greatly assisted in the preparation of the in-depth report. The members of the review team were:

IEA member countries

- Team leader: Mr. Lars Georg Jensen, Danish Energy Agency, Ministry of Energy and Building, Denmark
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- Mr. René Moor, Ministry of Economic Affairs, Netherlands
- Mr. Nick Clements, Department of Energy and Climate Change, United Kingdom
- Mr. Matthieu Craye, European Commission DG Energy (International relations and enlargement)

International Energy Agency

- Mr. Kijune Kim, Head of Country Studies
- Mr. Matt Wittenstein, Energy Analyst, Electricity Markets
- Mr. Simon Mueller, Energy Analyst – System Integration of Renewables
- Mr. Kieran McNamara, Desk officer, Country Studies Division

The review was conducted under the direction of Mr. Paul Simons, Deputy Executive Director of the IEA. Mr. McNamara managed the review and is the author of the report with the exception of Chapter 3 on Renewable Energy, which was drafted with Simon Mueller; Chapter 6 on Electricity, which was drafted with Matthew Wittenstein; and Chapters 7 and 8 on Oil and Natural Gas, respectively, which were drafted with Andrew Robertson.

Ms. Sonja Lekovic prepared and drafted the sections relating to energy data contained in each chapter. Ms. Helen Beilby-Orrin, Mr. Emanuele Bianco, Ms. Marc-Antoine Eyl-Mazzega, Mr. Carlos Fernandez-Alvarez, Mr. Paolo Frankl, Ms. Rebecca Gaghen, Ms. Costanza Jacazio, Mr. Kijune Kim and Ms. Roberta Quadrelli each contributed helpful comments throughout.

Ms. Sonja Lekovic, Ms. Catherine Smith and Mr. Bertrand Sadin prepared the figures. Ms. Roberta Quadrelli and Ms. Zakia Adam provided support on statistics. Ms. Viviane Consoli and Ms. Therese Walsh provided editorial assistance while Ms. Muriel Custodio and Ms. Astrid Dumond managed the production process. Ms. Catherine Smith and Ms. Sonja Lekovic helped in the final stages of preparation.

ORGANISATIONS VISITED

Acquirente Unico

Anigas

Assobiodiesel

Assocostieri

Assoelettrica

Assogas

Assomineraria

Confindustria

Confindustria Energia

Consorzio Obbligatorio degli Oli Usati

Coordinamento Fonti Rinnovabili ed Efficienza Energetica

Edison Stoccaggio

Energy Commission Piedmont Regional Council

Energy Strategy Group

Federesco

Federutility

Gestore dei Servizi Energetici (GSE)

Gestore del Mercato Elettrico (GME)

Igas Imprese Gas

Italian Central Stockholding Entity (*Organismo Centrale di Stoccaggio Italiano*)

Italian Regulatory Authority for Electricity, Gas and Water

Italian Competition Authority

Italian National Agency for New Technologies, Energy and Sustainable Economic Development

Marina Militare (Italian Navy)

Ministry of Economic Development

Ministry of Foreign Affairs

Ministry for the Environment, Land and Water

National Council of Consumers and Users

National Research Council

NGV Italia

Ricerca sul Sistema Energetico

Snam Rete Gas

Stogit

Terna

Transport

Unione Petrolifera.

ANNEX B:
ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY		1973	1980	1990	2000	2010	2013	2014
TOTAL PRODUCTION		**20.4**	**19.9**	**25.3**	**28.2**	**33.0**	**36.8**	**36.7**
Coal		0.3	0.3	0.3	0.0	0.1	0.0	0.1
Peat		-	-	-	-	-	-	-
Oil		1.1	1.7	4.5	4.7	5.6	5.7	6.0
Natural gas		12.6	10.3	14.0	13.6	6.9	6.3	5.9
Biofuels and waste[1]		0.2	0.8	0.8	1.7	10.2	11.8	11.1
Nuclear		0.8	0.6	-	-	-	-	-
Hydro		3.2	3.9	2.7	3.8	4.4	4.5	5.0
Wind		-	-	-	0.0	0.8	1.3	1.3
Geothermal		2.1	2.3	3.0	4.3	4.8	5.0	5.2
Solar/other[2]		-	-	0.0	0.0	0.3	2.0	2.1
TOTAL NET IMPORTS[3]		**99.5**	**111.3**	**123.1**	**148.0**	**142.3**	**118.0**	**110.1**
Coal	Exports	0.4	0.5	0.1	0.1	0.2	0.2	0.2
	Imports	8.2	12.2	13.9	13.2	14.0	13.2	13.1
	Net imports	7.7	11.7	13.7	13.1	13.8	13.0	12.9
Oil	Exports	29.0	12.2	19.7	21.8	30.1	24.9	21.2
	Imports	127.3	105.0	104.8	109.7	96.9	78.0	71.3
	Int'l marine and aviation bunkers	-8.3	-5.5	-4.2	-4.5	-6.1	-5.2	-5.0
	Net imports	90.1	87.2	81.0	83.5	60.7	47.9	45.1
Natural Gas	Exports	-	-	0.0	0.0	0.1	0.2	0.2
	Imports	1.6	11.8	25.3	47.0	61.7	50.7	45.7
	Net imports	1.6	11.8	25.3	47.0	61.6	50.5	45.5
Electricity	Exports	0.2	0.2	0.1	0.0	0.2	0.2	0.3
	Imports	0.3	0.7	3.1	3.9	4.0	3.8	4.0
	Net imports	0.1	0.5	3.0	3.8	3.8	3.6	3.8
TOTAL STOCK CHANGES		**-0.8**	**-0.3**	**-1.8**	**-4.6**	**-1.6**	**0.6**	**0.0**
TOTAL SUPPLY (TPES)[4]		**119.1**	**130.8**	**146.6**	**171.5**	**173.7**	**155.4**	**146.8**
Coal		8.1	11.7	14.6	12.6	13.7	13.5	13.1
Peat		-	-	-	-	-	-	-
Oil		90.3	88.2	83.3	86.9	65.3	53.3	51.6
Natural gas		14.2	22.7	39.0	57.9	68.0	57.4	50.7
Biofuels and waste[1]		0.2	0.9	0.9	2.3	12.7	14.6	14.0
Nuclear		0.8	0.6	-	-	-	-	-
Hydro		3.2	3.9	2.7	3.8	4.4	4.5	5.0
Wind		-	-	-	0.0	0.8	1.3	1.3
Geothermal		2.1	2.3	3.0	4.3	4.8	5.0	5.2
Solar/other[2]		-	-	0.0	0.0	0.3	2.0	2.1
Electricity trade[5]		0.1	0.5	3.0	3.8	3.8	3.6	3.8
Shares in TPES (%)								
Coal		*6.8*	*8.9*	*10.0*	*7.3*	*7.9*	*8.7*	*8.9*
Peat		-	-	-	-	-	-	-
Oil		*75.8*	*67.4*	*56.9*	*50.6*	*37.6*	*34.3*	*35.1*
Natural gas		*11.9*	*17.4*	*26.6*	*33.8*	*39.2*	*36.9*	*34.5*
Biofuels and waste[1]		*0.2*	*0.7*	*0.6*	*1.3*	*7.3*	*9.4*	*9.5*
Nuclear		*0.7*	*0.4*	-	-	-	-	-
Hydro		*2.7*	*3.0*	*1.9*	*2.2*	*2.5*	*2.9*	*3.4*
Wind		-	-	-	-	*0.5*	*0.8*	*0.9*
Geothermal		*1.8*	*1.8*	*2.0*	*2.5*	*2.7*	*3.2*	*3.6*
Solar/other[2]		-	-	*0.0*	*0.0*	*0.2*	*1.3*	*1.4*
Electricity trade[5]		*0.1*	*0.4*	*2.0*	*2.2*	*2.2*	*2.3*	*2.6*

0 is negligible, - is nil, .. is not available, x is not applicable. Please note: rounding may cause totals to differ from the sum of the elements.

Unit: Mtoe

DEMAND							
FINAL CONSUMPTION	**1973**	**1980**	**1990**	**2000**	**2010**	**2013**	**2014**
TFC	**96.6**	**102.2**	**114.9**	**128.8**	**133.7**	**121.0**	**116.6**
Coal	3.7	3.8	3.6	2.7	1.9	1.6	1.7
Peat	-	-	-	-	-	-	-
Oil	69.9	64.2	61.5	62.3	54.4	46.5	47.8
Natural gas	12.4	19.7	30.4	38.6	39.1	35.7	31.4
Biofuels and waste[1]	-	0.7	0.9	1.6	9.0	8.5	7.4
Geothermal	-	-	0.2	0.2	0.1	0.1	0.1
Solar/other[2]	-	-	0.0	0.0	0.1	0.2	0.2
Electricity	10.6	13.7	18.5	23.5	25.7	24.7	24.2
Heat	-	-	-	-	3.3	3.7	3.7
Shares in TFC (%)							
Coal	*3.8*	*3.7*	*3.1*	*2.1*	*1.4*	*1.3*	*1.4*
Peat	-	-	-	-	-	-	-
Oil	*72.4*	*62.8*	*53.5*	*48.4*	*40.7*	*38.4*	*41.0*
Natural gas	*12.8*	*19.3*	*26.4*	*29.9*	*29.2*	*29.5*	*26.9*
Biofuels and waste[1]	-	*0.7*	*0.8*	*1.2*	*6.8*	*7.0*	*6.4*
Geothermal	-	-	*0.2*	*0.0*	*0.0*	*0.0*	*0.1*
Solar/other[2]	-	-	*0.0*	*0.0*	*0.0*	*0.0*	*0.2*
Electricity	*11.0*	*13.4*	*16.1*	*18.2*	*19.2*	*20.4*	*20.8*
Heat	-	-	-	-	*2.5*	*3.1*	*3.2*
TOTAL INDUSTRY[6]	**47.3**	**44.5**	**44.5**	**46.7**	**39.7**	**32.3**	**32.5**
Coal	2.7	3.0	3.3	2.6	1.9	1.6	1.7
Peat	-	-	-	-	-	-	-
Oil	29.4	22.2	16.8	14.0	12.3	8.5	8.8
Natural gas	8.6	11.1	14.6	17.6	10.9	9.2	9.1
Biofuels and waste[1]	-	0.1	0.2	0.3	0.4	0.5	0.6
Geothermal	-	-	-	-	0.0	0.0	0.0
Solar/other[2]	-	-	-	-	0.0	0.0	0.0
Electricity	6.6	8.1	9.5	12.2	11.0	9.9	9.7
Heat	-	-	-	-	3.1	2.6	2.6
Shares in total industry (%)							
Coal	*5.6*	*6.7*	*7.4*	*5.6*	*4.7*	*5.0*	*5.1*
Peat	-	-	-	-	-	-	-
Oil	*62.1*	*50.0*	*37.8*	*30.0*	*31.1*	*26.3*	*27.2*
Natural gas	*18.2*	*24.9*	*32.9*	*37.7*	*27.5*	*28.4*	*27.9*
Biofuels and waste[1]	-	*0.3*	*0.5*	*0.6*	*1.1*	*1.7*	*1.8*
Geothermal	-	-	-	-	-	-	-
Solar/other[2]	-	-	-	-	-	-	-
Electricity	*14.0*	*18.2*	*21.4*	*26.1*	*27.7*	*30.6*	*29.9*
Heat	-	-	-	-	*7.9*	*7.9*	*8.1*
TRANSPORT[4]	**19.0**	**24.4**	**32.7**	**39.7**	**38.6**	**35.7**	**37.0**
OTHER[7]	**30.3**	**33.3**	**37.7**	**42.5**	**55.5**	**53.0**	**47.1**
Coal	0.9	0.8	0.3	0.1	0.0	-	-
Peat	-	-	-	-	-	-	-
Oil	22.2	18.3	12.7	9.7	6.6	5.5	5.0
Natural gas	3.6	8.4	15.5	20.7	27.4	25.5	21.3
Biofuels and waste[1]	-	0.6	0.6	1.3	7.2	6.7	5.8
Geothermal	-	-	0.2	0.2	0.1	0.1	0.1
Solar/other[2]	-	-	0.0	0.0	0.1	0.2	0.2
Electricity	3.6	5.2	8.3	10.5	13.8	13.9	13.6
Heat	-	-	-	-	0.2	1.1	1.1
Shares in other (%)							
Coal	*2.9*	*2.5*	*0.7*	*0.2*	-	-	-
Peat	-	-	-	-	-	-	-
Oil	*73.3*	*54.8*	*33.7*	*22.8*	*11.8*	*10.4*	*10.7*
Natural gas	*11.9*	*25.1*	*41.2*	*48.6*	*49.5*	*48.0*	*45.2*
Biofuels and waste[1]	-	*1.9*	*1.7*	*3.0*	*13.0*	*12.6*	*12.3*
Geothermal	-	-	*0.5*	*0.0*	*0.0*	*0.0*	*0.2*
Solar/other[2]	-	-	-	-	*0.2*	*0.3*	*0.4*
Electricity	*12.0*	*15.7*	*22.1*	*24.8*	*24.9*	*26.2*	*28.9*
Heat	-	-	-	-	*0.4*	*2.2*	*2.4*

Unit: Mtoe

DEMAND							
ENERGY TRANSFORMATION AND LOSSES	**1973**	**1980**	**1990**	**2000**	**2010**	**2013**	**2014**
ELECTRICITY GENERATION[8]							
Input (Mtoe)	27.9	35.7	43.1	52.7	59.0	54.4	52.5
Output (Mtoe)	12.4	15.8	18.3	23.2	25.7	24.8	23.9
Output (TWh)	143.9	183.5	213.1	269.9	298.8	287.9	278.1
Output Shares (%)							
Coal	*3.6*	*9.9*	*16.8*	*11.3*	*14.9*	*16.8*	*16.7*
Peat	-	-	-	-	-	-	-
Oil	*62.4*	*57.0*	*48.2*	*31.8*	*7.3*	*5.4*	*5.1*
Natural gas	*3.1*	*5.0*	*18.6*	*37.5*	*51.1*	*37.8*	*33.7*
Biofuels and waste[1]	*0.9*	*0.7*	-	*0.7*	*3.9*	*6.7*	*7.6*
Nuclear	*2.2*	*1.2*	-	-	-	-	-
Hydro	*26.1*	*24.7*	*14.8*	*16.4*	*17.1*	*18.3*	*21.1*
Wind	-	-	-	*0.2*	*3.1*	*5.2*	*5.5*
Geothermal	*1.7*	*1.5*	*1.5*	*1.7*	*1.8*	*2.0*	*2.1*
Solar/other[2]	-	-	-	*0.3*	*0.9*	*7.8*	*8.3*
TOTAL LOSSES	**22.3**	**28.5**	**31.6**	**41.8**	**40.8**	**34.1**	**32.1**
of which:							
Electricity and heat generation[9]	15.5	19.9	24.8	29.5	28.4	24.4	23.6
Other transformation	-1.6	-0.9	-2.4	2.9	0.6	-0.1	-0.2
Own use and transmission/distribution losses[10]	8.3	9.6	9.2	9.4	11.8	9.7	8.7
Statistical Differences	**0.3**	**0.1**	**0.0**	**0.9**	**-0.8**	**0.3**	**-1.9**
INDICATORS	**1973**	**1980**	**1990**	**2000**	**2010**	**2013**	**2014**
GDP (billion 2010 USD)	1075.00	1380.37	1749.88	2061.10	2126.62	2042.50	2033.43
Population (millions)	54.75	56.43	56.72	56.94	59.83	60.65	60.80
TPES/GDP (toe/1000 USD)[11]	0.11	0.09	0.08	0.08	0.08	0.08	0.07
Energy production/TPES	0.17	0.15	0.17	0.16	0.19	0.24	0.25
Per capita TPES (toe/capita)	2.18	2.32	2.58	3.01	2.90	2.56	2.41
Oil supply/GDP (toe/1000 USD)[11]	0.08	0.06	0.05	0.04	0.03	0.03	0.03
TFC/GDP (toe/1000 USD)[11]	0.09	0.07	0.07	0.06	0.06	0.06	0.06
Per capita TFC (toe/capita)	1.76	1.81	2.03	2.26	2.24	2.00	1.92
CO_2 emissions from fuel combustion ($MtCO_2$)[12]	328.0	355.2	389.3	420.3	391.9	337.4	319.7
CO_2 emissions from bunkers ($MtCO_2$)[12]	26.4	17.5	13.1	13.8	19.1	16.0	15.4
GROWTH RATES (% per year)	**73-80**	**80-90**	**90-00**	**00-10**	**10-12**	**12-13**	**13-14**
TPES	1.3	1.1	1.6	0.1	-3.6	-3.7	-5.5
Coal	5.4	2.3	-1.5	0.9	7.2	-13.9	-3.4
Peat	-	-	-	-	-	-	-
Oil	-0.3	-0.6	0.4	-2.8	-7.8	-4.0	-3.3
Natural gas	6.9	5.5	4.0	1.6	-5.1	-6.5	-11.6
Biofuels and waste[1]	20.8	0.3	9.1	18.8	3.4	8.4	-4.4
Nuclear	-4.9	-100.0	-	-	-	-	-
Hydro	2.7	-3.5	3.4	1.5	-9.5	26.0	10.9
Wind	-	-	-	32.2	21.2	11.1	1.9
Geothermal	1.1	2.6	3.7	1.2	1.9	1.2	4.4
Solar/other[2]	-	-	9.1	37.9	144.2	14.0	3.6
TFC	0.8	1.2	1.1	0.4	-3.2	-3.5	-3.7
Electricity consumption	3.8	3.0	2.4	0.9	-0.4	-3.2	-2.1
Energy production	-0.3	2.4	1.1	1.6	2.9	5.2	-0.2
Net oil imports	-0.5	-0.7	0.3	-3.1	-9.7	-3.2	-5.9
GDP	3.6	2.4	1.7	0.3	-1.1	-1.7	-0.4
TPES/GDP	-2.2	-1.2	-0.1	-0.2	-2.5	-1.9	-5.1
TFC/GDP	-2.7	-1.2	-0.5	0.1	-2.1	-1.8	-3.2

Footnotes to energy balances and key statistical data

1. Biofuels and waste comprises solid biofuels, liquid biofuels, biogases, industrial waste and municipal waste. Data are often based on partial surveys and may not be comparable between countries.
2. Other includes tide, wave and ambient heat used in heat pumps.
3. In addition to coal, oil, natural gas and electricity, total net imports also include peat, biofuels and waste and trade of heat.
4. Excludes international marine bunkers and international aviation bunkers.
5. Total supply of electricity represents net trade. A negative number in the share of TPES indicates that exports are greater than imports.
6. Industry includes non-energy use.
7. Other includes residential, commercial and public services, agriculture/forestry, fishing and other non-specified.
8. Inputs to electricity generation include inputs to electricity, CHP and heat plants. Output refers only to electricity generation.
9. Losses arising in the production of electricity and heat at main activity producer utilities and autoproducers. For non-fossil-fuel electricity generation, theoretical losses are shown based on plant efficiencies of approximately 33% for nuclear and solar thermal, 10% for geothermal and 100% for hydro, wind and solar photovoltaic.
10. If applicable, data on "losses" for forecast years often include large statistical differences covering differences between expected supply and demand and mostly do not reflect real expectations on transformation gains and losses.
11. Toe per thousand US dollars at 2010 prices and exchange rates.
12. "CO_2 emissions from fuel combustion" have been estimated using the IPCC Tier I Sectoral Approach from the 2006 IPCC Guidelines. In accordance with the IPCC methodology, emissions from international marine and aviation bunkers are not included in national totals.

ANNEX C: INTERNATIONAL ENERGY AGENCY "SHARED GOALS"

The member countries* of the International Energy Agency (IEA) seek to create conditions in which the energy sectors of their economies can make the fullest possible contribution to sustainable economic development and to the well-being of their people and of the environment. In formulating energy policies, the establishment of free and open markets is a fundamental point of departure, though energy security and environmental protection need to be given particular emphasis by governments. IEA countries recognise the significance of increasing global interdependence in energy. They therefore seek to promote the effective operation of international energy markets and encourage dialogue with all participants. In order to secure their objectives, member countries therefore aim to create a policy framework consistent with the following goals:

1. Diversity, efficiency and flexibility within the energy sector are basic conditions for longer-term energy security: the fuels used within and across sectors and the sources of those fuels should be as diverse as practicable. Non-fossil fuels, particularly nuclear and hydro power, make a substantial contribution to the energy supply diversity of IEA countries as a group.

2. Energy systems should have **the ability to respond promptly and flexibly to energy emergencies.** In some cases this requires collective mechanisms and action: IEA countries co-operate through the Agency in responding jointly to oil supply emergencies.

3. The environmentally sustainable provision and use of energy are central to the achievement of these shared goals. Decision makers should seek to minimise the adverse environmental impacts of energy activities, just as environmental decisions should take account of the energy consequences. Government interventions should respect the Polluter Pays Principle where practicable.

4. More environmentally acceptable energy sources need to be encouraged and developed. Clean and efficient use of fossil fuels is essential. The development of economic non-fossil sources is also a priority. A number of IEA member countries wish to retain and improve the nuclear option for the future, at the highest available safety standards, because nuclear energy does not emit carbon dioxide. Renewable sources will also have an increasingly important contribution to make.

5. Improved energy efficiency can promote both environmental protection and energy security in a cost-effective manner. There are significant opportunities for greater energy efficiency at all stages of the energy cycle from production to consumption. Strong efforts by governments and all energy users are needed to realise these opportunities.

6. Continued **research, development and market deployment of new and improved energy technologies** make a critical contribution to achieving the objectives outlined above. Energy technology policies should complement broader energy policies. International co-operation in the development and dissemination of energy technologies, including industry participation and co-operation with non-member countries, should be encouraged.

7. Undistorted energy prices enable markets to work efficiently. Energy prices should not be held artificially below the costs of supply to promote social or industrial goals. To the extent necessary and practicable, the environmental costs of energy production and use should be reflected in prices.

8. Free and open trade and a secure framework for investment contribute to efficient energy markets and energy security. Distortions to energy trade and investment should be avoided.

9. Co-operation among all energy market participants helps to improve information and understanding, and encourages the development of efficient, environmentally acceptable and flexible energy systems and markets worldwide. These are needed to help promote the investment, trade and confidence necessary to achieve global energy security and environmental objectives.

(The Shared Goals were adopted by IEA Ministers at the meeting of 4 June 1993 Paris, France.)

* Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Korea, Luxembourg, the Netherlands, New Zealand, Norway, Poland, Italy, the Slovak Republic, Spain, Sweden, Switzerland, Turkey, the United Kingdom, the United States.

ANNEX D: GLOSSARY AND LIST OF ABBREVIATIONS

In this report, abbreviations and acronyms are substituted for a number of terms used within the International Energy Agency. While these terms generally have been written out on first mention, this glossary provides a quick and central reference for the abbreviations used.

AAU	assigned amount unit
AEA	annual emission allocation
AEEGSI	Regulatory Authority for Electricity, Gas and Water
AEGE	Regulatory Authority for Electricity Gas and Water
AFV	alternative fuel vehicle
AGCM	Italian Competition Authority
AIRU	Italian Association of District Heating
ASI	Italian Space Agency
AU	*Acquirente Unico* (single buyer)
CCGT	combined-cycle gas turbine
CCS	carbon capture and storage
CDP	*Cassa Depositi e Prestiti*
CEF	Connecting Europe Facility
CEL	Central European Line
CER	certified emissions reductions
CHP	combined production of heat and power
CIPE	Inter-Ministry Committee for Economic Planning
CNG	compressed natural gas
CNR	National Research Council
COM	Covenant of Mayors
COOU	*Consorzio Obbligatorio degli Oli Usati*
CSP	concentrated solar power
CTE	Inter-Ministerial Technical Committee for Emissions of Greenhouse Gases
DGSAIE	Direction-General for Security of Supply and Energy Infrastructures
DH	district heating
DIA	declaration of commencement of activities
DSO	distribution system operator
ECBM	enhanced coalbed methane recovery
EEA	European Economic Area
EIA	environmental impact assessment
ENEA	National Agency for New Technologies, Energy and Sustainable Economic Development
ENTSO	European Network of TSOs (for electricity or gas)
EPC	energy performance contract

ERU	emissions reduction units
EEA	European Environment Agency
ESCO	energy services company
EU	European Union
EU-ETS	European Union Emissions Reduction Scheme
EV	electric vehicles
GDP	gross domestic product
GHG	greenhouse gas
GME	*Gestore del Mercato Energetico*
GSE	*Gestore de Servizi Energetici*
HFC	hydrofluorocarbons
IEA	International Energy Agency
INFN	National Institute of Nuclear Physics
ISPRA	Institute for Environmental Protection and Research
ISTAT	National Statistics Institute
ITS	National Intelligent Transport System
LDV	light-duty vehicle
LNG	liquefied natural gas
LPG	liquefied petroleum gas
LPS	local public services
LULUCF	land use, land-use change and forestry
MATTM	Ministry for the Environment, Land and Sea
MD	ministerial decree
MEAS	mutual emergency assistance service
MIUR	Ministry of Education, Universities and Research
MSE	Ministry of Economic Development
NEEAP	National Energy Efficiency Action Plan
NES	National Energy Strategy
NESO	National Emergency Strategy Organisation
NREAP	National Renewable Energy Action Plan
NSP	National Strategic Plan
NTN	National Transport Network
NZEB	near-zero energy buildings
OCSIT	Italian Central Stockholding Agency
OLT	Offshore LNG Toscana
PAS	simplified authorisation procedure
PCE	*Piattaforma conti energia*
PCI	project of common interest
PFC	Perfluorocarbons
PNR	National Research Programme

PPP	purchasing power parity
PSV	*punto di scambio virtuale*
PUN	*prezzo unico nazionale*
PV	photovoltaics
RES	renewable energy sources
RTD	research and technological development
RSE	*Ricerca sul Sistema Energetico*
SET	Strategic Energy Technology Plan
SETIS	Strategic Energy Technologies Information System
SMEs	small and medium-sized enterprises
TAL	Trans-Alpine Pipeline
TAP	Trans-Adriatic Pipeline
TEN-E	Trans-European Network for Energy
TFC	total final consumption of energy
TPA	third-party access
TPES	total primary energy supply
TSO	transmission system operator
TYNDP	Ten-Year Network Development Plan
UNFCCC	United Nations Framework Convention on Climate Change
VAT	value-added tax
WACC	weighted average cost of capital

Units of measure

b/d	barrels per day
bcm	billion cubic metres
Gcal	gigacalorie
gCO_2	grammes of carbon dioxide
gCO_2/km	grammes of carbon dioxide per kilometre
GJ	gigajoule
GW	gigawatt
GWh	gigawatts per hour
kb/d	thousand barrels per day
kt	kilotonne
$ktCO_2$	thousand tonnes of carbon dioxide
kW	kilowatt
kWh	kilowatt-hour
m^2	square metre
mb	million barrels

mb/d	million barrels per day
mcm	million cubic metres
Mt	million tonnes
$MtCO_2$-eq	million tonnes of carbon dioxide-equivalent
Mtcoe	million tonnes of crude oil-equivalent
Mtoe	million tonnes of oil-equivalent
MW	megawatt
MW_e	megawatt electrical
MW_{th}	megawatt thermal
tCO_2	tonnes of carbon dioxide
toe	tonne of oil-equivalent
TJ	terajoule
TWh	terawatt-hour

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Energy Policies of IEA Countries

Italy

Since the last in-depth review in 2009, Italy has made strong progress in the development and implementation of energy policy. The most notable improvement has been the publication of a comprehensive long-term energy strategy.

The adoption of the National Energy Strategy in 2013 sent a strong signal to stakeholders as to the government's medium- and long-term objectives for the energy sector. It established clear goals: reduce energy costs, meet environmental targets, strengthen security of energy supply and foster sustainable economic growth. Nonetheless, the adoption of the Strategy is only a first step towards achieving the government's ambitions. Monitoring implementation and maintaining momentum will present a challenge for the government.

Italy has experienced impressive growth in the renewable energy sector and has been successful in integrating large volumes of variable renewable generation. Containing costs is a priority, and policies need to focus on bringing deployment costs towards international benchmarks.

Italy has also continued to progress in terms of market liberalisation and infrastructure development, notably in the electricity market where transmission improvements between north and south, as well as market coupling, have resulted in price convergence throughout the country and wholesale prices tending towards those elsewhere in Europe. Development in the gas sector has been slower, and greater progress is needed if Italy is to be become a southern European gas hub. Furthermore, institutional arrangements within the energy sector remain complex and should be reformed and strengthened. Implementation of the National Energy Strategy provides a timely opportunity to address each of these challenges in a comprehensive way.

This review analyses the energy policy challenges facing Italy and provides recommendations for further policy improvements. It is intended to help guide the country towards a more secure and sustainable energy future.