



Austria 2020

Energy Policy Review

International
Energy Agency



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INTERNATIONAL ENERGY AGENCY

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Foreword

The International Energy Agency (IEA) has conducted in-depth peer reviews of its member countries' energy policies since 1976. This process not only supports energy policy development, but also encourages the exchange of and learning from international best practices and experiences. By seeing what has worked – or not – in the “real world,” these reviews help identify policies that achieve their objectives and bring concrete results. Since 2017, the IEA has moved to modernise the reviews by focusing on the key energy challenges in today's rapidly changing energy markets.

Austria's government, which assumed office in January 2020, is committed to achieving carbon neutrality by 2040 at the latest – 10 years earlier than the ambition set by the European Union. At such a critical time for clean energy transitions around the world, I commend the Austrian government's determination to accelerate the transformation of its energy system. The IEA looks forward to supporting this important policy.

The government's goal will require Austria to substantially enhance decarbonisation efforts across all parts of its energy sector. As in many other countries, decarbonising heat and transport is challenging. In fact, CO₂ emissions have been increasing in Austria since 2014, largely driven by an increase in final energy consumption in these areas. The government plans to phase out oil- and coal-fired heating systems by 2035, and to restrict the use of natural gas for heating in new buildings from 2025. In the transport sector, the government's new policy builds on Austria's frontrunner position in the provision of public transport and will be underpinned by its “Mobility Masterplan 2030.”

This report was finalised before the coronavirus (Covid-19) pandemic created an unprecedented international crisis. As a result, the report's analysis does not reflect the potential impact of this crisis on Austria's energy sector and CO₂ emissions. At the time of writing, Austria was drawing up stimulus plans to counter the economic damage from the coronavirus pandemic. Such plans may well offer the opportunity to improve energy security and boost progress on clean energy transitions while creating jobs and economic activity.

Right now, the IEA is devoting significant resources to studying the global lessons from previous stimulus programmes that included clean energy components and also to analysing the potential of new measures to create jobs. This work is intended to provide policy makers with the best possible advice to inform the hugely consequential decisions they will have to make.

It is my hope that this in-depth review will help guide Austria in its admirable efforts to accelerate its energy transition. The IEA is committed to helping the government achieve its energy policy goals of providing affordable, secure and clean energy to its population as it adapts to a fast-changing, international energy landscape.

Dr Fatih Birol

Executive Director

International Energy Agency

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1. Executive summary

Austria's new government, which assumed office in January 2020, is committed to achieve carbon neutrality at the latest by 2040, ten years earlier than the goal set by the European Union. Reaching this ambitious target will require Austria to substantially enhance decarbonisation efforts across all energy sectors, building on and expanding existing policies and measures.

Austria risks missing its mandatory emissions reduction target outside the European Union's (EU) Emission Trading System (ETS) of -16% in 2020 compared to the 2005 level. Austria's greenhouse gas emissions declined between 2005 and 2016, but started to rise again thereafter, notably in transport. For 2018, non-ETS emissions are estimated at 10% below the 2005 level. For 2030, Austria is obligated to reduce its non-ETS emissions by 36% below the 2005 level, a much larger challenge. If the current pathway is not significantly adjusted, Austria may only achieve a reduction of 27%.

Achieving carbon neutrality by 2040

In 2018, Austria released its climate and energy strategy, "#mission2030", for reaching the 2030 targets and advancing the long-term vision of a carbon-free energy sector by 2050. Commendably, the vision addresses all energy sectors, mobility and urban sprawl in one strategy. #mission2030 forms the basis of Austria's National Energy and Climate Plan (NECP).

The new government has now substantially increased its ambition to achieve carbon neutrality by 2040 and has announced concrete plans towards reaching the target. Among the measures are the enactment of a new climate protection law with binding greenhouse gas reduction pathways to 2040, interim targets for 2030, and sector-specific targets and timelines. The government has also committed to the installation of 1 million PV systems by 2030, which is a substantial increase from the target of "100 000 roof-mounted PV systems" under #mission2030.

Like in many other International Energy Agency (IEA) countries, decarbonising heat and transport is challenging. In fact, Austria's emission growth since 2014 has largely been driven by the increase in final energy consumption in the buildings and transport sectors, which has not yet been decoupled from population and economic growth. Austria is therefore not on track to meet its total final energy consumption target for 2020, and the government will need to extend the scope of measures to reach the target set for 2030.

In the building sector, the new government announced phasing out all oil- and coal-fired heating systems by 2035 and restricting the use of natural gas for heating in new buildings from 2025 onward.

In the transport sector, the new government's policy builds on Austria's frontrunner position in the provision of public transport and committed to develop a detailed "mobility masterplan 2030". A tax reform entered into force on 1 January 2020 to relieve the overall

tax burden while strengthening the green element in the tax system. In the transport sector, the tax burden is now shifted to those vehicles with above-average CO₂ emissions.

The new government is committed to a comprehensive tax reform based on ecological and social principals, with the aim to achieve true-cost pricing for CO₂ emissions in sectors not covered by the EU ETS. This would be achieved by introducing, for example, CO₂ pricing or a national ETS system. Lower diesel taxes in Austria result in what is called tank tourism, i.e. vehicles filling up their tanks in Austria to arbitrage on the lower prices compared to neighbouring countries. Tank tourism is estimated to contribute 5 million tonnes (Mt) of CO₂ emissions to Austria's non-ETS emissions.

Decarbonising the electricity sector by 2030

In order to reach carbon neutrality by 2040, the role of electricity in Austria's energy mix will increase significantly. The NECP sees electricity consumption possibly increasing by up to 23% in 2030 and by up to 66% in 2050, compared to 2017. The provision of low-carbon electricity is a condition for the sustainable electrification of the energy system.

Austria's last coal-fired power plant is scheduled to cease using coal in the first half of 2020; coal will then only be used in industry, where its replacement is more challenging given the lack of alternative fuels and technologies. Austria's carbon neutrality target will be achieved without nuclear power, which has been banned under its Constitution since 1999.

Austria has a target of a 100% renewable electricity supply (national balance)¹ by 2030. To successfully deliver this target, Austria needs to achieve a net increase of around 22-27 terawatt hours (TWh) of renewable electricity across all technologies. Austria is already a global leader in renewable energy. In 2018, renewables covered 29% of its total primary energy supply, the sixth highest among IEA countries, with the largest shares coming from bioenergy and hydropower. A little over three-quarters (77%) of electricity generation came from renewables in 2018, the third-largest share among IEA countries; hydro accounted for most of this generation.

Since the last in-depth review, the deployment of both wind and solar PV has accelerated, driven by feed-in tariffs and falling deployment costs. Thanks to this strong deployment of renewables, Austria is well on track to meet its 2020 EU target of 34% renewables in gross final energy consumption and 10% renewables in transport.

Hydropower accounted for almost 60% of total electricity generation in 2018. The new government plans to add 5 TWh from hydropower towards achieving the overall goal of adding 27 TWh by 2030. Hydropower could therefore account for up to 85% of total electricity generation in 2030. Austria's pumped storage will play an increasingly important role in the future electricity market in Austria, but also for the further integration of the European market, by providing needed storage and flexible dispatch to accommodate the growing share of variable renewable generation into the Austrian and European electricity systems.

¹ National balance is defined as total generation plus electricity exports minus electricity imports. The 100% renewable electricity target exempts generation required for balancing and control of the grid and self-consumption of electricity from industrial by-products.

Enhancing policy co-ordination at the federal and provincial levels

Austria's energy policy is concurrently conducted at the federal and provincial levels. At the federal level, the newly created Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology has sole competence for energy policy. At the regional level, the governments of the nine provinces retain competence for permitting of infrastructure, land use and zoning, to name but a few. Competencies for electricity infrastructure projects that extend to two or more provinces rest with the federal level.

In addition, the setting and implementation of building codes remains the prerogative of the nine provinces and further harmonisation of building standards will be important to contain energy demand in the sector and to accelerate the decarbonisation of heat.

#mission2030 recognises that the existing permitting process is complex and slow. At the federal level, responsibility for energy policy making was reorganised in January 2020 through the creation of a so-called "super ministry" combining climate action, environment, energy, mobility, innovation and technology. This will significantly reduce the administrative layers and co-ordination issues at the federal level. Even though the federal government has initiated several new legislations to reduce complexities and timelines, the issue of shared competencies with the nine provinces in the energy sector remains.

Austria is not alone among IEA countries to face challenges in expanding energy infrastructure. The 2014 in-depth review of Austria already noted the need to streamline approval procedures and suggested that the government assess the costs and benefits of the division of responsibilities. This suggestion is still valid today; a thorough review, and if necessary, changes to the legal and regulatory framework governing energy infrastructure expansion, is advisable

Broadening energy security parameters

Traditionally, Austria maintains a high level of oil and gas security. It continuously strives to further diversify the number of its oil and gas suppliers and supply routes, and benefits from its substantial oil and gas storage facilities. Austria has consistently complied with the IEA 90-day oil stock holding requirement.

Moving forward with the energy transition, energy security will increasingly be assessed against a broader set of parameters. The target to achieve 100% renewable energy supply (national balance) by 2030 requires a resilient and flexible electricity system capable of accommodating the growing share of variable renewables and more broadly the electrification of the energy sector, demand-side management opportunities offered by digitalisation, and an enabling legal and regulatory framework for more active consumer involvement.

Austria has strong ambitions towards greening gas supplies and for the deployment of renewable hydrogen. In fact, the government aims to inject 5 TWh of renewable gas into the grid by 2030 compared to a biogas supply to residential and service buildings of around 140 gigawatt hours, less than 1% of total gas consumption, in 2017.

Maintaining Austria's gas infrastructure is crucial with a view to ensuring electricity security in a decarbonised energy system. #mission2030's *Greening the Gas* flagship notes that power to gas facilities and seasonal storage of renewable gases would assist with the

integration of high shares of variable renewable electricity generation. Failure to maintain the gas infrastructure, including gas storages, and to accelerate the expansion of the electricity infrastructure along the value chain can become major impediments for the decarbonisation of the energy sector by 2040.

Becoming an innovation leader in the energy field

Since 2017, Austria's research, development and innovation (RDI) strategy focuses on implementation-oriented projects and encourages researchers to take a systems perspective in the innovation processes. The RDI strategy is an integral part of Austria's #mission2030 and steers activities towards national energy policy goals, ensuring they are consistent with broader regulations and priorities beyond the energy sector.

Austria is supporting more demonstration projects to accelerate the market uptake of emerging technologies and to seek greater innovation value for the money spent on RDI. It is desirable to provide innovation stakeholders with adequate funding certainty and medium-term strategic visibility, such as through multi-year budgets. The government has taken the first steps in this direction.

Austria has a strong record in mobilising private funding for RDI. For every euro spent by the government, the country mobilises on average EUR 2.5 in private funding, depending on where in the value chain the project is located. The multiplier can go up to ten for example for solar PV projects. In 2019, Austria published the first detailed report on the internal energy research expenditures by the private sector broken down by technology fields. This is a laudable initiative and sets a best-practice example among IEA countries.

Key recommendations

The government of Austria should:

- Develop concrete action plans for all energy sectors and energy efficiency to deliver on the targets set out in #mission2030 and in the government programme 2020-24.
- Use the 12 flagship projects of #mission2030 to demonstrate to the public that decarbonisation of the energy sector can come with social and economic benefits. This should include awareness campaigns and early and meaningful engagement with communities to promote public acceptance and behavioural change.
- Use stronger price incentives to decrease the carbon intensity in energy consumption while channelling revenues back to citizens and companies, linked to the promotion of renewable energy and energy efficiency.
- Continually strengthen the building standard guidelines and require provincial compliance to harmonise building energy efficiency implementation.

2. General energy policy

Key data

(2018)

TPES: 32.8 Mtoe (oil 35.5%, natural gas 22.5%, bioenergy and waste 18.8%, hydro 9.9%, coal 8.3%, electricity imports 2.3%, wind 1.6%, solar 0.9%, geothermal 0.1%), -2.1% since 2008

TPES per capita: 3.7 toe/cap (IEA average: 4.2 toe/cap, IEA median: 3.6 toe/cap), -7.7% since 2008

TPES per unit of GDP: 83 toe/USD million (2010 prices and PPP) (IEA average: 104 toe/USD million PPP, IEA median: 90 toe/USD million PPP), -9.8% since 2008

Energy production: 11.7 Mtoe (biofuels and waste 51.5%, hydro 27.8%, natural gas 7.4%, oil 6.0%, wind 4.5%, solar 2.6%, geothermal 0.3%), +5.5% since 2008

TFC: 27.6 Mtoe (oil 39.9%, electricity 19.6%, natural gas 18.1%, bioenergy and waste 13.9%, district heat 6.1%, coal 1.6%, solar 0.6%), +2.4% since 2008

Country overview

The Republic of Austria (hereafter, “Austria”) is located in Central Europe, bordering the Czech Republic and Germany to the north, Liechtenstein and Switzerland to the west, Italy and Slovenia to the south, and Hungary and the Slovak Republic to the east, with a land area of 83 859 km². Almost two-thirds of Austria’s territory is covered with mountains, but the east of the country has lower lying plains. Forests cover about 45% of the country. Austria’s climate is alpine in the mountainous western regions, with annual rainfalls of more than 1 000 mm, and continental in the north and east, with cold winters and hot, humid summers, but overall, less rain than in the west (Figure 2.1).

Austria has a population of 8.8 million, with 2 million citizens living in Vienna, the capital and largest city. Other large cities include Graz, Linz, Salzburg and Innsbruck. In the last decade, Austria’s population has grown by 6%, and it is forecasted to increase by another 9% through 2030.

Austria has a high standard of living; its nominal gross domestic product (GDP) per capita of EUR 45 000 was the 14th highest in the world in 2018 (OECD, 2019). As in most developed economies, services are the largest sector, accounting for some two-thirds of GDP; trade and industry make up about a third of GDP; and agriculture contributes just over 1% (Statistik Austria, 2019). Austrian industry is mostly comprised of small and medium-sized enterprises; the most significant industries include machinery, metallurgical products, construction and building, electronics and electrics, tourism, food and drinks,

logistics and transportation, automotive and chemical industries, as well as steel and mechanical engineering. The unemployment rate in Austria is slightly lower than the OECD average, at 4.9% in 2018 (OECD, 2019).

Austria's economy is closely tied to other EU economies. Approximately 70% of its imports come from other EU member states. Only 15% of exports are destined for non-EU member states. Tourism is the country's fastest growing sector, and generates around 10% of Austria's total economic output.

Austria is a federal republic, with nine federal states (provinces). Its bicameral Federal Assembly (*Bundesversammlung*) consists of Federal Council (Bundesrat; delegates are appointed by state parliaments in proportion to population) and the National Council (*Nationalrat*; members are elected by popular vote under a system of proportional representation).

Austria joined the European Union in 1995. It is part of the Schengen Area and adopted the euro as its currency. Austria is also one of the founding members of the Organisation for Economic Co-operation and Development (OECD) and of the International Energy Agency (IEA).

Figure 2.1 Map of Austria

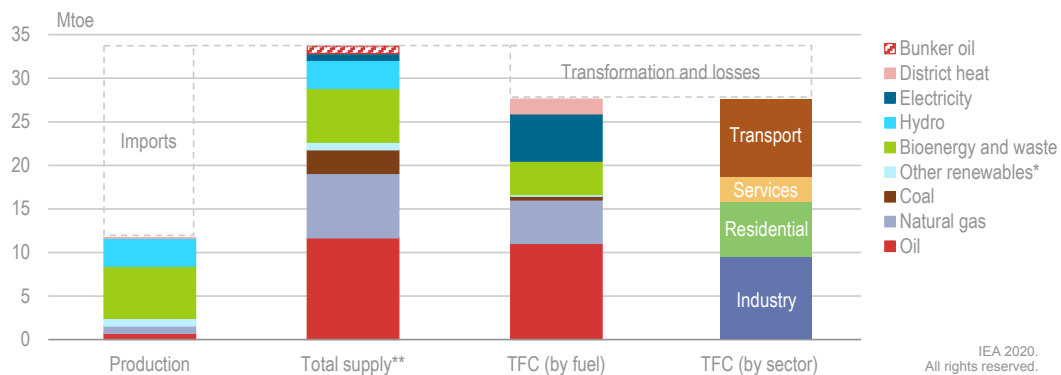


Supply and demand

Austria is heavily dependent on energy imports, despite large hydro and bioenergy resources. Its average self-sufficiency level has been 36% over the past decade, characterised by a high and continuously increasing share of renewable energy sources. Total primary energy supply (TPES) was 32.8 million tonnes of oil equivalent (Mtoe) in 2018, of which fossil fuels accounted for around two-thirds and renewables for the remaining third (Figure 2.2).

Total final consumption (TFC) by fuel was 27.6 Mtoe in 2018, of which oil accounted for 40%, electricity for 20%, natural gas 18%, and bioenergy and waste 14%. By end-use sector, TFC is split between the industry sector, transport and buildings (the residential and service sectors including agriculture), with roughly a third of consumption each. Renewable energy is especially large in electricity generation, where hydropower accounts for over half of the total, with continuously increasing shares of wind and solar.

Figure 2.2 Overview of the Austrian energy system by fuel and sector, 2018



Austria has large hydro and bioenergy resources, but is highly dependent on imports of oil and gas, which are the largest energy sources in TPES and TFC.

* *Other renewables* includes wind power, geothermal and solar energy.

** Total primary energy supply and oil fuels used in international bunkering.

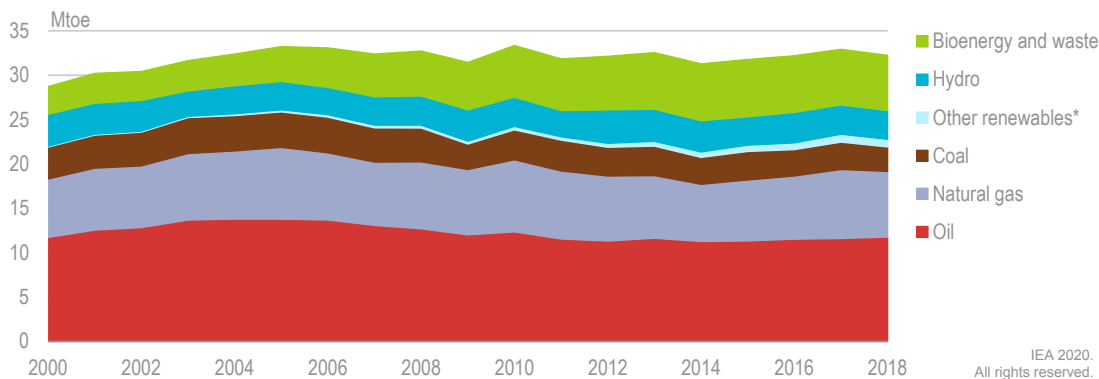
Notes: Mtoe: million tonnes of oil equivalent; TFC: total final consumption.

Source: IEA (2020), "World energy balances", *IEA World Energy Statistics and Balances* (database), www.iea.org/statistics.

Primary energy supply

In 2018, oil accounted for 36% of TPES, natural gas for 23% and coal for 8%. The remainder was low-carbon energy sources, in particular bioenergy and waste, which accounted for 19% of TPES, and hydro with 10% (Figure 2.3). Small shares of solar, wind and geothermal accounted for the remainder.

Figure 2.3 TPES by source, Austria, 2000-18



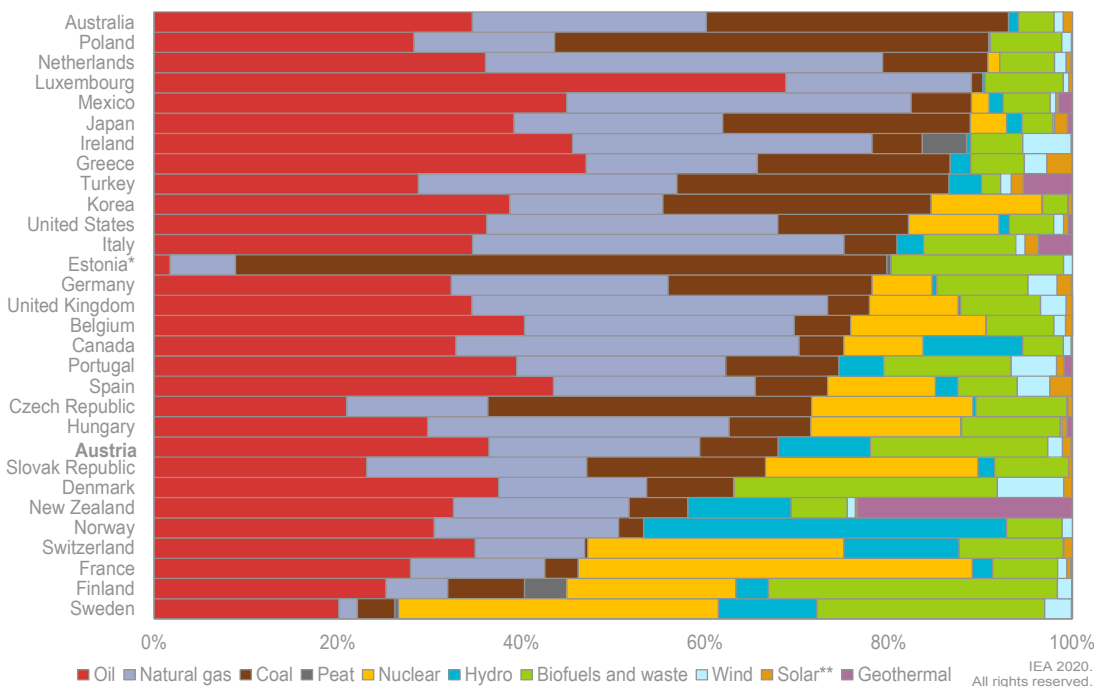
TPES has been quite stable, at around 33 Mtoe over the last decade, with a slight shift from fossil fuels towards renewable energy.

* *Other renewables* includes wind, solar and geothermal.

Notes: Mtoe: million tonnes of oil equivalent. Total primary energy supply does not include bunker fuels. Electricity imports and exports are not shown in the chart.

Source: IEA (2020), "World energy balances", *IEA World Energy Statistics and Balances* (database), www.iea.org/statistics.

Figure 2.4 Breakdown of TPES in IEA member countries, 2018



Fossil fuels (oil, natural gas and coal) accounted for 68% of TPES in Austria in 2018, which was the ninth-lowest share among IEA member countries.

* Estonia's coal is represented by oil shale.

** *Solar* also includes wave and tidal power, and energy sources not allocated to any other source.

Note: Data are provisional.

Source: IEA (2019), "World energy balances", *IEA World Energy Statistics and Balances* (database), www.iea.org/statistics.

Since 2000, there has been a continuous shift to renewable energy sources. Among renewables, bioenergy and waste increased the most in terms of absolute numbers, from 3 Mtoe in 2000 to 6 Mtoe in 2010. Since then, however, the bioenergy and waste supply has been stable. Wind and solar energy have increased about threefold over the last decade, and their share of TPES grew from below 1% in 2008 to nearly 3% in 2018. Meanwhile, coal supply fell by 28%, from 3.8 Mtoe in 2008 to 2.7 Mtoe in 2018. Oil supply decreased by about 7%, from 12.7 Mtoe in 2008 to 11.8 Mtoe in 2018, but remained the single largest fuel in TPES, while natural gas supply fluctuated between 6.4 Mtoe and 8.1 Mtoe during the same period. Compared to other IEA member countries, Austria's share of fossil fuels is lower than the median, with the ninth-lowest share in the comparison (Figure 2.4).

Energy production and self-sufficiency

In 2018, domestically produced energy was 11.7 Mtoe, of which 51% was bioenergy and waste, followed by 28% of hydro. Fossil fuels accounted for only 13% of domestic production in the same year and the trend is declining. Crude oil production fell by 30%, from 1.0 Mtoe in 2008 to 0.7 Mtoe in 2018.¹ Similarly, domestic natural gas production fell by 30% (32% in volume terms), from 1.2 Mtoe in 2008 to 0.9 Mtoe in 2018, following a peak in 2012 at 1.5 Mtoe.

Energy consumption

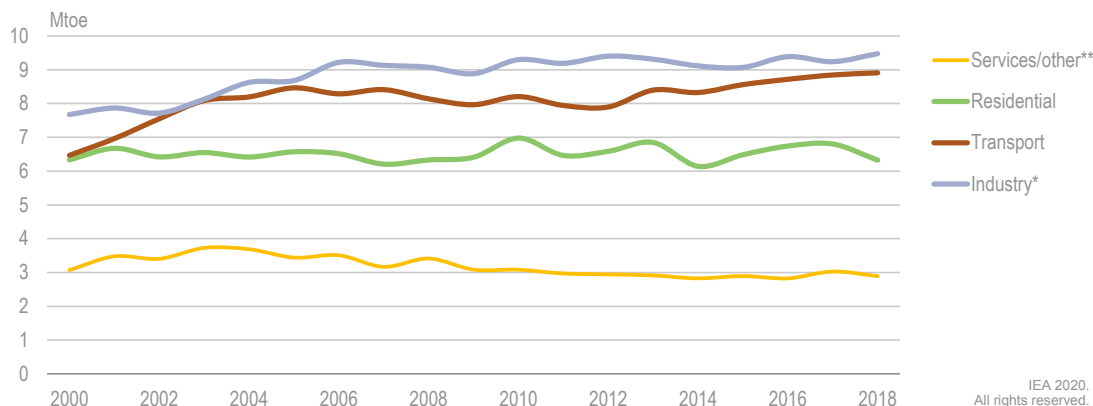
Energy consumption has been on an upward trend in the industry and transport sectors since 2014, while fluctuating in the residential sector (Figure 2.5). Austria will likely miss its total final energy consumption target for 2020. TFC increased from 26.4 Mtoe in 2014 to 27.9 Mtoe in 2017, which was the highest consumption level in Austria so far. In 2018, TFC fell slightly to 27.6 Mtoe, due to a drop in the residential sector after a previous increase. Consumption in the residential sector depends largely on the need for heating, and it has fluctuated between 6 Mtoe and 7 Mtoe over the last decade. The transport sector has seen the largest increase in recent years, from 7.9 Mtoe in 2012 to 8.9 Mtoe in 2018. Industrial consumption, including non-energy consumption, has also increased, although slowly, to a new high at 9.5 Mtoe in 2018. Meanwhile, consumption in the service sector has remained stable at around 3 Mtoe in the last decade.

Fossil fuels accounted for 60% of TFC in 2018 (Figure 2.6). The transport sector is highly dependent on oil, which accounted for 89% of the sector's total energy consumption. The industry sector is also heavily dependent on fossil fuels, which supplied 55% of total fuels consumed in industry, including for non-energy purposes. Of this, natural gas accounted for the largest portion, with 32%, followed by 19% of oil and 4% of coal. Almost all coal consumption in Austria is in the industrial sector. Electricity, bioenergy and waste are also important energy sources in industry.

In the residential and service sectors, energy is mainly used for heating or electrical appliances. Both the residential and the service sector use natural gas and oil for heating purposes, but bioenergy is the largest source of heat in residential buildings, while district heating the largest source of heat in the service sector.

¹ These numbers are in energy terms for the production of crude oil, including natural gas liquids and feedstock.

Figure 2.5 Total final consumption (TFC) by sector, Austria, 2000-18



TFC has increased in recent years to a record high level in 2017 and fell only slightly in 2018, driven by growth in transport demand and fluctuations in the residential sector.

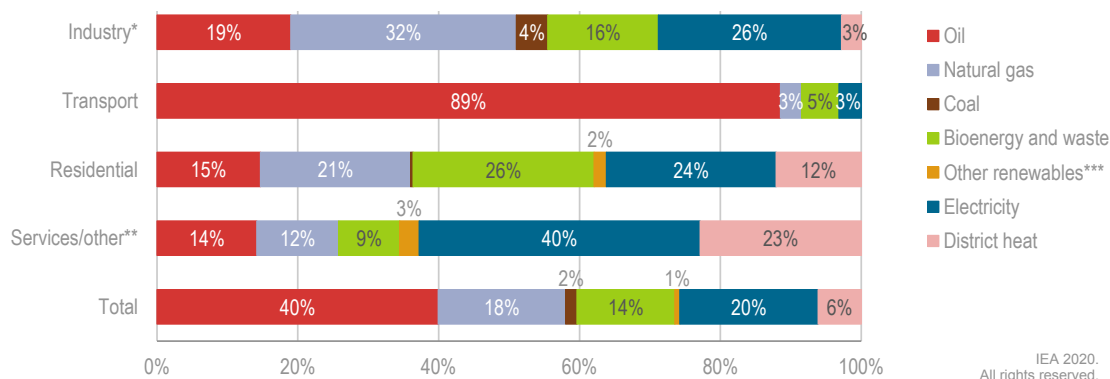
* *Industry* includes non-energy consumption.

** *Services/other* includes commercial and public services, agriculture and forestry.

Note: Mtoe: million tonnes of oil equivalent.

Source: IEA (2020), "World energy balances", *IEA World Energy Statistics and Balances* (database), www.iea.org/statistics.

Figure 2.6 Total final consumption (TFC) by source and sector, Austria, 2018



Oil is the largest energy source in TFC, with a dominant position in transport and high shares in industry and residential buildings; fossil fuels together account for around 60% of TFC.

* *Industry* includes non-energy consumption.

** *Services/other* includes commercial and public services, agriculture and forestry.

*** *Other renewables* includes geothermal and solar power.

Source: IEA (2020), "World energy balances", *IEA World Energy Statistics and Balances* (database), www.iea.org/statistics.

Policies for energy sector transformation

Austria is advancing the transformation of its energy sector in line with commitments under the Paris Agreement and at the European level. In 2018, the government launched the Austrian Climate and Energy Strategy 2030 (#mission2030), the guiding framework for Austria’s energy and climate policy to 2030 (FMST and FMTIT, 2018).

The 2030 targets include:

- reaching a share of 46-50% renewable energy in TPES
- 100% renewable electricity consumption (national balance)²
- eliminating electricity import dependency
- reducing primary energy intensity by 25-30% compared to 2015
- competitive energy markets with undistorted and competitive pricing
- safeguarding the resilience of the energy system to ensure security of supply.

To reach these targets, #mission2030 has identified 12 flagship projects as the first steps:

- Efficient Freight Transport Logistics
- Increase Rail-Bound Public Transport
- E-Mobility
- Thermal Building Renovation
- Renewable Heat
- 100 000 Roof-Mounted Photovoltaics and Small-Scale Storage Programme
- Renewable Hydrogen and Bio-Methane
- Green Finance
- Energy Research Initiative I: Building Blocks of the Energy System of the Future
- Energy Research Initiative II: Mission Innovation Austria Programme
- Communication, Education and Awareness Raising for a Sustainable Future
- Bio-Economy Strategy.

Austria supports the EU's 2050 climate neutrality objective that was adopted by the European Council in December 2019. The new Austrian government that assumed office in early January 2020 has committed to achieve climate neutrality by 2040 (Box 2.1). Austria's #mission2030 sets the ambition to achieve a carbon-free economy by 2050. Austria is committed to a nuclear-free decarbonisation; nuclear power has been banned under its Constitution since 1999.

Austria's National Energy and Climate Plan (NECP) for the period 2021-30 includes a "with additional measures scenario" that had notably been missing in the draft NECP. The NECP now also includes an annual breakdown of sector-specific shares of renewable energy from 2021 to 2030, the quantitative annual contribution of specific renewable technologies, as well as a breakdown of funding to achieve the targets described in the NECP (FMST, 2019).

Austria has set ambitious energy efficiency targets for 2030, but reaching these targets requires an improvement in energy efficiency across all sectors of the economy. #mission2030 includes five flagship projects dedicated to boosting energy efficiency. There is large potential in the building sector, but this requires swift harmonisation of building standards across the country to increase the renovation rate.

² Excludes electricity used for balancing, control energy and generated for self-use.

Box 2.1 The government programme for 2020-24

A new Austrian government took office in January 2020 consisting of the conservative *Die neue Volkspartei* under the leadership of Sebastian Kurz, the former and current Austrian chancellor and the Green Party. The new government has put climate change and the energy transition at the centre of its programme for the legislative period 2020-24. The importance of climate and energy to the new government is manifested by the creation of a “super ministry” that combines climate, environment, energy, mobility, innovation and technology.

The government programme largely builds on #mission2030 and Austria’s National Energy and Climate Plan (NECP), but is more ambitious by aiming to reach climate neutrality by 2040 at the latest. This is to be achieved while maintaining the competitiveness of the economy and ensuring the affordability of energy. The energy and climate targets of the new government are, among others, to:

- enact a new climate protection law with binding greenhouse gas reduction pathways to 2040 and interim targets to 2030, and the establishment of sector-specific targets and time plans
- rectify the NECP that was finalised in December 2019 and make it more concrete
- prohibit the installation of gas-fired heating systems in new buildings after 2025 and the mandatory phase-out of all oil- and coal-fired heating systems by 2035
- inject 5 terawatt hours (TWh) of green gas into the gas grid by 2030
- generate an additional 27 TWh of renewable electricity by 2030, of which photovoltaics (PV) solar will account for 11 TWh, wind 10 TWh, hydro 5 TWh and biomass 1 TWh
- install 1 million roof-mounted PVs by 2030; a tenfold increase compared to #mission2030’s Flagship Project 6 “100 000 Roof-mounted Photovoltaics”
- revise the energy efficiency law to include, among others, an increase of the range of industrial units mandated to undertake energy audits
- develop a detailed “mobility masterplan 2030” to enable the strategic shift of the mobility sector to comply with the Paris climate goals, including a significant increase in funding for the expansion of the public transport infrastructure.

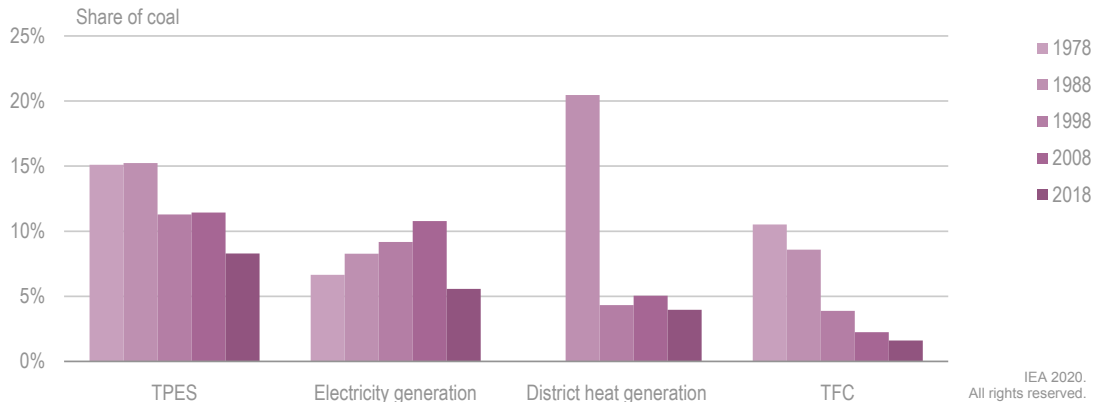
The new government is committed to a comprehensive tax reform built on ecological and social principals, with the aim to achieve true-cost pricing for CO₂ emissions in sectors not covered by the EU Emission Trading System (ETS), e.g. through CO₂ pricing or a national ETS system. The programme acknowledges the need to tackle fuel tourism, which contributes approximately 6.5% of Austria’s total energy-related emissions and results from transit traffic benefiting from the lower diesel prices in Austria compared to some of its neighbouring countries. The government privileges measures to specifically target these emissions, such as increasing the transit fee for heavy-duty vehicles and promoting the shift from road to rail. For this purpose, a task force will elaborate specific concepts and measures while ensuring that they comply with EU law and regulations.

Source: Die neue Volkspartei (2020), *Aus Verantwortung für Österreich, Regierungsprogramm 2020-2024*.
https://www.dieneuevolkspartei.at/Download/Regierungsprogramm_2020.pdf.

Coal phase-out

Coal has only limited importance in Austria's energy mix. In 2018, it accounted for 8% of TPES, 6% of electricity generation, 4% of district heat generation and less than 2% of TFC (Figure 2.7).

Figure 2.7 Share of coal in different energy supplies, Austria, 1978-2018

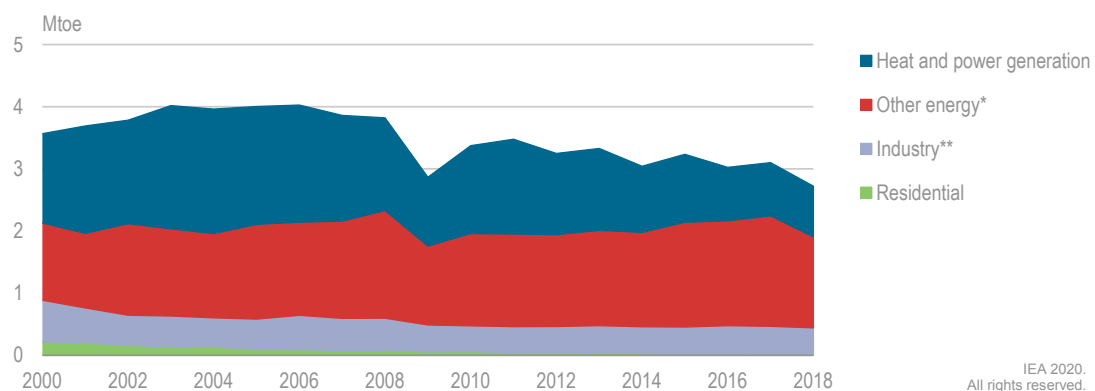


Notes: TPES: total primary energy supply; TFC: total final consumption.

Source: IEA (2020), "World energy balances", *IEA World Energy Statistics and Balances* (database), www.iea.org/statistics.

Coal is mainly used in transformation processes, in blast furnaces and in other uses in energy transformation, which accounted for 54% of total coal consumption in 2018 (Figure 2.8). The rest was consumed in heat and power generation (30%), industry (15%), plus a minor share in the residential sector (less than 1%). Despite its limited role in the energy system, coal consumption accounted for 17% of Austria's total energy-related CO₂ emissions in 2018.

Figure 2.8 Coal and coal product consumption by sector, Austria, 2000-18



Note: Mtoe: million tonnes of oil equivalent.

Source: IEA (2020), "World energy balances", *IEA World Energy Statistics and Balances* (database), www.iea.org/statistics.

Austria has not produced coal domestically since 2005, and all coal supply is imported. In 2017, imports came mainly from Poland (44%), the Czech Republic (18%), the United States (16%) and the Russian Federation (7%).

Austria is a member of the international “Powering Past Coal Alliance”, which is committed to advancing the transition away from unabated coal power generation (coal power generation without technologies that substantially abate CO₂ (e.g. carbon capture, utilisation and storage). Austria itself is not contemplating on carbon capture and storage for coal-fired power generation, as since 2011 a law prohibits the geological storage of CO₂ and related exploration, except for a small volume for research purposes. Consequently, clean coal technologies do not feature strongly in Austria’s national RD&D programme. In fact, Austria resigned from the IEA Technology Collaboration Programme “Clean Coal Centre” in 2016.

Coal phase-out in electricity generation

Austria has set an objective of promoting a rapid phase-out of its coal-fired power generation, but has not implemented any specific policies or measures to support this, nor set a specific target date (FMST and FMTIT, 2018). However, the power industry is proceeding with the phase-out of the last two coal generation plants, as CO₂ prices under the EU ETS are increasing and the plants are coming to the end of their economic lifetime.

The first coal-fired plant closed operations in 2019, five years earlier than originally planned. The 757 MW Dürnröhr plant in Lower Austria had been operating since 1986, and supplied a maximum of 1.7 million households when operating at full capacity. Dürnröhr’s first 405 MW block closed in 2015 and the remaining 352 MW second block was closed in August 2019. The plant’s operator, EVN, is now preparing to set up a large PV installation in the Dürnröhr area (EVN, 2019).

The second remaining coal-fired plant, the 246 MW Mellach plant, is owned by Verbund, Austria’s largest electricity sector company, and supplies district heat. Verbund announced it will discontinue coal-fired electricity generation in 2020, at the end of the heating period, as the Mellach plant has a contractual obligation to supply district heating until then (Verbund, 2019; Krone, 2019). The plant will then switch to natural gas.

Coal phase-out for other uses

Most of the coal use in Austria is for non-energy purposes, notably in the iron, steel and cement industries. Coal is not easy to substitute in those industrial processes, although research is underway globally. Notably, the Austrian company Voestalpine is heavily investing in transforming its steel production process with the use of hydrogen and electricity. Together with Verbund, Voestalpine is also participating in the European H2Future flagship project for the generation of green hydrogen from electricity generated from renewable sources.

The 2011 law that prohibits storage of CO₂ does not apply to the exploration for research, development or testing of new products and processes if the planned total storage volume of the CO₂ is less than 100 000 tonnes. Consequently, Austria only funds some small RD&D activities for carbon capture, utilisation and storage and for energy efficiency enhancements in industry.

Energy security and system resilience

In 2014, the federal government prepared the second Austrian Programme for Critical Infrastructure Protection (APCIP) Master Plan. The APCIP forms part of the Austrian

Security Strategy of 2013 that required the federal government to develop a strategy to increase Austria's resilience and to protect the country's critical infrastructure.

In addition to the APCIP, the provinces prepare their own plans to protect the critical infrastructure in their region. This takes place in close co-operation among the nine provinces and between the provinces and the federal government.

Oil

Austria complies with the IEA requirement to hold stocks corresponding to 90 days of the previous year's net imports. As of November 2019, Austria held stocks equivalent to 103 days of net imports. The last estimation of the potential for demand restraint during an oil crisis dates to 2014, and it would be advisable to update the study to take account of recent developments in the energy sector (see Chapter 5).

The last two national emergency response exercise (ERE) were in 2013 and 2018. The government should consider undertaking EREs more regularly and at shorter intervals. There is also a need to broaden the scope of the ERE towards emerging threats, such as cyberattacks and an electricity system failure.

Gas

Austria, which undertakes regular risk assessments for natural gas, has created a preventive action and an emergency plan. Austria largely exceeds the infrastructure standard (N-1), meaning that the gas market can meet a very high gas demand even if the largest infrastructure facility suffers from an outage. In 2019, the N-1 formula was 132%, indicating a high security of supply standard.

Given its high gas import dependency, Austria has substantial gas infrastructure, offering the flexibility and storage potential needed to accommodate the growing share of variable renewable electricity and hydrogen towards 2030. It will be important to ensure that the maintenance of this infrastructure remains viable in the transition period until new energy sources are ready to penetrate the market (see Chapters 4 and 9).

Electricity

Austria does not require mandatory risk assessments of the electricity sector, but they are prepared on a voluntary basis. While Austria has not prepared a preventive action plan, or an emergency plan for the electricity sector, the government considers the integrated network development plan, which is prepared annually by the Austrian Power Grid covering a period of ten years, as a preventive plan (see Chapter 3).

The network development plan contains several domestic and international high-voltage transmission lines that have been pending for decades due to failure to achieve planning permission. However, with a view to the supply of 100% renewable electricity by 2030 (national balance), these additional lines are becoming increasingly relevant for the resilience of the electricity system and are also considered by the European Commission as being critical for the further integration of European electricity markets. The IEA's 2014 in-depth review already highlighted the need to streamline the consenting and permitting process for energy infrastructure.

Streamlining permitting procedures

Austria's federal Constitution allocates the legislative competence for the energy sector between the federal and the provincial levels of government. In the electricity sector, basic legislation is set at the federal level, but implemented at the provincial level. The federal level also has the legislative competence for, among others, the gas, district heating, and mining and oil sectors, as well as for energy taxation and emergency response. However, legislative competence for issues relating to energy use (for example, building codes) rests with the provincial level. Moreover, the provincial level retains competence for land use, land zoning and permitting process for infrastructure projects, including for energy and transport. Only the competences for electricity infrastructure projects that extend to two or more provinces rest with the federal level. Traditionally, Austria also closely co-operates with civil society in the formulation and implementation of energy policy.

The existing legal and administrative procedures are complex and time-consuming and may become an impediment for the transformation of the energy system. To meet the 2040 target of a carbon-free energy sector and economy, substantial investments are needed in Austria's energy infrastructure, e.g. new generation installations, transmission lines, enhanced storage infrastructure and the expansion of the public transport network, to name but a few. Moreover, decentralisation is a key component of the energy sector of tomorrow and efficient trans-regional structures are needed to ensure an affordable and secure energy supply.

The last in-depth review of 2014 had already noted the need to streamline approval procedures to enhance transparency and early involvement of civil society and suggested that the government assess the costs and benefits of the current division of responsibilities. First steps are already being taken towards simplifying permitting procedures. In January 2019, a new law was passed to accelerate the permitting for major infrastructure projects declared by the federal government to be of special public interest. And to address the need to reduce administrative complexity at the federal level, under the 2016 "Energy Infrastructure Law", a centralised permitting process at the federal level is being created (see Chapter 3).

Assessment

A new Austrian government assumed office in January 2020 and has set the ambitious target to reach climate neutrality at the latest by 2040, ten years earlier than the target agreed upon by the European Council summit in December 2019.

Austria is committed to international climate targets via proactive climate protection and energy policies. The key interim objective of the Austrian government's climate policy is to reduce greenhouse gas emissions by 36% by 2030 compared to 2005 levels. A co-ordinated energy and climate policy towards reaching this goal was presented in May 2018 (#mission2030), and commendably, the vision addresses all energy sectors, mobility and urban sprawl issues in one strategy. #mission2030 aims to reach a carbon-free economy by 2050. It forms the basis of the National Energy and Climate Plan of Austria, which was submitted to the European Commission in December 2019.

The commitment is timely, as Austria's greenhouse gas emissions declined between 2005 and 2016, but started to rise again thereafter, notably in transport. New impetus is needed.

Equally, energy use increased at a slower rate than did GDP from 2005 until 2014, but in more recent years energy efficiency progress has stalled, indicating that a new boost for efficiency programmes is needed to meet the target of improved energy intensity of 25-30% by 2030 compared to 2015 levels.

A top priority for the Austrian government during the transformation of the energy system is maintaining a high level of energy security, by reducing the dependence on imported energy in two ways: 1) increasing output from domestic renewable sources; 2) improving the efficient use of energy. Both will require substantial investments in infrastructure, and as such, enabling framework conditions such as transparent and streamlined planning and approval processes are a prerequisite.

In 2018, renewable energy accounted for 29% of TPES and 77% of electricity generation, thanks to the large share of hydro (58%). Austria is phasing out coal for electricity production, with the last plant scheduled to end the use of coal in mid-2020. Austria aims for 100% electricity consumption to be covered by domestic renewables (national balance) by 2030, and it will electrify energy supply simultaneously, notably for transport and heating, by making use of sector coupling. The government is also aiming for a share of 46-50% of renewables in total gross final consumption by 2030, which indeed calls for deep decarbonisation of heat and transport quickly. Austria will reach the decarbonisation of the electricity system without nuclear power, which has been banned under its Constitution since 1999.

The government is supportive of an EU-wide minimum CO₂ price in the EU ETS to drive coal out faster in Europe. It is committed to a comprehensive tax reform built on ecological and social principals, with the aim of achieving true-cost pricing for CO₂ emissions in sectors not covered by the EU ETS, e.g. through CO₂ pricing or a national ETS system. An absence of a CO₂ price on transport fuels would make it challenging to tackle the growing emissions in the sector, and especially those resulting from tank tourism that are counted in Austria's balance while being consumed abroad. Non-tax measures will likely only have a limited impact, and may not be sufficient to reduce the emissions from the transport sector to the degree required to meet the 2030 and 2040 targets.

In this context, the IEA welcomes new government's decision to introduce a levy of EUR 12 on all flight tickets and to prepare a comprehensive tax reform based on social and ecological principles, in line with its ambition to be a climate policy role model in Europe.

Adjustments to the electricity market's design are being studied, as are adjustments of network tariff structures and enabling demand-response aggregators, to make the market more flexible and better prepared for accommodating larger shares of variable renewable generation. However, proper market functioning depends on an enabling and supportive infrastructure that is enhanced in a timely manner to create for sufficient redundancies in the system.

Like in many other IEA countries, heat and transport are more difficult to decarbonise than electricity generation. Austria is strengthening public transport as the backbone of its mobility system. It is a front-runner in passenger rail transport in the European Union. However, for rural areas, making use of electric vehicles, biofuels and hydrogen needs should complement enhanced public transport options. In freight, a modal shift from trucks to rail is needed, which would require not only investments, but also new logistic concepts, making use of digitalisation, as mentioned in the "Austria Railways Master Plan". The new

government's decision to develop a "Mobility Masterplan 2030" and its intention to accelerate the completion of the rail "Target Network 2025+" is to be applauded.

More use of waste heat and direct use of renewables in heating, like biogas and solar heat, along with energy efficiency can contribute to decarbonisation of the buildings sector. Like many countries, Austria is struggling to find effective measures for increasing the renovation rate of the existing building stocks, while new buildings are built with higher thermal standards and non-fossil fuel supplies. About a fifth of dwellings still have oil-fired heating systems that are on average around 20 years old.

The new government's target to phase-out all oil-fired heating by 2035 provides planning certainty for the oil sector. This action is accompanied by a funding programme to avoid social hardship. It is important to implement the proposed phase-out of gas heating in new constructions after 2035 in close co-operation with the gas industry. The gas industry should be encouraged to maintain the existing gas infrastructure with a view to its large potential for power-to-gas, and the government's objective to inject substantial amounts of hydrogen into the grid by 2030.

Affordability of energy is important to the government; the ambition is that energy and climate goals should be achieved without increasing the financial burden for citizens or the state. New technologies therefore have to play a role. The government is doubling its RD&D efforts in clean energy-related research to make new technologies available and to drive costs down. Nevertheless, the government could consider making wider use of financial incentives to steer behaviour, for instance by introducing a CO₂ tax in the non-ETS sectors, both for companies and consumers, and channelling revenues back to citizens and companies, so as to not increase the financial burden. Austria could also consider studying the design of a Swiss system in which the CO₂ tax increases in regular intervals when pre-set emission-reduction targets are not met and the tax revenues are redistributed to the Swiss population.

Responsibilities for energy policies are shared between the federal government, the states and local authorities. The ongoing review of the allocation of responsibilities with a view to creating a clear division of powers and avoiding duplications is notable; this is important also when it comes to funding instruments. The government is also reducing red tape, with a view to speeding up permitting processes for investments, notably for infrastructures that are needed for the energy transformation.

Recommendations

The government of Austria should:

- Develop concrete action plans for all energy sectors and energy efficiency to deliver on the targets set out in #mission2030 and in the government programme 2020-24.
- Use the 12 flagship projects of #mission2030 to demonstrate to the public that decarbonisation of the energy sector can come with social and economic benefits. This should include awareness-raising campaigns and early and meaningful engagement with communities to promote public acceptance and behavioural change.

- Use stronger price incentives to decrease the consumption of fossil fuels, while channelling revenues back to citizens and companies, linked to the promotion of renewable energy and energy efficiency.
- Promote RD&D to substitute coal in the iron and steel industry.

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3. Electricity

Key data

(2018)

Electricity generation*: 65.0 TWh (hydro 57.9%, natural gas 15.3%, wind 9.3%, bioenergy and waste 8.7%, coal 5.6%, solar 2.2%, oil 1.1%), +0.8% since 2008

Electricity net imports: 8.9 TWh (imports 28.1 TWh, exports -19.1 TWh)

Installed capacity: 25.6 GW

Electricity consumption**: 65.5 TWh (industry 43.8%, services 20.5%, residential 27.1%, transport 5.0%, energy 3.7%)

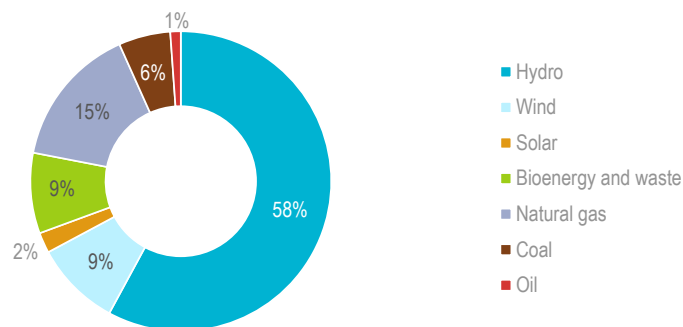
* Gross generation excluding pumped hydro.

** Final consumption excluding own use in power plants and distribution losses.

Overview

Renewable energy dominates Austria's electricity supply, accounting for 78% in 2018 (including waste). Hydropower accounts for over half of total generation (Figure 3.1). Wind and solar have increased strongly in the last decade, and have replaced fossil fuels in the power generation.

Figure 3.1 Electricity generation by source, Austria, 2018



Renewable energy and waste account for 78% of total electricity generation.

Note: Gross electricity generation excluding pumped storage.

Source: IEA (2020a), "World energy balances", *IEA World Energy Statistics and Balances* (database), www.iea.org/statistics.

Austria aims to supply 100% of electricity from renewable energy sources (national balance) by 2030 (see Chapter 9). This will require new investments in generation capacity, repowering of older wind turbines and additional grid infrastructure, while slow permitting procedures remain a challenge. As wind and solar power continues to increase, integration of variable renewable energy will become more important, and Austria will benefit from the flexibility offered by its hydropower. On the power market side, the split of the German-Austrian power wholesale market since 1 October 2018 has resulted in higher wholesale prices in Austria; the government needs to carefully monitor developments to ensure proper market functioning with a view to security of supply.

Electricity supply and demand

Electricity generation and trade

Hydro is by far the largest source of electricity generation in Austria, accounting for 58% of the total power generated in 2018. Coal, natural gas and oil together accounted for 22% of the total power generated. Austria has the fifth-highest share of renewable electricity generation and the tenth-lowest share of fossil fuels among IEA countries (Figure 3.2).

Figure 3.2 Electricity generation by source in IEA countries, 2018



The large hydropower resources grant Austria the fifth-highest share of renewables in power generation among IEA member countries.

* Estonia's coal represents oil shale.

** Includes solar PV, solar thermal, wave and ocean power, and other power generation (e.g. fuel cells).

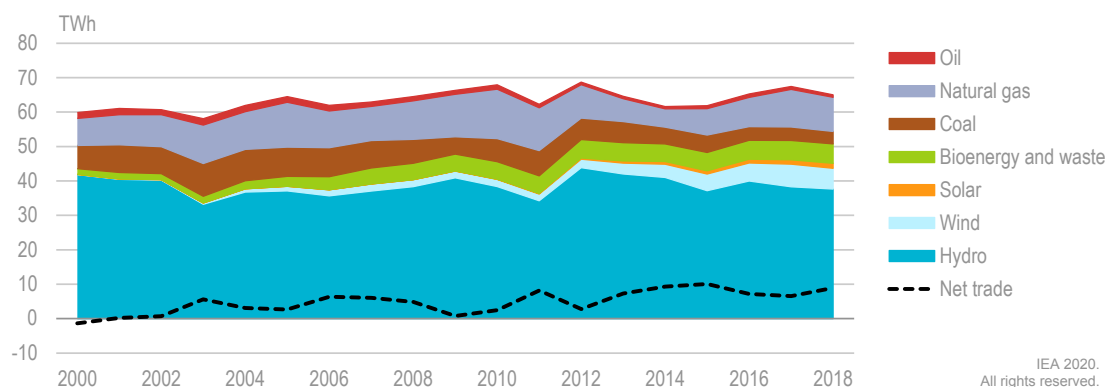
Source: IEA (2019a), *World Energy Balances 2019*, www.iea.org/statistics.

Total electricity generation increased between 2014 and 2017, reaching 67.4 terawatt hours (TWh) in 2017 (Figure 3.3). In 2018, however, total generation decreased by 4% to 65.0 TWh. Hydropower has dominated Austria's electricity generation for decades, and has accounted for around 60% of total generation in the last decade.

The share of coal, oil and natural gas is declining, mainly replaced by the increased use of other renewable energy sources, such as solar, wind and bioenergy. The share of renewable energy grew from 70% in 2008 to 78% in 2018. In particular, wind power has increased significantly and has contributed for most of the fossil fuel replacement in recent years. Wind power output has tripled in a decade, from 2.0 TWh in 2008 to 6.0 TWh in 2018, although the growth in capacity addition has stalled and production fell slightly in 2018, from 6.6 TWh in 2017. Solar power has been growing rapidly, and has more than doubled its production in the last five years, from 0.6 TWh in 2013 to 1.4 TWh in 2018. Bioenergy and waste increased rapidly from 2000 to 2010, but has since been quite stable around 5 TWh, with a small growth in recent years to 5.6 TWh in 2018.

Natural gas has the largest share of the fossil fuels, with 15% of total power generation in 2018. In the last decade, natural gas power generation first dropped significantly, from 14.4 TWh in 2010 to 5.3 TWh in 2014, but increased again to 9.9 TWh in 2018. Meanwhile, coal power is steadily being phased out, with a nearly 50% drop in a decade and a share of total power generation at 6% in 2018 (see Chapter 2).

Figure 3.3 Electricity supply by source, Austria, 2000-18



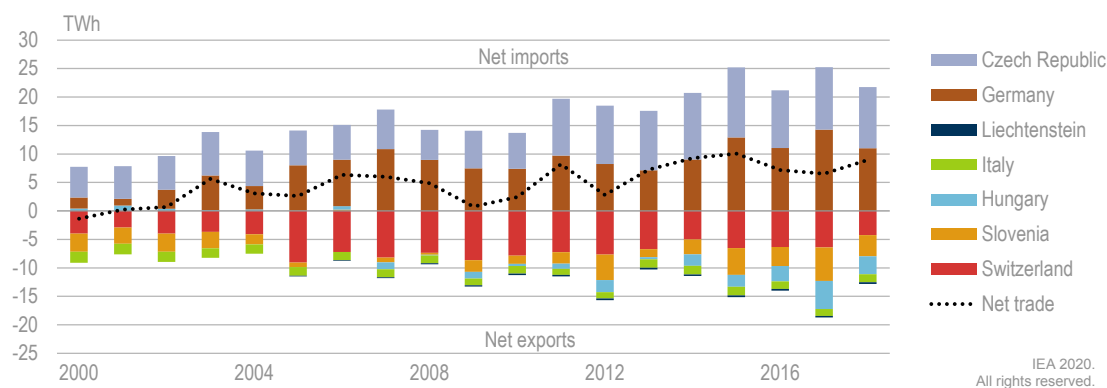
Total power generation has increased since 2014, with a slight decrease to 65 TWh in 2018; hydropower accounts for over half of the electricity generation.

* Not visible on this scale.

Note: TWh: terawatt hour.

Source: IEA (2020a), "World energy balances", *IEA World Energy Statistics and Balances* (database), www.iea.org/statistics.

Austria's power system is interconnected with seven neighbouring countries: the Czech Republic, Germany, Hungary, Italy, Lichtenstein, Slovenia and Switzerland. Austria is a net importer of electricity and total trade is growing. In 2018, Austria imported 28.1 TWh and exported 19.1 TWh, amounting to net imports of 8.9 TWh. The largest share of Austria's exports went to Switzerland, Slovenia and Germany, while imports came mostly from Germany and the Czech Republic (Figure 3.4).

Figure 3.4 Electricity net imports and exports by country, 2000-18

Austria is interconnected with seven neighbouring countries, and electricity trade has increased.

Notes: TWh: terawatt hour. The chart shows net trade by country. However, Austria both imports and exports electricity with all neighbouring countries, including for example peak load electricity exports to Germany.

Source: IEA (2020b), "World energy statistics", *IEA World Energy Statistics and Balances* (database), www.iea.org/statistics.

The energy transition toward renewables that is taking place in Austria is clearly visible when looking at installed capacity over the past decade (Table 3.1). Total installed capacity in 2018 was 25.6 gigawatts (GW), an increase by 24% from 2008 and 7% from 2013, largely due to significant increases in wind and hydropower. Installed wind power capacity almost tripled, from 1.0 GW in 2010 to 2.9 GW in 2017, and hydro capacity increased from 12.7 GW to 14.2 GW. Installed solar power also increased significantly, from 0.09 GW in 2010 to 1.3 GW in 2017. Meanwhile, installed capacity in power plants using combustible fuel decreased by 10% during the same period, from 7.3 GW in 2010 to 6.6 GW in 2017.

Table 3.1 Installed electricity-generating capacity, Austria, 2008-18 (GW)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Hydro	12.4	12.6	12.9	13.2	13.3	13.4	13.5	13.6	14.1	14.1	14.5
Wind	1.0	1.0	1.0	1.1	1.3	1.7	2.1	2.5	2.7	2.9	3.1
Solar	0.03	0.05	0.09	0.2	0.3	0.6	0.8	0.9	1.1	1.3	1.4
Geothermal	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Combustible fuels	7.2	7.3	7.3	8.2	8.2	8.2	7.9	7.7	7.3	6.6	6.5
Total capacity	20.7	21.0	21.3	22.6	23.1	23.9	24.3	24.7	25.2	24.9	25.6

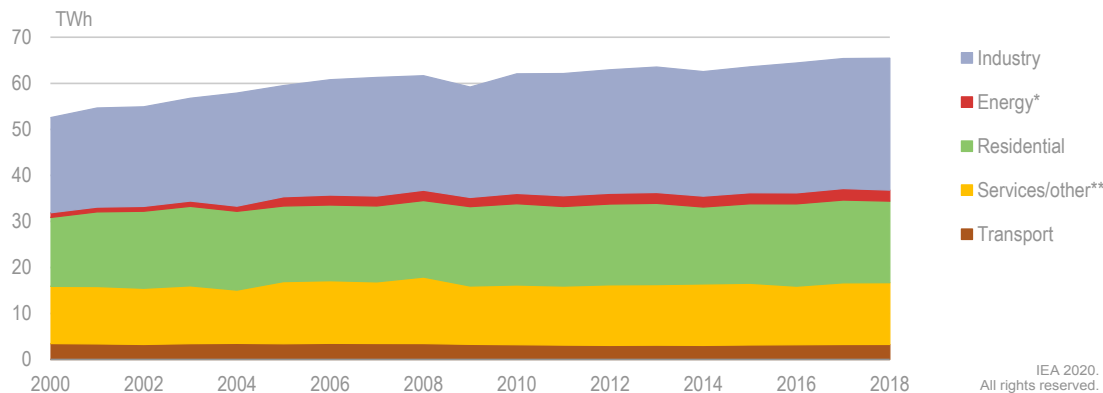
Source: IEA (2020b), "World energy statistics", *IEA World Energy Statistics and Balances* (database), www.iea.org/statistics.

Electricity consumption

Total electricity consumption has shown an increasing trend over the last decade, reaching a record high of 65.5 TWh in 2018. The residential and service sectors together accounted for 48% of Austria's total electricity consumption in 2018, followed by 44% for the industry sector, and small shares for transport and the energy sector's own use (Figure 3.5). In a ten-year comparison from 2008 to 2018, overall electricity consumption grew by 6%, largely due to increased consumption in the industry sector, by 15%, from 24.9 TWh in 2008 to 28.7 TWh in 2018. In particular, increased energy consumption in the machinery;

food, beverages and tobacco industries; and the chemical industry contributed the most to this increase. The other sectors remained more stable, with slight increases in the residential and energy sectors and small declines in the commercial and transport sectors.

Figure 3.5 Electricity consumption (TFC) by consuming sector, Austria, 2000-18



Electricity consumption has been increasing in Austria, largely due to the increase in the industry sector.

* *Energy* includes petroleum refineries, coalmines, oil and gas extraction, coke ovens, and blast furnaces.

** *Services/other* includes commercial and public services, agriculture and forestry.

Note: TWh: terawatt hour.

Source: IEA (2020a), "World energy balances", *IEA World Energy Statistics and Balances* (database), www.iea.org/statistics.

Electricity outlook

The role of electricity in Austria's energy mix is set to increase significantly over the period to 2030. Electricity consumption is expected to reach 80-85 TWh in 2030, an increase of 19-23% compared to 2017. Looking to 2050, electricity demand is seen to possibly increase to 108 TWh (FMST, 2019).

This is in line with the government's #mission2030 that strives for decarbonisation of the energy supply and anticipates the electrification of the energy sector in line with new technological developments and the possibilities offered by digitalisation. E-mobility will account for a large share of future electricity demand, as will heating and cooling (FMST and FTIT, 2018; FMST, 2019).

The provision of low-carbon electricity is a condition for the sustainable electrification of the energy system. Under #mission2030, Austria has committed that domestic renewable energy sources will account for 100% of total electricity supply on national balance by 2030.¹ These exemptions would account for around 6 TWh in 2030, meaning 74-79 TWh of electricity would need to be generated from renewable sources. Taking into account that some existing installations will be decommissioned before 2030, the net increase of renewable generation would be 22-27 TWh (FMST, 2019).

¹ The 2030 renewable electricity target is set at 100% of the national balance (defined as total generation + electricity exports – electricity imports). The 100% renewable electricity target exempts generation required for balancing and control of the grid, estimated to be approximately 1% of total generation in 2030. Efficient self-consumption of electricity from industrial by-products, estimated to cover about 6% of generation in 2030, is allowed.

Austria's last coal-fired power generation plant will close operations in mid-2020, though industry will continue using small amounts of coal for self-generation. Austria will reach the decarbonisation of the electricity system without nuclear power, which has been banned under its Constitution since 1999 and which the country does not consider as compatible with sustainable development.

Generation from hydropower is expected to increase by 5 TWh until 2030 as part of the overall goal to add 27 TWh of renewable electricity. However, the implementation of the "EU Water Framework Directive" could potentially undermine this ambition, by increasing costs. This is also relevant for existing plants that need to renew their permit and to expand their capacity. Moreover, pump storage plants have to pay the grid utilisation charge twice: once when using electricity to pump water up and again for the electricity produced.

Beyond contributing to the expected renewable generation growth, Austria's pump storage hydro plants play a critical role in the future electricity market by providing storage to accommodate the growing share of variable renewable generation into the electricity system. Ensuring their economic viability will be important to reach the country's energy and climate targets under #mission2030.

Generally, the scattered division of competencies between the federal and the provincial levels for energy legislation and the resulting complex planning and permitting structures create a key obstacle for Austria to reach its goals of a 100% renewable electricity supply. Efforts by the government to reset the legal framework to facilitate the creation of the necessary infrastructure for the energy transition are most welcome (see Chapter 2 and the next section).

Market model and regulatory framework

The key development in the Austrian electricity sector since the last in-depth review is the termination of the common wholesale market with Germany on 1 October 2018 (see Box 3.1). Electricity flows originating from exchanges between Germany and Austria are now considered cross-border flows instead of internal exchanges. They require different accounting practices and result in wholesale market price spreads.

Austria is part of the Central West Region (CWE) day-ahead market coupling scheme to allow the country's inclusion in the flow-based market coupling allocations. The CWE region covers Belgium, France, Germany, Luxembourg and the Netherlands, in addition to Austria.

Another major development has been the implementation of day-ahead market coupling between Austria and Italy in 2015 and between Austria and Slovenia in 2016. Austria still undertakes explicit auctions at its interconnections with the Czech Republic, Hungary and Switzerland, based on net transfer capacities due to existing transmission bottlenecks.

Box 3.1 Split of Austrian-German joint wholesale electricity market

Austria and Germany have been operating a unified electricity-pricing zone for unlimited transfer capacities since 2001, resulting in a single wholesale price level (E-Control, 2018). Austrian consumers benefited from the cheap wind power produced in Germany, while German consumers benefited from cheap hydropower imports during periods of low wind power production.

There is no capacity shortage on the Austrian-German interconnection, with a technical border capacity estimated of up to 10 700 megawatts (MW) (Verbund, 2019). However, Germany has domestic transmission capacity bottlenecks, as the expansion of the transmission network to transport wind power from northern to southern Germany is lagging. Frequently Austria bought more power from Germany than could be transported by the German grid, requiring expensive redispatch measures. Moreover, due to the transmission capacity constraints, power destined for Austria was often looped via the Czech Republic and Poland, creating congestion problems in those two countries.

In May 2017, an agreement was reached between the regulatory agencies of Germany (*Bundesnetzagentur*) and Austria (E-Control) to limit the long-term electricity trading capacity across the German-Austrian border to 4 900 MW. This is equivalent to about half of peak demand in Austria (E-Control, 2018). In the same agreement, Austria's transmission system operator (TSO) committed to provide at least 1 gigawatt (GW) of redispatch capacity to Germany to help stabilise the German grid. The split of the Austrian-German joint bidding zone became effective on 1 October 2018.

The first auction in September 2018 for monthly capacity for the period October to December of the same year showed prices ranging from 0.88 EUR/MWh to 5.75 EUR/MWh (E-Control, 2019a). The average price spread at wholesale level between Germany and Austria for the same three months period was about 7.3 EUR/MWh, with prices in Austria being 14% higher than in Germany. The additional annual costs for Austrian electricity consumers are estimated at EUR 100 million. However, while a comparison of the average wholesale baseload prices in Austria and Germany for the first nine months of 2019 confirmed that Austrian prices were higher than German prices, the price spread decreased from 4.1 EUR/MWh in the first quarter to 1.2 EUR/MWh in the second quarter to 0.8 EUR/MWh in the third quarter. This was in line with strong wind and hydropower generation in Austria (EC, 2019).

Sources: E-Control (2018), *Marktbericht 2017*, <https://www.e-control.at/documents/1785851/1811582/e-control-marktbericht-2017.pdf/c14286b4-aa86-1788-8c22-b0389913d583?version=1.0&t=1510745771991>; E-Control (2019a); EC (2019), *Quarterly Report on European Electricity Markets*, https://www.bmlrt.gv.at/dam/jcr:8548da5d-0258-4ffe-ad4f-e5b50a9669c5/Bericht_inkl.Visuals_engl_barrierefrei.pdf

A first of its kind in Europe is the co-operation between Austrian Power Grid (APG)² and the German transmission system operators (TSOs) since 2016 for secondary control. The co-operation was further intensified in 2019 with the introduction of joint purchase arrangements for secondary control energy. This is expected to help secure a minimum reserve exchange between the two countries, despite the separation of their common wholesale market in 2018 (E-Control, 2019a).

² Annex A provides detailed information about institutions and organisations with responsibilities related to the energy sector.

The government's ambition under #mission2030 requires changes to the legal and regulatory framework of Austria's electricity sector. A key component of this is the "Location Development Act, 2018", that intends to accelerate the permitting projects for major infrastructure projects declared by the federal government to be of special public interest. The act came into force on 1 January 2019. It requires the environmental impact assessment authority to issue its decision within 12 months upon submission of the project application. If no decision is taken within this period and upon an official complaint by the project promoter, the concerned administrative court has to issue the decision and can either grant the license or refuse it. The EU launched infringement proceedings against Austria in 2019 for incorrect transposition of the EU directive on environmental impact assessments. The responsible Austrian ministry issued a reasoned opinion in late 2019. The European Commission's response is awaited.

In 2016, an "Energy Infrastructure Law" came into force to reduce delays in permitting of new key infrastructure. The law includes a centralised permitting process at the federal level so that permits can be granted within a maximum of 3.5 years.

Looking forward, the government's vision of the new electricity system includes turning passive consumers of electricity into active customers and actors. The provision of a supportive legal and regulatory framework and the roll out of a nationwide smart metering system are key enablers in this regard. In 2017, an amendment to the Renewable Electricity Act 2012 introduced the legal basis for electricity sharing by permitting the creation of generation communities.

Austria is now in the process of preparing a new Renewable Deployment Act that is expected to come into effect in 2020 (see Chapter 9). One key aspect of the new law will be permission for the creation of "renewable energy communities" and the provision of opportunities of direct marketing for small renewable producers. Changes to the Electricity Law are also planned for 2020 to allow for the creation of these renewable energy communities. Moreover, also in 2020, the government plans to develop the conceptual and legal framework for aggregators that would be able to provide balancing and congestion management services.

Industry structure

Austria's electricity sector has seen a continuous increase in competition at all levels since liberalisation in 2001, but there remains room for improvement.

Generation, transmission and distribution

Austria's electricity generation industry is relatively diverse, with a large number of regionally based companies, several of which with generate more than 1 TWh annually. The largest generator is Verbund AG, which operates over 140 power plants. In 2018, it accounted for about 48% of domestic generation in 2018, compared to 55% at the time of the last in-depth review in 2014. Verbund is the largest electricity sector company in Austria.

Austria has two certified independent transmission system operators. The APG covers around 95% of the total Austrian transmission network. It is a 100% subsidiary of Verbund.

Vorarlberger Übertragungsnetz GmbH (VUEN) is the certified owner and operator of the transmission network in the province of Vorarlberg. Since 1 January 2012, Austria only operates one control area, which is managed by the APG. The APG is responsible for balancing and operational management of the entire Austrian transmission grid and is the sole contact point for processing imports and exports. The prices the TSOs can charge for the use of the network and their services are covered by a cost-plus regulatory system based on annual cost audits.

Austria has over 130 distribution system operators (DSOs), which are subject to an incentive regulatory system since 2006. Within the incentive regulation, network regulators are subject to an incentive regulation path on the cost side; they have to achieve appropriate cost specifications. Since uniform charges are calculated for each network area, an equal payment mechanism ensures that differences in the revenue structure between the network operators are eliminated. However, charges can vary if, for example, one DSO is investing strongly in network expansion. The number of DSOs covered under the incentive-based system is gradually increasing. The fourth regulatory system became effective on 1 January 2019, lasts five years and now covers 60 DSOs (E-Control, 2019a).

Retail market

A total of 155 suppliers were active in the retail market for small consumers in 2018, serving 4.3 million households and 1.4 million businesses and other small customers (CEER, 2019; E-Control, 2019a). Traditionally, the majority of suppliers limited their activities to a specific region in which they normally also owned the distribution network and they are owned by regional or municipal governments. Moreover, utilities increasingly have cross-shareholdings arrangements with each other, resulting in a high market concentration.

But the number of companies operating country-wide almost quadrupled, from 12 in 2012 to 45 in 2016, 15 of which have entered the market since 2015 (E-Control, 2018). The number further increased to 55 in 2017 and remained at the same level in 2018 (CEER, 2019). The stagnation in 2018 is seen as a response to the separation of the joint Austrian-German wholesale market, which created uncertainty for market players.

Austria is one of only seven EU member countries that have a Herfindahl-Hirschman Index (HHI)³ below 2 000 for the household market segment, indicating a low market concentration. Moreover, the HHI further decreased slightly from 2017 to 2018 (CEER, 2019). The number of suppliers and their offers varies throughout the country. While households in Vienna can choose between roughly 95 offers from over 40 suppliers, the number is lower in the less populous regions.

Yet, Austria's consumers are cautious in exploring the choices available. The supplier-switching rate is one indicator for a well-functioning retail market. Austria has a relatively low switching rate between suppliers at the household level, at 4.2% in 2018, compared to 4.3% in 2017 (E-Control, 2019a). Consumer groups have characterised the switching procedures as cumbersome and opaque, especially in light of the growing variety of product offers. Customers frequently only benefit from a reduced tariff for one year and then have to actively negotiate a new offer to avoid paying higher prices than before their initial supplier change.

Austrian consumers, however, display a growing preference to renegotiate contracts with their incumbent supplier. While this option was only chosen by 3% of household consumers in 2017, the share had increased to 16% in 2018 (CEER, 2019). A recent

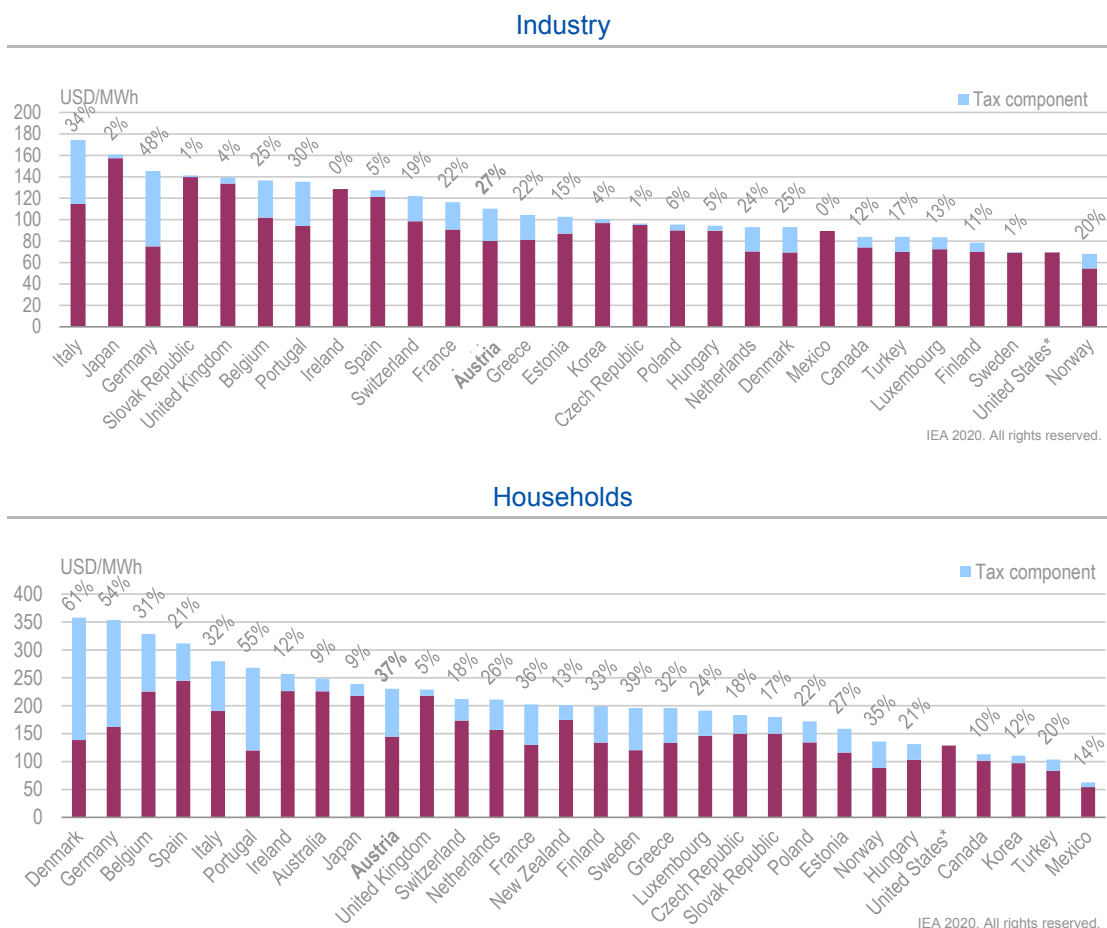
³ The HHI is used to assess the level of competitiveness in a market. It is calculated as the sum of the market squares of all firms in the market. An HHI above 2 000 signifies a highly concentrated market with a small number of firms.

development has been the market entry of intermediaries, which further increases the number and variety of contracts on offer. At the same time, the number of price comparison tools is increasing to support the switching of household electricity consumers. For example, E-Control offers tariff calculator and price monitor comparison tools on its website, for electricity and gas. The price monitor shows the cheapest total annual price offered and the difference between the cheapest and incumbent suppliers, including switching discounts and, in a separate chart, without switching discounts.

Prices and taxation

Austria's consumers pay relatively high electricity prices compared to other IEA member countries, mostly because of high taxation. The country ranked above the IEA median in terms of industry electricity prices in 2018 (Figure 3.6). Taxes account for 27% of total industry prices, which is the fourth highest among IEA countries. Electricity prices for households, of which 37% is taxes, ranked 10th in an IEA comparison.

Figure 3.6 Electricity prices in IEA member countries, 2018



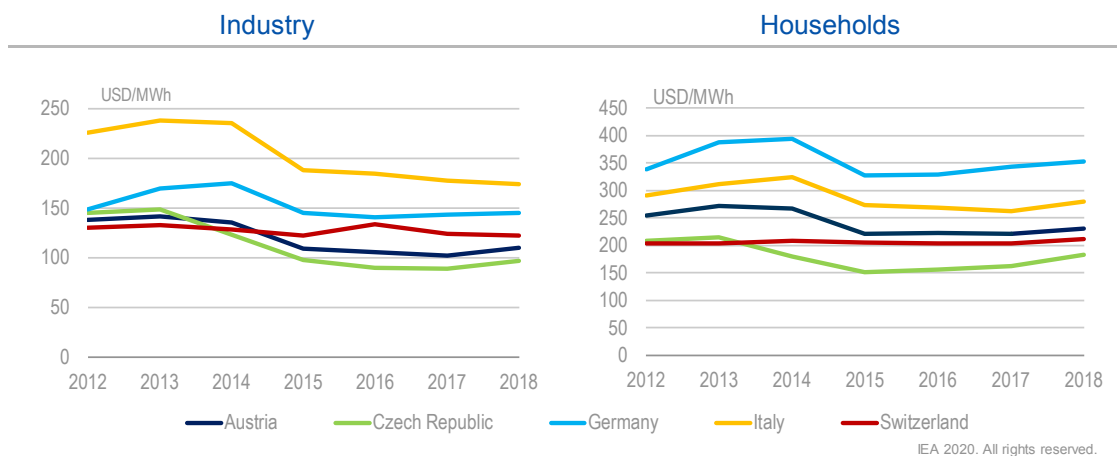
* No tax information is available for the United States.

Source: IEA (2019c), *Energy Prices and Taxes 2019* (database), www.iea.org/statistics.

Although Austria pays relatively high electricity prices, prices have decreased over the past five years and are lower than in some neighbouring countries engaged in electricity trade (Figure 3.7). Austria's electricity prices for both the industry and household sectors have

declined since 2012. In 2018, industry consumers paid an average of 110 USD/MWh, a 20% decrease from 2012, while households paid 230 USD/MWh, a 9% decrease from 2012.

Figure 3.7 Electricity prices in Austria and selected IEA countries, 2012-18



Source: IEA (2019c), *Energy Prices and Taxes 2019* [database], www.iea.org/statistics.

Infrastructure

Transmission system

At the end of July 2019, Austria's transmission system was 18 270 kilometres (km) long, consisting of 11 507 km of 110 kilovolt (kV) lines, 3 708 km of 220 kV lines and 3 055 km of 380 kV lines (E-Control, 2019b) (Figure 3.8). With about 95% of the total, the APG's transmission lines form the backbone of the Austrian system. The Austrian transmission system also comprises 89 substations above 220 kV and 1 032 substations up to 220 kV (E-Control, 2019b).

Austria has a well-developed transmission system, but it is still experiencing bottlenecks in certain regions. Completion of the 380 kV ring project for Austria has been pending for decades due to permitting issues. The planned ring would connect all load centres to major generation units and would facilitate the integration of the growing share of variable renewable generation into the Austrian grid in line with the energy and climate vision expressed in #mission2030. Moreover, completion of the outstanding sections of the 380 kV ring will also contribute towards the integration of the internal European electricity market.

Integrated network development plan

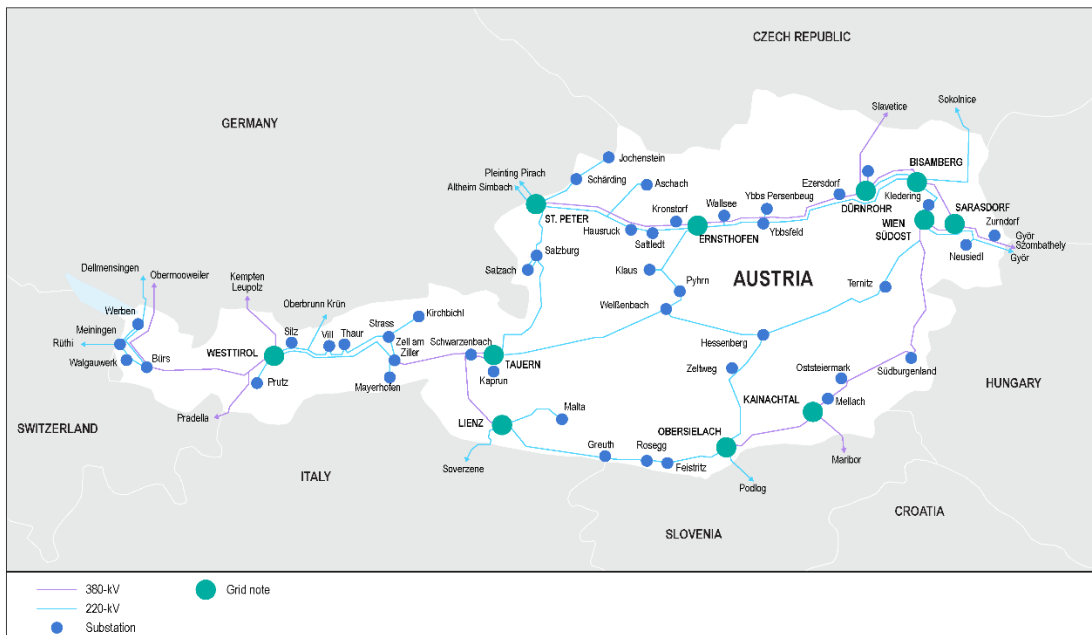
In its role as the control area manager, the APG is statutorily obliged to produce a rolling ten-year integrated network development plan (NDP) for all of Austria that must be approved by E-Control. The current plan covers the period 2019-28 (APG, 2019). The NDP includes a list of investments that have already been approved as well as projects that will need to be implemented within the next three years.

Given Austria's central location in Europe and its close interconnection with neighbouring countries, the APG's plan is closely linked to ENTSO-E's ten-year NDP and several of its

projects are classified as projects of common interest (PCI). These projects are of significant importance for reaching the EU’s climate and energy targets. Under the fourth PCI list, the priority corridor “North-South Electricity Interconnections in Central Eastern and South Europe” includes the following projects:

- 380 kV Salzburg line to close the gap between the nodes at St. Peter and Tauern that is missing to close the Austrian 380 kV ring
- 380 kV interconnection between St. Peter in Austria and Isar (Germany) to enable greater transfer of capacities between the two countries
- 380 kV line between West Tyrol and Zell-Ziller that will be linked to the existing 380 kV ring.

Figure 3.8 Austrian transmission grid



The internal 380 kV-line between Lienz and Obersielach in Carinthia intended to close the 380 kV was part of the third PCI list, but has been excluded from the fourth list. However, the APG is committed to complete this section given its importance for the domestic grid system.

In addition, under the priority corridor “North-South Electricity Interconnections in Western Europe”, the capacity increase of the hydro-pumped electricity storage in Kاونertal, Tyrol (Austria) is included as a PCI project.

All projects aim to not only ensure long-term security of supply and system security, but also to link Austria’s storage plants to wind and solar sites in other parts of Austria and other parts of Europe, especially in Germany. Moreover, the construction of these lines will allow Austria to develop additional pump storage sites, which will further facilitate the integration of variable renewables and allow for flexible, market-based interaction with neighbouring countries.

The progress of all projects is delayed considerably due to complex and time-consuming permitting procedures in Austria that involve federal and provincial level legislations. Moreover, the proposed routing of the lines is challenged in ongoing court cases.

In this regard, the government's two legal initiatives to facilitate and speed up the planning and construction process are welcome (see section on legal and regulatory framework).

Regional interconnection

Austria is located in the centre of Europe and has close electricity connections with seven of its neighbouring countries. In 2017, its interconnection rate was 15.3%, exceeding the European target of 10% by 2020. Yet despite this major achievement, Austria still experiences bottlenecks in its interconnections with neighbouring countries, especially for north-south electricity flows as discussed above. Table 3.2 shows the actual traded volumes in total during 2019.

Table 3.2 Traded volumes in total, 2019

Imports					
CZE → AUT	HUN → AUT	SVN → AUT	ITA → AUT	CHE → AUT	DEU → AUT
9 297 GWh	18.4 GWh	148.2 GWh	1.1 GWh	557.2 GWh	12 939 GWh
Exports					
AUT → CZE	AUT → HUN	AUT → SVN	AUT → ITA	AUT → CHE	AUT → DEU
6.1 GWh	6 206 GWh	5 852.4 GWh	1 228 GWh	4 283.1 GWh	337.3 GWh

Source: APG.

Smart grids

Austria sees the digitalisation of the electricity sector as a key contributor to the sector's decarbonisation by 2030. The introduction of smart meters for all electricity end-consumers was originally expected to be completed by the end of 2022 under the 2012 Ordinance on the introduction of smart meters. But in 2017, the government amended the ordinance to postpone the target to the end of 2022 for an installation rate of at least 95%. The revised ordinance also targets the provision of smart meters to at least 80% of Austrian electricity consumers by the end of 2020, where technically feasible.

At the end of 2018, only about 15% of the 6.2 million end-consumers had been equipped with a smart meter, or a total of 950 000 million consumer points. Reaching the 2020 and 2022 targets will be a challenge for the retail companies (E-Control, 2019c). E-Control publishes an annual monitoring report that tracks the progress of installations, experiences with data protection, and evolution of consumers' energy demand and network conditions. Urgent completion of the rollout of smart meters is a prerequisite to enhancing the active role of customers in the electricity market.

In 2016, E-Control initiated a discussion among power generators, grid operators and civil society on the modernisation and restructuring of the electricity network charges. This was done to address the government's policy objectives under #mission2030. These were aimed towards more variable renewable generation, decentralised electricity production, and the increasing digitalisation of the electricity system, which offers the technical potential to transform passive consumers into active consumers. Under the proposal, small-scale consumers who want to actively contribute to the grid stability would be able to participate in the new possibilities offered, as is already possible for industry and large-end consumers. However, a final decision on the implementation of the new network charges regulation requires amendments to the Austrian Electricity Act. Draft legislation is expected to enter the legislative process in late 2020.

Austria is also actively supporting the roll out of smart grids to support energy- and cost-efficient system operation. Several pilot projects are ongoing in test regions and cities (see Chapter 10).

Security of supply

Austria has a high level of security of electricity supply with a high reliability. In the absence of a government definition of desirable electricity security of supply standards, E-Control annually assesses if domestic electricity capacity is sufficient to cover hourly peak demand over a three-week period. This was the case for 2018, the last year for which data are available (E-Control, 2019a).

However, in terms of #mission2030's target for 100% renewable electricity supply (national balance), security of supply will be assessed differently. Austria will need to ensure sufficient balancing and control energy and to maintain the required flexibility for network operations at any given time. Enhanced investments in storage and network infrastructure will equally be needed.

Moreover, while Austria aims to become almost 100% self-sufficient in electricity generation by 2030, it is a member of the European Union. Given its favourable location, Austria's pumped storage plants are also of high value to facilitate the further integration of the European electricity market. Close co-operation with neighbouring countries will therefore continue.

Assessment

Renewables dominate electricity supply in Austria. They accounted for more than three-quarters of total generation in 2018 (including waste); hydropower alone accounted for 58%. Coal accounts for only a small share of electricity and Austria is committed to exit coal-fired generation soon, although no specific date has been set. Austria has a strict anti-nuclear position; nuclear power has no part in future supply scenarios.

Electricity consumption in Austria has been steadily growing. In 2018, Austria consumed over 65 TWh of electricity, a 6% growth in a decade. Industry is the largest consumer, accounting for over 44% of electricity consumption in 2018.

Electricity consumption is set to grow strongly, as it will be increasingly used for mobility, the buildings sector and the productive industries to replace fossil fuel use in those sectors.

The government's vision of the electricity sector in 2030 sees electricity consumption in the range of 80-85 TWh, which requires a net addition of renewable generation in the range of 25 TWh.

In its #mission2030, the government has set a target of meeting 100% of total national electricity consumption (national balance) from renewable energy sources by 2030. System integration of increasing variable renewable electricity will be a challenge for the Austrian electricity system regarding network stability and security of supply. Reaching the 2030 target requires developing all renewable energy vectors: generation from all renewable sources, network infrastructure, storage facilities, and an enabling legal and regulatory framework for more active consumer involvement. The current requirements for connections of new renewable power plants to the network are not conducive for attaining the renewable energy targets.

Austria's hydropower resources are set to play an important role in the future electricity system due to their flexibility and their storage potential that will contribute to Austria's security of supply. In some scenarios, the share of hydropower could increase to around 80% of total generation. Reaching this share, however, requires a supportive framework to ensure that new investments in hydropower are financially viable. As well, it is necessary to flexibly transpose the provisions of the "EU Water Framework Directive", which is resulting in higher costs for operators. Moreover, the existing double grid fees for injection and withdrawal from pump storage plants appear to have a negative impact on storage operation, even though those plants are subject to reduced grid fees and a full exemption for grid fees applies for new pump storage and power-to-gas plants until the end of 2020.

Austria's interconnections with its neighbouring countries were 50% higher in 2017 than the 10% target for 2020. Cross-border flows have increased in recent years. Austria is a net importer of electricity. Under the government's vision for 2030, Austria will reduce its import dependence as it aims to cover demand from domestic renewable sources only, with the exception of balancing power and for industrial self-generation.

However, given Austria's position at the heart of Europe and its above-average storage capacity, it will remain a key enabler for the continued integration of the European electricity market. In addition to reinforcing the internal grid, interconnections will also need to be strengthened with a view to support the integration of balancing markets with neighbouring countries.

Since the liberalisation of their electricity markets, Germany and Austria have been in one common electricity wholesale market. On 1 October 2018, this German-Austrian price zone was split and the long-term interconnection capacity available for trade between the countries was limited to 4 900 MW, compared to 7 500-9 000 MW previously. Consequently, there is now a price spread at wholesale level, with prices in Austria consistently higher than are those in Germany. Moreover, the separation has also reduced the liquidity in the Austrian electricity futures market, which in turn makes the market less competitive.

Permitting procedures for transmission grid projects are complex and long as they fall under the shared competence of the federal and the provincial levels of government. The new Energy Infrastructure Law of 2016 has centralised the permitting process at one ministry at the federal level to limit the time for issuing permits to a maximum of 3.5 years. However, responsibility for routing and other permitting procedures lies with the province, which is inefficient for permitting of national transmission grid projects, since they cross several states.

The Location Development Act of 2018 introduced the notion of declaring major infrastructure projects to be of special public interest and, as such, to benefit from an accelerated permitting process that would be completed in about 18 months, including the environmental impact assessment. To speed up permitting procedures, this new *lex specialis*⁴ overrides other laws. It is currently under consideration as to whether the law is also applicable for transmission grid projects.

Austria has been rolling out smart meters to all connections since 2012. However, in 2017, the target date for 100% metering was postponed from the end of 2020 to a target of 95% by the end of 2022. Reaching this target would still make Austria one of the early achievers in an international comparison. However, reaching #mission2030's targets, and in particular the integration of decentralised electricity production and the roll out of e-mobility, necessitate the existence of active customers, the possibility of bi-directional power flows and demand-side responses, all of which require smart meters and smart grids. The completion of the roll out should therefore be a priority.

Relatively low switching rates in the retail market indicate untapped potential for cost savings for consumers. Savings potential due to switching suppliers is substantial across Austria. However, competition in the retail market has increased in recent years and there has been a significant increase in product diversity. Suppliers increasingly use digital distribution channels and online contracting, which was one of the recommendations of the last in-depth review. In this context, the complexity and multitude of the terms and conditions of available offers appear to discourage some customers from more active participation in the market. This is perhaps partly driven by negative experiences made public, where customers found themselves paying higher prices just one year after having switched suppliers, as they were caught unaware about the need to actively renegotiate the rebate annually. While the number of price comparison tools has increased, there is still room for further transparency.

Recommendations

The government of Austria should:

- Improve and clarify the legal framework and basic conditions to speed up permitting procedures for electricity grids, connections and power plants.
- Carefully monitor the consequences of the split of the German-Austrian market zone on market functioning and consumer prices. Take actions to improve wholesale market functioning and security of supply after the split of the German-Austrian market zone.
- When drafting the Renewable Deployment Act, consider improving the economic conditions under which existing and new hydro plants are permitted.
- Investigate and address the challenges stemming from integrating higher shares of variable renewables.
- Ensure all consumers benefit from competitive prices and harness cost-saving potential in procurement of electricity.

⁴ A law governing a specific subject matter.

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4. Natural gas

Key data

(2018)

Domestic production: 1.0 bcm (0.9 Mtoe), -32% since 2008

Net imports: 7.8 bcm (13.1 bcm imports, 5.2 bcm exports)

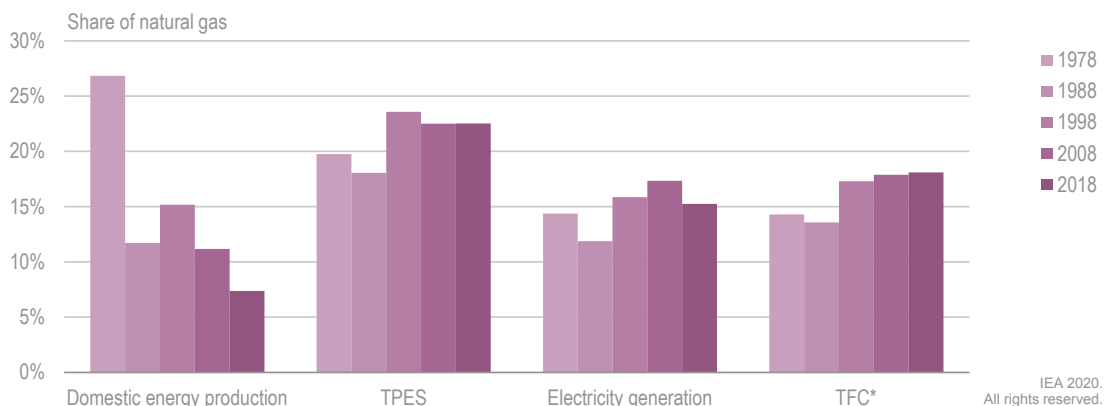
Share of gas: 22.5% of TPES, 15.3% of electricity generation, 18.1% of TFC

Gas consumption by sector: 8.9 bcm (power and heat generation 29.5%, industry 41.1%, residential 18.3%, service 4.5%, transport 3.7%, other energy 3.0%)

Overview

Natural gas is the second-largest energy source in Austria, accounting for 22% of total primary energy supply (TPES) and 18% of total final consumption (TFC) in 2018 (Figure 4.1). Natural gas is also the second-largest power source, accounting for 15% of total electricity generation.

Figure 4.1 Share of natural gas in Austria's energy system, 1978-2018



The share of natural gas in TPES has decreased while the share of natural gas in TFC has increased over the decades.

Notes: TPES: total primary energy supply; TFC: total final consumption.

Source: IEA (2020a), "World energy balances", *IEA World Energy Statistics and Balances* (database), www.iea.org/statistics.

Domestic natural gas production in Austria has declined over the past decade and most of the gas supply relies on imports. Diversifying imports and keeping access to gas storage are important for security of supply. Austria is a major transit route for European gas supply and its role as a trading hub, based on the large gas storage facilities at Baumgarten, has increased notably since 2011. Furthermore, gas will have an important role in Austria's energy transition and the country is seeking to integrate the gas and electricity sectors and to green the gas by replacing fossil gas with biomethane and hydrogen.

Supply and demand

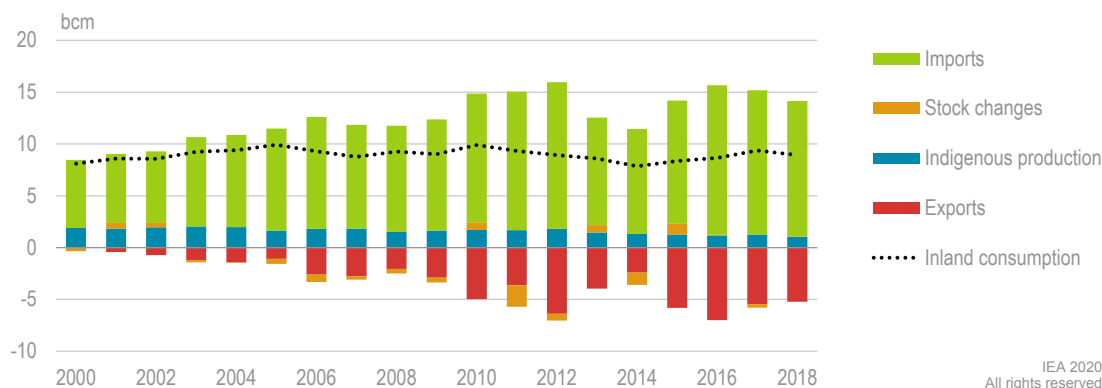
Production

Domestic natural gas production increased between 2008 and 2012, reaching a peak of 1.8 billion cubic metres (bcm) in 2012. Since then, production has declined to 1.0 bcm in 2018, the lowest in ten years. Remaining proven reserves are 8-9 bcm. Production is expected to continuously decline until reserves are exhausted by 2040.

Domestic production accounted for 12% of the total gas supply in 2018 and imports covered the rest, mostly Russian gas. Since 2013, Austria's mandatory data reporting to the International Energy Agency does not include any information on imports and exports by country of origin or country of destination. This was already pointed out in the last in-depth review in 2014. The current report echoes the earlier suggestion to resume gas data reporting by country.

For the last year for which country data were reported, the Russian Federation accounted for 63% of total imported gas. For the past decade, total net imports have fluctuated between 6.0 bcm and 10 bcm. Net imports, however, have continued to increase since 2015, with a slight decline to 7.8 bcm in 2018.

Figure 4.2 Overview of Austria's total supply of natural gas, 2000-18



Domestic natural gas production decreased from 1.8 bcm in 2012 to 1.0 bcm in 2018, while net imports, mostly from Russia and Norway, fluctuated between 6.0 bcm and 9.0 bcm.

Note: bcm: billion cubic metres.

Source: IEA (2020b), "World energy statistics", *IEA World Energy Statistics and Balances* (database), www.iea.org/statistics.

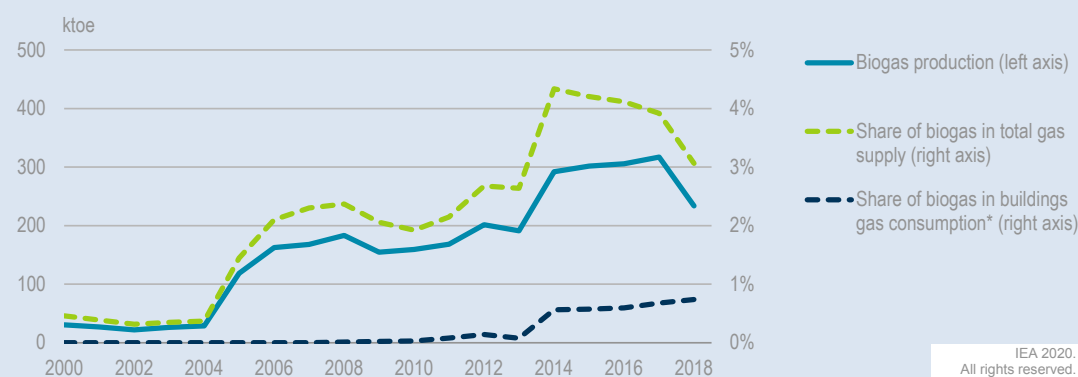
Austria also produces biogas, which accounts for around 3% of total gas supply (Box 4.1).

Box 4.1 Biogas in Austria

Austria produced 234 kilotonnes of oil equivalent (ktoe) (around 0.26 bcm in biomethane quality) biogas in 2018, equal to 3.1% of total gas supply (natural gas + biogas). Biogas production increased tenfold in a decade, from 29 ktoe in 2004 to 291 ktoe in 2014. However, since a peak at just over 300 ktoe in 2016, production declined in 2017-18 (Figure 4.3).

Around 80% of the produced biogas is used in energy transformation, mainly in power plants. In 2018, biogas power generation was 628 gigawatt hours (GWh), equal to 1.0% of total electricity generation in Austria. The remaining 20% of the biogas is used in final energy consumption, mostly in the industry sector. Less than 5% of the biogas is upgraded to biomethane and supplied to buildings (residential and services), and biogas accounted for only 0.7% of total gas consumption in buildings in 2017.

Figure 4.3 Biogas production and share of total gas supply, Austria, 2000-18



* Share of biogas in total gas consumption (biogas + natural gas) in the residential sector and the commercial and public services sector.

Note: ktoe: kilotonnes of oil equivalent.

Source: IEA (2020a), "World energy balances", *IEA World Energy Statistics and Balances* (database), www.iea.org/statistics.

Consumption

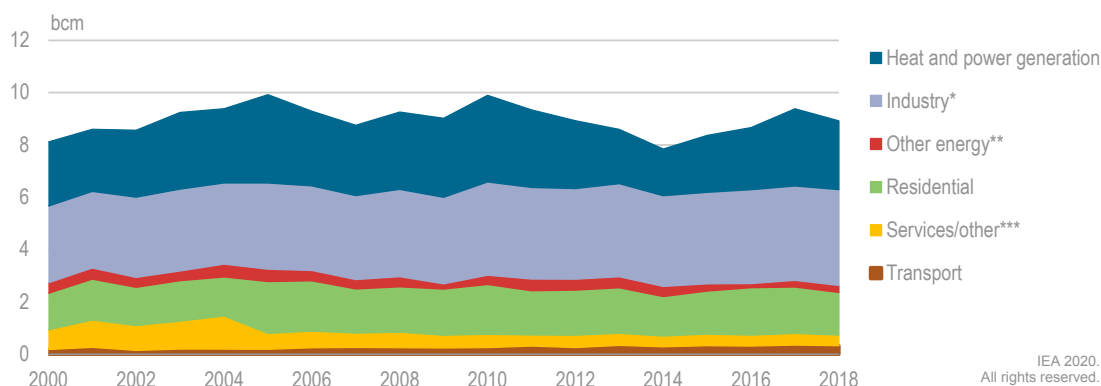
Natural gas consumption in Austria peaked at 9.9 bcm in 2010, but decreased to 7.8 bcm in 2014, its lowest level in the last decade. Gas consumption then began to increase again to reach 8.9 bcm in 2018, which was a 14% increase from 2014 (Figure 4.4).

The power and heat generation sector, which accounts for the second-largest gas demand in Austria, has contributed the most to the fluctuation in gas consumption over the last decade, as it is highly dependent on winter temperatures (for heating demand) and reactive to lower water levels in dry years that impact hydro generation. After a peak of 3.3 bcm in 2010, gas consumption in power and heat generation was reduced by almost half in 2014. Since then, consumption has increased, reaching 2.6 bcm in 2018, which contributed to the rising total gas consumption.

Meanwhile, gas consumption in the industry sector has been relatively stable, between 3.5 bcm and 3.6 bcm since 2010, until it reached a peak of 3.7 bcm in 2018. It accounts for the largest gas consumption in Austria, with 41% of the total. The chemical industry is the largest sector, accounting for 24% of total industrial gas consumption, followed by 18% of paper and 14% of the iron and steel industry.

Gas consumption in the residential sector, the third-largest gas consumer, peaked at 1.9 bcm in 2010 and decreased to 1.5 bcm in 2014. Since then, gas consumption has increased, to 1.8 bcm in 2016 with a slight decrease to 1.6 bcm in 2018. The rest of the gas is consumed in commercial and services buildings (including agriculture and forestry) (5% of total consumption), transport (4%), and other energy, including oil and gas extraction and refineries (3%).

Figure 4.4 Natural gas consumption by sector, Austria, 2000-18



Natural gas consumption in heat and power generation has varied between 1.8 bcm and 3.0 bcm in the last decade, while the remaining demand has been more stable around 6 bcm.

* *Industry* includes chemicals and petrochemicals as well as non-energy use.

** *Other energy* includes oil and gas extraction, refineries, coal mining, and distribution losses.

*** *Services/other* includes public and commercial services, agriculture and fishing.

Note: bcm: billion cubic metres.

Source: IEA (2020b), "World energy statistics", *IEA World Energy Statistics and Balances* (database), www.iea.org/statistics.

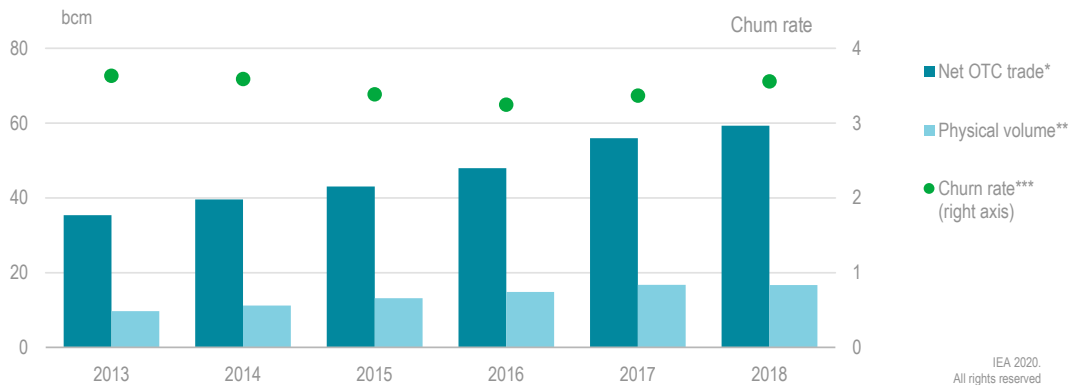
Market model and regulatory framework

Since 2013, Austria has been operating an entry-exit market model with a virtual trading point (VTP) in line with the EU directive and related regulation about the full liberalisation of the European gas market. The Central European Gas Hub (CEGH)¹ is majority owned by Austria's largest energy company, operates the VTP and provides a gas nomination platform for international gas companies. The CEGH, together with Powernext SAS, established the PEGAS CEGH Gas Exchange Services GmbH (PCG) in 2016, which supports the Austrian and Central and Eastern European gas markets.

¹ Annex A provides detailed information about institutions and organisations with responsibilities related to the energy sector.

Baumgarten is Austria's major gas entry point and trading hub. All gas flows, whether for transit or domestic consumption, must be traded at the VTP (EC, 2014). The CEGH is considered an advanced hub, and, with its strategic geographical location, is a reference market for central and parts of Eastern Europe and an important source of supply (ACER and CEER, 2019). Trading volumes at the PEGAS CEGH day-ahead market went up from 0.986 bcm in 2013 to 6.331 bcm in 2018. Over-the-counter trading (including all types of contracts) increased from 35 bcm in 2013 to almost 60 bcm in 2018.

Figure 4.5 Development of trade on the CEGH, 2013-18



Traded volumes over-the-counter on the CEGH almost doubled between 2013 and 2018, while the churn rate oscillated between three and four.

* Refers to volumes traded over-the-counter.

** Refers to the physical deliveries of the hub.

*** The churn rate is the ratio between the traded volumes and the physical deliveries of the hub. It effectively shows how many times a gas molecule has been traded. A churn rate of ten or above usually indicates a liquid hub.

Notes: bcm: billion cubic metres; OTC: over the counter. The numbers have been converted from TWh to bcm, using a conversion factor of 1 TWh = 0.09 bcm.

Source: CEGH (2019), *VTP Market Data*, <https://www.cegh.at/en/vtp-market/vtp-market-data>.

While traded volumes grew considerably on the CEGH, the churn rate remained relatively stable, oscillating between three and four, well below ten, which usually indicates a liquid, mature gas hub. That said, the CEGH is the most-developed gas hub in Central and Eastern Europe. It has greatly improved its score in the European Federation of Energy Traders' Gas Hub Assessments, from 13 points out of 20 in 2014 to 17 out of 20 in 2019 (against an average of 9 in the rest of the region) (EFET, 2019). Further improving the liquidity of the hub and benefiting from Austria's central location in the European gas system could help to establish the CEGH as a regional price benchmark.

To support the implementation of the new gas market model and in order to comply with EU legislation (Directive 2009/73/EC and Regulation [EC] No. 715/2009), several gas network codes have also entered into force since 2013:

- capacity allocation mechanism (November 2013) and its amendment for incremental capacity (April 2017)
- gas balancing of transmission networks (April 2014)
- interoperability and data exchange rules (May 2015)
- harmonised transmission tariff structures (April 2017).

Also in 2017, implementation was completed of the EU regulation (2017/1938) concerning measures to safeguard security of gas supply and new solidarity obligations among EU member countries.

In the new balancing regime introduced on 1 January 2013, Austria expanded the existing balance group system to include the transmissions system. Until then, the balance group model only applied to the distribution level and included suppliers, traders and final consumers. The Austrian model is not fully aligned with Commission Regulation (EU) No. 312/201, as the balancing rules limit the commercial freedom of network users and the separate balancing requirements for the transmission and distribution system creates risks for fragmentation (ACER, 2016).

Market players have been critical of the contractual and operational challenges of the new gas market model, which involves a multitude of system agents and is in effect operating a two-tier balancing mechanism. In addition to the transmission system operators (TSO) and distribution system operators (DSOs), the new model also allocates responsibilities to the distribution area manager, the market area manager, the clearing and settlement agency, and the CEGH. *Ex ante* balancing is undertaken by the market area manager, with mandatory exchange trading, and co-exists with *ex post* balancing, which is handled by the clearing and settlement agent (E-Control, 2019a).

This results in additional layers of administrative burden and costs for market participants. The model is also not fully aligned with Austria's Natural Gas Act of 2011, which requires harmonising balancing rules at the transmission and distribution level (E-Control, 2019a).

On 1 June 2017, the Austrian Gas Grid Management AG (AGGM) assumed responsibilities as Austria's market and distribution area manager following approval by E-Control, the energy market regulator. In this first step towards a more commercially efficient and leaner institutional market set-up, the AGGM is now also undertaking, in addition to its existing role as distribution area manager, the tasks previously assigned to the market area managers (E-Control, 2019a).

E-Control is in the process of redesigning the Austrian gas balancing system. The major objective is the establishment of an integrated and central balancing system at transmission and distribution level to reduce current institutional, contractual and operational complexity. A single entity will be in charge of *ex ante* and *ex post* balancing in the future market model. With a view to exploit additional synergies, the AGGM's functions as market area manager and distribution area manager will be merged into a single market area and distribution area manager for all Austrian market areas. The mandatory gas exchange trading for market participants will become optional.

The new integrated gas-balancing framework will be implemented through a new gas market model ordinance to be issued in 2020 and to become effective on 1 October 2021. The procedure to nominate the new single clearing entity will be completed in mid-2020 to allow it take up duties on 1 October 2021 (E-Control, 2019a).

Austria does not have a single countrywide gas grid, but three distinct regional systems. Only the eastern part of the country forms part of the interconnected pipeline network. The western provinces of Vorarlberg and Tirol are not connected to the national pipeline system, or with each other, and are supplied exclusively from Germany. In effect, since October 2013, the provinces of Vorarlberg and Tirol form part of the market area Net

Connect Germany (EC, 2014). The AGGM carries out the responsibilities of distribution area manager for the two provinces.

The redesign of the Austrian gas-balancing framework is focused primarily on the eastern market area, which accounts for about 95% of Austria's gas consumption (E-Control, 2019a). However, the new single clearing entity will likely also be charged with clearing the market areas of Vorarlberg and Tirol. Supply for the two provinces will be transferred to the market area and distribution area manager at the German VTP (E-Control, 2019a). The remainder of this chapter focuses on the Austrian interconnected gas system in the eastern part of the country.

Greening the gas

Austria's climate and energy strategy, #mission2030, puts the country on a decarbonisation pathway to 2050 that includes a specific focus on greening the gas. Flagship Project 7 of #mission2030 on "Renewable Hydrogen and Biomethane" describes how sector coupling will facilitate greening the gas, by, for example, using biomethane from biogenic waste, and hydrogen and synthetic methane from renewable power sources (FMST and FMTIT, 2018). Austria's long-term vision is to provide for a renewable gas consumption on net balance in 2040, consisting of renewable, domestically produced gas (for more details see Chapter 9). Nevertheless, the decarbonisation of the national gas consumption has to be addressed in light of Austria's role as a European gas hub. This will also support the decarbonisation of energy-intensive industries. Reaching this target will require the continuous support of research, development and innovation in green gas technologies and hydrogen and for their applications and pilot projects.

Renewable gas and hydrogen will be injected into the gas grid instead of being used at production sites, as is currently the case for biogas. The government also plans to increasingly feed biomethane (upgraded biogas) directly into the gas system to improve the resilience of the entire system at the interface between electricity and gas (AGGM, 2019). However, legal and regulatory restrictions will need to be addressed that currently only allow a maximum of 4% hydrogen injection into the grid and no biomethane injection in underground storage facilities.

#mission2030 targets a 100% renewable electricity supply by 2030 (on national balance) (FMST and FMTIT, 2018). For this, Austria's extensive gas infrastructure can play an important role by offering the needed flexibility and storage facilities to allow the optimal integration of renewable energy into the electricity market. It will also help cushion fluctuations between the time of generation from variable renewable electricity and electricity consumption.

The implementation of Flagship Project 7 will result in new transport and storage requirements that need to be reflected in long-term co-ordinated network planning of the electricity and gas grid and the deployment of renewable energy sources, to ensure the energy system is considered holistically. Close co-operation between the federal, provincial and local authorities is required, as responsibilities are allocated among different levels of government in Austria (FMST and FMTIT, 2018).

To support the long-term co-ordinated planning, and within the context of the development of the National Hydrogen Strategy, the AGGM is developing a biogas map for Austria

showing potential production sites to facilitate their eventual connection to the gas grid. In addition, the AGGM in co-operation with the Austrian Power Grid AG, is also developing a “Power to Gas” (P2G) map for the development of the National Hydrogen Strategy, to identify the most suitable locations for the establishment of P2G plants for the production of green hydrogen. The mapping work includes analysing options for creating dedicated hydrogen storages to address flexibility requirements resulting from seasonal gas demand variability. The Renewable Deployment Act, which should be issued in 2020, will also address the issues of dedicated hydrogen storage.

A stable and enabling regulatory and legal framework is required to facilitate sector coupling and provide confidence to investors. As part of the Tax Reform Act 2020, the government revised the Natural Gas Tax Act to provide tax relief for hydrogen and biogas and to create more legal certainty for investors to unlock necessary investments (RIS, 2019).

Infrastructure

Gas pipelines

Austria’s importance as a European gas transit country is reflected in its high level of interconnection. It has seven interconnection points with neighbouring countries, four of which operate in the entry/exit mode (figure 4.6). In 2017, Austria’s gas transport system consisted of a total of 45 951 kilometres (km), of which 1 690 km formed the transmission grid and 44 300 km constitute the low-pressure distribution network (AGGM, 2019). Austria has added almost 7 700 km to its gas transport system since the last in-depth review in 2014.

Two major gas transit pipelines traverse the country. Both converge at Baumgarten, Austria’s transit hub at the border with the Slovak Republic that allows east-west gas flows from Central Europe. The Trans Austria Gas (TAG) pipeline system consists of three connected pipelines, each with a length of 380 km connecting Baumgarten at the border with the Slovak Republic to southern Austria, close to the Italian border. The entire TAG pipeline system also includes five compressor stations for a total of around 480 megawatts (MW) of installed power, auxiliary equipment, and two physical entry, and one exit, points; and it supplies the Austrian market through 10 physical exit points. The TAG system can be operated both in direct and reverse flow. TAG GmbH, which owns the TAG pipeline system, is a joint venture of Italian Snam S.p.A. (84.47%) and Gas Connect Austria GmbH (15.53%) (AGGM, 2019).

The West Austria Gas pipeline (WAG) runs 245 km from Baumgarten through Lower Austria and Upper Austria to Oberkappel at the border with Germany and supplies France, Germany and Central Europe. Approximately 140 km of the WAG is enhanced by a parallel pipeline. The WAG pipeline system is bi-directional. It is owned by Gas Connect Austria GmbH, which is owned by a joint venture between OMV GmbH (51%) and AS Gasinfrastructure (49%). AS Gasinfrastructure, in turn, is owned 50% by Allianz Group of Germany and 40% by Italian Snam S.p.A. (AGGM, 2019).

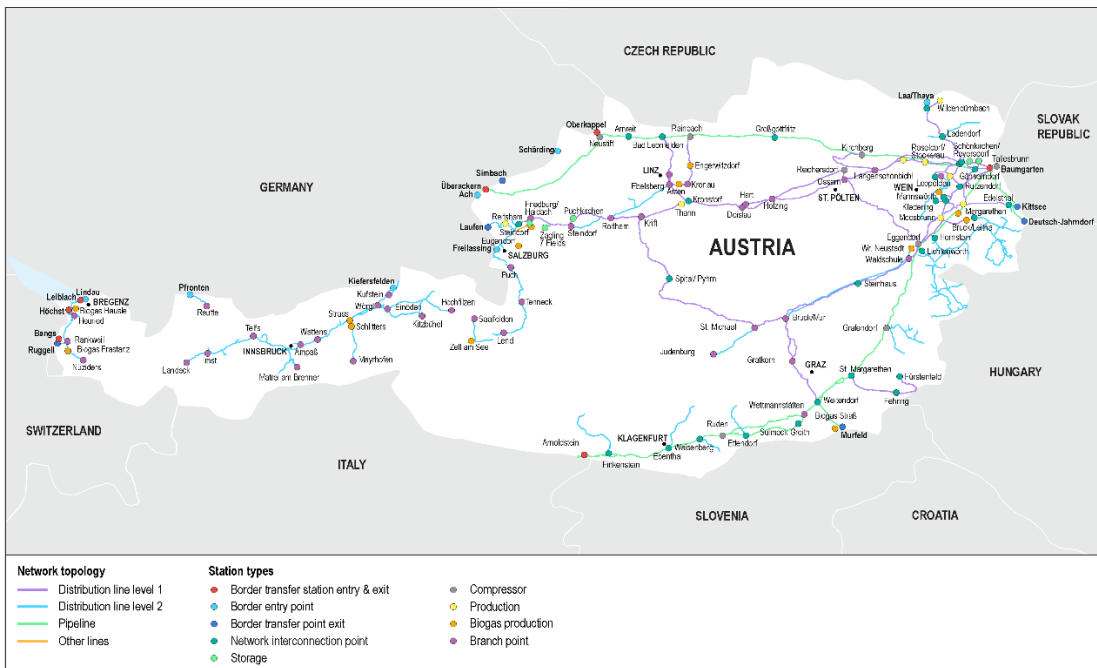
In addition to the two transit pipeline systems, five additional pipelines constitute the Austrian gas transition system. All are owned by Gas Connect Austria:

- the South-East-Line pipeline system runs 26 km long and connects with the TAG pipeline and allows gas transit to Slovenia and onward to Croatia
- the Penta West pipeline connects to the WAG pipeline at Oberkappel and runs 95 km across Upper Austria to the German border and supplies France, Germany and Central Europe
- the Hungary-Austria pipeline runs 45 km and supplies gas to Hungary
- the Kittsee-Petrzalka pipeline runs 4 km to supply the Slovak Republic
- the Primary Distribution System covers a total of 330 km and supplies the Vienna and Lower Austria regions.

Gas Connect Austria's entire transmission system has seven physical entry and nine physical exit points and five compressor stations for a total capacity of 146 MW. End consumers in Austria are supplied either by the distribution system or by the transit pipelines (AGGM, 2019).

The TAG system connects at various points with Gas Connect Austria's system in Baumgarten. This facilitates the allocation of transmission capacities at the Austrian entry/exit points and offers a high grade of flexibility between the two companies.

Figure 4.6 Natural gas infrastructure in Austria



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.

Network development plan

In line with the EU's Third Internal Energy Market Package, the AGGM's responsibilities include the preparation of the annual co-ordinated network development plan (CNDP). The 2019 plan covers the period 2020-29. It does not include the provinces of Tirol and

Vorarlberg, as these two are not part of Austria's integrated gas infrastructure system. Gas Connect Austria and TAG GmbH submit their respective company-specific network development plans to the market area manager. E-Control approves the CNDP (AGGM, 2019).

The key objectives of the CNDP are to meet the demand for capacities to supply consumers while considering emergency scenarios, ensuring the security of supply of the infrastructure, meeting transport needs and complying with the obligation to meet the infrastructure standard in the market area (AGGM, 2019). The emphasis of the CNDP is on creating additional bi-directional flows at Austria's major interconnection points. The creation of bi-directional capacity at the interconnection point with Slovenia at Murfeld is also included in the fourth list of the European Union's projects of common interest (PCI). The connection of the pipeline system between Austria and the Czech Republic to create a new bi-directional Austria-Czech Interconnection is on the fourth PCI list and has been in the CNDP since 2016 (AGGP, 2019).

Austria, through OMV, is also supporting the Nord Stream 2 import pipelines from the Russian Federation to Germany that will transport gas onward east and south and which could eventually reach Austria via Baumgarten and, if built, via the bi-directional Austria-Czech Interconnection. This would maintain Austria's role as a key gas transit corridor and strengthen security of supply in Austria and its neighbouring countries.

Gas storage

Gas storage capacity has increased by 28% since the last in-depth review. Gas demand in Austria is highly seasonal and during the winter, when heating demand spikes, and/or during dry years when hydro generation is impacted, can be up to three times higher than in the summer. Gas demand during the heating period is met through withdrawal from gas storages that consist of partially depleted natural gas reservoirs. Gas storage therefore has a major role in ensuring security of supply and the country's storage capacities, at 8.4 bcm, are the sixth-largest domestic facilities in Europe (AGGP, 2019). Austria's gas storage has helped to cope with supply disruptions at Baumgarten, which have occurred several times over the last ten years without any impact felt by consumers. Suppliers of the domestic market in Austria dominate the demand for storage capacity, but international wholesalers and traders active in the CEGH are also booking capacity (E-Control, 2019b).

In 2018, five commercial gas storage operators were active in Austria. The total working gas volume of their seven storage facilities was 92 TWh (or 8.4 bcm) (AGGM, 2019). Austria's gas storage market is highly competitive. OMV closed its Thann storage facility in 2017 due to economic reasons, which reduced the working gas volume of its total facilities to 25.2 TWh. It is worth noting that the Haidach facility is not directly connected to the Austrian market, but is filled through the German gas network and mainly serves the German market. However, the gas also reaches the Austrian market via Germany, appearing as an import. The 61.8 TWh storage capacities that are directly connected to the market area East account for over 60% of total annual domestic consumption (E-Control, 2019c).

Third-party access to storage is provided on a negotiated basis. Storage operators have observed a declining interest in booking firm storage capacities ahead of the winter season as the gas market becomes more liquid and offers flexible products in direct competition with storage capacity. In addition, decreasing summer-winter spreads in Europe are also reducing the attractiveness of long-term capacity bookings. A trend to booking short-term

capacity has also been observed, as it is cheaper than booking capacity long term and hence is of value to traders who use storage for the arbitrage of day-ahead trading for example (E-Control, 2019c).

This has started to impact on the financial position of the storage operators and can potentially reduce their incentive to invest in maintaining and expanding capacity as the longer-term commercial viability of the storage business becomes doubtful in the changing market.

Yet, Austria's extensive gas storage capacity is potentially one of the key enablers of future sector coupling between the power and the natural gas markets. The gas storage capacity is 30 times more than the combined capacity of all pumped storage hydropower plants. The storage infrastructure therefore has a high systems value to support the energy transition. It would facilitate the rollout of future technologies, such as hydrogen and sector coupling through P2G.

Table 4.1. Gas storage companies and storage capacity in Austria

Company	Input capacity (MWh/h)	Share in total input capacity	Output capacity (MWh/h)	Share in total output capacity	Working gas volume (TWh)	Share of total working gas volume (MWh)
OMV gas storage	8 758	25.2%	12 656	28.9%	25.2	27.4%
RAG energy storage	8 026	23.1%	8 362	19.2%	17.1	18.6%
Uniper energy storage	6 742	19.4%	10 112	23.2%	19.4	21.1%
Total market Region East	23 526		31 130		61.8	
Astora Haidach	3 757	10.8%	4 358	9.7%	10.4	11.3%
GSA Haidach	7 384	21.3%	8 258	18.9%	20.0	21.7%
Total Austria	34 666	100.0%	45 745	100.0%	92.2	100.0%

Notes: MWh/h: megawatt hour per hour; TWh: terawatt hour.

Source: E-Control (2019c), *Bericht über die Situation am österreichischen Flexibilitäts- und Speichermarkt gemäß § 98 Abs. 2 GWG 2011*, https://www.e-control.at/documents/1785851/1811582/Speicherbericht_2019_03_21_final.pdf/0903c64d-cc6b-2c1a-2400-197c83ea7a18?t=1553511761516.

Industry structure

Two companies produce natural gas in Austria: OMV Exploration & Production GmbH, which is 31.5% owned by the government, and RAG Exploration and Production GmbH, which has been a 100% subsidiary of RAG Austria AG since 2018. The market share of both companies is roughly the same; in 2017, OMV's share was just under 53%.

TAG GmbH and Gas Connect Austria are the two certified independent TSOs. Gas Connect Austria's first certification as an independent TSO of 2012 was expanded in July 2014 to include the operation of the WAG pipeline (EC, 2014). A total of 20 DSOs are active in the country.

Supply and trading

The introduction of the new market model has noticeably increased competition in the Austrian gas market. The reduced congestion in the transmission system following the implementation of the network code on the allocation of capacity and the congestion management procedures has facilitated the entry of new market players.

Austria is an important gas transit country located in the centre of the European gas market. Its Baumgarten facility is one of Europe's most important gas import hubs. Annual gas transit is almost five times Austria's domestic consumption. In 2017 and 2018, over 80% of all physical gas imports were re-exported (E-Control, 2018).

Trading at the CEGH's VTP has increased by 68% since it became operational in 2013. Traded volume increased by 5% in 2018 compared to 2017, to reach 659 TWh (59.3 bcm), which was traded by 124 virtual traders from 24 countries. In total, 238 members were registered with the CEGH in 2018. The traded volume compares to a domestic consumption of 9.4 bcm in the same year (E-Control, 2019b). Spot prices are largely aligned with the Dutch Title Transfer Facility hub, with spreads averaging below transmission costs. This is partly due to the existence of long-term transit contracts, which shippers consider as sunk costs. Hence, this might change once the long-term contracts expire.

The number of suppliers serving Austria's domestic market is also continuously increasing. In 2018, 52 suppliers were active in Austria's domestic market, 10 more than in 2017 (CEER, 2019).

Before the introduction of the new market model, Austria's wholesale gas market was highly concentrated, with a Herfindahl-Hirschmann Index² (HHI) of 3 371 in 2011 (EC, 2014). Since the introduction of the entry-exit model with the VTP, the number of traders and suppliers has been continuously increasing. The HHI was just above 1 100 in 2018 (CEER, 2019).

There is, however, still scope to increase the competitiveness of the Austrian gas market. As discussed above, the double-tier balancing rules and the requirement for system contracts with the independent TSOs create additional administrative barriers and increase the cost of potential new market entrants. In addition, improvements to the data interfaces and integration of processes to facilitate switching of clients would further reduce the barriers for new market entrants.

E-Control is aware of these barriers, and in addition to the process of reforming the gas balancing code, it is also offering advisory services to prospective new market entrants, including a dedicated help desk.

Retail market

Competition in Austria's household retail market is slowly but steadily increasing, with the number of suppliers reaching 47 in 2018, up from 40 in 2017 (E-Control, 2019c; 2018). The variety of products is also increasing, and some suppliers are offering special green options with different shares of biogas, some even up to 100% (E-Control, 2019b.).

² The HHI is used to assess the level of competitiveness in a market. It is calculated as the sum of the market squares of all firms in the market. An HHI above 2 000 signifies a highly concentrated market with a small number of firms.

Austria's retail market remains highly concentrated. The HHI for all of Austria fell under 4 000 in 2017 and was 3 600 in 2018. However, not all suppliers are active nationwide, as the Austrian retail gas market is organised in distinct geographical areas that roughly equal the distribution grids and hence, competition is less dynamic than indicated by the countrywide HHI. In 2018, one-third of the suppliers were only active in their traditional geographical area (CEER, 2018; E-Control, 2019b). Around 1.2 million out of 3.8 million households are connected to the gas grid and this number is unlikely to increase in the future, as economically viable regions already have access to the grid.

The HHI therefore varies strongly between Austria's three gas market areas between 5 000 and 9 000 across various distribution networks. However, while the market region east has the largest number of suppliers, the provinces of Tirol and Vorarlberg are also witnessing an increasing number of suppliers. In 2017, 19 suppliers with 47 different contract variations were active in Tirol, compared to just 2 in 2012 before full market opening (E-Control, 2018). Generally, competition at the retail level is impacted by the fact that DSO unbundling was not undertaken at the ownership level. Consumers struggle to distinguish between "their" traditional local distribution company and the affiliated supply company, as names, logos and colours remained the same.

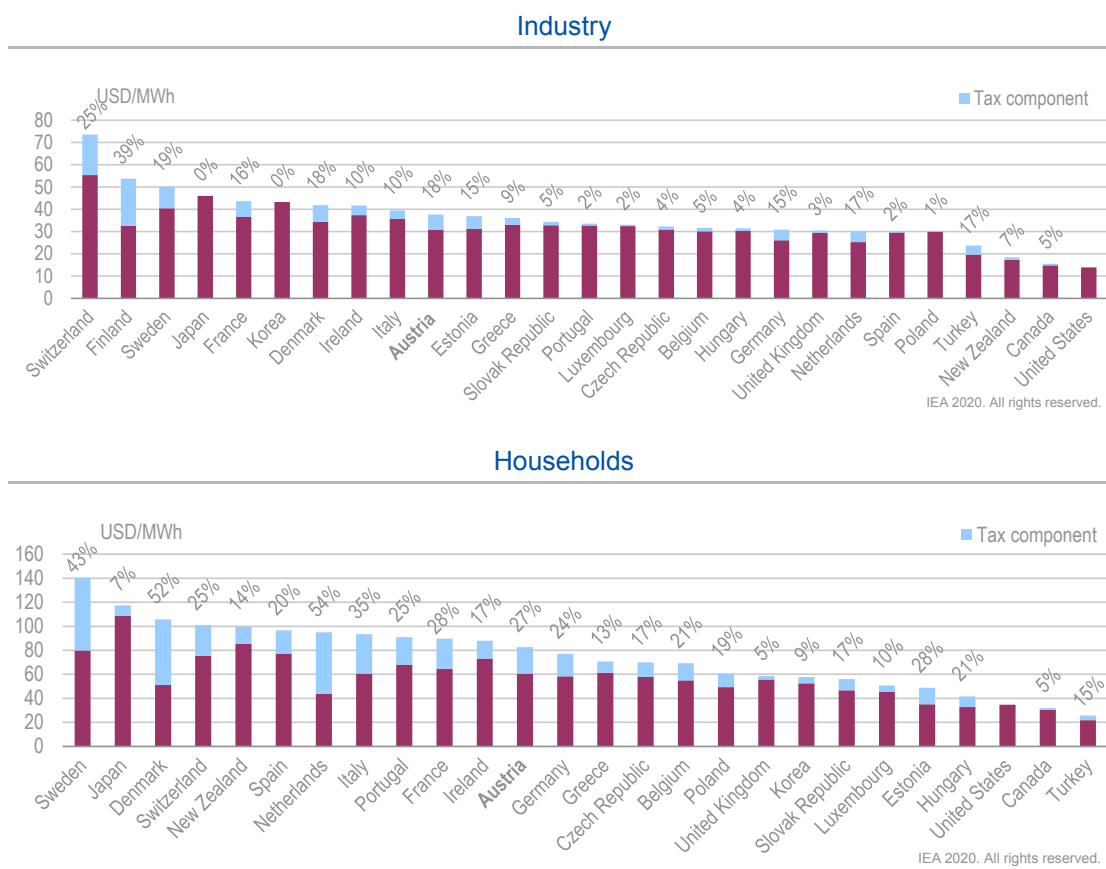
Another measure for assessing competition is the switching rate at the retail level, which has gradually increased and reached a new all-time high in 2018. In 2018, 6.1% of all retail gas customers changed supplier, up from 5.1% in 2017. The province of Vienna accounts for almost half of the households that switched supplier (E-Control, 2019c; 2018). The growing switching rate demonstrates not only the increased competition between suppliers and their offers, but also that the simplified switching procedures do entice consumers to become proactive (E-Control, 2019c).

Prices

Austria does not regulate gas prices. Small consumers below 400 MWh annual consumption are subject to published retail prices while consumers above that threshold can negotiate prices and conditions. Network charges for transmission and distribution grids are set by the national regulatory authority for energy, E-Control.

Retail gas prices in Austria are slightly above the median value among IEA member countries, with relatively high tax rates. In 2018, gas prices for industry were 33.9 USD/MWh, the tenth highest among IEA member countries. Taxes accounted for 18% of the total industry price (Figure 4.7). The household price was 80.5 USD/MWh, the 12th highest in an IEA comparison, with a tax rate at 27%. Compared to neighbouring countries, Austria's gas prices are below those in Italy and Switzerland, but above those in Germany, the Czech Republic, the Slovak Republic, and Hungary.

Figure 4.7 Natural gas prices in IEA member countries, 2018



Austria's natural gas prices are slightly above the IEA median, ranking tenth-highest among IEA member countries for industry and 12th highest for households in 2018.

Notes: Tax information not available for the United States. Industry price data not available for Australia and Mexico and household price data not available for Australia, Finland and Mexico.

Source: IEA (2019), *Energy Prices and Taxes 2019* (database), www.iea.org/statistics.

Security of supply

Austria maintains a high security of supply standard for gas. According to the infrastructure standard (N-1), Austria's gas market can meet a very high demand, even in the case of an outage of the largest infrastructure facility, in this case Baumgarten. The result of the N-1 formula in 2019 is 132%, indicating a good security of supply and meeting the requirement according to Regulation (EU) No. 2017/1938 (AGGM, 2019). The Haidach storage facility, which is not directly connected to the Austrian market area, was excluded from the calculation. Maintaining high security of supply is not only important for the domestic market, but in light of Austria's essential role as an important hub for the European gas market, contributes to ensuring security of supply in neighbouring countries as well.

Emergency response policy

The Austrian Energy Intervention Act 2012 foresees the creation of a system of measures to maintain the supply of energy in the event of a crisis, and to comply with Austria's

obligations under international law to introduce emergency measures. The act covers solid and liquid energy sources, electricity, and natural gas.

The risk assessment for natural gas and the creation of a preventive action plan and emergency plan are carried out under the leadership of the Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK in its German acronym), in close co-operation with E-Control and the AGGM. The BMK is charged with the implementation of the recent EU Security of Gas Supply Regulation 2017/1938 that became effective on 1 November 2017. The emergency plan contains crisis levels in line with the EU regulation (early-warning level, alert level and emergency level), a description of the relationships between actors (including information flow, e.g. alert chains), the allocation of tasks and roadmaps in critical supply situations or during a crisis, and energy intervention measures. The publicly available preventive action plan includes the results of the risk assessment, the results of the calculation of the infrastructure standard, and the assessment of compliance with the supply standard and with the requirements placed on natural gas companies.

The BMK is in the process of revising the preventive action plan and the emergency plan, and may include a broader definition of protected customers, which currently only comprise households. However, no formal decision has yet been taken. Under guidance from the BMK, the AGGM is updating the existing definitions of market-based and non-market-based emergency measures (E-Control, 2019b).

Industry expressed concern that the new EU regulations for security of supply are not stringently followed by all countries with reverse flow capacity and at all interconnection points. This is seen as creating an uneven playing field. The AGGM is also developing solidarity measures that include bilateral agreements between member states.

Emergency response measures

There are no storage obligations on gas suppliers under Austrian law. No public information is available about the possible contribution from demand-side measures during an emergency situation. The government does not have information about the number of interruptible gas consumers, nor about the potential for fuel switching or any other demand-restraint measures.

Assessment

Natural gas accounts for a substantial share of the Austrian energy mix, with 18% of TFC in 2018; total consumption was around 9 bcm. Demand for natural gas has been relatively stable since 2010, and is expected to remain at comparable levels until 2050. In 2018, the industrial sector was the largest user, with 41% of total gas consumption, followed by heat and power generation, and the residential sector. Gas plays only a moderate role in the power sector, while over 39% of district heating was fired by natural gas.

Domestic production covered around 12% of total demand. Production is expected to phase out around 2040. The majority of natural gas consumed in Austria has to be imported, mostly from Russia. Biogas production has increased, to 270 mcm in 2018, most of which is used on-site for electricity generation. Austria followed up on the IEA's 2014 recommendation to investigate the shale gas potential by launching a study, which is expected to be completed in 2020.

Due to its location, Austria is an important transit route for gas both from Russia and from northern Europe towards countries in the east and south of Europe. Transit flows have increased significantly since 2013 and in 2018 were over five times the domestic gas consumption. The role of Austria as a trading hub has increased, but it could be increased further, not only by changing the balancing system but also by improving transparency and the provision of a larger variety of long-term products.

Concentration on the wholesale market has decreased significantly, though there is still scope for further competition. Wholesale and retail gas markets in Austria are fully liberalised in accordance with EU energy law. Competition is less developed in the retail market despite the recent increase of market entries. In 2017, only about one in five households were being supplied by suppliers other than the incumbent. Retail prices for households have increased by 14% since 2008, while industry prices have fallen by the same percentage.

The Austrian gas network is operated by 2 TSOs, unbundled in accordance with the independent TSO model, and 20 distribution operators. Customers in Tirol and Vorarlberg are supplied exclusively via Germany and are not connected to the rest of the Austrian system, or with each other.

Austria currently uses a two-tier balancing regime involving *ex ante* and *ex post* balancing, with separate balancing obligations for the transmission and distribution systems. The model, which was introduced in 2013, is not fully aligned with the EU network code on gas balancing adopted in 2014. The separate balancing zones create an additional administrative burden, which presents a potential barrier for retail market entry. E-Control is currently preparing a consultation on a new integrated balancing regime that will become effective in October 2021.

The Austrian gas market benefits from the presence of several underground gas storage facilities, with a total capacity of 8.4 bcm (including Haidach), roughly equivalent to annual demand. These storage facilities are operated by five different companies under market conditions with negotiated third-party access. There are no storage obligations on gas suppliers under Austrian law. Maximum storage levels in summer have fluctuated between 3.9 bcm and 5.6 bcm in recent years (excluding the Haidach facility, which is only connected to Germany). However, low summer-winter price spreads on the Austrian and European market over extended periods may be a disincentive for storage use.

Storage plays a crucial role in providing security of supply during cold winter days. In the event that the main import route via the Slovak Republic is interrupted (as was the case during the gas crisis in 2009), reverse flow from Italy provides another potential emergency source, which could increase in importance after the completion of the Southern Gas Corridor (Trans-Adriatic Pipeline). A number of ongoing PCI projects aim at establishing a new route from the Czech Republic (linking to liquid hubs in the north of Europe), and further reverse flow connections from Slovenia (linking to the Krk LNG terminal in Croatia) and Hungary (linking to potential new gas fields in the Black Sea). New EU legislation requires Austria to co-operate with other countries in regional groups to assess common supply risks and to develop and agree on joint preventive and emergency measures. In August 2019, Austria submitted the updated preventive action and emergency plans that are required under the revised EU Regulation on security of gas supply.

Austria's long-term energy and climate strategy, #mission2030, envisages a gradual substitution of fossil gas with biomethane and hydrogen ("greening the gas"), and

continued utilisation of existing gas grids and storage through sector-coupling technologies such as P2G. The new government has set a target to substitute 5 TWh of fossil gas by 2030. #mission2030 does not envisage any specific adaptations to the regulatory framework nor specific financial support for relevant technologies. Currently, the injection of biomethane and/or hydrogen into the gas grid and gas storages appears to be limited by regulatory and technical restrictions. To address this gap, the government has been working on a national hydrogen strategy since March 2019 in close co-operation with industry, research, environmental stakeholders and the public. The strategy, which will be published in 2020, also addresses biomethane. The IEA commends Austria for this initiative.

The Austrian gas industry welcomes the “greening the gas” initiative, as it offers new business opportunities in a stagnant gas market and secures the relevance of the existing gas infrastructure. However, for the gas infrastructure to play its role in Austria’s energy transition and to allow investments in new technologies, a supportive legal and regulatory framework is required. The IEA commends the Austrian government for addressing these issues in the Renewable Deployment Act that will become effective in 2020.

There is also the question of how to ensure the financial viability of the existing gas infrastructure in the transition period until biomethane and hydrogen are ready to penetrate the market. The IEA supports the proposal by E-Control to undertake a detailed analysis of the system value of storage, and how to ensure that sufficient capacity is maintained for the anticipated future sector coupling and the shift to renewable energy sources. Close co-operation between the government; gas sector actors; and the research, development and innovation community (RDI) to accompany innovative technology solutions towards market penetration is desirable. Similarly, it will be important to ensure sufficient funding for RDI in green gas technologies.

Energy data gathering is well organised in Austria, and data submissions to the IEA are timely and of good quality. There is one exception, however: data for annual trade in natural gas are not reported by country of origin or country of destination.

Recommendations

The government of Austria should:

- Foster the integration of the gas and electricity sectors by:
 - > adapting the regulatory framework where needed to facilitate the use of renewable gases
 - > requiring cross-sector network planning
 - > providing financial support for research and development on scaling up relevant technologies such as biogas production and power-to-gas.
- Reduce reliance on any single source or route of gas imports by encouraging domestic production of renewable and natural gas, and by establishing bidirectional interconnections and, *inter alia*, interconnections to new external sources.

- Ensure the continued availability of gas storage facilities, reflecting the positive externalities for security of supply and their potential as a future means of storing low-carbon energy.
- Simplify the current gas-balancing regime in order to facilitate market entry and ensure compliance with Commission Regulation (EU) No. 312/2014.
- Improve data gathering for the mandatory reporting of natural gas trade to the IEA, broken down by country.

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5. Oil

Key data

(2018)

Domestic oil* production: 14.2 thousand barrels per day (kb/d), -30% since 2008

Net imports of crude oil: 168 kb/d, +6% since 2008

Domestic oil products production: 202.5 kb/d

Net imports of oil products: 76 kb/d, -12% since 2008

Share of oil: 35.6% of TPES, 1.1% electricity generation, 39.9% of TFC

Oil consumption by sector : 11.7 Mtoe** (transport 67.6%, industry 15.4%, residential 8.0%, services 3.5%, commercial 3.3%, power generation 2.9%, other energy 2.6%)

* Includes conventional crude oil, natural gas liquids (NGLs) and non-conventional oils.

** Consumption by sector data are presented in energy units (Mtoe) for comparisons over different fuels and sectors.

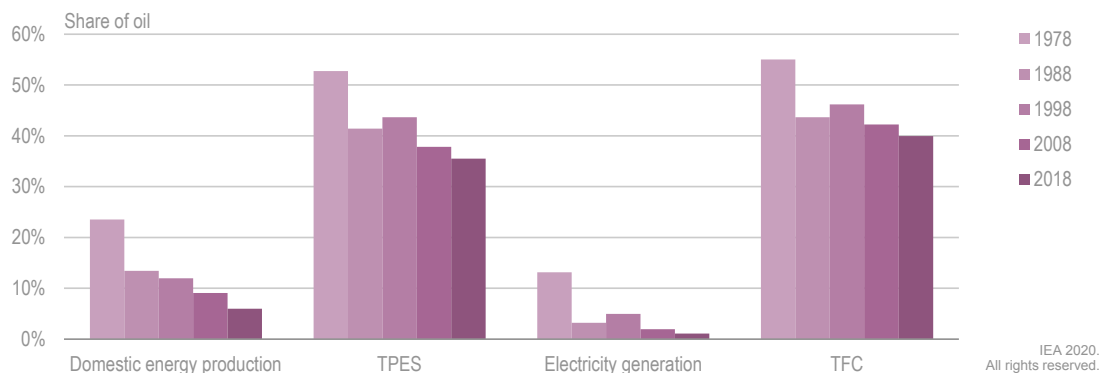
Overview

Oil remains the single largest energy source in Austria. It accounted for close to 40% of both the total primary energy supply (TPES) and total final consumption (TFC) in 2018 (Figure 5.1). Total oil consumption has been stagnant over the last decade, but with shifts between sectors.

In 2018, only about 8% of oil was produced domestically; the remainder was imported. Despite ongoing efforts on exploration and production, no major discoveries have been made in the last decades, and the existing fields are in continuous decline. Austria has one refinery, Schwechat, which can cover all domestic demand for refined oil products except for transport fuels. Transport is the largest oil-consuming sector, accounting for around two-thirds of total oil consumption.

There has been no major change to the structure of the oil market or oil sector policies since the last in-depth review in 2014. To improve the diversification of supply routes and sources to enhance security of supply, Austria has long promoted the construction of a new crude pipeline connecting the Schwechat refinery to Bratislava in the Slovak Republic, but no progress has been made. Plans to decarbonise the transport and heating sectors would be reducing future oil demand and counteracting increasing demand for transport and housing in line with continuous population and economic growth.

Figure 5.1 Share of oil in energy production, TPES, electricity and TFC, Austria, 1978-2018



The share of oil in Austria's energy mix has been declining over the last decades, but it remains the largest energy source, accounting for around 40% of TPES and TFC.

Notes: TPES: total primary energy supply; TFC: total final consumption.

Source: IEA (2020), "World energy balances", *IEA World Energy Statistics and Balances* (database), www.iea.org/statistics.

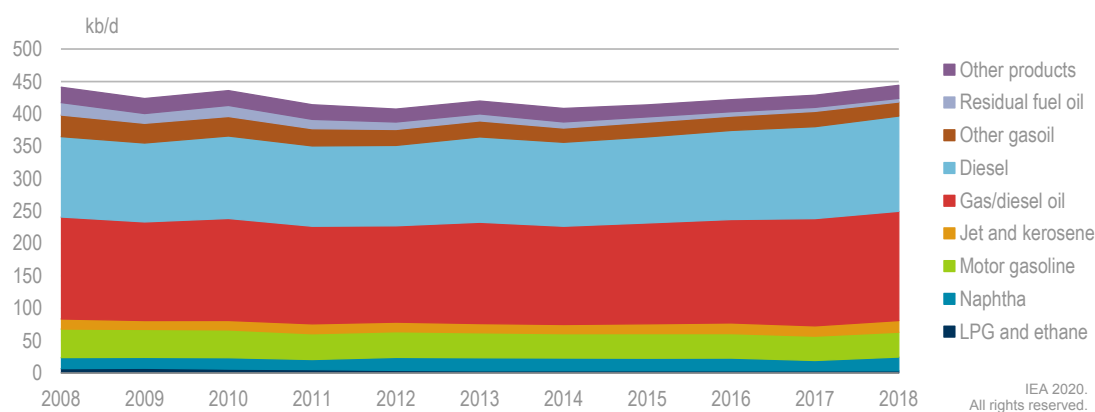
Supply and demand

In 2018, Austria's domestic oil production was 14.2 thousand barrels per day (kb/d), which is 30% lower than a decade ago. At the end of 2018, Austrian oil reserves amounted to 5.6 million tonnes (Mt). At current levels, production can continue for another eight years (FMST, 2018).

Oil consumption

Austria's total oil demand in 2018 was 275.4 kb/d (Figure 5.2). Oil demand has been increasing steadily since 2014, when it stood at 256.6 kb/d, mainly driven by diesel, jet and kerosene, and naphtha for the transport and industry sectors. In 2018, diesel and motor gasoline accounted for the largest share of total oil demand, at 53% and 14% respectively; followed by other gasoil, naphtha, jet and kerosene, and other products, at around 7%; and minor shares of residual fuel oil, liquefied petroleum gas and ethane.

By sector, the transport sector, mainly road transport, is by far the largest oil-consuming sector, accounting for 67% in 2017; followed by industry, including the growing chemical and petrochemical sector (15%); residential (9%); and the minor shares of commercial, heat and power generation, and other energy (3% respectively).

Figure 5.2 Oil demand in Austria, 2008-18

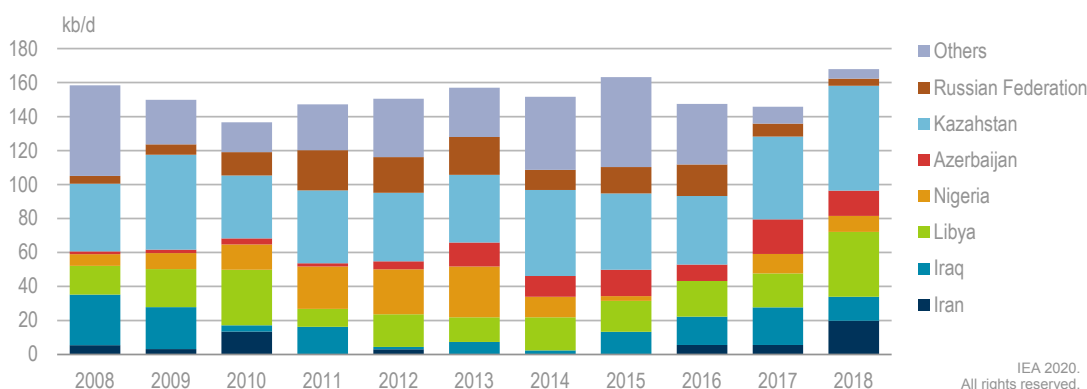
Austria's oil demand has started to pick up since 2014, mainly driven by strong growth in gasoline and diesel, the two most consumed oil products in Austria.

Notes: kb/d: thousand barrels per day; LPG: liquefied petroleum gas.

Source: IEA (2019a), *Oil Information 2019*, www.iea.org/statistics.

Trade

Austria is highly reliant on crude oil imports. In 2018, it imported 168 kb/d of crude oil, up 6% from 2008 (Figure 5.3). Kazakhstan accounted for 37% of total crude imports in 2018, followed by Libya (23%), the Islamic Republic of Iran (12%), Azerbaijan (9%), Iraq (8%), Nigeria (6%) and the Russian Federation (3%). Although the share of countries from which Austria imports fluctuates on an annual basis, it has well-diversified crude oil import sources and imported from 12 different countries in 2018 (FMST, 2018).

Figure 5.3 Crude oil net trade by country, 2008-18

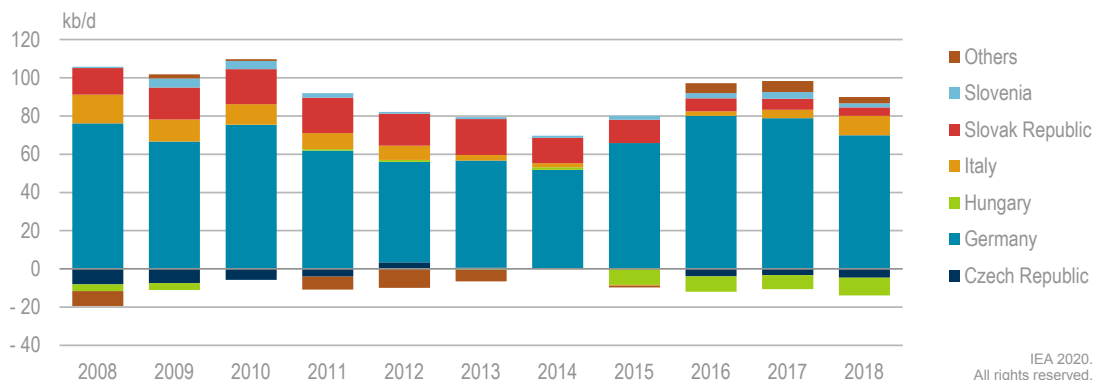
Austria has well-diversified crude oil import sources, dominated by Kazakhstan and Libya.

Source: IEA (2019a), *Oil Information 2019*, www.iea.org/statistics.

In 2018, Austria's total refinery outputs were 202.5 kb/d. To meet domestic demand, Austria imported 144.6 kb/d of oil products, mainly gas/diesel oil, and exported 68.7 kb/d, resulting in net imports of 76 kb/d. In line with domestic oil demand trends, Austria's net imports of oil products started to pick up in 2014, although they declined again in 2018.

Germany is by far the largest import source, accounting for 56% of Austria's total oil products imports in 2018, followed by Italy (11%), the Slovak Republic (9%) and Slovenia (6%) (Figure 5.4). Hungary and the Czech Republic are the biggest recipients of Austria's oil product exports, accounting for 25% and 10% of total exports respectively.

Figure 5.4 Oil products net trade by country, 2008-18



Although Austria produces oil products domestically, the country is also reliant on imports, mostly from Germany and Italy.

Note: kb/d: thousand barrels per day.

Source: IEA (2019a), *Oil Information 2019*, www.iea.org/statistics.

Austria's oil supply and demand outlook

Austria is highly dependent on oil imports. In 2018, its oil import dependency¹ reached 95.3%. Looking ahead, efforts to decarbonise the transport and heating sectors and the promotion of biofuels will curb Austria's oil demand.

The government is working on an integrated transport policy combining various measures to decarbonise the transport sector. Policy measures include increasing the blending requirements for biofuels, the use of natural gas, enhanced support for electric mobility, introduction of hydrogen and improved public transport options (see Chapters 6 and 9 for more details).

Austria introduced a successively increasing biofuel blending target in 2012. The current blending target of 5.75% (energy content) was exceeded in 2018, with a 6.25% blending share. In 2018, 210 000 tonnes of FAME was used for blending with diesel/gas oil and 90 000 tonnes of ethanol was blended with petrol (WKO, 2019a). Half of the biodiesel is produced in Austria and the country even exports domestically produced ethanol (see Chapter 9 for more details on biofuels).

The government also plans to halve the number of oil boilers in the residential sector by 2030. About 700 000 homes in Austria still heat with oil products, and residential oil consumption accounted for 9% of the total consumption in 2017. The government offers a generous subsidy to replace oil boilers, though not that many oil boilers will be at the end of their economic lifetime by 2030 (see Chapter 7 for more details).

¹ Import dependency = total oil imports/total oil demand.

Oil industry structure

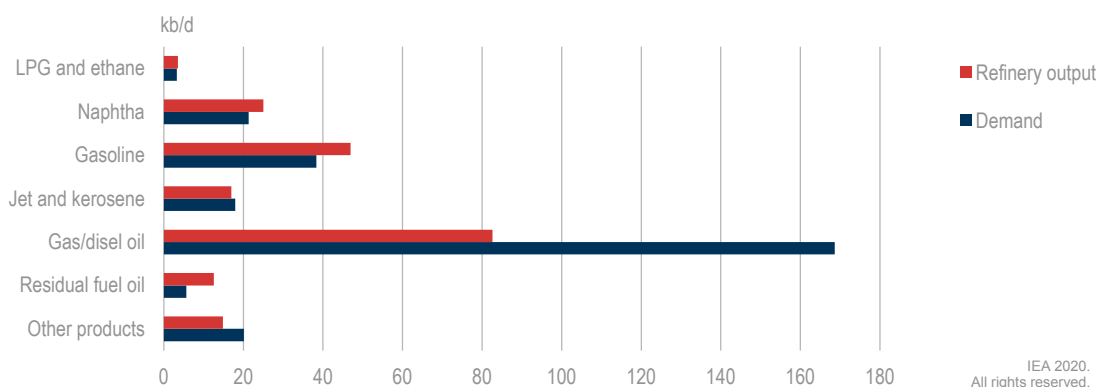
OMV² is Austria's largest petroleum company. It undertakes petroleum exploration and production, refining, transport, and wholesale and retail sales on a domestic and international level. OMV also owns and operates Austria's only refinery located in Schwechat. OMV is owned by the government of Austria (31.5%) and the government of Abu Dhabi (24.9%), while the remaining shares float on the stock market. OMV is also the country's only crude oil importer.

Since 2018, only two companies produce oil in Austria, OMV AG and RAG AG Austria, following the buy-out of RAG Exploration and Production GmbH by RAG Austria AG. OMV accounted for 88% of total crude production in 2018 (WKO, 2019a).

Refining

The Schwechat refinery processes domestic and imported crude oil and produces a full range of oil products for domestic consumption and export. It has an annual refining capacity of 9.6 MT. The utilisation rate was 94% in 2018, up from 86% in 2017 (WKO, 2019a). In 2018, Austria's total refinery outputs were 202.5 kb/d, 41% of which was gas/diesel oil (Figure 5.5). Other produced oil products are motor gasoline (23%), naphtha (12%) and kerosene-type jet fuel (8%), with minor shares of other products. Austria is self-sufficient for most oil products, except for gas/diesel oil used for transportation and heating.

Figure 5.5 Austria's refinery outputs, 2018



Austria's production of gas/diesel oil only covers 49% of domestic demand.

Notes. kb/d: thousand barrels per day; LPG: liquefied petroleum gas. Refinery outputs exclude refinery losses.

Source: IEA (2019a), *Oil Information 2019*, www.iea.org/statistics.

Market structure

In addition to OMV, approximately 65 companies import petroleum products, some for their own use. In addition to OMV, 20 companies export products. There are also 10-15 blending companies active in the Austrian market.

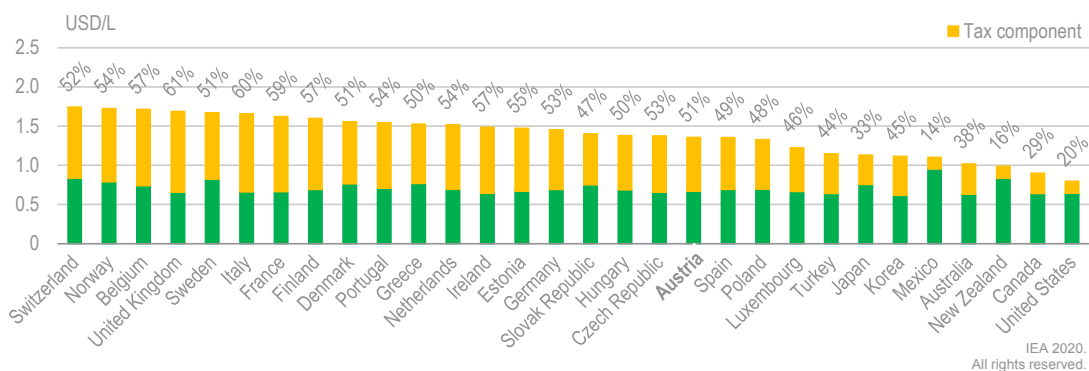
² Annex A provides detailed Information about institutions and organisations with responsibilities related to the energy sector.

Eighty companies are active in the wholesale market of petroleum products, and small and large-scale consumers are supplied by 20 companies in the fuel and lubricants trade. Austria's retail market only has one competitor, ENI of Italy, controlling more than 10% of motor fuel sales. There were 2 699 retail fuel stations at the end of 2018, compared to 2 503 at the time of the last in-depth review in 2014 (WKO, 2019b).

Prices and taxation

The government deregulated oil prices in 1981. Wholesale and retail prices are mainly set by the international market; the government's role is mostly limited to determine the taxes on fuels. However, the government introduced legislation in 2009 allowing retail fuel stations only one daily price increase that must be exercised at noon; and banning price increases before and during major holidays (Easter, mid-August, Christmas) within specified periods. This fuel-price regulation was extended until the end of 2020. Price reductions are possible at any time. Retail station operators are required to report every price change of every filling station to a central database. The Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology publishes a price comparison across the EU on a weekly basis to enhance market transparency and competition. In addition, the government has the prerogative to set maximum retail prices for motor fuels, which can be exercised for a period of up to six months at a time.

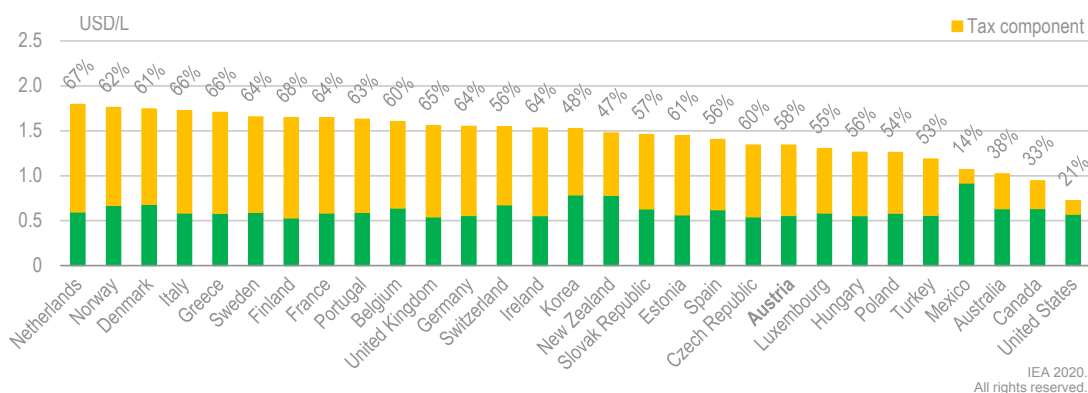
Figure 5.6 Price comparison for automotive diesel in the IEA, Q1 2019



Source: IEA (2019b), *Energy Prices and Taxes – First Quarter 2019*, www.iea.org/statistics.

Fuel prices for automotive diesel in Austria are slightly below the average of IEA member countries, with taxes accounting for around half of the total price (Figure 5.6). However, Austria's fuel prices are lower than are those of some of its neighbours. In the first quarter of 2019, Austria's diesel fuel price was 7% lower than in Germany and 18% lower than in Italy. This price difference has resulted in so-called "fuel exports" or "tank tourism". This describes the practice of heavy-good vehicles transiting Austria filling up their tanks while crossing the country. According to estimates from the Austrian Energy Agency, this results in additional fuel consumption of 23% of total demand. This practice results in substantial additional tax revenues for the government – estimated to be around USD 1 billion annually, but the "fuel exports" also increase annual CO₂ emissions by approximately 5 Mt/CO₂-eq.

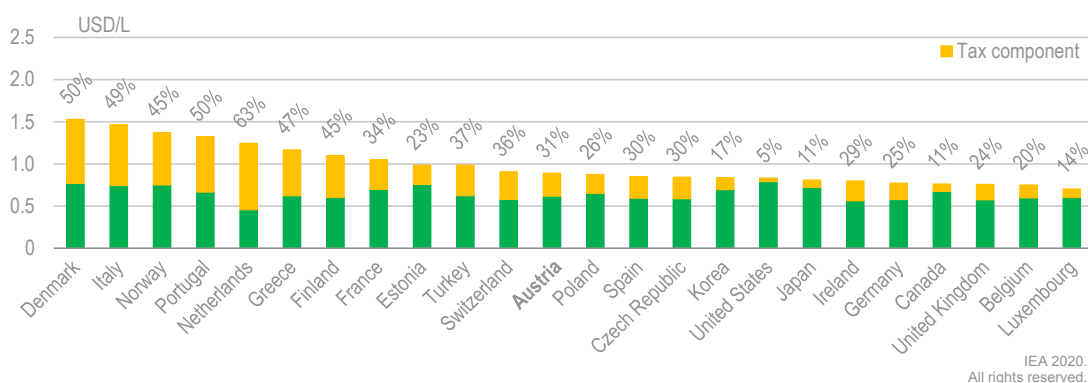
Gasoline is more heavily taxed than diesel, with taxes accounting for 58% of the total price (Figure 5.7). For fuel oil, Austria is close to the median among IEA countries, with taxes accounting for 31% (Figure 5.8).

Figure 5.7 Price comparison for unleaded gasoline (95 RON) in the IEA, Q1 2019

IEA 2020.
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Note: Data are not available for Japan.

Source: IEA (2019b), *Energy Prices and Taxes – First Quarter 2019*, www.iea.org/statistics.

Figure 5.8 Price comparison for fuel oil in the IEA, Q1 2019

IEA 2020.
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Fuel prices in Austria are close to the median among IEA member countries; gasoline is the most heavily taxed fuel.

Note: Data not available for Australia, Hungary, Mexico, New Zealand, the Slovak Republic and Sweden.

Source: IEA (2019b), *Energy Prices and Taxes – First Quarter 2019*, www.iea.org/statistics.

Oil supply infrastructure

Pipelines

The Trans-Alpine pipeline (TAL) that runs 752 km from the Italian city of Trieste on the Adriatic coast to Ingolstadt in Germany supplies crude oil to Austria. The TAL branches out onto the Austria-Wien pipeline (AWP) at the Austrian city of Würmlach, which is on the border with Italy. The 420 km-long AWP feeds the OMV Schwechat refinery near Vienna. The TAL has an annual transport capacity of approximately 45 Mt and in 2017 the total throughput was 42.4 Mt of crude oil. Of this, 18% was transported via the AWP to Schwechat. The AWP has an annual capacity of 8 Mt annually. A 14 km long branch of the AWP supplies crude directly to the strategic storage site of Lannach. Domestically produced crude oil from the fields in Lower Austria is transported via the dedicated GSU pipeline to the Schwechat refinery. OMV owns a 25% stake in TAL and operates the AWP.

Austria also has one product pipeline, the 172 km Produktenleitung West (PLW), owned by OMV, which links the Schwechat refinery to the west of the country, and terminates at the St. Valentin tank farm also owned by OMV. The PLW transports on average 1.3 Mt of petroleum products annually. In addition, a dedicated jet aviation fuel pipeline links the OMV refinery to the Vienna international airport that is also located in Schwechat. Petroleum products are also transported by road, rail and ship for final distribution.

To diversify crude oil supplies further, Austria seeks a connection to the Druzhba pipeline to get direct access to Russian oil supplies, which can be around 10% cheaper than the current seaborne supplies via a pipeline connection with Italy. The connection would require a pipeline to the Bratislava refinery in the Slovak Republic, some 60 km from Schwechat. The pipeline is included in the fourth list of EU projects of common interest under the “Priority Corridor Oil Supply Connections in Central Eastern Europe” (EC, 2019). All permits for the pipeline were granted on the Austrian side in 2004 for the first time. However, as the pipeline routing on the Slovak side still has to be decided and permitted, Austria has extended the permits several times. In 2017, permits were extended for the fourth time until the end of 2020.

Storage

Austria has a number of storage sites for crude oil and refined products geographically dispersed across the country, with a total capacity of 6.9 million cubic metres, or 43.4 million barrels (mb) in 2017.

There are approximately 40 storage sites located throughout Austria. Most of the capacity is located in the eastern and southern regions, primarily near the Schwechat refinery, along the AWP, and near Linz. There is also a significant number of smaller product storage sites in western Austria, the volumes of which could be distributed by rail in an emergency. In addition to stocks held in Austria, some stocks are also held at the Trieste oil terminal in Italy (Table 5.1). Stocks held at the significant oil storage capacity located in Trieste at the start of the TAL pipeline can be counted to cover Austria’s stockholding obligation.

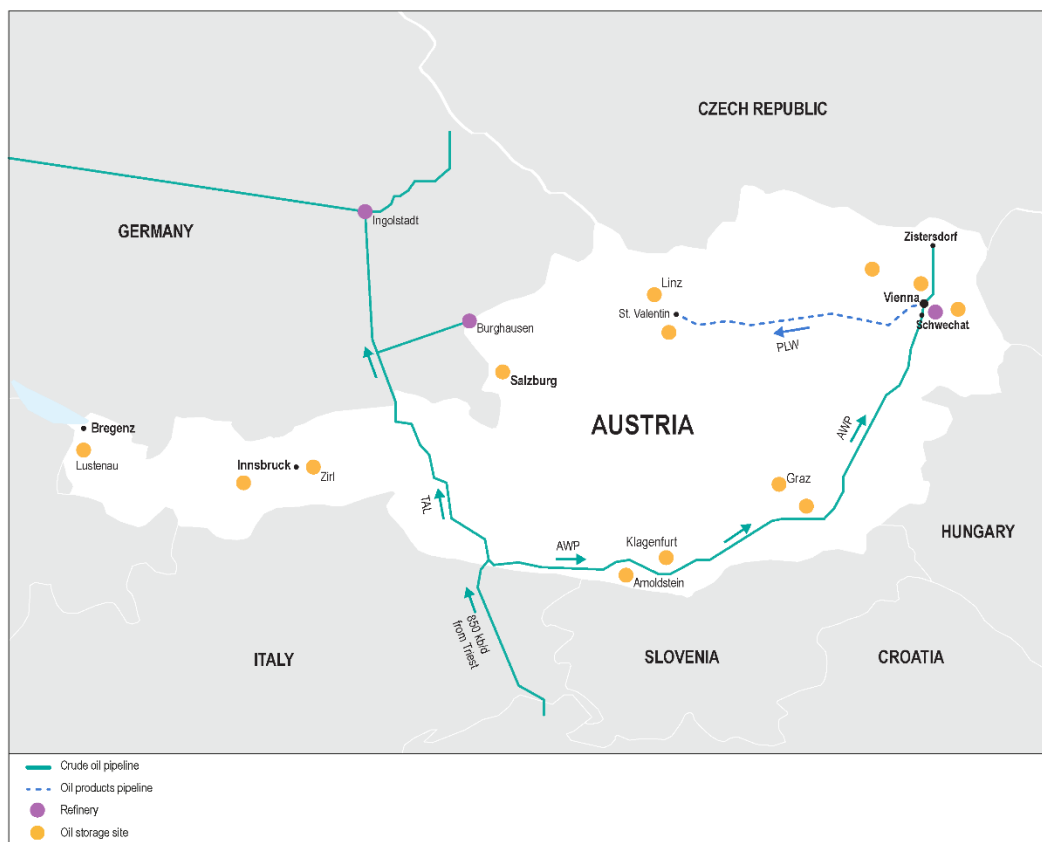
Table 5.1 Austrian oil storage capacity, 2017 (thousand cubic metres)

Storage site	Crude oil	Intermediates	Gasoline	Distillates	Fuel oil	Total refined product	Total oil (crude and products)
Schwechat/Lobau (refinery)	380	491.5	737.7	1 093.2	220.3	2 051.2	2 922.7
Trieste	2 030						2 030
Lannach	370			155		155	525
Valentin			86.6	374.2	3.6	464.4	464.4
Kremsmunster	240						240
Wurmlach	237.5						237.5
Linz			47.5	149.2		196.7	196.7
Lobau				156		156	156
Zistersdorf	73						73
Auersthal	39						39
Graz			2.9	5.2		8.1	8.1
Lustenau			1.4	4.2		5.6	5.6
Total	3 369.5	491.5	876.1	1 464.2	377.3	3 037	6 898

Stocks are a mix of crude oil and product, with crude oil comprising the largest share (41%), followed by middle distillates (40%), gasoline (11%) and fuel oil (8%) as of 2017.

Approximately 75% of agency stocks (both crude oil and refined products) are commingled with industry stocks. Crude oil stocks are primarily segregated, located at facilities along the AWP and at domestic production sites.

Figure 5.9 Map of Austria's oil infrastructure



Oil emergency policies and organisation

Emergency response policy

The Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK in its German acronym) is the lead agency with responsibility for contingency planning and emergency measures in Austria on matters related to energy.

The Austrian government's preferred response to a domestic oil supply disruption or participation in IEA collective action is a stock release. Austria ensures it is capable of participating in a collective action by imposing a compulsory stockholding obligation on all importers of crude oil and petroleum products. Austria has a strong record of compliance with the IEA 90-day stockholding obligation.

The Austrian National Emergency Strategy Organisation (NESO) is embedded on a stand-by basis in the Department of Energy and Mining in the BMK. In the event of its activation

(i.e. during an emergency), experts on a range of issues from across the department would be consulted – depending on the nature of the emergency. The head of NESO is the Director-General for Energy and Mining, who is also the Austrian representative on the IEA Governing Board.

The government has developed a comprehensive Emergency Response Handbook to be used by NESO members. The handbook outlines procedures, roles and responsibilities for key stakeholders in emergency situations. It has previously been tested during emergency response exercises, most recently in 2017.

New emerging threats to the oil and overall energy sectors, such as cyberattacks and electricity blackouts, need to be taken into account. The use of energy is becoming increasingly digitalised and automated, which provides increased risks of cyberattacks on the energy system in combination with traditional physical damage (EPRS, 2019). In 2017, the IEA published the first comprehensive analysis on the challenges of the digitalisation of the energy sector. The report stressed the need to ensure the cybersecurity of the energy sector infrastructure by comprehensively addressing the risk of intentional and unintentional threats to maintain system stability and reliability (IEA, 2017). Given these new risks of energy disruption, Austria also needs to include them in its emergency response policy and the regular emergency response exercises.

Emergency oil reserves

Approximately 65% of all stocks held in Austria are public stocks; the remaining 35% consist of industry stocks. Until March 2017, Austria held public stocks sufficient to meet the country's IEA obligation without needing to count on commercial industry stocks (the country then held stocks equivalent to 123 days of net imports, of which 100 days are public stocks and the remaining 23 days commercial industry stocks). Since then, however, the share of public stocks has gradually decreased. As of November 2019, the country held stocks equivalent to 103 days of net imports (93 days of public stocks and the remaining 10 days commercial industry stocks).

In the event of a proposed stock release under the initial contingency response plan of the IEA, the Federal Minister of Science, Research and Economy takes the final decision on whether or not to release stocks. This decision would be based on the outcome of discussions in the Energy Intervention Council. The entire decision-making process (i.e. organising a session of the Energy Intervention Council, holding discussions within this committee and arriving at a decision) is expected to take one to two days. During this time, NESO staff would remain in contact with staff from the IEA Secretariat and the European Commission.

The Austrian stockholding system allows an immediate delivery of released stocks. Stocks are sold at market price and distributions would be arranged according to product, facilities and activities of the market participants.

Oil demand restraint

Austria has undertaken a comprehensive study to develop estimates for the volumetric savings of a broad range of demand-restraint measures. The study, entitled *Effects of Demand Restraint Measures on the Austrian Oil Supply in Crisis Situations* (AEA, 2014),

examines the expected impacts of measures grouped in three stages – light, medium and heavy-handed – depending on the nature and severity of the crisis, and would mostly concern the transport sector (EC, 2014).

At the time of the study, the administration estimated that these measures could result in savings of up to 19% of total consumption. For automotive fuels, the potential measures are broken down by sector, including private, public and commercial sectors. The administration has not developed an estimate for the volumetric impact of these measures for automotive fuels. At least two months' lead-time would be required to implement these "heavy-handed" measures.

Assessment

Oil is the single biggest energy source in TPES and TFC in Austria, accounting for around 38% of both. A small portion is produced domestically. Exploration is ongoing, but no major discoveries have been made in the last decades, and existing fields are in decline.

Crude oil is sourced from a well-diversified number of countries. In 2018, Kazakhstan accounted for over a third of total net imports of crude oil, followed by Libya.

Austria has one refinery, at Schwechat, which receives all crude from the port of Trieste in Italy via pipelines. The refinery does not produce enough to satisfy domestic demand. Around 25% of oil products need to be imported, mainly from Germany. Austria is well-endowed with storage facilities, which are spread out over the country to ensure smooth logistics, also in times of interruptions in oil supplies. The country was not heavily impacted by recent oil supply disruptions from Iran and Libya.

Austria has to fulfil its duties in securing oil supply as a member of the IEA and the European Union. It has to hold oil emergency stocks, have demand-restraint measures ready and an emergency organisation in place that conducts emergency response exercises on a regular basis; the last exercise was in 2018 and the one before that was carried out in 2013. To be ready in a crisis, it is necessary to have exercises more frequently, to ensure that the right people know what to do in an emergency. A new phenomenon for the oil sector, and for the energy sector more broadly, are potential cyberattacks and electricity blackouts. These kinds of scenarios should also be exercised to prepare the country.

To increase security of crude oil supply, Austria has been pursuing the construction of a pipeline from Bratislava in the Slovak Republic to the Schwechat refinery for over 15 years. The pipeline would allow Austria to connect to the southern arm of the Druzhba pipeline, while allowing the Slovak Republic to be supplied from the west through the TAP and via the AWP. However, due to environmental concerns in the Slovak Republic about a suitable routing of the pipeline, no progress has been made as of today. The anticipated reduction of oil demand in Austria due to the planned decarbonisation of the transport and heating sectors and a continuous shift to biofuels makes it uncertain whether the pipeline construction will ever go ahead, although it would have benefits for regional supply security.

Total oil consumption in 2018 was some 12 million tonnes of oil equivalent (Mtoe), with the transport sector accounting for two-thirds. The industry sector is the second-largest oil-consuming sector, accounting for 15% of total oil consumption. The residential sector is

the third-largest oil consumer with 8%. Oil consumption, which peaked in 2005, then declined by 14% until 2012. In 2018, oil consumption was 3% above the 2012 level, due to growth in transport oil demand.

Positioned in the heart of Europe, Austria is a transit country for many goods. Trucks cross the country north to south and east to west, resulting in disproportionately high oil consumption, notably diesel (75% of transport fuel). Moreover, taxes on transport fuels are low compared to some of its neighbouring countries, providing an incentive to fill up tanks while crossing the country. According to estimates from the Austrian energy agency, this results in an additional fuel consumption of 23%. This provides Austria with a benefit of around EUR 1 billion per year in tax revenues, but also with a “cost” of 5 Mt of additional CO₂ emissions. A reduction of price-reduced fuel exports in vehicle tanks would therefore help Austria meet its climate objectives.

Recommendations

The government of Austria should:

- Conduct emergency response exercises on a regular basis, and use those exercises to update handbooks, procedures and contact lists.
- Regularly identify and assess the potential consequences of emerging risks, like cybersecurity or electricity blackouts, and adapt procedures and preparedness as needed.

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6. Climate change and transport

Key data

(2017/18)

Total greenhouse gas (GHG) emissions (2017):

GHG emissions without LULUCF*: 82.3 Mt CO₂-eq, -11.1% since 2005, +4.6% since 1990

GHG emissions with LULUCF*: 77.4 Mt CO₂-eq, -5.6% since 2005, +16.0% since 1990

Energy-related CO₂ emissions (2018):

CO₂ emissions from fuel combustion: 61.5 Mt CO₂, -17.4% since 2005

CO₂ emissions by fuel: oil 50.6%, natural gas 27.2%, coal 16.9%, other (including non-renewable waste) 5.3%

CO₂ emissions by sector: transport 40.3%, power and heat generation 21.0%, industry 17.6%, residential 10.0%, other energy 7.8%, service 3.4%

CO₂ intensity per GDP (2017)**: 0.17 kg CO₂/USD (IEA median 0.19 kg CO₂/USD)

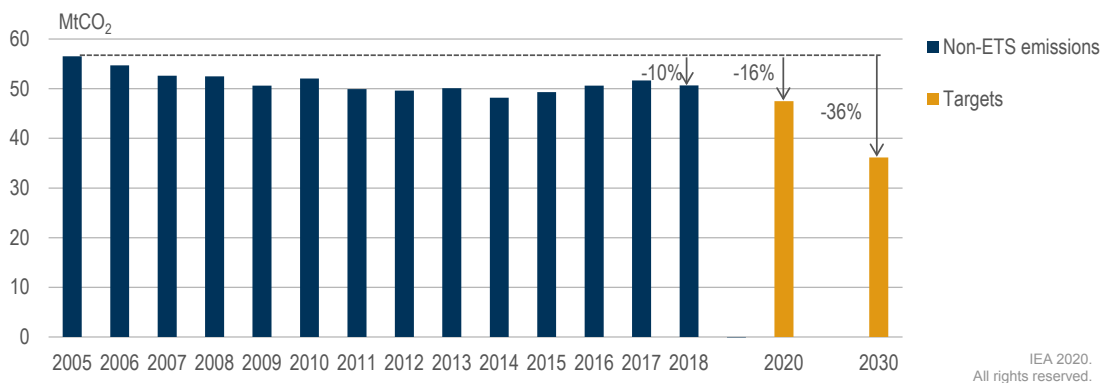
* Land use, land-use change and forestry (Source: UNFCCC).

** Gross domestic product in USD 2010 prices and PPP (power purchase parity).

Overview

Austria's climate policy is guided by the European Union (EU)'s climate policy framework, which sets specific emission-reduction targets for sectors covered under the Emission Trading System (ETS) and for non-ETS sectors. Transport falls under the non-ETS.

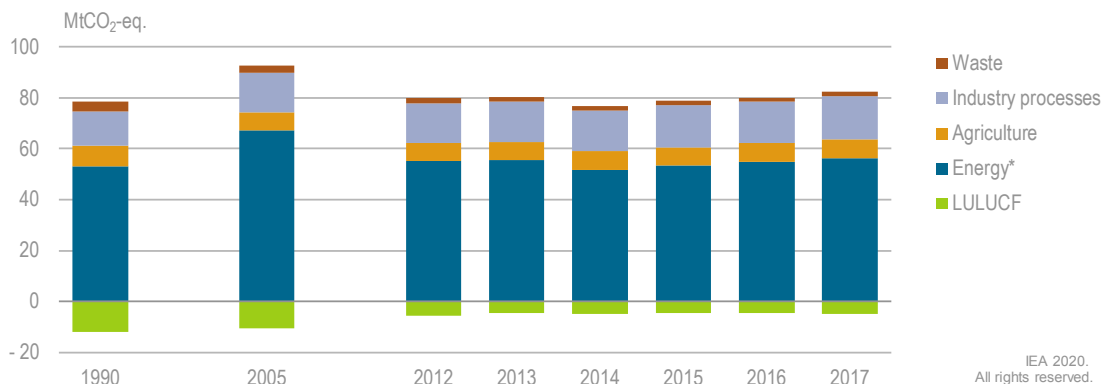
Austria risks missing its mandatory emissions reduction target outside the EU ETS of -16% in 2020 compared to the 2005 level. In 2018, non-ETS emissions (estimates) were 10% below the 2005 level (Figure 6.1). For 2030, Austria is obligated to reduce its non-ETS emissions by 36% below the 2005 level, a much larger challenge. If the current pathway is not significantly adjusted, Austria may miss its 2030 target by up to 20% (EC, 2019).

Figure 6.1 Non-ETS emissions and EU targets, 2005-30

Austria's greenhouse gas emissions outside the ETS have fallen by 10% since 2005, but the country will likely not meet the 2020 and 2030 targets.

Source: EEA (2019a), *Greenhouse Gas Emissions Under the Effort Sharing Decision (ESD)*, <https://www.eea.europa.eu/data-and-maps/data/esd-2>.

Energy-related emissions account for the largest share of Austria's total greenhouse gas (GHG) emissions. Austria's total as well as energy-related GHG emissions increased three years in a row (2015-17) (Figure 6.2), suggesting a need for further policies and measures. These may include establishing binding accountabilities of federal ministries and provinces, enhancing monitoring systems, and addressing increasing energy consumption in the transport sector through taxation.

Figure 6.2 Greenhouse gas emissions by sector, Austria, 1990-2017

Austria's greenhouse gas emissions, which fell significantly from a 2005 peak, have been trending upwards since 2014.

* Energy includes power and heat generation, commercial, households, industrial energy consumption, and transport.

Note: Due to different reporting methodologies, some of the emissions under "industry processes" in the chart are included in the IEA data on energy-related emissions (emissions from auto-producers of heat and power in industry). Therefore, the energy sector emissions in this chart are lower than total energy-related CO₂ emissions stated above.

Notes: LULUCF: land use, land-use change and forestry; Mt CO₂-eq: million tonnes CO₂ equivalent.

Source: UNFCCC (2019), *Austria 2019 National Inventory Report*, <https://unfccc.int/documents/194891>.

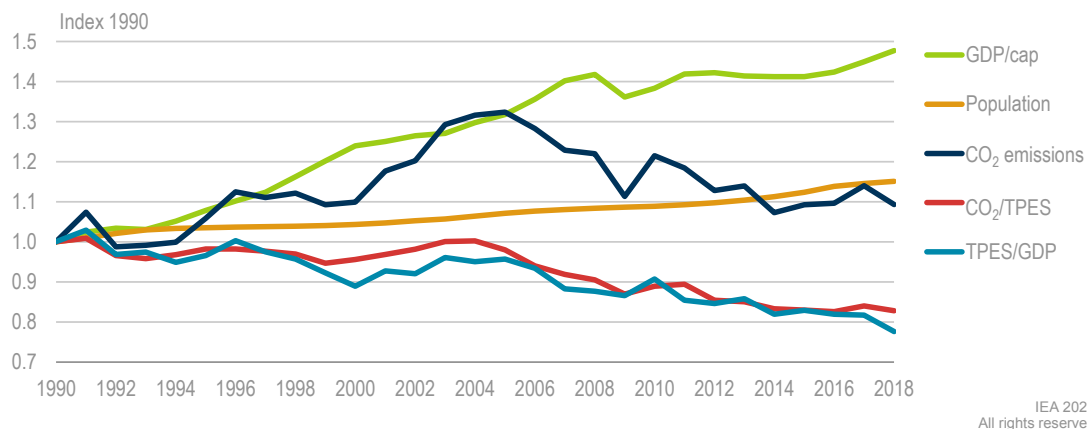
CO₂ drivers and carbon intensity

From 1990 to 2005, Austria's energy-related CO₂ emissions grew at a similar average rate as gross domestic product (GDP) per capita (Figure 6.3). Emissions peaked in 2005 and have since decoupled from economic growth, with a 17% reduction in CO₂ emissions between 2005 and 2018. This was achieved through a 19% reduction in the energy intensity of the economy and a 15% decline in the carbon intensity of energy supply since 2005. However, the trend was recently broken and CO₂ emissions increased by about 2% between 2014 and 2018.

Austria ranked at the median among IEA countries in terms of CO₂ emissions per capita in 2017. In terms of emissions per GDP (in power purchasing parity, PPP), Austria was in the lower half when compared with other IEA member countries. In 2017, Austria's CO₂ intensity was 167 kg CO₂/USD (PPP), which was about 30% below the IEA total, and just below the total among European IEA countries (Figure 6.4). Since 2014, however, Austria's CO₂ intensity trend has been flat.

Austria has relatively low CO₂ intensity per GDP due to its low emissions from power generation, which is largely based on hydropower. Austria emitted around 160 g CO₂/kWh of electricity and heat in 2017, which is significantly below the IEA average (Figure 6.5). However, growth in renewable electricity generation has plateaued since 2012, and consequently the emission intensity of the power and heat generation has not improved further in recent years.

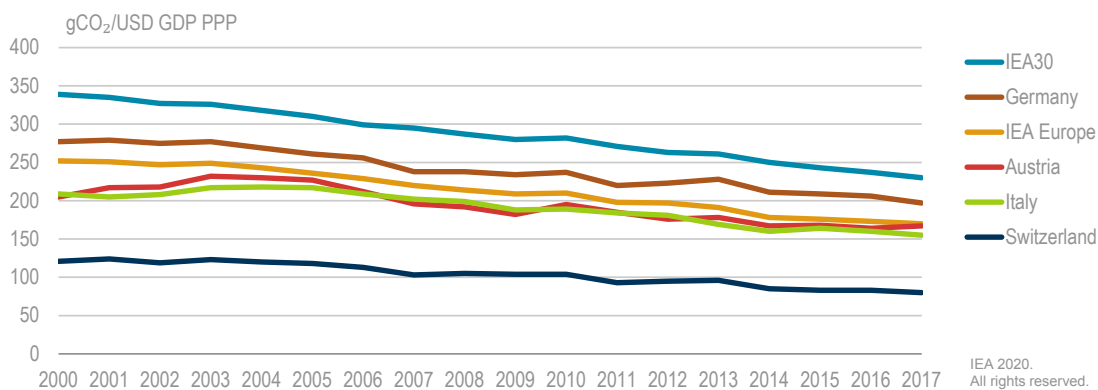
Figure 6.3 Energy-related CO₂ emissions and main drivers in Austria, 1990-2018



CO₂ emissions declined in the early 2000s as both carbon intensity of the energy system and energy intensity of the economy fell, but the trend has been quite stable in recent years.

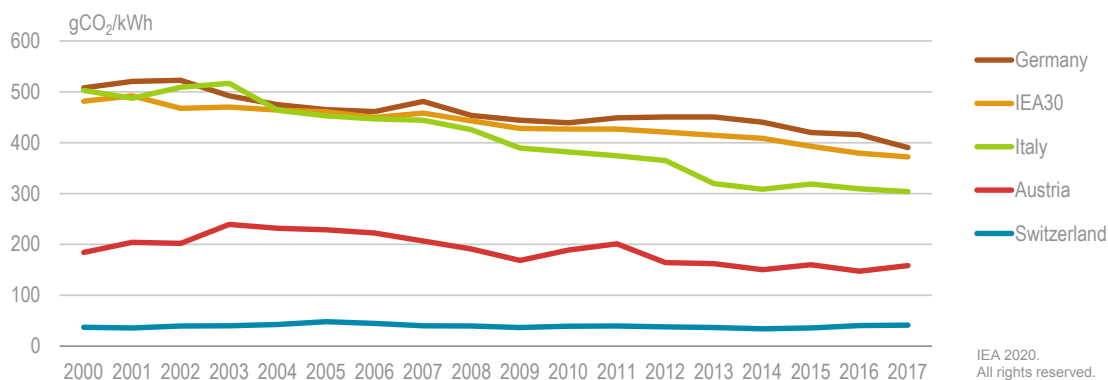
Notes: GDP: gross domestic product; TPES: total primary energy supply. Real GDP in USD 2010 prices and PPP.

Source: IEA (2020), "CO₂ emissions by product and flow", *IEA CO₂ Emissions from Fuel Combustion Statistics* (database), www.iea.org/statistics.

Figure 6.4 CO₂ intensity in Austria and selected IEA member countries, 2000-17

Austria's CO₂ intensity is in the lower half in an IEA comparison, just below the average of European IEA countries, but in recent years the CO₂ intensity has stalled.

Source: IEA (2019a), *CO₂ Emissions from Fuel Combustion 2019*, www.iea.org/statistics.

Figure 6.5 CO₂ intensity of power and heat generation in Austria and in selected IEA member countries, 1990-2017

Austria has low CO₂ emissions per kWh heat and power, mostly thanks to the large share of hydropower, although electricity generated by hydro has been flat in recent years.

Source: IEA (2019a), *CO₂ Emissions from Fuel Combustion 2019*, www.iea.org/statistics.

CO₂ emissions by sector

Energy-related CO₂ emissions have experienced significant changes in the last few decades. In 2018, total emissions were 61.5 Mt CO₂, 17% below the peak from 2005, but 9% above the level from 1990, the Kyoto benchmark (Figure 6.6). Transport is the largest source of energy-related CO₂ emissions in Austria. In 2018, the sector accounted for 40% of total emissions, followed by power and heat generation (21%), industry (18%), residential (10%), other energy (8%), and services (3%).

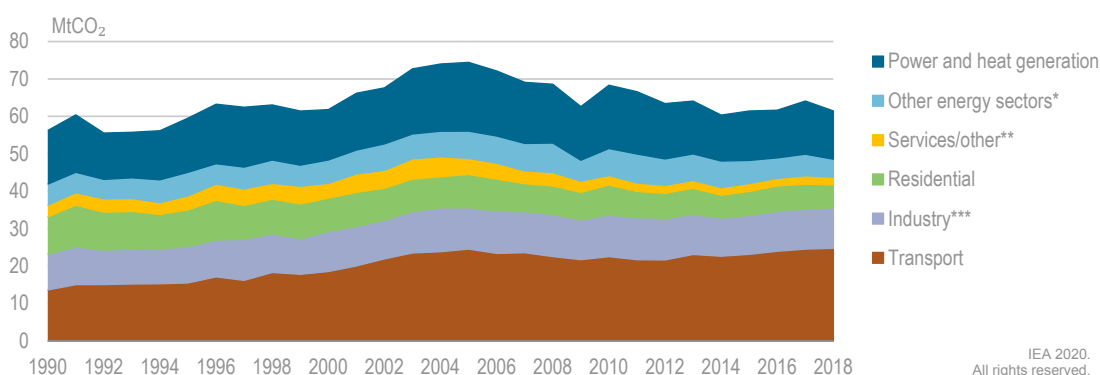
Compared with 2005, most sectors have experienced a reduction in emissions, but industry and transport have remained stable. Emissions from the transport sector have been on an increasing trend for the last six years. In 2018, the transport sector emitted 24.8 Mt CO₂, the highest level yet, 1% above the previous peak level in 2005 and 14%

above the level in 2012. Meanwhile, the industry sector has remained relatively stable, with a 2018 emission level at 10.8 Mt CO₂, the same as the average over the last decade.

Emissions from power and heat fluctuate due to changes in the fuel mix in electricity generation related to various factors, including access to hydropower and international trade and market prices. In the last decade, power- and heat-related emissions varied from 12.3 Mt CO₂ in 2014 to 16.9 Mt CO₂ in 2010. However, the long-term trend is towards declining emissions, which in 2018 were 30% below the 2005 level.

Residential emissions declined by 31% during the same period, largely due to fuel switching from heating oil to bioenergy and district heating, but have been quite stable since 2014. Other energy – including emissions from coal, oil and gas extraction and transformation – have decreased by a third since 2005, mainly because of declined emissions from oil refineries. Service sector emissions have declined the most, with a 52% drop from 2005 to 2018, mainly due to a decline in oil consumption.

Figure 6.6 Energy-related CO₂ emissions by sector, Austria, 1990-2018



The transport sector accounted for 40% of total energy-related CO₂ emissions in 2018; the sector has contributed the most to the growth in total emissions in recent years.

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

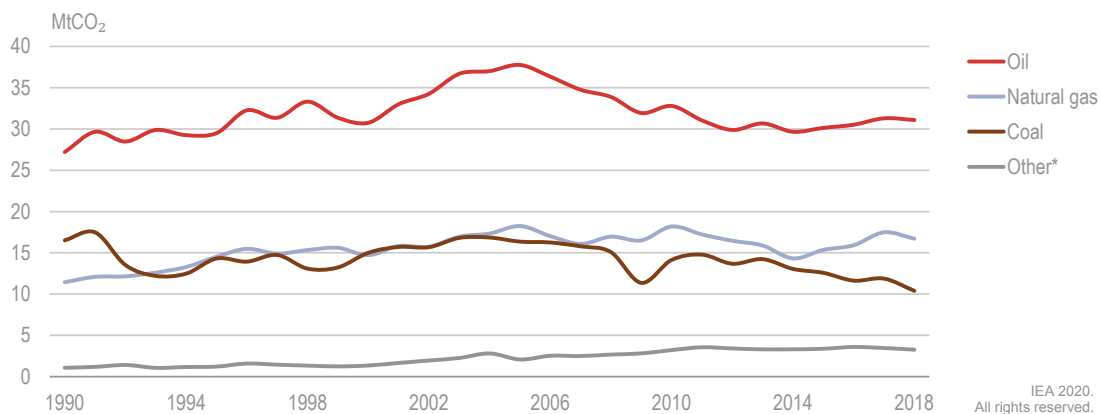
** Other energy includes emissions from coal, oil and gas extraction, oil refineries, blast furnaces and coke ovens.

*** Industry includes CO₂ emissions from combustion at construction and manufacturing industries.

Note: MtCO₂: million tonnes CO₂.

Source: IEA (2020), "CO₂ emissions by product and flow", *IEA CO₂ Emissions from Fuel Combustion Statistics* (database), www.iea.org/statistics.

In 2018, oil accounted for 51% of total energy-related CO₂ emissions, followed by 27% from natural gas and 17% from coal (Figure 6.7). Natural gas emissions have increased over the past few years, as the share of gas in power and heat generation increased. Oil emissions have also increased recently, due to growth in the transport sector, which relied on oil to meet 89% of its energy demand in 2018. Coal emissions, on the other hand, have declined over the last decade, due to the fuel shift to natural gas and renewables in the power sector.

Figure 6.7 Energy-related CO₂ emissions by energy source, Austria, 1990-2018

Oil accounts for about half of total energy-related emissions, mainly because of its dominant position in transport, but also from remaining shares in industry and buildings.

* Includes emissions from non-renewable waste.

Note: MtCO₂: million tonnes CO₂.

Source: IEA (2020), "CO₂ emissions by product and flow", *IEA CO₂ Emissions from Fuel Combustion Statistics* (database), www.iea.org/statistics.

Climate policy framework

The EU climate framework

As an EU member state, Austria's climate policy is guided by the European Union's climate policies: the 2020 climate package and the 2030 climate framework. Member states are jointly committed to reducing EU-wide GHG emissions by 20% below 1990 levels by 2020 and by at least 40% by 2030 compared to 1990. Specific targets exist for the ETS and non-ETS sectors.

The ETS is a cap-and-trade system for large power and heat plants (at least 20 thermal megawatt [MW_{th}]) and heavy industry. It covers around 45% of the EU's total emissions. By law, ETS sectors must reduce emissions by 21% below the 2005 level by 2020 and by 43% from 2005 to 2030 (EC, 2018). This is an EU-wide target, without national sub-targets, as ETS allowances can be traded across the EU. The ETS sectors' emissions are thus mainly subject to the EU policy framework.

The non-ETS sectors include transport, residential and commercial sectors, non-ETS industry and power, agriculture, and waste management. Non-ETS sectors' emissions are subject to the Effort Sharing Decision (ESD) (for 2013-20) and Effort Sharing Regulation (ESR) (for 2021-30). The EU-level reduction targets for GHG emissions in the non-ETS sectors are 10% by 2020 and 30% by 2030, compared with 2005 levels. While the EU-ETS target applies for the EU as a whole, the EU-level target for the non-ETS sectors is translated into binding targets for each member country.

In 2017, 63% of Austria's total GHG emissions and 72% of its energy-related CO₂ emissions were in the ESD, underlining that the country's emission mitigation path is largely determined by domestic policy measures (EEA, 2019). Austria has come off-track

to meet its 2020 target: a reduction of non-ETS emissions by 16% compared to the 2005 level. In 2018, non-ETS emissions (estimates) were 10% below their 2005 level (UBA, 2019a).

Up to 2017, Austria was able to keep annual GHG emissions below the trajectory for the non-ETS sectors. However, starting in 2017, emissions exceeded their annual binding level. The flexibility mechanisms provided for under the ESD allow Austria to still meet its 2020 target. These mechanisms allow banking unused allowances in one year and counting them towards targets in future years (EEA, 2018). However, the recent growth of transport sector emissions exceeds projections, which might leave Austria unable to meet the 2020 target through domestic measures only (EEA, 2019). Missing the 2020 target would require substantial additional efforts to meet the 2030 target of reducing emissions by 36% compared to 2005 levels. Non-ETS emissions should not exceed 36.4 MtCO₂-eq in 2030.

Environment Agency Austria¹ regularly assesses the effectiveness of the policies and measures to reduce GHG emissions and makes emissions projections every two years that currently cover the period up to 2035. Its latest *Greenhouse Gas Projections and Policies and Measures* report (UBA, 2019b) clearly shows that Austria is not on track to meet its targets. The 2019 projections take into account all policies and measures implemented by 1 January 2018, but only prepared a “with existing measures” (WEM) scenario as negotiations between stakeholders for a “with additional measures” (WAM) scenario were pending the finalisation of the national climate and energy plan (NECP). The 2019 projections are therefore based on the most conservative scenario (UBA, 2019b). The WAM scenario is included in the final NECP that was published in December 2019.

Austria will most likely miss its compliance obligation in 2020 by 3 MtCO₂-eq under the WEM (UBA, 2019b). Environment Agency Austria projects in the WEM that based on the current trajectory, Austria could exceed its carbon budget of 2030 by up to 11.5 MtCO₂-eq, or 27% (UBA, 2019b). The projected emissions trajectory is due to the anticipated economic growth and associated growth in energy demand. Austria will reduce the gap to the 2030 target to 5.2 MtCO₂-eq in the WAM scenario.

Domestic climate policies

The Climate Change Act provides the legal basis for Austria’s climate policy in the non-ETS sectors. It was first issued in 2011 and has been revised twice, the last time in 2017. The act provides for the negotiation and implementation of a set of policy measures for the period 2013-20 covering both the federal and the provincial levels. It rests on three main pillars:

- annual targets for six sectors to 2020 and an aggregate total for 2020 each of the years (2013-20)
- policies and measures to meet the sectoral targets
- rules on the sharing of costs between the federal government and the provinces in case targets are not met and emission allowances must be purchased.

While the act sets targets for 2013-20, its last revision has not yet taken into account the mandatory 2030 targets. The negotiation of policies and measures are a mandatory

¹ Annex A provides detailed information about institutions and organisations with responsibilities related to the energy sector.

requirement and work is ongoing to set them out for the period to 2030. However, this will first require the establishment of annual sectoral targets (required under a legal act by the European Commission).

Austria has put in place a comprehensive framework of policies and targets to guide its climate policy to 2030, and to advance the long-term vision of a carbon-free energy sector by 2050 as set out in the 2018 Climate and Energy Strategy, #mission2030 (FMST and FTIT, 2018). #mission2030 simultaneously addresses environmental, sustainability, energy security, competitiveness and affordability objectives for the first time in one integrated policy document. The IEA commends Austria for this. The new federal government that took office on 7 January 2020 has presented an even more ambitious programme to reach climate neutrality by 2040 (see Chapter 2 for more details on the government programme).

#mission2030 sets out how Austria will embark on a technology neutral, but nuclear-free, decarbonisation pathway for the energy and transport sectors. This pathway will use the synergies of different levels of government to reach commitments under the Paris Climate Agreement. #mission2030 is designed as the first step in a long-term process to bring together climate, energy and mobility policies and provides general guidelines for all key areas in the longer term, and more specific investment guidelines to 2030. Funding for the proposed policies will be supported by regulatory and fiscal measures. The government will evaluate the progress made towards the targets every five years to ensure Austria's trajectory remains on track, and identify appropriate corrective actions as needed. The first evaluation is scheduled for 2023.

#mission2030 forms the basis for Austria's NECP, a mandatory requirement for EU member countries that sets the national energy and climate targets to 2030. Austria submitted its draft NECP to the European Commission in December 2018 and its final NECP at the end of 2019. The plan covers the period to 2030. The NECPs include country-specific targets in the field of GHG reductions, renewables and energy efficiency, and electricity inter-connection levels, and they will be monitored through biannual progress reports.

The Climate Change Act mandated the establishment of a National Climate Change Committee (NCCC) in 2011 with broad representation from government, politics and stakeholders from the civil society, science and industry, both from federal and state levels. The NCCC supports the co-ordination of climate change-related measures and also prepares programmes consisting of different policies and instruments to meet the targets of the act.

The NCCC also initiates negotiations on additional policies and measures for those sectors that do not meet their annual emission-reduction targets, if the aggregate total of all sectoral targets is not met in a given year. However, there is only limited flexibility for discussions around which sector is best placed to make up the missing emissions. The NCCC meets at least once a year, which limits the impact it can have on facilitating corrective policy actions. Moreover, the current system allows for retrospective analysis only, and an agreement on new measures might be concluded years after the targets have been missed.

A key challenge for climate policy in Austria is the sharing of responsibilities between the federal, state and municipal levels and the spread of responsibilities among different ministries at the federal level. As a result, there is no uniform legal basis for national

measures to mitigate climate change and the legal basis for individual instruments range from, for example, the Green Electricity Law at the federal level to the technical construction regulations of buildings at the level of states. This is a particular challenge towards reaching the emission-reduction target in the building sector of 3 Mt by 2030 as per #mission2030.²

Policy implementation and monitoring of results are also carried out separately as per the different instruments and responsible administrative units. Reducing the complexity of climate policy setting, implementation and monitoring is therefore part of the government's ambition to reallocate responsibilities and to simplify and unify regulations between the federal and state levels (see Chapter 1).

Policies to reduce emissions from the electricity and industry sectors

About 80% of GHG emissions from the electricity and industry sectors are covered by the EU ETS system. Future ETS prices will therefore guide investments for emission-reduction investments in both sectors. ETS prices, which have increased strongly since the beginning of 2018, are expected to increase further in line with the new EU policies after 2020.

Austria's power sector already has one of the lowest emission intensities among IEA countries, as fossil fuels accounted for less than a quarter of annual generation in 2018 (see Chapter 3). In 2018, the emission intensity per kWh of electricity and heat generated was below 150 g CO₂, the tenth lowest in the IEA. Austria is committed to rapidly phase-out coal for electricity production (which in 2018 accounted for 5.6% of total generation) in light of increasing CO₂ prices under the ETS and the fact that the plants are coming to the end of their economic lifetime.

In its #mission2030 and the NECP, Austria has set a target for 100% renewable electricity consumption (national balance) by 2030. This ambitious target will drive the decarbonisation of the electricity sector. Policies and measures to reach the target include the removal of the tax on self-consumed electricity, activities under #mission2030's Flagship Project 6 "100 000 Roof-mounted Photovoltaics and Small-scale Storage Programme", promoting renewable energy communities and self-consumption and reducing administrative barriers (see Chapters 2 and 9). Since then, the new government has expanded Flagship Project 6 to 1 million roof-mounted photovoltaics, underlining its commitment to the 2040 target year.

About 15% of the industrial sector's GHG emissions fall outside of the ETS system. Austria's domestic policy for the industry sector primarily targets a more efficient use of resources in the transformation and production processes, as well as a shift to less carbon-intensive fuels (EEA, 2019) (see Chapter 7). #mission2030, and especially Flagship Project 9 "Building Blocks of the Energy Systems of the Future", places an important role on renewable-based electricity and hydrogen, synthetic renewable methane (power-to-gas) and biogenic materials for the technological transformation of the industry sector. The government also promotes increased research and development for those industrial sectors where there is not currently any technological option available for an energy-efficient and low-carbon production. This primarily affects the iron, steel and

² The building sector is discussed in detail in Chapters 7 and 8.

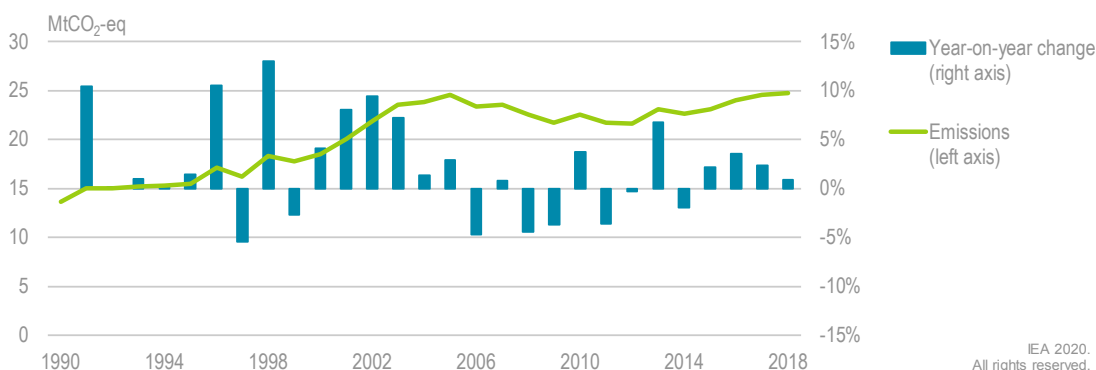
cement industries, where the use of coal for non-energy purposes cannot easily be substituted, although globally research is underway.

Policies to reduce emissions from the transport sector

To reach its 2030 emission-reduction commitment, Austria needs to specifically target the transport sector, which was the single largest emitter of non-ETS emissions in 2017 at around 46%, and which has seen a strong rebound in emissions since 2013 (FMST and FMTIT, 2018). Transport sector CO₂ emissions increased by 82% between 1990 and 2018 despite several years of decreasing emissions from 2005 to 2014 (Figure 6.8). Environment Agency Austria expects emissions from the transport sector to continue their upward trajectory until 2024 due to the continuous increase in vehicle kilometres driven by heavy-duty vehicles and buses. This is due to the anticipated GDP growth, low global oil prices and the low fuel prices in Austria compared to its neighbouring countries. According to the Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology, so-called fuel exports (fuel sold in Austria and used in neighbouring countries) are estimated to account for 23% of transport emissions (UBA, 2019b).

Austria already has in place a comprehensive transport sector policy package for the period to 2020. It is also the country with the highest share of rail transport in the European Union and has a well-developed urban public transport system. Yet, Austria's low fuel prices, due to lower taxation compared to neighbouring countries, has proven to have a counteracting effect on emissions, and is partly negating the impact of the policy package. The new government, which has committed to addressing this matter, will constitute a task force to elaborate specific concepts.

Figure 6.8 Transport sector CO₂ emissions, Austria, 1990-2018



Note: MtCO₂-eq: million tonnes CO₂ equivalent.

Source: IEA (2020), "CO₂ emissions by product and flow", *IEA CO₂ Emissions from Fuel Combustion Statistics* (database), www.iea.org/statistics.

Austria's long-term aim is the decarbonisation of mobility. As a first step, Austria is committed to reduce transport emissions to approximately 15.7 MtCO₂-eq by 2030, towards the country's 2030 target of reducing non-ETS emissions by 36% (FMST and FMTIT, 2018; Klimafonds, 2018). However, with the new aim to reach climate neutrality by 2040, the decarbonisation of mobility must happen ten years earlier and the new government is now revising the transport-related strategies.

The government will develop a Mobility Masterplan 2030 to comply with the Paris climate goals and the ambition of decarbonising mobility by 2040. The federal government is responsible for the creation of strategic framework plans, inter-regional infrastructure

development, transport-related taxation and financing issues, including the allocation of tax revenues to provinces and municipalities. Each of the nine Austrian provinces has also committed to reduce transport sector emissions. Several provinces have submitted provincial strategies for the transport sector. These strategies primarily target the provision of a range of local and regional public transport, pedestrian and cycling infrastructure, and improved parking space management or parking ordinances, in addition to supportive spatial planning (FMST, 2019c).

The federal government, the provinces and municipalities announced 230 measures targeting the transport sector. According to the draft NECP, these measures have a potential to save 1.1-2.5 MtCO₂-eq. This is not sufficient to reach the 2030 target, and the WEM scenario would deliver a gap of 4.8-6.2 MtCO₂-eq. The WAM scenario in the final NECP sees substantial reductions in transport sector emissions in 2030; however, transport would remain the largest non-ETS emission sector at 49% (FMST, 2019a).

The government is pursuing its goal of fossil-free mobility by 2050 through a four-pronged policy to facilitate a comprehensive mobility transition: 1) e-mobility offensive; 2) sustainable alternative fuels; 3) multimodal mobility shift; and 4) taxation. The policies follow the concept of *avoid*, e.g. through teleworking; *shift*, e.g. to public transport; and *improve*, making alternative transport modes carbon free.

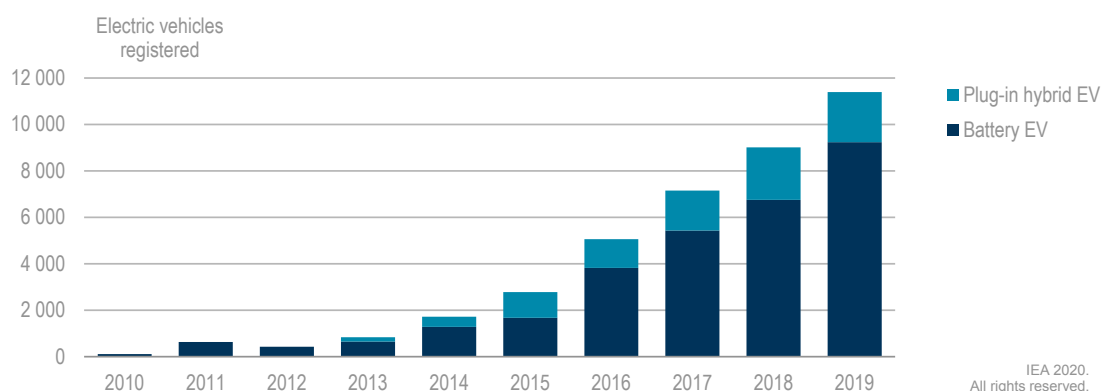
E-mobility offensive

The e-mobility offensive is one of #mission2030's 12 flagship projects (see Chapter 1) focusing on enhanced roll-out of electric vehicles (EVs) and their infrastructure, further electrification of the railways and the roll-out of e-mobility services (e-mobility management, e-fleets and e-logistics).

Austria's railway infrastructure had an electrification rate of about 73% in 2017; the government aims to increase this to 85% by 2030. This implies an annual electrification of 50 km of track of the main infrastructure manager "ÖBB-Infrastruktur AG" and 20 km of track of other infrastructure managers. Austria is keen to promote the electrification of secondary rail lines through new technologies like hydrogen, fuel cells and batteries, which do not require alimentation through overhead electricity lines (VCÖ, 2018). Research initiatives can apply for funding *inter alia* through the Climate and Energy Fund in support of the implementation of the e-mobility initiative. A narrow gauge hydrogen project, which is a promising pilot, is in the design phase in the Zillertal valley.

Austria has made notable progress in increasing the share of EVs (annual new car registrations for EVs increased from just over 100 in 2010 to over 11 000 in 2019, mostly from battery electric vehicles) (Figure 6.9). By the end of 2019, the electric passenger vehicle stock had increased to 39 000 cars, including around 40 fuel cell vehicles; however, they accounted for only about 1% of the total passenger vehicle fleet. In addition, just over 13 000 other EVs (e.g. motorbikes, buses) were operating on Austria (FMTIT and Austriatech, 2019).

The Austrian government has long provided subsidies for the purchase of EVs and fuel cell vehicles and investment in EV charging infrastructure. In January 2019, the "E-mobility offensive 2019 and 2020", a comprehensive deal to support e-mobility with renewable energy in Austria, commenced in close collaboration with vehicle importers. It is a follow up of the E-mobility programme of 2017 and 2018 (FMST, 2019b). The "E-mobility offensive 2019 and 2020" has a budget of EUR 93 million for both years (FMST, 2019b).

Figure 6.9 Electric vehicle registrations in Austria, 2010-19

Electric vehicles have increased steadily in recent years, reaching nearly 34 000 by mid-2019, of which pure battery cars accounted for 78%.

Source: FMTIT and Austriatech (2019), *Electromobility in Austria, Facts & Figures January 2020*, https://www.austriatech.at/assets/Uploads/Publikationen/PDF-Dateien/68e9ddd74d/Facts_Figures_2020_01_E.pdf.

EV subsidies are funded through a public-private partnership between vehicle importers and the government, represented by the Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology. Subsidies are provided for up to a maximum of 30% of the eligible purchase cost, but apply only for EVs with a purchase price below EUR 50 000 for personal vehicles and less than EUR 60 000 for commercial vehicles (klimaaktiv mobil, 2019; FMST, 2019b). The provision of subsidies for e-cargo bikes is newly included for the period 2019-20 (Table 6.1).

Table 6.1 Electric vehicle subsidies by vehicle type in Austria

EV type	Maximal subsidy (EUR)
E-bike and cargo bike	200-400
E-scooter	700
Electric motorcycle	1 000
Plug-in hybrid electric vehicle	1 500
Battery electric vehicle	3 000
Light- and heavy-duty commercial electric vehicle	5 000-50 000
Electric bus	Up to 100 000

Sources: klimaaktiv mobil (2019), *#mission2030 "E-Mobilitätsoffensive"*, <https://www.klimaaktiv.at/mobilitaet/elektromobilitaet/foerderung/emob2019.html>; FMST (2019b).

Zero-emission buses, company cars and duty vehicles of statutory bodies and associations complying with certain eligibility criteria, can also benefit from financial purchase incentives. The government aims that by 2030, the majority of newly registered light-duty vehicles will be electric or fuel cell, and that the total electric vehicle stock in 2035 will be one-third of the total car fleet (EEA, 2019b). The public procurement strategy to privilege the acquisition of zero- and low-emission vehicles will further boost e-mobility (EC, 2019).

To facilitate the expected growth of e-mobility, the government is supporting the rollout of a clean mobility infrastructure. At the end of June 2019, Austria had 4 178 publicly available charging points, 12% of which are fast charging. This is almost double the number installed at the end of 2016 (FMTIT and Austriatech, 2019). However, significant additional effort is needed in this area as well. In comparison, in Norway, where EVs account for almost 50% of new car sales, there are over 11 000 EV charging stations, while the Netherlands had over 35 000 EV stations in 2018 (IEA, 2019b).

The government plans to further expand and upgrade the charging infrastructure in co-operation with private sector suppliers. This will include a particular focus on creating a charging infrastructure for electric buses, which are increasingly deployed at the provincial and municipal levels. Moreover, the government plans to modify the building legislation to facilitate the installation of charging points in apartment buildings and a “right to plug” commitment is included in the new government programme. Subsidies for the installation of private EV chargers are provided for single-family households, and they have been newly introduced in the “E-mobility offensive 2019 and 2020” for multi-family residences as well (FMST, 2019b). Subsidies for EV chargers for the period 2019-20 are given in Table 6.2.

Table 6.2 Electric vehicle charger subsidies in Austria

Electric vehicle charger type	Subsidy (EUR)
Single-family residence	200
Multi-family residence	600
Public charger up to 22 kW	1 000
Public charger up to 43 kW	2 000
Public DC fast charger above 43 kW	10 000

Source: FMST (2019b).

A key concern is e-mobility management, which aims to overcome non-monetary barriers to the adoption of e-mobility. A bundle of measures is grouped under this concept to support the integration of e-mobility management, e-fleets and e-logistics into overall mobility planning processes of regions, towns and municipalities and in corporate logistics.

In particular, all operators in the transport sector (urban, local and regional authorities; tourism operators; firms; fleet operators; mobility service providers; logistics service providers; associations) should be motivated through incentives and mobility management to introduce e-mobility solutions and mobility services, such as e-carpooling, e-taxi systems, demand-driven e-mobility services, electric bus-on-demand services, e-bike hire systems, e-delivery services and logistics.

Since the beginning of 2019, the Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology published an online list of all public recharging facilities for EVs in Austria, including the technical equipment, recharging options and charging power available at every public recharging site. The government hopes this measure will stimulate competition between the recharging infrastructure operators (FMST, 2019c).

The government closely monitors the longer-term impact of the e-mobility offensive on the electricity sector, and the need to ensure sector coupling with a view to the larger objective

of establishing an electricity-based energy system. Special focus is given to support research and pilot projects aimed at energy storage solutions. The energy storage programme, which was successfully supported by the government from basic research towards building up demand for storage, is now rolling out at provincial and municipal level.

Expanding the use of alternative fuels and technologies

Austria's key focus in the transport sector is the e-mobility offensive. However, the government is also actively promoting the use of alternative sustainable fuels and technologies for those transport applications for which electrification is only a limited option, e.g. heavy goods vehicles, agriculture and aviation.

Austria is promoting a wide range of alternative fuels, ranging from first- and second-generation biofuels to hydro treated vegetable oils to biomethane and hydrogen from renewable sources (see Chapter 9). Biodiesel, bioethanol and hydrated vegetable oil are mainly used for blending with fossil fuels, whereas small quantities of vegetable oil are distributed in its pure form for the use in agricultural machines.

In 2017, the share of biofuels was around 6%, above the legally required substitution level for fossil fuels of 5.75% (energy share) and resulted in the saving of 1.55 MtCO₂. However, the share of biofuels has declined since 2015 because of sustained low prices of fossil fuel, leading to higher sales of non-blended fuels, as well as a decrease in pure biofuel sales (UBA, 2019a). Yet, despite this decrease, Austria is on track to meet the renewables in transport goal for 2020 (see Chapter 9).

There is less government support for biofuels and biogas (bio-CNG/bio-LNG) cars compared to EVs; only non-private vehicles in rural areas – with at least 50% biogas/biofuel of the yearly fuel consumption – are eligible for financial support. This is partly a reflection of limited demand, but also due to EU regulations limiting the use of first-generation biofuels. It is important to keep in mind that the shift towards e-mobility is likely to result in a reduction of biofuel sales, commensurate with the reduction of petrol and diesel sales.

Mode shifting and new mobility concepts

Austria already belongs to the group of EU member states with the highest share of rail transport (both passenger and freight transport) and it plans to further shift transport needs to rail through large investments in new infrastructure. Flagship Project 2 of the #mission2030 targets to increase rail-bound public transport. This will be achieved through a combination of infrastructure development, especially augmenting the capacity of urban public transport, and operational measures to exploit the switching potential. Austria also plans to invest almost EUR 14 billion into the railway system from 2018 to 2023 under the Austrian Railways Master Plan. A key objective is to significantly shorten the travel times between Austria's large urban centres and key destinations in neighbouring countries. Infrastructure upgrades are complemented through the introduction of an integrated scheduling system, as already successfully used in Switzerland.

New mobility concepts are needed to meet transport needs in rural areas, between rural and urban areas, and in freight transport through low-emission modes. Rail accounts for 32% of freight transport and the government is actively supporting a further shift away from road to rail in freight transport, especially on the environmentally sensitive and strongly frequented Brenner Corridor between Austria and Italy (Eurostat, 2019). However,

commensurate investments and policy measures in neighbouring countries are needed to ensure the success of Austria's efforts. Austria also plans to shift freight transport increasingly to inland waterways.

#mission2030's Flagship Project 1 for Efficient Freight Transport Logistics will support the implementation of Austria's Transport Plan to ensure that freight demand is met more efficiently and maintains high standards while reducing its negative impact.

The implementation of new mobility concepts requires better mobility management and enhanced digitalisation to allow multimodal networking. A key requirement is the close co-operation between the federal and the provincial level, as the success of a large number of planned activities relies on implementation at the municipal and provincial levels through, for example, land-use planning, traffic organisation and prioritisation of infrastructure investment. The klimaaktiv mobil programme will support different stakeholders, including the business community, to implement mobility management (klimaaktiv mobil, 2019).

The federal government's 2015-2025 Cycling Masterplan aims to increase the share of bicycle use from 7% in 2018 to 13% by 2025 (FMST, 2019c). The complimentary 2015-2025 Walking Masterplan aims, among others, to improve the walking infrastructure. The success of both plans will depend on improving the interface with public transport options at the local level. Digitalisation of services and optimising the scheduling of public transport will facilitate the seamless shift between different mobility modes. The continuity between private car use and public transport will be enhanced by offering park & ride and carpooling schemes (EC, 2019; FMST and FMTIT, 2018).

Policy measures supporting modal shift are adapted to the specific requirements in urban and rural areas. On average, 14.6% of all roads are reserved for public transport on an average working day, but the percentage varies on a local level and increases with population density (FMST and FMTIT, 2018). However, the existing urban public transport infrastructure is quickly reaching saturation and Austria plans extensive infrastructure investments to allow better exploitation of the switching potential from private motorised to public transport.

Taxation

Austria is implementing a comprehensive reform of taxing individual mobility as part of the larger policy of greening the tax system (see Chapter 2). Since 2014, the standard consumption tax that is imposed when a car enters the Austrian market for the first time is levied based on CO₂ emissions instead of fuel consumption. Vehicles that emit less than 90 g CO₂/km do not have to pay any tax, while for vehicles emitting above this threshold, the standard consumption tax increases progressively with increasing emissions (FMST, 2019c).

A unique feature in Austria is the high percentage of private use of company-owned cars that are provided as remuneration in-kind to employees. In the first nine months of 2019, over 62% of newly registered cars were company owned. The tax reform of 2015 introduced an environmental component for remuneration in-kind. It introduced a monthly tax charged at 2% of the initial car costs up to a pre-set maximum. However, it simultaneously introduced a tax rebate for cars that emit less than 130 g CO₂/km, for which only 1.5% of the initial costs have to be paid monthly, again up to a pre-set monthly maximum. The relevant CO₂ rate decreases from 2017 to 2020 by 3 g annually. Employees using company-owned vehicles that emit 0 CO₂/km are exempted from paying

tax for the benefits derived from the use of the company car. The relevant CO₂ limitations have been adapted in 2020 due to new measurement rules.

Moreover, in January 2016, a tax deduction for the value-added tax (VAT) for certain types of service vehicles with zero CO₂ emissions was introduced. Similarly, zero-emission vehicles enjoy exemptions from the motor vehicle and the vehicle-related insurance tax. Combined, these measures set an incentive to purchase vehicles with low CO₂ emissions.

A larger tax reform entered into effect on 1 January 2020 with the objective of relieving the overall tax burden while strengthening the green element in the tax system. The key principle in the transport sector is to link the tax burden to CO₂ emissions and shift it to those vehicles with above-average CO₂ emissions. The insurance tax will be now also be linked to CO₂ emissions, with exceptions for small vehicles with low engine capacity. An entirely new feature is the consideration of CO₂ emissions for motorcycles. The government also plans to introduce a VAT tax deduction for the purchase of electric bicycles and motorbikes for business use, to treat them equal to EVs, which already benefit from a VAT deduction. The CO₂ threshold values for tax relief for the private use of company cars will also be adjusted to 141 g and will be adjusted downward in the coming years. In addition, a socially acceptable and ecological restructuring of the “standard consumption tax” (the motor vehicle registration tax) has taken place as a result of the changed CO₂ values based on the new measuring process.

However, Austria is not considering a revision of its road transport fuel taxation system to bring pump fuel prices closer in line with neighbouring countries. If Austria’s transport fuels remain cheaper than those of its neighbouring countries, there is little chance that “fuel tourism” will decrease in the future. The new government is committed to tackle fuel tourism as well as the heavy goods vehicle traffic transiting Austria and is exploring ways to do so in a politically acceptable manner and in alignment with European rules.

It is also uncertain whether the measures proposed to impose higher charges on cars with larger engines alone will be sufficient to shift users towards low-, or even zero-emission vehicles, when fuel prices remain relatively low.

Adaptation policies

Austria has recorded an increase in average annual temperatures of around 2°C since 1880, significantly higher than the global temperature rise of 0.9°C. The increase was the strongest in the period after 1980, which registered a surge of 1°C. Austria is susceptible to weather extremes, and is already seeing clear consequences, including a growing number of hot days, faster melting glaciers, thawing permafrost ground and longer vegetation periods, with environmental and economic impacts. Among other possible future impacts are a slight reduction in electricity production from hydropower and a potential increase in extreme weather events that may test the resilience of infrastructure.

Austria addresses adaption through the Strategy for Adapting to Climate Change and its integrated National Adaption Plan, adopted in 2012 and revised in 2017. These two documents aim to reduce the negative impacts of and build resilience to climate change. The Strategy for Adapting to Climate Change focuses on the strategic components of adaptation, i.e. policy developments at various levels, research activities, social aspects of adaptation, etc. The National Adaption Plan presents a catalogue of 136 adaptation options for 14 areas, including energy (focusing on the electricity sector), water resources and water management, ecosystems/biodiversity, cities and business/industry/trade.

The Climate and Energy Fund launched the Climate Change Adaptation Model Regions Programme in 2016 to provide support for regions (administrative units below the state level) on climate adaptation. In the period 2018-20, several regions will receive financial support for the implementation of the selected adaptation measures at the local and regional scales. Funding is decided annually, subject to federal budget discussions.

Austria was one of the first countries to introduce a concept for monitoring and evaluating the adaptation strategy in 2014, which sets out a method for monitoring progress, raising awareness and a process for review. The government published a progress report in 2015, which was the first report of its kind published in Europe. The report found that most suggested adaptation measures to ensure security of electricity supply had only partially been implemented. However, several measures were found to have been fully implemented, including the optimisation of linking electricity demand and supply, and demand reduction through energy efficiency. The next progress report is expected in 2020 (FMAFEW, 2015).

Assessment

Austria risks missing its climate target of a 16% reduction of non-ETS emissions by 2020 compared to the 2005 level. In 2018, non-ETS emissions were 10% below the 2005 level, and have increased since 2014. Austria has also agreed to reduce non-ETS emissions by 36% below the 2005 level by 2030. Both targets are above the average EU reductions.

Austria's CO₂ emissions increased in the 1990s until the early 2000s. After a peak in 2005, emissions declined, but have plateaued in recent years, with a small increase in 2017. In 2018, total energy-related CO₂ emissions were 61 Mt, 17% below the 2005 value, but 9% above the 1990 value.

The Climate Change Act (2011, revised in 2015 and 2017) provides the legal basis for Austria's climate policy in non-ETS sectors. It sets out targets to 2020 (but has not yet been updated with 2030 targets), and the sectoral targets are of indicative nature.

Climate and energy policy is a mix of reserved and devolved responsibilities, with the provinces having sole responsibility for a number of policies, including building regulations. Austria has established a National Climate Change Committee with broad representation from government, politics and stakeholders to co-ordinate climate-related measures. However, there is no uniform legal basis for national measures on climate protection, nor centralised policy implementation and monitoring of results.

Compared with 2005, all sectors have experienced a reduction in emissions, or remained stable. Industry emissions have been stable in the last decade, while transport emissions fell until 2012, but have been growing since. Emissions in heat and power generation have been on a declining trend since 2005, as renewables have partially replaced fossil fuel power and coal to gas switching.

Looking forward, projections for Austria's total GHG emissions in the conservative "with existing measures" (without land use, land-use change and forestry) scenario show a decrease of 6% from 1990 to 2030, and a decrease of 8.6% from 1990 to 2050. For the non-ETS sectors, emissions are projected to decrease by 15.7% between 2005 and 2030, significantly short of Austria's target of 36%.

Austria has seen some success in decoupling its emissions from GDP growth, but this stalled in 2014 and existing policies could lead to higher emissions in the case of increased

economic growth. Austria should also look at the co-benefits and opportunities of a transition to a low-carbon economy, such as reaping benefits for businesses and industry, increasing security of supply, cutting consumer bills, increasing the number of highly skilled jobs, and improved health through better air quality.

The Climate Change Act requires the NCCC to arrange for negotiations on additional measures for those sectors where targets were not met if the aggregate total of all sectoral targets exceeds the annual target. However, while a laudable obligation in principle, it is retrospective only, and policy discussions are likely to conclude two years after the targets have been missed. A forward-looking approach based on trends might be helpful to avoid sectors moving further off their expected trajectory, as is currently the case for the transport sector. Moreover, there is only limited flexibility for discussions about which sector is best placed to make up the missing emissions, weakening the potential benefit from the discussions of the NCCC. Austria should establish metrics for delivery and mandate reporting from the provincial level to the federal level so that there are more opportunities to assess whether progress is on track.

#mission2030 sets out Austria's high-level strategy and brings together energy security, emission reductions, competitiveness and affordability for the first time. This is an ambitious strategy, identifying targets for 2030, including specific emission-reduction targets for the buildings (-3 Mt) and transport (-7.2 Mt) sectors, and identifying 12 flagship projects across transport, buildings, renewables, green finance and RD&D. However, it does not contain detailed targets for all sectors, pathways to meet the targets, or detailed policies and proposals. Austria should develop a clear pathway to both 2030 and 2050.

#mission2030 forms the basis for Austria's National Energy and Climate Plan, a mandatory requirement for EU member states that sets the national energy and climate targets to 2030. Austria acknowledges that the Climate and Energy Strategy and the NECP are only the first steps. #mission2030 will need to be updated to incorporate new data and knowledge. The ambitious targets for 2030 and 2040 require substantive change to the existing legal, regulatory and policy frameworks. The final NECP has to set out proposals to tackle the challenges in the transport sector, Austria's largest emitting sector, as policies identified in the draft NECP would deliver only a small fraction of the necessary savings by 2030. However, the new government has committed to revisiting the ambition set out in the NECP and to increasing efforts with a view to reaching carbon neutrality by 2040.

Increasing energy consumption levels in the transportation sector remain a major issue, given that approximately 95% of energy consumption in transport is still non-renewable. From 1990 to 2018, CO₂ emissions from the transport sector increased by 82%. Nearly all of these emissions come from road transport. Contributing to the problem are fuel exports in vehicle tanks; fuels sold in Austria but used elsewhere, which have increased substantially since 1990. Fuel export, or "fuel tourism", is estimated to account for approximately 23% of total diesel and petrol sold in Austria in 2016, and 5 Mt of CO₂ emissions.

Immediate and significant interventions are required to reverse this trend. #mission2030 describes an ambition to switch to zero-emission vehicles and e-mobility powered from renewable sources. This includes ensuring that the correct incentives are in place to drive electric vehicle deployment, and that infrastructure is in place to encourage the switch to public transport and walking and cycling. The main financial measures include tax relief and investment support for several types of zero-emission vehicles and charging infrastructure.

Austria implemented a comprehensive taxation reform for the transport sector on 1 January 2020 to support a shift to EVs and other alternative fuels to address the continuous growth of transport emissions. However, the government does not favour the introduction of a domestic CO₂ tax on transport fuels, but instead plans to tackle the problem through other policy measures that will be developed by a task force specifically created for this purpose. As pointed out in the last in-depth review of 2014, there is a need to weigh the tax increase versus the tax income and any cost due to a possible non-compliance with emissions targets.

Heavy-duty freight vehicles transiting Austria are the main cause of fuel exports. Therefore, the government's intention to shift this type of traffic onto rail would reduce the impact in the longer term. In addition, if the government is reluctant to levy a domestic CO₂ tax on all transport fuels, it could consider increasing the tax on diesel fuel consumed by the transiting freight trucks. Domestically, diesel vehicles account for a declining share of Austria's newly registered passenger vehicles.

Austria considers adaptation to climate change of equal importance to mitigation, addressing it through the Strategy for Adapting to Climate Change of 2012. Austria has recorded an increase in average annual temperature of around 2°C since 1880, more than double the global temperature rise of 0.9°C.

The Climate and Energy Fund started a climate change adaptation programme in 2016 and supports regional authorities to apply the latest knowledge to minimise the negative effects of climate change. The programme plays an important role in linking federal and regional strategies.

Recommendations

The government of Austria should:

- Develop an implementation plan for how all sectors will meet their greenhouse gas emission-reduction targets to 2030 and beyond, including the policies and support mechanisms needed, and with clear responsibilities assigned to ministries and provinces.
- Improve forward-looking monitoring and governance, to ensure action and strategic decisions are taken before climate targets are missed, including identifying which sectors are best placed to address any expected shortfall.
- As part of the larger social-ecological tax reform planned by the new government, consider increasing the progressive CO₂ consumption tax for inefficient vehicles, increasing subsidies for zero-emission cars and for modal shift, and consider increasing the petrol and diesel fuel tax to meet the climate targets in the transportation sector.

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7. Energy efficiency

Key data

(2018)

Total final consumption (TFC): 27.6 Mtoe (oil 39.9%, electricity 19.6%, natural gas 18.1%, bioenergy and waste 13.9%, district heat 6.1%, coal 1.6%), +2.4% since 2008

Consumption by sector: industry 34.3%, transport 32.3%, residential 22.9%, services/other 10.5%

Energy consumption (TFC) per capita: 3.1 toe (IEA average in 2017 2.9 toe)

Energy intensity (TFC/GDP, 2018): 59.8 toe/USD million (2015 prices and PPP), -7% since 2008

Overview

Austria will most likely miss its total final energy consumption (TFC) target for 2020 of not exceeding 1 050 Petajoules (PJ) (25.1 million tonnes of oil equivalent [Mtoe]). Austria had made progress towards the target until 2014, but since then TFC and total primary energy supply (TPES) have increased together with economic and population growth (Figure 7.1). Austria is, however, well on track to meet its cumulative energy savings target for 2020.

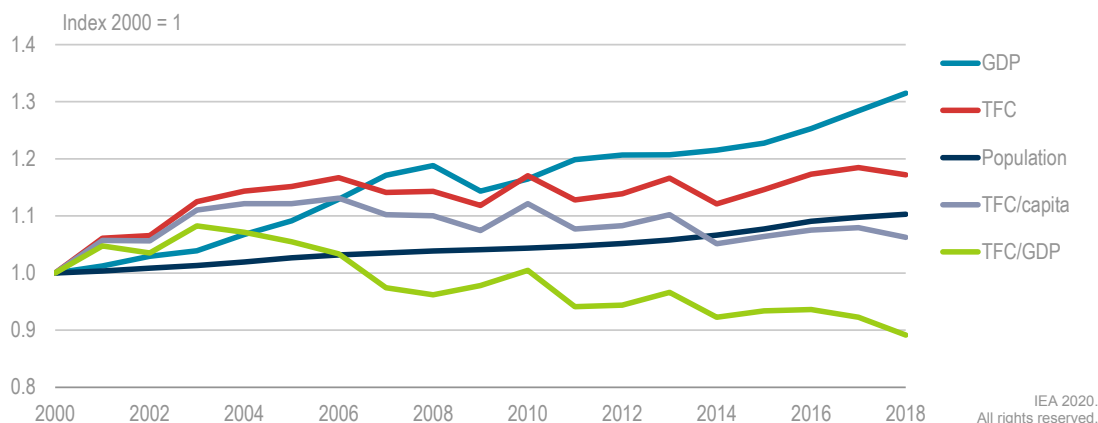
The country has set new ambitious targets for 2030, including improving primary energy intensity by 25-30% compared with 2015 and limiting primary energy demand¹ to 1 200 PJ (if demand increases further, it should be met by additional renewable energy). A new set of policies and measures is needed to meet these targets. Those could include measures across different sectors, such as improving energy standards in buildings and promoting the market for energy service companies to provide further efficiency improvements in industries and households.

TFC has historically been increasing, but since the period around 2005, has fluctuated around 10-20% above the level in 2000 (Figure 7.1). Since 2014, however, TFC has increased, although with a small decline in the last year. In 2018, Austria's TFC was 27.6 Mtoe, 2% above the 2005 level and 5% higher than in 2014. Meanwhile, population increased by 7% between 2005 and 2018 and gross domestic product (GDP) grew by 20% (in purchasing power parity). TFC is thus showing signs of decoupling from both population and GDP, with a 5% drop in TFC/capita and a 16% drop in TFC/GDP since 2005. However,

¹ The EU defines primary energy consumption as gross inland energy consumption minus the fuels consumed for non-energy use. Gross inland energy consumption represents the energy necessary to satisfy the inland energy consumption of a country. Gross inland consumption is calculated as follows: primary production + recovered products + total imports + variations of stocks – total exports – bunkers (EEA, 2019).

since 2014, the decoupling has been less apparent. The industry, transport and buildings (residential and services) sectors consume roughly one-third of TFC each. Most of the recent increase has come from the transport sector (Figure 7.2).

Figure 7.1 Energy consumption and drivers, Austria, 2000-18



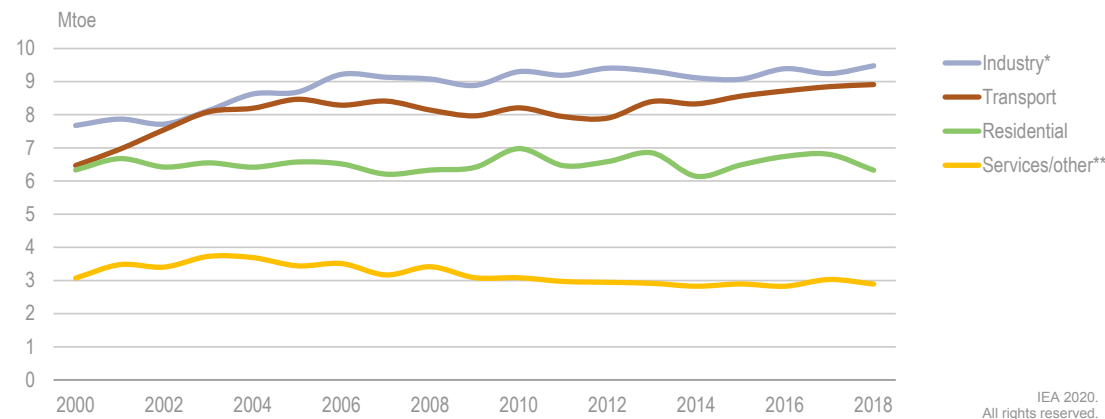
Austria's TFC has increased at a slower rate than the economy and population growth in the last decade, but since 2014, there has been no decoupling.

* GDP data are in billion USD 2010 prices and purchasing power parity.

Notes: GDP: gross domestic product; TFC: total final consumption.

Source: IEA (2020a), "World energy balances", *IEA World Energy Statistics and Balances* (database), www.iea.statistics.

Figure 7.2 Final energy consumption by sector, Austria, 2000-18



The recent trend shows increased energy consumption in industry, transport and residential buildings, bringing TFC up by 5% in three years. Only the commercial sector has been stable.

* Industry includes non-energy use.

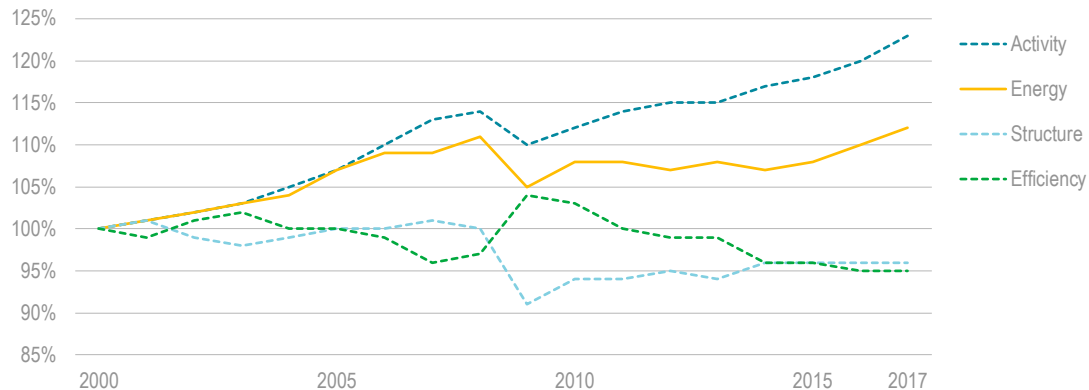
** Services/other includes commercial and public services, agriculture, forestry and fishing.

Note: Mtoe: million tonne of oil equivalent.

Source: IEA (2019b), *World Energy Balances 2019*, www.iea.org/statistics.

A decomposition analysis² of energy consumption shows that structural changes in the economy and energy efficiency improvements have not been able to keep up with the growth in activity, including growth in population, industry output and transport service demand (Figure 7.3).

Figure 7.3 Energy consumption decomposition analysis, Austria, 2000-17



Structural changes and energy efficiency have contributed to reduced energy demand since 2000, but stronger growth in economic activity have led to an overall increase in energy use.

Note: Data is preliminary and may change before the publication.

Source: IEA (2020b), *Energy Efficiency Indicators Highlights 2020 (forthcoming)*, www.iea.org/statistics.

Policy targets and measures

As a member of the European Union (EU), Austria's energy efficiency policy is embedded in the EU's energy policy framework: the EU Energy Efficiency Directives, the EU 2030 Framework for Climate and Energy, and the EU's international energy and climate commitments.

The Energy Efficiency Act of 2014 sets Austria's policy framework for the period to 2020 and transposes EU targets into national law. Austria's ambitious target for 2020 is to stabilise final energy consumption at 1 050 PJ, implying a reduction of 21% compared to the 2005 level. Austria was on track to reach the target until 2014, but higher than expected economic and population growth and weather variations have since resulted in a reversal of the trend. Austria is currently not on path to reach its 2020 final energy consumption target. Final energy consumption reached 1 130 PJ in 2017 (FMST, 2019b).

The 2014 act also sets a target to achieve cumulative energy savings of 310 PJ over the period 2014-20. Of this, 159 PJ are to be attained through the energy suppliers' obligation scheme (see next section) and 151 PJ through alternative policy measures such as energy taxes, and technical and financial support for refurbishment of buildings (BMFW, 2017).

² The activity index refers to value-added output in industry and services, population in the residential sector and passenger/tonne-kilometre for transport. The structure index refers to economic structural changes in industry, floor area per person in the residential sector and modal shift in the transport sector. For more information on the decomposition methodology, see IEA (2018).

At the end of 2017, Austria had reached 44% of the final value (FMST, 2019b). Although Austria has not set a specific annual path towards the 2020 target, the government is confident it will meet the target.

Hence, Austria is likely achieving its cumulative energy savings targets in 2020 while missing the final energy consumption target. Austria will need to intensify efforts to deliver energy savings towards the 2020 target, but also with a view of reaching the longer-term targets that are even more ambitious.

Austria's target for 2030 is to improve primary energy intensity by 25-30% compared to its 2015 level and to not exceed a primary energy consumption of 1 200 PJ. Energy consumption beyond that level should be met from renewable sources (national balance) (see Chapters 2, 3 and 9). In 2018, TPES was 1 375 PJ (32.8 Mtoe), 15% above the 2030 target level, while TPES/GDP (in PPP) had declined by 6% compared to 2015.

Austria's climate and energy strategy, #mission2030, includes five flagship programmes targeting energy efficiency in the heating, building and transport sectors to reach the 2020 target and to move the country towards reaching the ones for 2030. A central concern of #mission2030 is to safeguard continuous economic growth, especially the competitiveness of Austria's industrial sector, while advancing the transition to a low-carbon future (FMST and FMTIT, 2018).

In September 2018, Austria launched a process to redesign the Energy Efficiency Act, to align the national energy efficiency framework with recent legislative developments in the EU and with the Paris Agreement, so to ensure a return to the energy efficiency and emission-reduction target pathway to 2030. Policy options are developed in close collaboration with relevant stakeholders with a view to deliver the energy efficiency savings in a more effective and less bureaucratic way.

A key challenge for energy efficiency policy in Austria is the lack of an explicit allocation of authority for general policy oversight in the Austrian Federal Constitution. Both the federal and the provincial governments are authorised to adopt laws in this field. However, the Constitution does provide for a way to circumvent the problem of split responsibilities by adopting a so-called competence coverage clause in an act. This clause allows the federal government to regulate matters that do not actually fall in its legislative competence. The 2014 act includes such a competence clause. In practice, however, the federal government will limit its intervention in the legislative competence of the provinces to a minimum.

The 2014 act provides for the establishment of a National Energy Efficiency Monitoring Body. The monitoring body is independent from the obligated parties and was established within the Austrian Energy Agency.³ The body undertakes monitoring and verification activities and plausibility checks of all energy efficiency measures. It carries out desktop checks of the detailed documentation of undertaken measures, and carries out on-site checks for a representative sample of the measures. All reporting is via an online portal and the data are processed electronically. The monitoring body also evaluates the qualifications of energy service providers and regularly reports on the status of the energy service company market. At the end of 2018, 880 qualified energy service providers were

³ Annex A provides detailed information about institutions and organisations with responsibilities related to the energy sector.

registered with the monitoring body, 564 of which were included in the public register of external energy service providers (FMST, 2019a).

The body is further tasked with producing the energy efficiency action plans and progress reports, an obligation under the Energy Efficiency Directives (BMWWF, 2017). The latest energy efficiency action plan, which was prepared in 2017, will also be the last one, for energy efficiency reporting will be subsumed into the National Energy and Climate Plan 2021-30 as from 2021.

The IEA commends Austria for the creation of a national monitoring body that responds to one of the recommendations of the IEA's 2014 in-depth review, to ensure an appropriate feedback loop is maintained in the energy efficiency sector.

Public sector energy efficiency

The 2014 act requires the public sector to lead by example. The central government is obliged to renovate 3% of its building stock each year to achieve 48.2 gigawatt hours (GWh) cumulated savings by 2020. Austria met the annual targets for 2014-18 and reached cumulative savings of 36.39 GWh by the end of 2018 (FMST, 2019b).

The savings are largely due to the early initiation of energy contracting projects, making use of energy services companies. Over the period to 2020, energy savings from contracting are twice as large as all other categories together. Those categories include the downsizing of total floor space occupied, renovation and energy management. Another reason for the progress is the concentration of ownership and use of public sector buildings by just three federal ministries, which facilitates administrative procedures and allows for economies of scale (FMST, 2019b). In addition, the public sector is incorporating life-cycle energy consumption as a requirement into tenders for public procurement.

Moving forward, the government is committed to stop using fossil liquid energy in all buildings owned and used by the federal and provincial governments by 2030 (FMST, 2019a). The final National Energy and Climate Plan for the period 2021-30 will set a specific energy savings target for all buildings owned and used by the federal government. Given the success achieved through energy contracting so far, the government plans to expand the use of this instrument for the period to 2030.

Energy efficiency obligation scheme

The 2014 act introduced an obligation for energy suppliers that took effect from 1 January 2015. Commercial energy suppliers who supplied at least 25 GWh to final energy consumers in Austria in the previous year are obliged, for the years 2015-20, to provide evidence of the implementation of final energy efficiency measures. These measures can concern the energy suppliers themselves, their own final customers or other final energy consumers, and must amount to 0.6% of their previous year's sales. The obligation applies for each calendar year individually and all measures must be reported to the monitoring body set up under the 2014 act. The obligation covers all energy sources (BMWWF, 2017).

The scheme does oblige each supplier to achieve 40% of annual savings in households. Savings derived from measures implemented in low-income households are weighted with a factor of 1.5 against the annual obligation. At the end of 2017, cumulative energy savings under the obligation scheme had reached 47 PJ (FMST, 2019b). In aggregate, energy

suppliers have exceeded their annual targets every year since 2015, even if a handful have not met their annual targets (Monitoringstelle Energieeffizienz, 2018).

Buildings

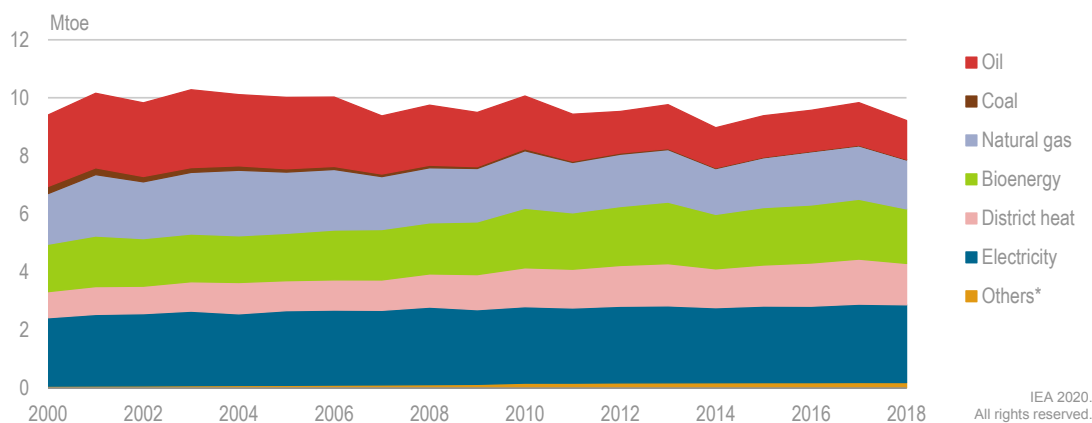
Consumption

The residential and service sectors together accounted for 33% of TFC in 2018. Consumption has been around 9 Mtoe in the last decade, with annual fluctuations because of weather conditions, as colder winters mean higher heating demand in buildings. In 2018, the sectors consumed 9.2 Mtoe, 5% lower than in 2008 and 3% higher than in 2014, which marked the lowest demand in the ten-year period.

Energy demand in buildings is spread across many energy sources (Figure 7.4). Electricity, mainly used in appliances, is the largest energy source, with 29% of total consumption in 2018. Bioenergy and other renewables (small shares of solar and geothermal heat) accounted for 22% of total consumption, while fossil fuels, mainly natural gas and heating oil, accounted for 33%. The remaining 16% was from district heating, which is an important heat source in urban areas (see Chapter 8) and a small share of solar heat.

Most energy demand in buildings is used for heating purposes. In the residential sector, space heating accounted for 71% of total energy demand in 2017, and water heating for another 14% (Figure 7.5). The rest is used in electric appliances, space cooling, lighting and cooking.

Figure 7.4 Total final consumption in residential and service sectors by source, Austria, 2000-18



Residential and commercial energy demand has been relatively stable around 9 Mtoe in the last decade, with a slow shift from oil towards bioenergy and district heating.

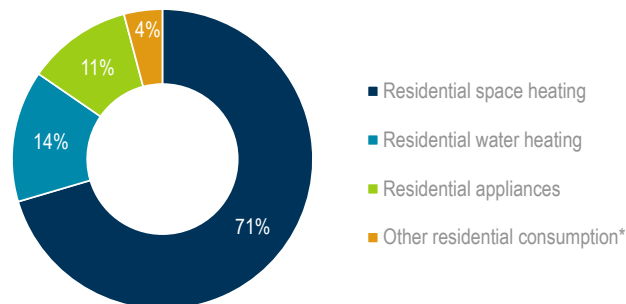
* Includes solar and geothermal.

Notes: Mtoe: million tonne of oil equivalent. Includes consumption in residential, commercial and public services, agriculture, forestry and fishing.

Source: IEA (2020a), "World energy balances", *IEA World Energy Statistics and Balances* (database), www.iea.statistics.

In the last decade, there has been a shift from oil, mainly to bioenergy. Oil consumption declined by 35% from 2008 to 2018, while bioenergy consumption grew by 7% and district heating by 25%. In the last five years, however, oil consumption has remained stable. Oil for heating is used mostly in rural areas that are not connected to the natural gas or district heating networks. Oil maintains a substantial share of heating in buildings, with 15% of total energy use in the residential and service sectors in 2018. Oil accounts for half of direct CO₂ emissions from buildings (not including indirect emissions from the production of electricity and district heating used in the sectors).

Figure 7.5 Breakdown of energy use in the residential sector, Austria, 2017



IEA 2020.
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Space and water heating account for 85% of residential energy consumption.

* *Other residential consumption* includes energy for cooking, lighting and space cooling.

Source: IEA (2019a), *Energy Efficiency Indicators Highlights 2019*, www.iea.org/statistics.

Policies and measures

Austria's building sector is faced with a triple challenge over the coming decades. It needs to accommodate an increasing population, significantly reduce energy consumption and replace fossil fuel use with renewable energies. In 2017, Austria's housing stock consisted of 2.4 million buildings, of which 2.1 million were residential buildings. Three-quarters of the occupied residential buildings were constructed before 1990 (FMST and FMTIT, 2018).

The potential for energy efficiency savings in the building sector is substantial. Heating, cooling and hot water use in buildings account for 27% of Austria's TFC and were responsible for around 16% of greenhouse gas (GHG) emissions in the non-ETS sector in 2017 (FMST and FMTIT, 2018).

The tasks ahead are complicated by the fact that the Austrian Constitution has assigned legislative authority for building sector regulations, with the exception of federal buildings, and planning laws to the nine Austrian provinces. Therefore, there is no unified building code in Austria. The provinces have created the Austrian Institute for Construction Engineering (Österreichisches Institut für Bautechnik, OIB) to establish harmonised guidelines for building standards in general, including for energy efficiency standards. Nevertheless, provinces are free to either adopt the harmonised guidelines or modify them to reflect local needs, as long as the requirements still meet the obligatory standards.

OIB Guideline 6 "energy saving and heat insulation" contains all relevant thermal-energetic building standards and is the main basis for the national implementation of the EU's Energy

Performance of Buildings Directive. Guideline 6 has been transposed into law in all provinces, which allows the issuance of a single standardised building energy pass in all of Austria (Oesterreich.gv.at., 2019).

A modification of OIB Guideline 6 was published in April 2019. The key purpose of the revision was to ensure that from 1 January 2021 onwards, all new buildings will be designed as nearly zero-energy buildings and to prohibit the use of fossil fuels for space heating and cooling and hot water. However, the new building code allows for flexibility of the design standards to adapt to different locations, i.e. densely built-up areas or individual building sites, purpose of use, and provincial space planning laws and resource endowment. The new building regulations also include climate change adaptation measures, for example, installation of shades for passive cooling of buildings.

#mission2030 includes two dedicated flagship projects to address energy efficiency and emission reductions in the buildings sector. The key objectives of the two flagship initiatives is to reduce emissions from the sector by at least 3 million tonnes of CO₂ equivalent (MtCO₂-eq) by 2030 and to move towards almost full decarbonisation of the building sector by 2050. This will be achieved through a combination of measures supporting thermal renovation, expected to also make an important contribution to the local economies, and a shift away from the use of fossil fuels, including in the existing building stock.

Flagship Projects 4: Thermal Building Renovation and 5: Renewable Heat

The new government has set a target to increase the average annual building renovation rate to 3% annually between 2020 and 2030, up from 0.7% in 2018. Studies undertaken for the preparation of #mission2030 estimated a potential to save over 1 Mt CO₂ through thermal building renovation alone, without also changing the heating system (FMST and FMTIT, 2018).

However, the government is aware that the renovation rate alone will not deliver the desired outcome. Renovations must also adhere to high technical standards and be implemented in an integrated fashion, keeping the overall building in mind, and not as piecemeal interventions. The government therefore makes accompanying technical advisory services available to help owners develop multi-annual and long-term renovation concepts. The provision of high-efficiency building services and building energy management systems is expected to contribute to a higher uptake of thermal renovations, while the issuance of energy certificates should help spread awareness among owners and tenants.

Austria has approximately 700 000 oil-fired heating systems, which are on average more than 20 years old. The conversion of fossil oil-fired heating systems to renewable systems is expected to save about 2 MtCO₂ by 2030 and another 1.5 Mt by around 2045. Austria supports the installation of a number of alternative heating systems, including biogenic resources, solar energy, high-efficiency heat pumps, and local and district heating systems (FMST and FMTIT, 2018).

Overall, the government aims for a complete exit of fossil oil-fired heating systems over the next 15 years. As a first step, the phasing out of oil-fired boilers older than 25 years will be targeted in a socially acceptable manner as of 2025.

Gas-fired heating is even more prevalent, as oil-fired heating is rarely used in new buildings. The conversion from a natural gas to a renewable heating system is a longer-term objective, as there are currently not enough alternatives, especially in some urban areas. In addition, the government is also actively promoting a “greening the gas” initiative (see Chapters 4 and 9).

One particular challenge is the renovation and heat conversion of buildings constructed between the 1950s and 1980 due to ownership structures and principal-agent problems, as investments are frequently substantial and have long amortisation periods. The government therefore plans to revise the housing laws to simplify approval for renovation measures and to overcome problems posed by the ownership structure of buildings.

Consultation with stakeholders revealed that red tape, cumbersome application processes and imprecise requirements often deter owners from undertaking renovations. The government is therefore simplifying the application procedure for funding and other incentive schemes, to make support schemes more accessible and the processing procedure faster and smoother.

The government should also build on the work of the Austrian Energy Agency to promote markets for energy service companies and to explore ways to leverage such companies or similar services to address the challenge of increasing residential building efficiency, including the decarbonisation of heating technologies.

Financial support schemes

Financial and technical support for thermal renovations and the installation of renewable heating systems is provided through several instruments. The provinces provide investment grants for energy efficient improvements of the building shell and the heating system, primarily in the residential sector. The level of subsidy depends on the thermal quality achieved and the efficiency of the heating system. Subsidies for new constructions are subject to stricter requirements regarding primary energy demand and emissions than those requested for rehabilitation of the existing building stock.

For the period 2014-17, 50% of all energy savings in the residential sector were obtained through upgrading and replacing heating and hot water systems. Investments targeting the building envelope accounted for 28% of the total savings (Monitoringstelle Energieeffizienz, 2018). For the years 2014-16, the combined funding support for energy efficiency from the federal and provincial governments amounted to EUR 11.1 billion and achieved savings of 15 160 terajoule (TJ). The largest part of the funding was provided by the provinces for residential buildings. In addition, another EUR 195 million was provided for thermal refurbishment of residential buildings. For the period 2013-17, the federal government channelled over EUR 315 million of complimentary funding through the Domestic Environmental Support Scheme (UFI).

For 2019, the domestic energy and environmental subsidy programme made EUR 62.7 million available as subsidies for the phasing out of oil heating systems and for thermal refurbishment of buildings. Within the total allocation, around EUR 39 million is allocated for the programme to phase out fossil oil-fired heating systems.

Austria is currently preparing a new Heat Strategy to 2030 that will be finalised in 2020. The strategy is being developed through a consultative process between the federal government, the provinces, and a large number of other stakeholders and experts. The

objective is to reduce thermal energy demand in buildings and replace it with renewable energy sources and high-efficiency district heating and cooling. The strategy covers residential and non-residential buildings, process heat, heating and air conditioning, and hot water supply (see Chapter 8), and the “greening the gas” initiative (see Chapters 4, 6 and 9). The provision of tax incentives through shortened depreciation periods and a reduced value-added tax for energy efficiency improvements are discussed as part of the consultations on the new Heat Strategy, and within the framework of the draft National Energy and Climate Plan (FMST, 2019a).

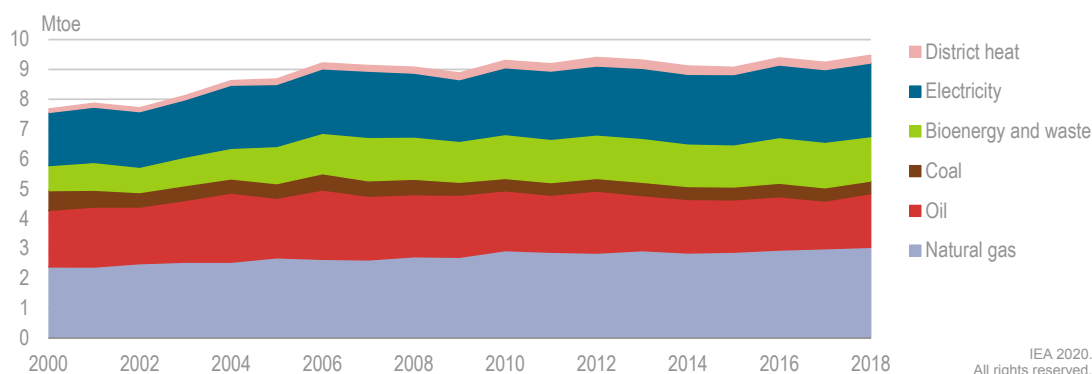
Looking towards the larger ambition of the transformation of the energy system, the government is keenly aware of the benefits of sector coupling between electrical and thermal systems. This could be achieved by, for example, using the building mass as a thermal accumulator for space heating and cooling, flexible load management of buildings, and the installation of a smart e-charging infrastructure. The Austrian Spatial Planning Partnership “Energy Spatial Planning 2” was introduced in 2014 to improve co-ordination between spatial planning, the energy sector, and the provincial and regional government units. The federal government and the provincial governments are implementing several pilot projects in the Climate and Energy Model Regions, and under the Smart Cities project (see Chapter 10) (FMST and FMTIT, 2018).

Industry

Consumption

The industry sector accounted for 34% of TFC in 2018. This includes fuels used for non-energy purposes, mainly oil products used in chemical industries and construction work. Industrial energy consumption has been quite stable, just over 9 Mtoe in the recent decade, and in 2018, total consumption was 9.5 Mtoe, an increase of 4% from 2008 (Figure 7.6).

Figure 7.6 Total final consumption in industry by source, Austria, 2000-18



Industrial energy consumption has grown by 4% in the last decade, and a 13% decline in oil use was compensated for by strong growth in electricity and natural gas.

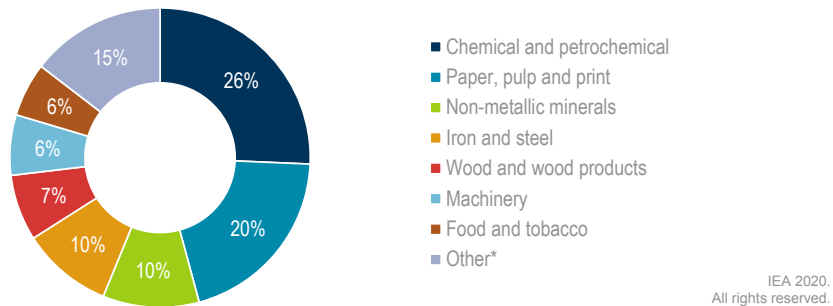
Notes: Mtoe: million tonne of oil equivalent. Includes non-energy consumption.

Source: IEA (2020a), “World energy balances”, *IEA World Energy Statistics and Balances* (database), www.iea.statistics.

Natural gas is the largest energy source in industry, with 32% of total consumption, followed by electricity (26%), oil (19%), and bioenergy and waste (16%). The rest is small shares of coal (4%) and district heating (3%).

The chemical and petrochemical industry is the largest industry sector in terms of energy consumption, with 26% of total industrial demand in 2018 (Figure 7.7). Over half of that was for non-energy purposes. The paper industry is the second-largest energy-consuming industry sector, and the largest consumer of bioenergy.

Figure 7.7 Energy consumption in manufacturing industry sectors, Austria, 2018



The chemical and petrochemical industry, including non-energy fuel consumption, and paper industries account for the largest shares of industrial energy consumption.

* Other includes construction, non-ferrous metals, mining and quarrying, transport equipment, textile and leather, and non-specified industry consumption.

Note: Includes fuel consumption for non-energy use.

Source: IEA (2020a), "World energy balances", *IEA World Energy Statistics and Balances* (database), www.iea.statistics.

Policies and measures

The 2014 act requires large energy-consuming companies to either commission an external energy audit every four years or to implement a recognised energy management system, as well as to undertake an internal or external energy audit every four years, in the period 2015-20.

At the end of 2017, almost 1 600 mandatory energy audits had been reported to the monitoring body, of which 59% were undertaken by an external auditor (Monitoringstelle Energieeffizienz, 2018). The actual number of audits in Austria is larger than the reported numbers. Large industrial groups only submit a consolidated group audit, which usually covers the reports of several sub-units.

An analysis of the audits undertaken through the end of 2017 found an over proportional energy savings potential in the way enterprises use and organise transport services and in measures targeting the building stock of industrial sites. While the two sectors accounted for only 18% of total energy consumption of the audited industries, their savings potential was estimated at 36% (Monitoringstelle Energieeffizienz, 2018).

The provision of subsidies for energy efficiency investments in industry is a new policy measure under #mission2030 to encourage the use of high-efficiency industrial

equipment. The UFI provides grants for up to 30% of the investment costs for energy-efficient commercial and industrial production processes, the thermal renovation of buildings, and heat recovery systems.

#mission2030 also promotes the introduction of energy management systems for small and medium-sized enterprises. This will primarily be achieved through the provision of energy advisory services, for which around EUR 5 million has been earmarked by the Austrian Energy Agency (FMST and FMTIT, 2018). In addition, the UFI will also co-finance energy advisory programmes for small and medium-sized enterprises in the provinces (FMST, 2019a).

The government should explore the use of digital technologies beyond smart meters, which would also address the requirements of the 2018 EU Energy Performance of Buildings Directive regarding mandatory requirements for installation of building automation and control systems for certain non-residential buildings by March 2020.

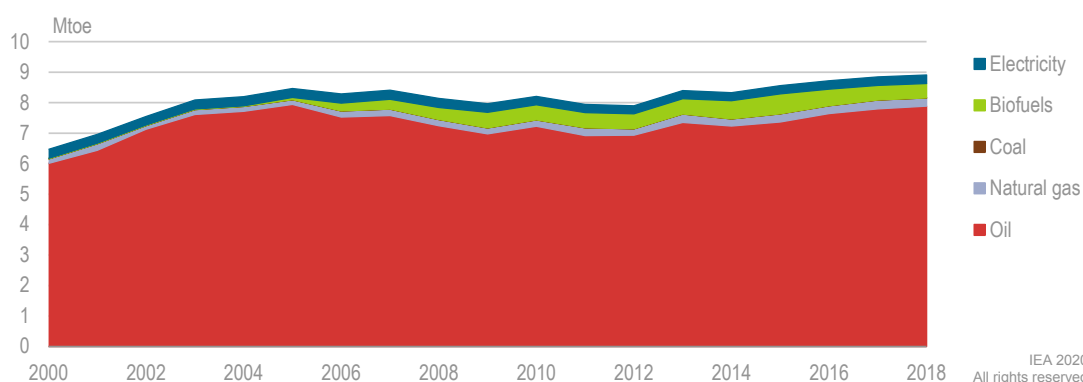
Transport

Consumption

The transport sector accounted for 32% of TFC in 2018. Transport consumption had been slightly decreasing for a decade, from 2003 until 2012, but has increased steadily since. From 2012 to 2018, transport consumption grew by 13%, representing the fastest growth in Austria's TFC in recent years.

Road transport accounted for 93% of total domestic transport demand in 2018. The rest was mainly used in rail transport and in pipeline transport for natural gas, plus minor shares for domestic aviation and navigation. International aviation and navigation are not included in the domestic transport statistics.

Figure 7.8 Total final consumption in transport by source, Austria, 2000-18



Transport energy demand has increased by 13% in the last six years, almost exclusively covered by oil fuels, which accounted for 89% of total demand in the sector in 2018.

Notes: Mtoe: million tonne of oil equivalent. The transport sector demand excludes international aviation and navigation.

Source: IEA (2020a), "World energy balances", *IEA World Energy Statistics and Balances* (database), www.iea.statistics.

Oil fuels dominate transport energy demand, accounting for 89% of the total in 2018. Diesel fuel, in particular, is large, and accounted for 69% of the total transport demand. Gasoline is much smaller with 19% (Figure 7.8). This can partly be explained by so-called “fuel tourism”, where vehicles, including many diesel-fuelled freight trucks, fill up when passing through Austria to benefit from lower fuel taxation than in neighbouring countries.

Biofuels accounted for 5% of total transport energy use in 2018, most of which was biodiesel. The supply of biofuels increased by nine-fold between 2005 and 2015, but then decreased by 28% through 2018.

Policies and measures

Austria’s overall transport plan has defined targets and guidelines up to 2025. It became effective in 2012 and aimed to reduce energy consumption in the transport sector to 210 PJ by 2015. Measures implemented under the plan include support for e-mobility, expansion of public transport and a shift towards non-motorised transport through the improvement of inter-modal transport options. Austria’s provinces are implementing a variety of measures to promote alternative mobility in conjunction with federal initiatives. For example, the mobility initiatives in Lower Austria and Styria expect to save 1 080 TJ and 30 TJ respectively by 2020 (BMFWF, 2017).

In 2004, the government launched the “klimaaktiv mobil” programme for climate-friendly mobility management. The first phase of the programme ran until 2012 and in light of its success was continued and expanded for a second phase from 2013 to 2020. Measures financed during the second phase of the programme are expected to result in cumulative energy savings of 164 TJ for the period 2014-20 (BMFWF, 2017).

The focus of the programme is on supporting efficient, environmentally friendly mobility through mobility management; the conversion of vehicle fleets to alternative propulsion systems; e-mobility with renewable energy; and encouraging cycling, innovative mobility services, intelligent multimodal mobility and eco-driving. The services offered range from advice and consulting, awareness raising, education and certification and partnerships to financial support in the form of grants. Klimaaktiv mobil supports activities at the urban, municipal and regional level and co-operates with businesses, fleet operators and associations, tourism operators, schools, and citizens in the transformation towards clean low-emission mobility.

A central part of the klimaaktiv mobil initiative is the Austrian EcoDriving initiative to promote climate-friendly mobility. The activities are carried out in close co-operation with the Professional Association of Driving Schools in the Austrian Federal Economic Chamber and the Austrian automobile clubs. The programme estimates that eco-driving can save 5-15% fuel for each journey. The main pillars of the initiative are:

- training of driving instructors to become certified klimaaktiv mobil EcoDriving trainers and driving schools
- EcoDriving offers for fleet operators for EcoDriving training with cars, trucks and buses, tractors, and construction machinery
- integration of energy-efficient driving into driving school curriculum and driving examinations.

In addition, final energy savings in the transport sector were achieved through energy taxation and the toll on heavy-good vehicles (HGV toll). While the government has not specifically estimated the energy savings obtained through taxation, the energy savings due to the HGV toll are estimated to amount to 980 TJ for the period 2014-20 (BMWWF, 2017). The toll is applicable to HGVs with a maximum permissible total weight of over 3.5 tonnes. The amount of the toll depends on the distance travelled, the emission class and the number of axles (BMWWF, 2017). The HGV toll is also raising significant revenues: EUR 1.25 billion in 2015 (BMWWF, 2017).

#mission2030 includes three flagship projects to address energy efficiency and emission reduction in the transport sector: Flagship 1 “Efficient Freight Transport Logistics”, Flagship 2 “Increase Railbound Public Transport” and Flagship 3 “E-Mobility Offensive”. These flagship projects and other transport sector policy measures are discussed in more detail in Chapter 6.

Assessment

Energy efficiency must improve across all sectors of the Austrian economy in order to achieve the 2030 energy and climate change objectives. Austria has set ambitious targets, including improving primary energy intensity by 25-30% by 2030 compared to 2015, and mandating that if primary energy demand exceeds 1 200 PJ by 2030, then the surplus must be covered by renewables.

Prior to #mission2030, the federal government introduced the Energy Efficiency Act in 2014, which set out energy efficiency goals for 2020. The 2020 goals include a final energy consumption target of 1 050 PJ, and a cumulative energy savings target of at least 310 PJ. The act also established a range of measures. These included the National Energy Efficiency Monitoring Body; an energy efficiency obligation on energy suppliers (0.6% energy savings per year, cumulative 159 PJ); an energy audit obligation or an energy management system for large-scale industry, or, alternatively the introduction of an energy management system; and a public building retrofit target (cumulative 48.2 GWh savings by 2020). In addition, a bundle of strategic policy measures that can be divided into the categories industrial buildings, production and services as well as trade and small-scale consumption, mobility, energy provision, security of energy supply, and general measures are included. The act is currently being reviewed to bring it in line with new EU regulation and the 2030 timeline.

Notably, Austria’s calculated cumulative energy savings in 2017 were 136 PJ, well above its EU obligations and trajectory for 2020. Until recently, Austria was also on track to reach its final energy consumption goal, however the trend reversed in 2014. Austria will now most likely miss its final energy consumption target. The main driver for the increase was a significant rise in the final energy consumption of the transport sector, attributed to an increasing population, climatic conditions and buoyant economic activity.

This trend is alarming since it highlights a growing divergence between expected energy savings and observed final energy consumption. The difference is likely due to a mix of factors, including rebound and other behavioural effects, as well as an increasing population and buoyant economic activity. Weather effects that influence, in particular, the building sector by increasing heating and cooling days also contribute to increasing demand.

However, other countries have shown that continuous population and economic growth can be successfully decoupled from energy consumption, notably in neighbouring Switzerland, which also faces similar climatic conditions as Austria. Greater monitoring and feedback to customers, especially in the residential sector, is needed to determine the causes of this energy efficiency gap.

To combat this problem and help reach the 2030 targets, #mission2030 includes five flagship projects with energy efficiency initiatives. They are thermal building renovation; green finance to subsidise energy efficiency measures in industry; renewable heat; promoting the use of energy management systems for small and medium-sized enterprises; and broadly advising on efficient energy use.

Building sector energy efficiency

The building sector represents a substantial energy and emissions savings opportunity. The challenge for this sector is that responsibility for delivering energy efficiency measures is split between the federal government and the provinces. For example, the federal government is responsible for gas and district heating, while the states look after building standards. Compounding this problem is a lack of consistency between provinces in how they collect and share data on energy savings and installed measures.

To help meet its renovation target of 3% per annum and address the energy efficiency opportunity in the building sector, the provincial governments regularly improve building standards and the federal government is currently consulting on a new heat strategy. However, it will be up to the regions to implement any final changes to building standards. Further harmonisation of standards will be important to reach the target. However, raising awareness of the potential of energy savings among building occupants is equally important. With a view to the roll-out of smart meters, it will also be important that the laws governing privacy around access to and use by third parties of energy data are fit-for-purpose and future-proofed.

Industry energy efficiency

The industry sector is the second-largest energy consumer in Austria, accounting for nearly 30% of total final energy consumption. From that, the chemicals and petrochemicals industry is the largest energy-consuming group. #mission2030 stresses the importance of using energy efficiency to maintain the sector's competitiveness.

The motivation to improve energy efficiency in industry is well aligned with economic incentives, although the use of energy service companies is not widely adopted. Since larger firms are more easily able to invest in energy efficiency, it is important to target small and medium-sized enterprises for energy efficiency support measures. The government should minimise the administrative burden associated with these measures and ensure that subsidies provide additionality and material energy savings. Energy services providers will play an important role in unlocking the potential in this sector by offering complete solutions that minimise the burden on business owners. It will also be important to assess whether subsidy programmes are being utilised to capture the large savings potential in industry.

The government should also explore additional market-based instruments, such as the extension of the utility obligation scheme to industries, featuring white certificates trading, or the auction mechanism used to promote industrial efficiency in Switzerland.

Transport

As in most IEA member countries, final energy demand in the transport sector is steadily increasing. The increase in Austria is driven by strong population and economic growth that has resulted in a growth in kilometres driven. This is exacerbated by the fuel export phenomena: heavy-good transit vehicles filling their tank in Austria where diesel is substantially cheaper than in neighbouring countries. Austria's strategic approach to reducing demand in the transport sector and to achieving its objective of fossil-free mobility by 2050 is to shift transport to modes that are more efficient and to increase the use of alternative fuels and technologies.

The highest energy efficiency gains come from shifting transport from road to rail and to electrified transport means, such as trams, underground and suburban train lines, and local and long-distance electrified railways and electric buses. However, as in the building sector, responsibilities for transport policy are split between the federal and provincial governments and the municipalities. This increases the complexity for the introduction of smart mobility management, which is necessary to offer a seamless shift between modes of transport and to offer smart mobility services.

The government should regularly assess whether flagship projects are effective in improving the efficiency of the transport sector, and explore the use of digital technologies to improve transport efficiency, for example in the area of freight logistics or urban traffic management.

Recommendations

The government of Austria should:

- Improve energy monitoring and feedback to customers, such as through the smart meter rollout, to ensure energy efficiency measures provide their expected energy savings.
- Continually strengthen the building standard guidelines and require provincial compliance to harmonise building energy efficiency implementation.
- Create a conducive market framework that supports the growth and take-up of energy service companies.

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8. District heating

Key data

(2018)

District heating production (2018): 23.1 TWh (2.0 Mtoe) (bioenergy 44.3%, natural gas 36.7%, waste 10.3%, oil 3.8%, coal 4.0%, other 0.9%), +25% since 2008

Share of district heat from co-generation: 59.5%

District heating consumption: 19.6 TWh (1.7 Mtoe) (residential 45.3%, services 39.1%, industry 15.6%)

Share of district heating: In TFC: 6.1%; in residential buildings 12.1%; in service sectors 22.9%; in industry 3.4%. The share in TFC was the seventh-highest share among IEA countries in 2017 (IEA median 2.4%)

Overview

District heating (DH) is a significant heat source in Austria, available in urban areas across the whole country. DH supply has increased significantly in the last two decades, especially in new buildings. Overall, DH supplies 26% of all apartment buildings and is the largest heat source in commercial and public service buildings. Austria also has a small but growing market for district cooling (DC), which is used mainly in hospitals and commercial buildings in large cities.

Most of the growth in DH production has come from bioenergy and waste; bioenergy has also become an important source of renewable heat in Austria. However, the growth of bioenergy use has stalled in recent years, despite several investment subsidy schemes, and fossil fuels still account for close to half of total DH production. For DH to become a more relevant low-carbon heat supply technology in the future, a further shift from fossil fuels towards different renewable and recovered energy sources is needed.

Austria's DH systems are mostly owned by municipalities or municipal companies. Prices are generally unregulated and set by the suppliers, and can vary significantly from system to system. As the DH systems are operated as monopolies, customers that are unhappy with prices cannot switch supplier. To improve the situation for DH customers, more transparency in how prices are set and adjusted should be provided.

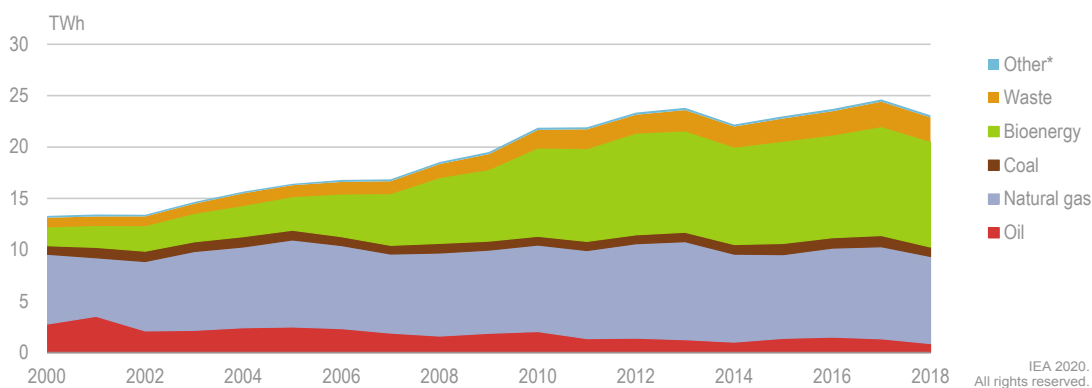
Supply and demand

Austria's DH generation nearly doubled during the decade from 2000 to 2010. Growth has mainly contributed to replacing oil for heating in buildings. Between 2000 and 2010, heating oil consumption in the residential and service sectors fell by 7.5 terawatt hours (TWh), while DH consumption increased by 6.6 TWh (IEA, 2019a). Since 2010, however, the DH supply has remained relatively stable, at around 22-25 TWh per year, with annual fluctuations reflecting varying heat demand from weather and temperature variations (Figure 8.1).

The rapid expansion in DH production came from growth in bioenergy and waste, which now accounts for over half of total DH generation. In 2018, bioenergy plants produced 44% of total DH generation. Waste incineration of industrial and municipal waste (renewable and non-renewable) accounted for an additional 10%. Natural gas accounted for 37% of total DH generation and the rest was mainly oil and coal, with 4% each. A small share of Austria's DH is supplied by excess heat from industrial processes and other sources.¹

Around 60% of total DH generation in Austria is produced in co-generation heat and power (CHP) plants. Natural gas plants in particular are often large CHP plants.

Figure 8.1 District heating generation by fuel, Austria, 2000-18



District heating generation increased rapidly between 2000 and 2010, driven by heat from bioenergy and waste, but growth has stalled in recent years.

* Other includes industrial excess heat, geothermal, solar, and electricity and heat pumps.

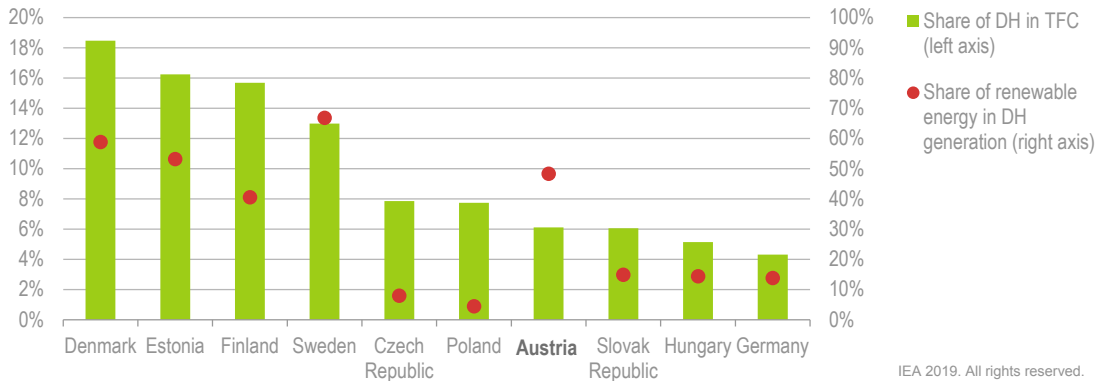
Note: TWh: terawatt hour.

Source: IEA (2020), "World energy balances", *IEA World Energy Statistics and Balances* (database), www.iea.statistics.

Austria has a relatively high share of renewable energy in DH generation compared to other countries with large DH sectors. In 2018, renewable energy accounted for 48% of Austria's DH generation (excluding non-renewable waste), which was similar to the levels in the bioenergy-rich Nordic countries, while significantly above other Central and Eastern European countries (Figure 8.2).

¹ According to information from a representative of the Association of Gas and District Heating Supply Companies (FGW) during the review visit, not all of the industrial excess heat is captured in the data reported to the IEA. A survey the DH industry carried out among its members (which covers more than two-thirds of the total national DH production) indicated a share of industrial excess heat at around 3% of total DH production.

Figure 8.2 Share of district heating from renewable energy in selected IEA countries, 2018



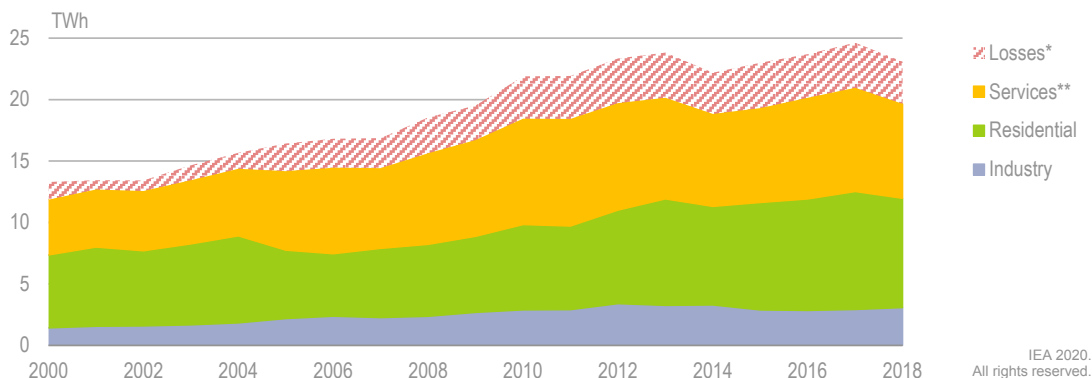
Among the countries with the largest share of DH in total final consumption, Austria has the fourth-highest share of renewable energy in DH generation at nearly 50%.

Notes: DH: district heating; TFC: total final consumption. Charts the ten countries with the largest share of DH in total final consumption. Data are provisional for countries other than Austria.

Sources: IEA (2020), "World energy balances", *IEA World Energy Statistics and Balances* (database), www.iea.statistics; IEA (2019a), *World Energy Balances 2019* (database), www.iea.org/statistics.

DH is consumed across the whole country in mainly urban areas. The residential and service sectors have similar amounts of total DH consumption, with 39% in commercial and public service buildings and 45% in residential buildings. The remaining 16% is consumed by industry (Figure 8.3). In 2018, final consumption of DH was 19.6 TWh, compared to total DH production of 23.1 TWh, indicating thermal losses of around 15% in the distribution. The losses have increased slightly with the expansion of DH networks to new areas.

Figure 8.3 District heating consumption by sector and distribution losses, 2000-18



Residential and service buildings together consume around 85% of total DH consumption; industry accounts for the remaining 15%.

* Losses shows the difference between district heating output and final consumption, which is mainly thermal distribution losses.

** Services includes public and commercial services, agriculture, and forestry.

Note: TWh: terawatt hour.

Source: IEA (2020), "World energy balances", *IEA World Energy Statistics and Balances* (database), www.iea.statistics.

Support for district heating

The central government and regional authorities are preparing a joint Heat Strategy that focuses on reducing the thermal energy demand of buildings and replacing fossil fuels with renewable energy sources and high-efficiency DH. Renewable heat is also a flagship project of *#mission2030*, which states targets to replace oil-fired heating with renewables in new buildings by 2020. Oil-fired boilers older than 25 years must be replaced from 2025 and all others by 2035. The new Heat Strategy will look further into how these targets can be reached.

Renewable heat and DH is promoted through several different investment support schemes for both heat production and infrastructure investments. These include the Domestic Environmental Support Scheme (UFI), the CHP Act, and the Heating and Cooling Pipeline Development Act. Austria has no specific CO₂ taxation on heating, but energy taxation applies to fossil fuels with EUR 50 per tonne of coal, 6.6 cents per m³ natural gas and EUR 60 per 1 000 litres of heating oil. Furthermore, as roughly half of DH production is in large plants that fall under the EU Emissions Trading System (ETS), there is some kind of carbon taxation applied to DH.

Domestic Environmental Support Scheme

The UFI provides incentives to use renewable energy in heating and cooling. The support is mainly directed at small-scale heating and cooling systems, such as solar thermal or heat pumps installed by households or businesses; biomass-based DH can also apply for support. The support can be as much as 30% of investment costs. In addition, the UFI increasingly supports the use of waste heat.

CHP Act and other co-generation support

Austria's Combined Heat and Power Law (KWK Gesetz) took effect in early 2009 to promote CHP through investment grants. New or modernised CHP plants for public DH can receive investment subsidies up to 10% of the total cost if they result in savings in energy and CO₂ emissions compared with separate production of heat and electricity (RES Legal, 2018a; IEA, 2017).

Bioenergy-based co-generation is also supported through feed-in tariffs for renewable electricity (see Chapter 9). Electricity from solid biomass can receive around 0.1-0.2 EUR/kWh, depending on plant capacity and efficiency. In addition, plants using waste with a high biogenic share are eligible for a reduced feed-in tariff that applies to solid biomass plants (RES Legal, 2018c).

The Heating and Cooling Pipeline Development Act

The District Heating and Cooling Act provides subsidies for the construction of DC and DH networks based on excess heat from industry and renewable energy sources. The act was introduced in 2009 and provides state aid of up to EUR 60 million per year for construction of new DH and DC infrastructures, to cover up to 35% of the investment cost (RES Legal, 2018b). Actual payments have been smaller – from EUR 70 million during an initial three-year period (2010-12) to EUR 12 million in 2018 and EUR 9 million in 2019.

Markets and regulation

DH systems are based on grid infrastructure, similar to electricity and gas systems, but the market structures are very different. DH markets are local in nature and heat distribution is difficult to unbundle from production, as in most DH systems the heat source is tailored to the network. As a result, most DH systems run as vertically integrated monopolies. This means that customers cannot switch DH supplier. Furthermore, in most cases, once the contract between the building owner and the DH supplier is signed, tenants cannot change to an alternative heat source.

Due to the monopolistic nature of DH supply, many countries regulate the prices charged to end customers; while others let the market players set the price themselves. Regulation varies significantly across European DH markets (see Box 8.1). In Austria, this is decided on a provincial level, and most DH is supplied without price regulation.

Market structure

Austria's DH systems are usually operated by one company, which owns at least one facility of heat production (co-generation or heat-only boiler) and the corresponding network. In many cases, these companies are fully or partly owned by local authorities such as the municipality. Many DH suppliers use service companies to handle metering and billing.

The Association of Gas and District Heating Supply Companies² is the legally commissioned representative for Austria's natural gas and DH industries. It works together with its members to ensure that natural gas and district heat are used in Austria in an economical, safe and environmentally friendly manner.

Regulation on district heating markets

The base for price regulation of DH is the Price Act from 1992. The act gives the Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology the authority to decide on principles and structures of tariffs for DH supplying companies. However, in practice, the decision and implementation of price regulation has been delegated to local authorities at the provincial level.

Some cities and municipalities have introduced regulated prices in certain city areas, e.g. Vienna, Linz and Graz, mainly as a way to protect vulnerable customers. In such areas, price limits are set for end consumers usually by the municipal government or another local authority. For other customers, prices are set by the supplier. Prices can differ significantly between different DH networks, both for the energy costs and the service costs.

The regulator E-Control, which has no influence over DH price setting, has nevertheless received complaints from consumers over high prices and lack of transparency in price setting. The Chamber of Labour also reports it has received calls from DH customers complaining about high prices and lack of influence and transparency around price setting.

² Annex A provides detailed information about institutions and organisations with responsibilities related to the energy sector.

Box 8.1 Variations of district heating regulation in Europe

Regulation for district heating (DH) in European countries varies significantly between free market competition and price regulation. If using a free market price principle, DH is considered to compete with other heating technologies on a free heat market. This approach is used in several large DH markets, including Austria, Finland and Sweden. A free heating market requires the possibility for customers to switch from one heat supplier to another, or to other heating options. However, even where this is allowed, it can be difficult for single apartment owners to switch to another heat source.

In some countries with free price setting, there are systems in place to improve consumer protection. Governments can ensure that the market is fair by setting up a process to monitor price setting and review complaints about abuse of market dominance. An example of this is Finland, where the Competition Authority can initiate investigations if it suspects that a DH company is charging unreasonably high prices or otherwise abusing its dominant market position. In Sweden, there is instead a market-based initiative to improve price transparency, called the Price Dialogue (see Box 8.2).

Within countries with regulated prices, different models exist, ranging from strict price setting by a government to various way of regulating the DH companies' profits. Hungary is an example of a country where the government sets the DH price directly. DH companies are then subsidised to cover for losses if production cost exceeds the regulated price. In several Eastern European countries, for example the Slovak Republic, DH prices are regulated using a cost-plus model that allows companies a limited profit after having covered their costs and investments.

In the Netherlands and Norway, DH prices are capped based on alternative heating costs (natural gas in the Netherlands and electricity in Norway) to protect customers that are connected to DH networks. In Denmark, DH prices have been regulated based on a non-profit model. However, the country is moving towards a more competitive model to use benchmarking to identify potential for efficiency improvements and define allowed profits.

Figure 8.4 Different models for district heating regulation



Sources: IEA (2018a), *Energy Policies of IEA Countries: Denmark 2017 Review*, <https://webstore.iea.org/energy-policies-of-iea-countries-denmark-2017-review>; IEA (2018b), *Energy Policies of IEA Countries: Slovak Republic 2018 Review*, <https://webstore.iea.org/energy-policies-of-iea-countries-slovak-republic-2018-review>.

Box 8.2 The Price Dialogue in Sweden

Sweden has had a liberalised district heating (DH) market since 1996, with prices set by the suppliers. DH is considered to compete with other heat sources on a free heat market, and customers are allowed to switch from DH to other options.

After liberalisation, the DH prices increased at a fast rate, which led to political pressure to strengthen consumer protection. In 2008, the government adopted the District Heating Act, which confirms the liberalised nature of the heat market, but also requires suppliers to increase the transparency of their pricing. Following this, in 2011, the main producers (energy companies) and consumers (housing organisations) jointly established the non-profit organisation Prisdialogen (the Price Dialogue) to assess changes in DH prices and improve transparency and consumer confidence.

This voluntary process, which builds on dialogue between local producers and consumers, has resulted in written agreements between the parties (a local DH company and customers) on the principle for calculating price adjustments. In 2017, such local agreements covered 72% of total DH supply in Sweden. The Swedish Energy Markets Inspectorate (the energy regulator) evaluated the process in 2016 and concluded that it had strengthened consumer protection and provided transparency to the pricing mechanisms.

Source: IEA (2019b), *Energy Policies of IEA Countries: Sweden 2019 Review*, <https://webstore.iea.org/energy-policies-of-iea-countries-sweden-2019-review>.

Assessment

Renewable district heating has increased, but not replaced fossil fuels

DH, which is widespread in Austria, grew rapidly in the period 2000-10. In particular, the use of bioenergy and waste increased, driven by investment subsidies. This has been a successful development for renewable heat in Austria. In 2018, around half of DH generation was from renewable energy, a relatively high share in an international comparison. DH from bioenergy and waste has mainly replaced oil as a heat source and thus contributed to more low-carbon heating. #mission2030 highlights the role for DH as one of the options for replacing the remaining heating oil and for driving the decarbonisation of the heating sector.

However, fossil fuels still account for the other half of the DH supply and have remained at stable production levels. The growth in renewable DH has not led to a decline in fossil fuel-based DH. Around half of the DH production falls under the ETS and fossil fuels are subject to energy taxation. However, stronger price signals are required to drive a significant shift from fossil fuels to alternative energy sources in Austria's DH.

The future for DH in Austria will be set out in more detail in the Heat Strategy, which is planned to be finalised in 2020. To make the most of this strategy, the government should take a broad perspective on heating and support low-emission heat supply across different technologies. DH can be one option, but the share of renewable and excess heat must

increase further for DH to remain relevant as a low-carbon heat supply. The government should provide incentives to drive the shift from fossil fuels to low-carbon heat, in DH and in other heating technologies.

Several subsidy schemes promote district heating from biomass

The investment subsidies available through the domestic support scheme (UFI) have been successful in increasing biomass-based DH. However, by supporting specific technologies and fuels, other cost-effective opportunities might be overlooked. Other low-carbon sources account for only small shares of Austria's DH production. Excess heat from energy-intensive industries, in particular, has large potential to increase. This heat, which is not considered renewable, represents an efficient use of available resources that should be utilised further. The UFI includes support for projects aimed at using industrial waste heat, which is a good step towards tapping into that potential.

Rather than supporting specific fuels, Austria should aim at creating a level playing field for different heating options based on clear energy and emission criteria. This can include taxation of CO₂ emissions and other negative externalities to complement the EU ETS, as well as investment support for renewable and excess heat from different sources. By levelling the playing field, different DH options can compete with each other as well as with other heating technologies, and the market players can choose the most cost-effective solution. Support policies should also provide more stability and predictability for investors. Several of the subsidy schemes have not delivered funding for DH projects in recent years, which correlates with how DH growth has stalled. In light of this, the government should evaluate the existing subsidies and design systems that are better suited to support investments in low-carbon heat options.

Price transparency should improve

Despite the monopolistic markets, most DH prices in Austria are unregulated and can differ significantly between networks. Both the Chamber of Labour and the regulator E-Control have received complaints from consumers over the lack of transparency and consumer influence over price setting. The use of service companies to handle metering and billing contributes to the lack of transparency for customers, who can find it hard to know where to direct complaints. More market oversight is needed to increase transparency for DH customers.

Improved transparency can come either from introducing a new regulatory framework or from expanding voluntary market dialogues. As a first step, an independent body could be responsible for gathering price information and facilitating discussions between suppliers and customers. There are already some price negotiations between DH suppliers and different stakeholders in areas where prices are regulated. These discussions could be expanded to include all DH supply. The Price Dialogue system in Sweden is an example of where market players have managed to improve transparency without state interference. If this cannot be achieved on voluntary terms, however, stricter regulation should be introduced.

Regulatory models for DH vary substantially between different countries, and Austria can draw inspiration from other markets in Europe. A regulatory framework should ensure transparent price setting and encourage continuous efficiency improvements by DH

suppliers. With more oversight of the costs involved in production and distribution of DH, a regulator can use benchmarking between different systems to define best practice and efficiency requirements. Austria should explore these options to improve its DH markets.

Recommendations

The government of Austria should:

- Ensure that the upcoming national Heat Strategy introduces a policy framework that strongly promotes highly efficient heat supply, based on renewable energy sources, technology neutral and with cost effectiveness as guiding principles.
- Create a level playing field for different heating options taking into account external effects, including emissions and system efficiencies. Initially, provide more stability and predictability in investment subsidies and distribute funds based on emission savings rather than specific fuels or technologies.
- Give an independent body responsibility for national oversight of district heating pricing to increase transparency for customers. In addition, assess the need, jointly with industry and consumer groups, to introduce a regulatory framework that guarantees fair price setting and promotes efficiency improvements by DH suppliers.

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9. Renewable energy

Key data

(2018)

Total supply: 9.6 Mtoe (29.3% of TPES) and 50.0 TWh (77.0% of electricity generation)

IEA average: 10.2% of TPES and 25.6% of electricity generation

Bioenergy and renewable waste*: 5.5 Mtoe (16.9% of TPES) and 4.9 TWh (7.6% of electricity generation)

Solar: 0.3 Mtoe (0.9% of TPES) and 1.4 TWh (2.2% of electricity generation)

Wind: 0.5 Mtoe (1.6% of TPES) and 6.0 TWh (9.3% of electricity generation)

Hydro: 3.2 Mtoe (9.9% of TPES) and 37.6 TWh (57.9% of electricity generation)

Geothermal: 0.04 Mtoe (0.1% of TPES) and 0 TWh (0% of electricity generation)

* Excludes 0.6 Mtoe (0.7 TWh) non-renewable municipal and industrial waste.

Overview

Austria is a global leader in renewable energy. In 2018, renewable sources of energy covered almost 30% of total primary energy supply (TPES), the sixth-highest share among IEA countries. The share of renewables in total final consumption (TFC) was 32% and the share in electricity generation was 77% (Figure 9.1). Bioenergy was the largest renewable energy resource in both TPES and TFC and supported the integration of renewable energy and the provision of heat for buildings and industry, electricity generation, and transport.

Austria's share of renewables in electricity generation was the third highest in the IEA in 2018. Thanks to substantial hydro resources, renewable energy has accounted for most of Austria's electricity generation for many decades. In recent years, a feed-in tariff and falling technology costs led to accelerated growth in renewable electricity from other sources, especially wind power.

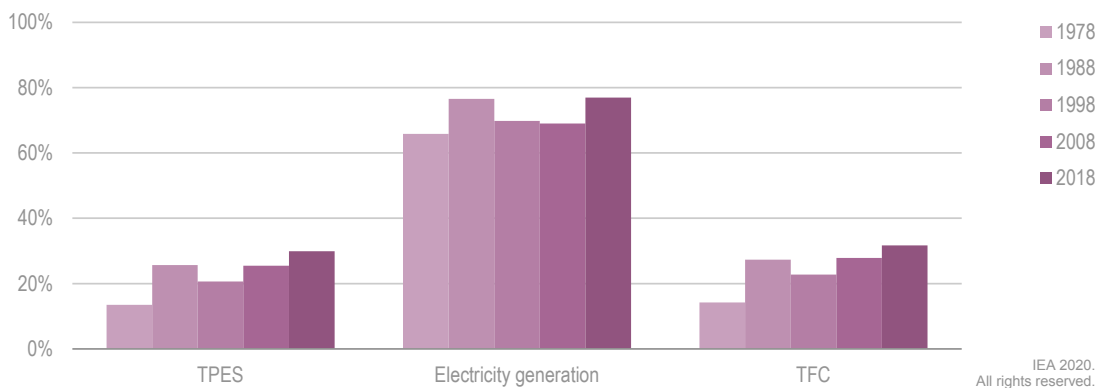
Austria covered 7.7% of transport consumption in 2018 with renewable energy. This share came mostly from biofuels. However, the growing number of electric vehicles also contributed, given the high share of renewables in Austria's electricity generation mix. Austria currently covers almost half of its heating and cooling consumption with renewables (see Chapter 8), mostly from solid biomass for heat production.

Austria's National Energy and Climate Plan (NECP) sets 2030 targets of 46-50% renewable energy in gross final consumption and 100% renewable electricity consumption

in the national balance. The new government programme adopted in January 2020 call for Austria to reach climate neutrality by 2040, which will require a significant increase in the pace of renewables deployment (FMST and FMTIT, 2018). Austria should develop an implementation plan for renewable energy across all sectors that clearly supports the 2030 targets and the 2040 decarbonisation goals.

The upcoming Renewable Deployment Act will define a new support scheme to drive renewables deployment to meet the 2030 targets. Austria is also promoting renewables through numerous #mission2030 flagship projects that target key areas needed for an accelerated and sustained growth in renewables. These projects include solar photovoltaics (PV) plus storage, renewable heating and cooling, e-mobility, biogas and hydrogen from renewables.

Figure 9.1 Shares of renewable energy in the Austrian energy system, 1978-2018



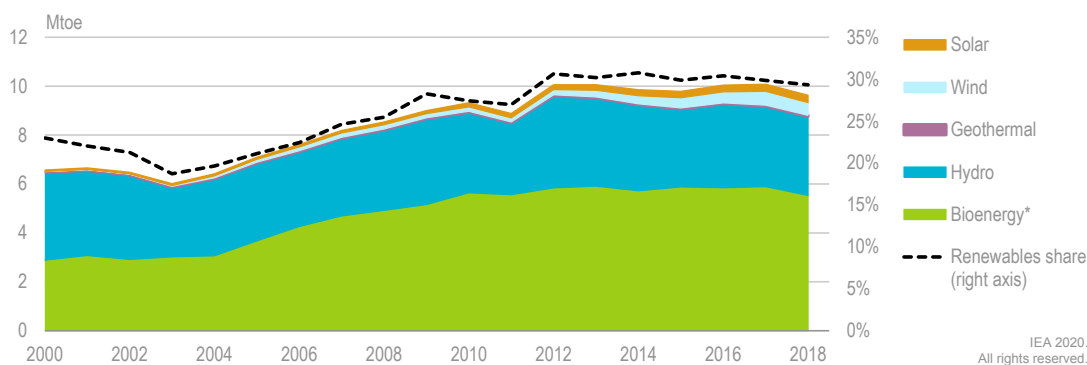
Renewable energy is a key part of Austria's energy system, especially in electricity, where it accounts for nearly 80% of generation.

* Includes direct use of renewables in TFC and indirect use from renewable share of electricity and district heating.
Notes: TPES: total primary energy supply; TFC: total final consumption. Latest available data for TFC are for 2017.
Source: IEA (2020), "World energy balances", *IEA World Energy Statistics and Balances* (database), www.iea.statistics.

Supply and demand

Renewable energy in TPES

Austria's renewable energy supply is dominated by bioenergy and hydropower (Figure 9.2). In 2018, bioenergy accounted for 17% of TPES, which includes thermal losses in heat and electricity generation. Hydro accounted for 10% of TPES and together wind and solar (PV and solar thermal) contributed 2.5%. Between 2002 and 2012, renewable energy in TPES increased by nearly 50%, mainly from a growth of bioenergy used in combined heat and power (CHP) plants. Since 2012, the renewables share in TPES has been stable at around 30%.

Figure 9.2 Renewable energy and waste in TPES, Austria, 2000-18

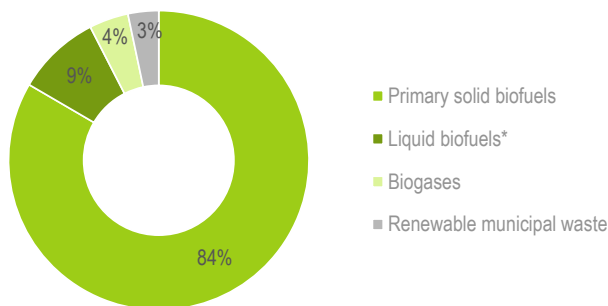
Bioenergy, primarily wood, is the largest renewable energy source in TPES.

* Bioenergy includes solid primary biofuels, liquid biofuels, biogases and renewable municipal waste.

Notes: Mtoe: million tonne of oil equivalent. TPES includes thermal losses for bioenergy used in heat and power generation.

Source: IEA (2020), "World energy balances", *IEA World Energy Statistics and Balances* (database), www.iea.statistics.

Primary solid biofuels, mostly woody biomass from forestry sources in the Austrian context, accounted for 84% of bioenergy supply in 2018 (Figure 9.3). Around one-third of primary solid biofuels support heat and electricity generation and another third are used for residential heating. The remaining share is mainly used in industry processes.

Figure 9.3 Bioenergy supply by source, Austria, 2018

Primary solid biofuels account for most of Austria's bioenergy, mainly used in heat and electricity generation, residential heating, and industrial processes.

* Liquid biofuels consists mainly of biodiesels and some biogasoline.

Note: Total supply of bioenergy was 5.5 Mtoe. In addition, there was 0.7 Mtoe of non-renewable municipal and industrial waste in Austria's TPES in 2018.

Source: IEA (2020), "World energy balances", *IEA World Energy Statistics and Balances* (database), www.iea.statistics.

Liquid biofuels accounted for 9% of the bioenergy supply in 2018, when Austria produced 334 kilotonnes of oil equivalent (ktoe) of liquid biofuels domestically in its seven biofuel production plants. This domestic production covered around two-thirds of total supply of liquid biofuels; the remainder was imported. Biodiesel used in road transport accounts for the main part of liquid biofuels. In 2018, biodiesel covered about 5% of total energy used in road transport.

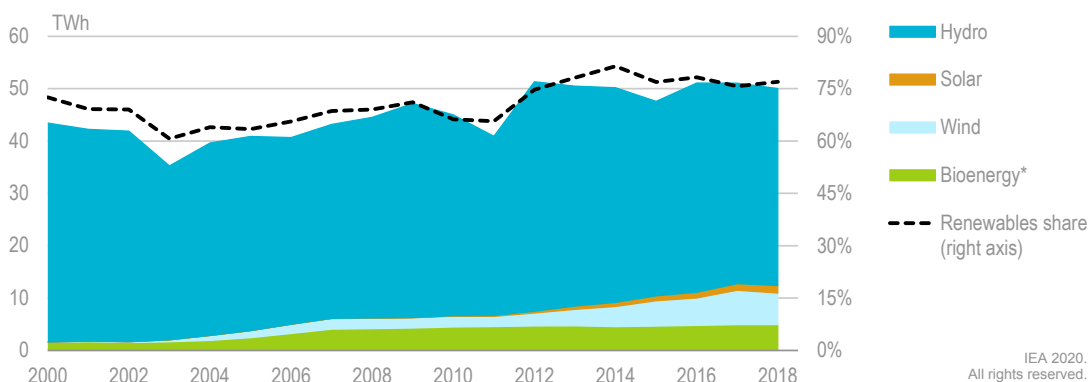
Domestically produced biogas accounted for 5% of the bioenergy supply in 2018. Austria's biogas production increased from around 30 ktoe per year in the early 2000s to around 200-300 ktoe per year since 2014. Most biogas (84% in 2018) is used in heat and electricity generation. However, a small share is upgraded to biomethane¹ and injected into the gas grid. At the end of 2017, Austria had 15 operational biomethane plants, mostly based on waste feedstocks. In 2018, grid-injected biomethane covered only 0.19% of natural gas consumption. In 2019, 127.7GWh of biomethane was injected into the grid. However, biomethane production is relatively new, and European countries, including Austria, are at the forefront of market development.

Electricity from renewable energy

Hydropower has been the largest electricity source in Austria for many decades. In 2018, hydropower generated 38 terawatt hours (TWh), representing 58% of total generation (Figure 9.4). Precipitation levels and other weather conditions affect annual hydropower generation, but the long-term trend in hydro generation has been stable. In the last two decades, average hydropower generation was 39 TWh per year.

Austria has significantly increased generation from wind and solar PV. In 2018, wind accounted for 9% of total electricity generation and PV for 2%. Wind generation has more than tripled since 2010, and installed wind capacity increased from 1.0 gigawatt (GW) in 2010 to 3.1 GW in 2018. PV generation is also increasing rapidly, growing from just 0.09 GW in 2010 to 1.4 GW in 2018. Residential rooftop systems provide 95% of PV generation. Austria is among the top five countries globally in terms of residential PV capacity per capita. Its combined wind and PV generation give it the 12th-highest share of variable renewable generation in the IEA (Figure 9.5).

Figure 9.4 Renewable energy in electricity generation, Austria, 2000-18



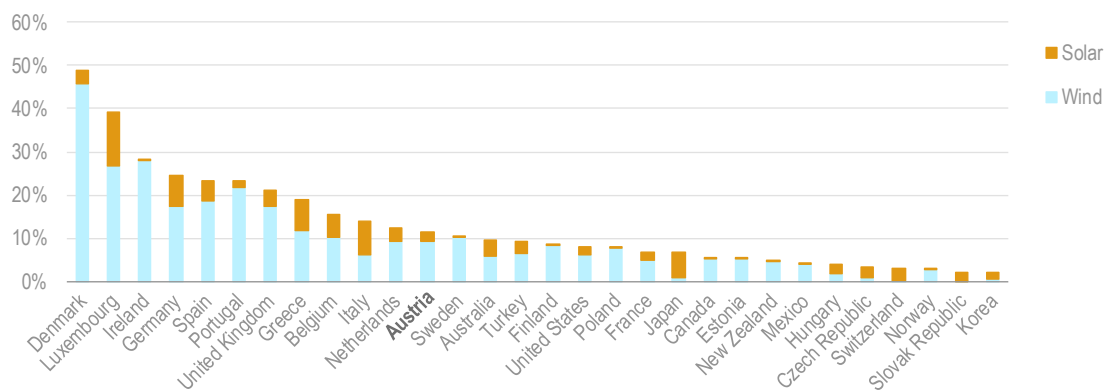
Wind power accounted for most of the recent increase in renewable electricity, but hydropower remains the dominant source in Austria, with nearly 60% of total generation.

* Bioenergy includes solid primary biofuels, liquid biofuels, biogases and renewable municipal waste.

Notes: TWh: terawatt hour. The reduced wind generation in 2018 reflects poor wind resource conditions that year.

Source: IEA (2020), "World energy balances", *IEA World Energy Statistics and Balances* (database), www.iea.statistics.

¹ An almost pure source of methane produced either by upgrading biogas (by removing CO₂ and other impurities) or through the gasification of solid biomass or waste followed by methanation.

Figure 9.5 Share of solar and wind in electricity generation in IEA countries, 2018

Austria has the 12th-highest share of variable renewables in electricity generation in the IEA.

Note: Data are provisional.

Source: IEA (2019), *World Energy Balances 2019* (database), www.iea.org/statistics.

Targets, policy and regulation

Austria's renewable energy targets are driven by obligations under the European Union's Renewable Energy Directive (RED II). Table 9.1 gives Austria's 2020 targets as defined in the 2010 National Renewable Energy Action Plan, the 2030 targets proposed in the NECP, along with the status of these targets in 2016 (FMEFY, 2010; FMST, 2018).

Table 9.1 Austria's 2020 and 2030 renewable energy targets and status in 2018

Renewable share by sector (% of gross final consumption)	Status 2018	Targets	
		2020	2030
Gross final consumption	33.4%	34%	46-50%
Transport	9.8%	10%	14%
Electricity	73.1%	No target	100%*

* The 2030 renewable electricity target is set at 100% of the national balance (defined as total generation + electricity exports – electricity imports). The 100% renewable electricity target exempts generation required for balancing and control of the grid, estimated to be approximately 1% of total generation in 2030. Efficient self-consumption of electricity from industrial by-products, estimated to cover about 6% of generation in 2030, is allowed, but must be offset by an equal amount of exported renewable electricity to maintain 100% renewables in the national balance.

Sources: FMEFY (2010), *National Renewable Energy Action Plan*, <https://ec.europa.eu/energy/en/topics/renewable-energy/national-renewable-energy-action-plans-2020>; FMST (2018), *Draft Integrated National Energy and Climate Plan for Austria 2021-2030*, https://ec.europa.eu/energy/sites/ener/files/documents/austria_draftnecp_en.pdf.

The new government programme adopted in January 2020 calls for Austria to reach climate neutrality by 2040. The NECP calls for fossil fuel-free transport by 2050. Austria's 2030 renewable energy target has been set at 46-50% of gross final consumption. The NECP also contains a goal for 100% renewable electricity by 2030 in national balance.

Renewables in electricity

Austria is a world leader in renewable electricity. In 2018, 77% of its electricity generation came from renewable energy, primarily hydropower (58%), but with notable contributions

from biomass (9%), wind (9%) and PV (2%). According to EU calculation methods, renewables covered 73.1% of gross final electricity consumption in 2018. Building on this solid base, Austria has embraced an ambitious 2030 target of 100% renewable electricity (in the national balance). This would require an increase of 22-27 TWh in the level of generation from renewables, a significant part of this increase will need to come from variable renewable generation (PV and wind), as hydropower resources are already mostly exploited and generation from biomass is not expected to grow significantly. The government, which recognises the need for strong action to achieve this target, is redrafting the renewable energy subsidy scheme to support a transformation of the electricity sector.

Austria supports electricity generation from renewable energy with a feed-in tariff and investment subsidies. It also has a subsidy budget cap, which has been declining annually since 2012. The current renewables support scheme, defined in the Green Electricity Act 2012 (Government of Austria, 2012), will likely be in place until the end of 2020, after which the government plans to update the scheme to focus on achievement of the 2030 targets. The government has indicated that the updated scheme will introduce a competitive auction system for large renewable installations, including utility-scale PV.

Currently, the key support mechanism for renewable electricity is a feed-in tariff that subsidises generation from wind, solid and liquid biomass, biogas or geothermal energy regardless of system capacity (MW). The feed-in tariff for PV is limited to systems with a capacity above 5 kilowatts (kW). For hydropower, the feed-in tariff only applies to systems with a capacity of less than 2 MW. The feed-in tariff has additional technology-specific requirements relating to system efficiency, the type of fuel stocks used and other technical specifications. Since 1 January 2018, solid, liquid and gaseous biomass power plants have stricter eligibility conditions. To receive the feed-in tariff, a generation asset must be registered as a green electricity plant (Ökostromanlage) with the regional government. Registered plants are eligible to receive the feed-in tariff for 13 years, or 15 years for biomass and biogas plants (EC, 2019a).

The Minister for Climate Action, Environment, Energy, Mobility, Innovation and Technology² (BMK in its German acronym) adjusts the level of the feed-in tariff on an annual basis for each technology. In general, tariffs have been reduced to reflect falling deployment costs. In 2019, feed-in tariffs were EUR 0.047-0.21/kWh depending on technology (PV was EUR 0.077/kWh, wind was EUR 0.081/kWh). The Clearing and Settlement Agency (OeMAG), a private enterprise established under the Green Electricity Act 2012, is obliged to purchase all electricity generated by renewable energy sources at a price determined by the relevant feed-in tariff and the market price and sell this electricity to traders who, in turn, sell the electricity on the wholesale market. A number of contractual obligations and benefits for renewable power plants give them preference in selling their electricity versus non-renewable generation (EC, 2019a).

The Green Electricity Act 2012 initially allocated an annual budget of EUR 50 million for the feed-in tariff, with certain percentages of this budget designated for specific technologies. The overall budget is reduced by EUR 1 million per year to reflect falling technology costs and the government's desire to slowly reduce subsidy support as renewables become more price competitive. Renewable energy projects are selected for the feed-in tariff on a first-come, first-served basis until the annual budget is exhausted.

² Annex A provides detailed information about institutions and organisations with responsibilities related to the energy sector.

Since its inception, the feed-in tariff has been oversubscribed, with the number of projects submitting an application exceeding the annual budget and some projects having to wait for an extended period to access the feed-in tariff. In response, the government has amended the Green Electricity Act 2012 several times. The most recent amendments took place in 2017 and 2018 to allocate additions to the budgets for wind power (EUR 30 million in 2017 and EUR 15 in 2018), small hydropower (EUR 1 million in 2017), and EUR 2 million in 2017 and EUR 1.5 million in 2018 for any technology (EC, 2019a).

The budget for the feed-in tariff is financed through several mechanisms, including a renewable energy surcharge paid by electricity customers. The surcharge is set every three years by the Minister for Climate Action, Environment, Energy, Mobility, Innovation and Technology. The amount of the surcharge varies depending on the voltage level of the customer's grid connection. The charges for 2018-20 range from EUR 28 per year for customers at the lowest voltage level up to EUR 90 287 per year for customers connected to the highest voltage levels. In addition, 37% of the grid utilisation and network loss charges paid by all customers is used to support the feed-in tariff. Additional funding comes from revenues that the Clearing and Settlement Agency earns on the sale of electricity from renewable sources to the electricity traders. This revenue results from the difference between the market price and the higher price electricity traders must pay under the Green Electricity Act 2012. Electricity traders pass these costs on to the final customers (EC, 2019a).

In addition to the feed-in tariff, Austria has five investment subsidies supporting renewable electricity. The investment subsidy for small hydropower, which covers 10-35% of investment costs for plants up to 20 MW capacity, is allocated over a sliding scale, where smaller capacity projects have a higher percentage of their costs covered. The per-project support cap varies with capacity within a range of EUR 400-1 750/kW. There are limits on the amount of the subsidy, depending on the size or annual revenue of the company building the project, with smaller companies receiving a higher payment. Existing hydro projects retrofitted with new equipment are eligible for the subsidy if the investment increases plant capacity by at least 15%. Hydro projects of less than 2 MW can receive both the investment subsidy and the feed-in tariff (EC, 2019a).

PV projects smaller than 500 kW that are integrated into buildings (e.g. rooftop PV) are eligible for an investment subsidy covering 30% of project costs (capped at EUR 250/kW). These projects also qualify for the PV feed-in tariff. Since 2017, the investment subsidy also covers the cost of battery storage. Small hydro and building-integrated PV investment subsidies are funded through the same renewable energy surcharge paid by electricity customers that supports the feed-in tariff (EC, 2019a).

An investment subsidy supports off-grid generation from wind, PV, small hydropower and biogas CHP. This subsidy covers 30% of investment costs, with a per-project cap of EUR 1.5 million. An additional 5-15% subsidy is available for projects that meet certain environmental or technical requirements and the subsidy allows for joint funding under the European Regional Development Fund. A project budget of at least EUR 10 000 is required to qualify for the subsidy. This subsidy is funded through the Austrian Climate and Energy Fund; in 2018, EUR 4.5 million was allocated to support this subsidy (EC, 2019a).

The Austrian Climate and Energy Fund was established under the Act on the Climate and Energy Fund in July 2007. The fund delivers up to EUR 150 million per year to boost innovative projects and award contracts to projects that contribute towards the

government's goals on energy efficiency, sustainability and climate (FMST, 2019). The Austrian Climate and Energy Fund also supports two investment subsidies for PV, one for PV projects on private residences or commercial properties, and one for PV projects in the agriculture and forestry sector. These subsidies cover EUR 200-375/kW of the first 5-50 kW of a PV project, with the level of support depending on the sector, project size and configuration. In 2018, a budget of EUR 3.7 million was allocated to support this subsidy (EC, 2019a).

Austria plans to replace the current support scheme for renewable electricity described above with a new system based on market premiums and competitive allocation of aid. Austria has indicated that it will maintain investment subsidies and use tenders and auctions only "where appropriate". For example, a technology-specific tender is proposed for biomass CHP plants. The guiding documents for the update of the renewables support scheme are #mission2030 and the NECP, which give a general indication of the policies and measures Austria will implement to support renewables.

The details of the new support scheme will be defined in the upcoming Renewable Deployment Act (planned for publication in 2020) and amendments to the Green Electricity Act 2012, the Electricity Economy and Organization Act 2010 (Government of Austria, 2010), and the Natural Gas Act 2011 (Government of Austria, 2011). The government is broadly examining other needed changes to laws and regulations and has noted that sector coupling and a transformation of the electricity system can help to achieve the 2030 renewable energy targets and the broader goals of #mission2030.

The government also envisions a significant change in how renewable energy projects sell electricity. Currently, the Clearing and Settlement Agency, which purchases all electricity generated by renewable energy, is responsible for the sale of this electricity. This system will be replaced with a "self-marketing principle" under which renewable energy projects directly participate in electricity markets.

Austria is working on legislative changes to allow full market participation by renewable energy projects, including access to the balancing and control market and the grid reserve market. Market access will require renewable projects to meet certain technical and operational requirements intended to allow easier and more secure integration of renewables into the electricity system. The government plans to define a project capacity (MW) above which renewable projects will be required to sell electricity directly through the market. Small projects below this limit will be able to choose between self-marketing or selling electricity to the Clearing and Settlement Agency, as under the current system.

Austria plans to promote self-consumption of renewable electricity through deployment of PV plus battery storage systems in buildings, with the goal that future buildings should be able to cover a greater share of their own electricity consumption. This policy aims to increase renewable electricity generation while providing relief to the transmission and distribution system by removing some electricity demand of buildings from the grid. The government is supporting the deployment of PV plus storage systems through #mission2030's Flagship Project 6: 100 000 Roof-mounted Photovoltaics and Small-scale Storage Programme, which calls for implementation of the following four measures:

- introduction of a dedicated investment subsidy for building-integrated PV plus storage systems to be implemented through the Renewable Deployment Act
- elimination of the tax on private electricity generation (currently only the first 25 MWh of private generation is exempt)

- elimination of investment barriers in housing and industrial installation laws, including changes to the permitting process for communal and commercial PV systems and clarification that PV systems on commercial roofs do not require an industrial installation permit
- development of renewable energy communities by allowing micro grids, bilateral supply contracts and co-operative-like structures for the production, storage and delivery of renewable electricity even across property boundaries.

The government programme of January 2020 aims to expand Flagship Project 6 to “one million roof-mounted photovoltaics”. The Tax Reform Act 2020 abolished the tax on private electricity generation with regard to PV (Government of Austria, 2020). According to the current government programme, a full exemption on all renewable energy sources regarding private electricity generation is planned.

Renewables in transport

Austria is well on track to achieve its 2020 target of 10% renewables in gross final energy consumption in transport. In 2018, the share of renewables in transport was 9.8% when applying EU methodology that allows double-counting (FMST, 2018). Current and planned policy measures could support the overall 2030 goal of 14% renewables in transport. However, significant work will be required to achieve the required EU target for advanced biofuels from waste and residue feedstocks (1% of gross final transport consumption in 2025 and 3.5% in 2030) and scale-up the consumption of biofuels and renewable electricity to deliver Austria’s vision of “fossil-free mobility” in 2050.

Currently, the main policy mechanism supporting renewables in transport is a biofuel quota that has been in place since 2005 and was raised on 1 January 2009. The quota requires all fuel suppliers to cover 5.75% of fuel sales with biofuels on an energy basis. There are fuel specific biofuel quotas for petrol (3.4%) and diesel (6.3%). The quota can be met through either blending or sales of pure biofuels (EC, 2019a). In 2017, almost the entire quota was met through blending. The biofuels quota is defined in the Austrian Fuel Act (FMAFEW, 2012), which was amended in 2012 and 2014 (IEA, 2016).

The use of biofuels is encouraged through lower taxation rates for transport fuels based on their biofuel content as defined in the Mineral Oil Tax Act (EC, 2019a).

- petrol with a biofuel content of at least 4.6% is taxed at EUR 0.482/L compared to a tax of EUR 0.515/L for petrol with less than 4.6% biofuel
- diesel with a biofuel content of at least 6.6% is taxed at EUR 0.397/L compared to a tax of EUR 0.425/L for diesel with less than 6.6% biofuel
- E85 (70-85% biofuel content) fulfilling specific sustainability criteria and other conditions may benefit from a mineral oil tax refund for the biofuel component of 0.482 EUR/L
- pure biodiesel (100% biofuel content) fulfilling specific sustainability criteria and other conditions may benefit from a mineral oil tax exemption of 0.397 EUR/L.

Until 1 August 2018, Austria also provided an investment subsidy supporting the conversion of internal combustion engine vehicles to run on biofuel. There is now limited government support for biofuel vehicles in combination with the European Agricultural Fund for Rural Development. Only non-private biogas vehicles in rural areas – with at least 50% biofuel – are eligible for klimaaktiv mobil financial support (see Chapter 7 for more details on this support scheme).

In addition to biofuels, Austria aims to increase renewable energy in transport through electrification, encouraging the use of public transport and switching freight from road to rail. The high share of renewable energy in Austria's electricity generation mix (77% in 2018) and extensive electrification of the Austrian rail network (73% of train tracks in 2018) make electrification of transport and modal shifts from road to rail attractive options for increasing the share of renewables in transport. In comparison, fossil fuels covered 94.3% in road transport in 2018.

The government is developing a Mobility Master Plan 2030 to help achieve the 2030 targets and the ambition of decarbonising the transport sector. #mission2030 also supports renewables in transport through three flagship projects focusing on efficient freight transport logistics, an increase in rail-bound public transport and an e-mobility offensive that aims to implement three bundles of complementary measures covering: 1) e-mobility for road vehicles and infrastructure; 2) e-mobility by rail; and 3) e-mobility management, e-fleets and e-logistics. (For a more detailed discussion of the transport sector, see Chapter 6.)

Renewables in heating and cooling

In 2018, the renewable energy share in heating and cooling was 34%. The draft NECP contains a goal for 100% renewable heating by 2040-50, but no 2030 target is defined in either the NECP or #mission2030. Austria should consider defining an ambitious 2030 goal that will support the 2050 vision of 100% renewables in heating and cooling.

The renewable share in heating and cooling currently comes mostly from wood-based heating through biomass boilers and CHP plants, which is discussed in Chapter 8. Austria is a leader in terms of household biomass boilers and stoves, both in their use and the manufacturing of advanced systems. In 2017, 24% of residential energy demand was covered by biomass. Deployment of biomass boilers and stoves is especially high in the Upper Austria Region. Solar thermal plays a small, but notable, role in Austria; in 2017, it covered around 3% of the combined heat consumption of the residential and commercial sectors. Solar thermal heat production grew from 2000-14, but has been flat since then.

Most heating and cooling policy is addressed through building regulations at the state or municipal level. #mission2030 Flagship Project 5: Renewable Heat, provides insights on how the government plans to co-ordinate federal and local policy on renewable heating in buildings. See Chapter 7 for a more detailed discussion.

The government provides subsidies for renewables in heating and cooling through the Domestic Environmental Support Scheme (UFI) under the Environmental Aid Act (UFG). The UFI supports the installation of solar thermal and geothermal systems, heat pumps, and biomass heating plants. The type and amount of subsidy granted depends on numerous factors, including the technology; system size; whether it is installed on a private residence, a business or a municipal building; and by other technical, financial and operational requirements. The nine states also have their own support schemes for renewable energy in heating and cooling. Depending on the project, support from the state is granted in addition to or instead of the UFI subsidy. As a result, the geographic location of a project also affects the amount of subsidy received (EC, 2019a).

The government also provides an additional subsidy for use of solar thermal in a variety of heating applications. This subsidy ranges from EUR 700 to EUR 1 100 per MWh of heat

production. Eligibility and the exact amount of the subsidy depend on numerous technical, financial and operational requirements (EC, 2019a).

Flagship Project 7: Greening the Gas Initiative

#mission2030's Flagship Project 7: Renewable Hydrogen and Biomethane, also known as the "Greening the Gas Initiative", represents the government's initial effort towards an ambitious goal of replacing a significant share of natural gas with domestically produced renewable gases (biomethane, synthetic methane and hydrogen from renewable energy). Under this initiative, Austria aims to move away from the current use of biogas in CHP plants at the site of biogas production towards the injection of biomethane and hydrogen into the gas grid. This shift is intended to support increased shares of renewable energy in numerous sectors, including heating, electricity, industry and transport (particularly captive fleets and road freight) and to facilitate seasonal renewable energy storage through existing gas storage facilities.

In 2018, grid-injected biomethane covered only 0.19% of natural gas consumption, reflecting the early stage of development of biomethane production in Austria. The Austrian natural gas system balance co-ordinator, the Austrian Gas Clearing and Settlement AG (AGCS), maintains the Austrian Biomethane Register, which tracks all biomethane production in Austria and provides guarantees of origin for end-users that consume biomethane (AGCS, 2019). The government should have a clear strategy for biomethane grid injection that does not lower the contribution of biogas to the overall renewable share and avoids stranded assets in relation to existing biogas electricity and heat production.

On an energy basis, renewable gas could cover 5-7% of gas consumption by 2030 and almost a quarter of gas consumption by 2050. These estimates assume that total gas consumption will not significantly change from 2017 levels and that renewable gas will have a mix of around 80% biomethane and 20% renewable hydrogen. The new government has set a target to inject 5 TWh of renewable gas, just over 0.5 bcm, into the grid by 2030. There is currently no production of hydrogen from renewable energy in Austria. However, a 6 MW hydrogen electrolysis pilot project supporting steel manufacturing began operation in November 2019 in the greater Linz area, a location specifically chosen under Flagship Project 7 (EC, 2019b).

To support an increase in renewable gas production, the Greening the Gas Initiative calls for implementation of the following measures:

- Seasonal storage of hydrogen should be enabled, developed and supported by, for example, (partially) deducting investment costs in related infrastructure for power-to-gas, for example, when calculating gas and oil royalties under the Mineral Raw Materials Act.
- Excess electricity generation from renewable energy should be used to produce hydrogen through electrolysis. Linking funding for renewable energy with the provision of storage capacity under the Renewable Deployment Act could speed up the development of hydrogen production and storage.
- Appropriate instruments should be developed under the Renewable Deployment Act to support injection of hydrogen and renewable methane into the natural gas network.
- In order to boost renewable gases and create legal security for investors, hydrogen and renewable methane should be brought under the authority of the Natural Gas Tax Act.

Hydrogen and renewable methane have been given tax relief through the Natural Gas Tax Act, which entered into force on 1 January 2020 through the Tax Reform Act 2020. The current government programme aims to expand through the Green the Gas Initiative, with a goal of injecting 5 TWh green gas (hydrogen and renewable methane) into the gas network by 2030. This goal will be supported by dedicated funding programmes and quotas, as well as through a system for guarantees of origin and labelling.

The Greening the Gas Initiative also notes that power-to-gas facilities and seasonal storage of renewable gases would assist with integration of high shares of variable renewable electricity generation. Substantial production of renewable hydrogen will likely require a large and consistent supply of electricity from renewable energy, likely much more than will be available from excess renewable generation. The government should perform a detailed analysis to determine the needed capacity (MW) and generation (MWh) of renewables necessary to support the desired level of hydrogen productions, as already foreseen in the National Hydrogen Strategy, which is currently being developed by the government.

The government recognises that numerous challenges need to be overcome to realise the goals of the Greening the Gas Initiative and aims to use the Renewable Deployment Act to clarify a number of issues, including:

- defining what support mechanism will be used for renewable gases; the government is considering a market premium or quota system
- providing an opportunity for existing biogas plants to switch from current CHP use to the new support mechanism for upgrading and injecting biomethane into the gas grid
- updating gas grid charges to support injection of renewable gases into gas distribution networks
- including renewable gas infrastructure in the gas Grid Infrastructure Plan (see Chapter 4)
- establishing partial relief from electricity charges for electrolysis plants
- clarifying the role of transmission system operators and distribution system operators in energy conversion/electrolysis
- creating legal and regulatory definitions of renewable gas, renewable hydrogen, power-to-gas and other terms
- clarifying how to issue renewable gas guarantees of origin in line with the second EU Renewable Energy Directive (RED II).

In March 2019, the government, in co-operation with industry, started working on a National Hydrogen Strategy to define specific measures supporting renewable hydrogen that can be implemented through the Renewable Deployment Act and the NECP. The government will also need to address the higher cost of biomethane and hydrogen versus natural gas.

On 1 January 2020, the Gas Labelling Regulation (*Gaskennzeichnungs-Verordnung*) of the National Regulation Authority entered into force. This regulation established a scheme for guarantees of origin for renewable gases in accordance to the RED II Art. 19. As further RED II implementation issues are under discussion at the EU level, the guarantees of origin scheme will be incorporated and revised through the Renewable Deployment Act.

Assessment

Austria is a global leader in renewable energy. In 2018, renewables covered 30% of Austria's TPES (sixth in the IEA), with the largest shares coming from bioenergy and hydropower. Just over three-quarters of electricity generation came from renewables in 2018 (third in the IEA), with hydro accounting for most of this generation (73% renewable electricity in gross final consumption using EU reporting methods). Since the last in-depth review, there has been an acceleration in deployment of both wind (9.3% of generation in 2018) and PV (2.2% of generation in 2018), driven by feed-in tariffs and falling deployment costs. Thanks to strong deployment of renewables, Austria is on track to meet its 2020 targets of 34% renewables in gross final energy consumption (33.4% in 2018) and 10% renewables in transport (9.8% in 2018).

Looking to the future, the Austrian NECP sets a renewable energy target of 46-50% of gross total final consumption and an ambitious target for 100% renewable electricity consumption in the national balance.³ The government estimates that the 100% renewable electricity goal will require 22-27 TWh of additional annual renewable generation in 2030, although other studies estimate that the required additional generation could be significantly higher, in the range of 28-34 TWh (TU Wien, 2017). In comparison, renewable electricity generation was 50 TWh in 2018. A large part of the increase in renewable generation needed to achieve the 100% target will have to come from variable renewable energy, wind and PV, as hydropower resources are mostly exploited and generation from biomass is not expected to grow significantly. In 2018, only 6.0 TWh of generation came from wind and an only 1.4 TWh came from PV. To achieve the 100% renewable electricity target, Austria will need to support sustained deployment of large capacities of PV and wind generation, which will likely require substantial integration measures.

In the near term, needed integration measures include adequate transmission capacity to ensure that regions with the best potential for large-scale deployment of wind and utility-scale PV have adequate connections to electricity demand centres (cities and industry) and pumped hydro facilities. The final shares in the 100% goal will likely require an adjustment of regulations and grid codes that will depend on how renewable deployment takes place between 2019 and 2030. Austria should proactively examine the most likely development pathways to the 100% goal and determine what kind of system integration measures would best support achievement of 100% renewable electricity.

Reaching the 100% renewable electricity target by itself will not be sufficient to achieve the 2030 target for 46-50% renewables in gross final consumption. Significant additional renewable deployment needs to take place in other sectors, notably in transport and heat, which are currently dominated by fossil fuels. #mission2030 provides a strategic vision for the decarbonisation of transport, heating and cooling, and industry by 2050, but no specific measures or plans are established that clearly show how these goals will be achieved, and there are no 2030 targets for renewables in heating and cooling. It is critical that clear, ambitious and achievable 2030 targets be defined for all sectors as soon as possible. Clarity on targets, market structures and support mechanisms could accelerate the deployment of renewables by offering insight on challenges and opportunities to energy sector stakeholders and reduce risk by providing policy certainty to investors.

³ The 100% target exempts generation required for balancing and control of the grid (about 1% of total generation in 2030). Efficient self-consumption of non-renewable electricity from industrial by-products (about 6% of generation in 2030) will also be allowed.

The bundle of measures to support e-mobility management, e-fleets and e-logistics include integrating e-mobility into the mobility planning processes of regions, towns and municipalities, and in corporate logistics. In particular, all operators in the transport sector (urban, local and regional authorities; tourism operators; firms; fleet operators; mobility service providers; logistics service providers; associations) should be motivated through incentives and mobility management to introduce e-mobility solutions and mobility services, such as e-carpooling, e-taxi systems, demand-driven e-mobility services, electric bus-on-demand services, e-bike hire systems, e-delivery services and logistics.

Austria is currently in the process of drafting the Renewable Deployment Act, which will define the new renewable energy support scheme that will replace the current feed-in tariff system. The government has indicated that floating market premiums will likely be the key support mechanism, while investment subsidies and quotas will continue to be used, and auctions will be deployed “as appropriate”. For example, a technology-specific tender is proposed for biomass CHP plants.

Austria is also planning to amend the Electricity Organization Act to alter the way renewable electricity generation assets participate in the market. It is envisioned that the current system, under which all renewable generation is purchased by the Clearing and Settlement Agency, would be replaced by a self-marketing principle. Under the new system, renewable generators would gain access to a wide range of electricity markets, but would have to meet an increased set of technical and regulatory requirements designed to make variable generation easier to integrate.

It is critical that Austria take an integrated approach to developing renewable policies, including the renewable subsidy scheme, the participation of renewables in the electricity market and the other initiatives. A lack of visibility across the numerous ongoing processes relating to renewable energy risks missing opportunities to create synergies, and could create unintended challenges to renewables deployment.

The IEA encourages Austria to transition from feed-in tariffs to floating market premiums that are regularly adjusted to reflect changing market prices and technology-specific deployment cost reductions. The IEA notes that well-designed tenders and auction processes are a cost-effective way to allocate aid if there is viable competition. At the same time, they allow governments better budgetary control and the ability to manage the type and quantity of renewable generation coming on line. Investment subsidies have an important role to play when there is a lack of competition or for developing technologies.

#mission2030's Flagship Project 6: 100 000 Roof-mounted Photovoltaics and Small-scale Storage Programme, has been welcomed by electricity sector stakeholders. If successful, it would serve as an excellent roadmap for widespread deployment of distributed renewables and storage that strengthen grid security, while reducing the costs of both generation and grid operation. Austria should use this project to clearly identify and address market, regulatory and technical barriers to self-consumption of renewable electricity and deployment of battery storage.

Under the Greening the Gas Initiative, the new government has set a target to inject 5 TWh of renewable gas into the gas grid by 2030. Renewable gas would consist of biomethane and renewable hydrogen. Under this initiative, Austria aims to move away from biogas in CHP plants at the site of biogas production towards grid injection of biogas and renewable hydrogen to increase the renewable share in numerous sectors, including heating, electricity and industry, and to facilitate seasonal energy storage.

Currently, there is no renewable hydrogen production in Austria and grid-injected biomethane is still at an early stage, covering only 0.19% of total gas supply (in 2017, 80% of biogas was used in onsite CHP plants). Austria needs quick action to increase the share of renewable gas, while assessing the long-term feasibility of the Greening the Gas Initiative. In the short term, the government should identify and address the immediate barriers to increased renewable gas production and grid injection. Dedicated RD&D funding and the creation of test areas with reduced regulatory barriers could support the large-scale pilot projects needed to demonstrate the potential of renewable gas, drive investments and make renewable gas a viable player in Austria's energy sector.

Recommendations

The government of Austria should:

- ❑ Develop an implementation plan for renewable energy across all sectors that clearly supports the 2030 targets and the 2040 decarbonisation goals.
- ❑ Use an integrated approach when updating the Renewable Deployment Act, Electricity Market Act and other relevant acts to identify synergies and avoid unintended consequences.
- ❑ Use the expanded 1 million rooftop PV plus storage flagship project to identify and address the technical, market and regulatory challenges to widespread self-consumption of renewables.
- ❑ Take immediate action to increase the share of renewable gas while assessing the long-term feasibility of the Greening the Gas Initiative.

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10. Energy technology research, development and innovation

Key data

(2018)

Government energy RD&D spending: EUR 144 million, of which over 99% in low-carbon technology areas

Share of GDP: 0.37 per 1 000 GDP units (IEA median*: 0.32)

RD&D per capita: USD 19.2 (IEA median*: USD 14.1)

Exchange rate: EUR 1 = USD 1.18; USD 1 = EUR 0.85

* Calculated using 2017 data (for 26 countries).

Overview

Austria is considered a “strong innovator” in the latest European Innovation scorecard, ranking particularly high in the linkages,¹ innovators and intellectual assets dimensions. (EC, 2019). However, Austria could further improve the business and regulatory environment for innovation to fully leverage this achievement to deliver higher employment and economic output. Austria is a very active participant in multilateral efforts for energy innovation, notably under the IEA Technology Collaboration Programme, as well as Mission Innovation.

Austria spent on average EUR 140 million on energy-related research, development and demonstration (RD&D) annually over the 2010-18 period, with moderate fluctuations. Nearly all of these energy RD&D expenditures were allocated to low-carbon technology areas, notably in energy efficiency. IEA data suggest that government spending for energy RD&D in Austria is above the IEA average, both as a share of GDP and per capita (see key data box above). Increased funding is expected from the new RD&D strategy of 2017, although 2018 funding levels remained around EUR 140 million. A key aspect of the new strategy is to change the funding focus from basic research to implementation-oriented projects, i.e. to later stages of technology development. This may require specific policy measures, such as mainstreaming the switch from annual to multi-year investment funding as well as developing new market introduction programmes to accelerate market adoption.

¹ The European Commission includes three aspects under the linkages dimension: 1) innovative small and medium-sized enterprises collaborating with others; 2) public-private co-publications; and 3) private co-funding of public R&D expenditure.

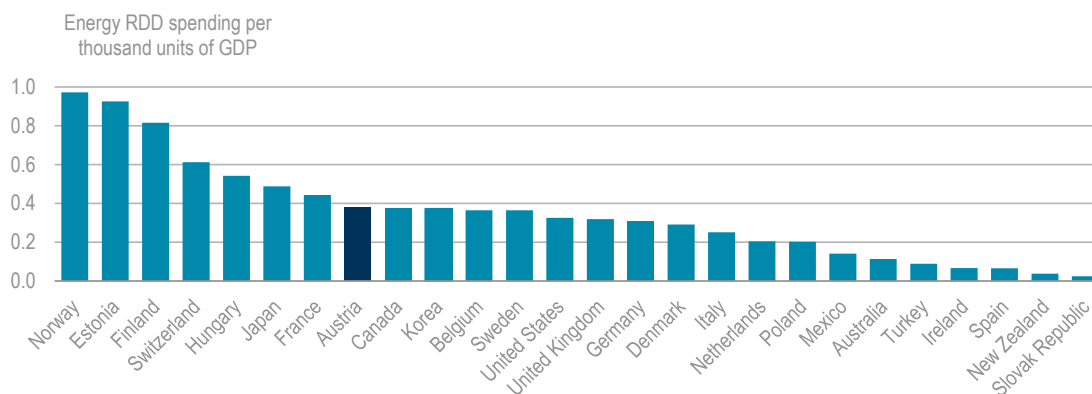
Public spending on energy RD&D

Austria spent 0.037% of its gross domestic product (GDP) in 2018 on energy-related RD&D, which ranks it in the upper half in terms of RD&D expenditure per GDP among IEA member countries, above the median value of 0.032%² (Figure 10.1).

Total energy RD&D spending almost doubled, from EUR 84 million in 2008 to EUR 139 million in 2010 (2018 prices). Since then, energy RD&D spending has been between EUR 130 million and EUR 150 million. In 2018, public energy RD&D spending was EUR 144 million, 6% smaller than the peak in 2014, but 8% larger than in 2012, which was the lowest since 2010 (Figure 10.2). Under Mission Innovation (MI), Austria has pledged to double energy RD&D funding for the “flagship projects” initiative, from an average of EUR 16 million per year in 2014-16 to EUR 32 million in 2020.

In terms of the allocation of energy RD&D funds, the largest share went to energy efficiency, with 46% of the total in 2018. Most energy efficiency funding was directed at improving efficiency in the transport sector, but funding was also directed at buildings, communities and industry. Power and storage technologies received 16% of the total budget, mainly used for research in electricity transmission and distribution, as well as energy storage. Renewables also received 16% of total public funding, mainly directed at solar photovoltaics and biofuels development. Crosscutting technologies received 15% of total funding, and hydrogen just over 5%, a large increase from previous years. The rest were small shares for nuclear (1% through international nuclear fusion research collaboration), fossil fuels (0.4%) and fuel cells (6%).

Figure 10.1 Government energy RD&D spending per GDP in IEA countries, 2017/18



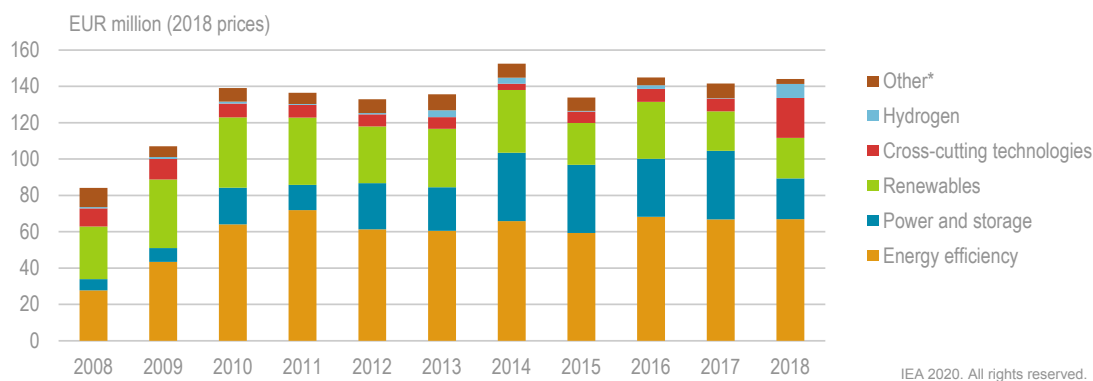
IEA 2020. All rights reserved.

Austria ranked eighth among IEA countries on GDP spending on energy RD&D in 2017.

Notes: Data are not available for the Czech Republic, Greece, Luxembourg and Portugal. The chart uses 2017 data as 2018 data available are not available for many countries, but the share for Austria is very similar (0.038% in 2017 compared to 0.037% in 2018).

Source: IEA (2019a), *Energy Technology RD&D Budgets 2019: Overview* (database), www.iea.org/statistics.

² Calculated using 2018 data where available (for 10 countries) and otherwise using 2017 data (for 16 countries).

Figure 10.2 Government energy RD&D spending by category, 2008-18

Energy efficiency technologies account for 46% of total public energy RD&D spending.

* Other includes fuel cells, fossil fuels and nuclear.

Source: IEA (2019a), *Energy Technology RD&D Budgets 2019: Overview* (database), www.iea.org/statistics.

General RD&D strategy and funding

Austria issued a new Energy Research and Innovation Strategy (ERIS) in 2017, replacing the Energy Research Strategy of 2009. The new strategy, which aims to exploit the economic opportunities of the energy transition, is integrated into Austria's comprehensive climate and energy strategy, #mission2030 (FMTIT, 2017). The 2017 strategy has shifted towards an integrative and systems-oriented perspective and the role of the innovation processes. The ERIS supports sector coupling of heating, cooling and electricity and has six strategic focus areas:

- energy systems and networks
- buildings and urban systems
- industrial energy systems
- transportation and mobility systems
- conversion and storage technologies
- transition processes and social innovation.

The ERIS is integrated into #mission2030, which sees a key role for research, development and innovation (RDI) in the decarbonisation of the economy and for positioning Austria as an energy innovation country to ensure the future competitiveness of its economy. #mission2030 sets out a range of activities for RDI in two “flagship projects”: Flagship Project 9 – Building Blocks of the Energy Systems of the Future and Flagship Project 10 - Mission Innovation Austria Programme.

Flagship Project 9 addresses the needs to integrate multiple technologies in the future energy system and to create interaction between various industries and sectors in a technology-neutral way. Activities include integrated regional energy systems, breakthrough technologies for industry and energy-efficient mobility systems of the future. Flagship Project 10 focuses on large-scale field tests and real-life laboratories building on the ongoing “Flagship Region Energy” (see below). The implementation plan for the

flagship projects is being finalised by the Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology.³ A first version was presented at the Mission Innovation Austria week in May 2019. A final version will be available by the end of March 2020.

Funding mechanisms

The Climate and Energy Fund (KLIEN) is a well-established instrument for RD&D funding and has a solid track record of achievements, e.g. the roll out of electric vehicles (EV) and EV infrastructure and the smart grid model regions (see below). KLIEN is relatively free in how it allocates funding along the RDI cycle, offering flexibility to adapt to new requirements. For administrative reasons, the subsidies for private EVs, wall-charging boxes, electric two-wheelers and cargo bikes is channelled through KLIEN. However, the budget for these schemes is additional; it is not part of the budget available for RDI.

In line with the strategic reorientation, new funding instruments are being introduced for all phases of the innovation cycle: covering test cases, sandboxes, innovation laboratories and pre-commercial procurement up to the successful implementation. The “innovation laboratories” funding scheme provides support for testing new technologies and solutions under real and large-scale conditions in selected regions of Austria and promotes public-private partnerships.

The actual financial administration of KLIEN programmes and projects is carried out by several other financing agencies. These include the Research Promotion Agency specialising in supporting applied R&D, and Austria Wirtschaftsservice, providing funding for innovation and start-ups, as well as ambitions of Austrian enterprises to expand internationally. The Kommunalkredit Public Consulting manages KLIEN’s energy market implementation programmes. Under #mission2030, all funding agencies are encouraged to co-operate more closely to leverage their specialisations and create one “clearing house” that would allocate funding across the entire innovation value chain.

The new strategic shift from energy research towards implementation and testing phases in the later stages of the innovation value chain has reduced the availability of funding for basic and applied research. As a result, since 2016, around 80% of applications that have been positively evaluated were rejected due to shortage of funding. This high figure could imply that the research community has not yet adapted to the new strategy. The Austrian government may benefit from exploring ways to support better adaptation and perhaps develop tools that could be complementary to the new strategic shift.

Austria has a strong record in mobilising private funding for RD&D. For every euro spent by the government, the country mobilises on average EUR 2.5 in private funding, depending on where in the value chain the project is located. The multiplier can go up to EUR 10, for example for solar PV projects. Some examples include, the “Competence Centre for Excellent Technologies in Advanced Metallurgical and Environmental Process Development”, which is mainly financed by industry partners. The focus is on environmental process development in metallurgy, energy efficiency and reducing CO₂

³Annex A provides detailed information about institutions and organisations with responsibilities related to the energy sector.

emissions. Another example is the Flagship Region “Green Energy Lab”, which is financed 50% by public funds and 50% and the local energy power companies from Lower Austria, Burgenland, Styria and Vienna.

Every two years, Statistik Austria undertakes an analysis of the reported data of RD&D expenditure by the private sector. The latest available data are for 2017 and show that the roughly 3 500 companies covered in the survey spent a total of EUR 7.9 billion on their internal R&D, an increase of 5.2% compared to 2015. Of this, EUR 681 million, or 9%, was spent on programmes supporting the production, storage and distribution of energy (Statistik Austria, 2019).

For the first time, the report *Energy Research Expenditure – Business Sector in Austria 2017* (FMTIT, 2019a) shows the energy research expenditures of the private sector in 2015 and 2017. It is based on Statistik Austria’s biannual RD&D expenditure survey of the private sector. Based on these data, companies active in following technology fields were analysed concerning private and public R&D expenditures: solar PV, solar thermal, wind energy, hydropower, bioenergy (fuels, biogas, boilers, stoves, CHP plants), lighting, electrical storage and heating, cooling, and climatisation. It illustrates that mature technologies, such as wind energy, lighting or biomass boilers, stoves and CHP plants, mobilise mainly private funds. On the other hand, PV, solar thermal, biomass fuels and biogas, electrical storage as well as heating, cooling and climatisation are still funded by a higher percentage of public funds.

Policies and programmes

A key change in the Austrian RDI landscape is the move to a mission-based focus; two of such missions are presented in more detail below. Austria’s research community welcomes this change, but notes that the implementation requires a longer term planning perspective and multi-year funding certainty. Government RDI budgets and funding commitments are prepared annually, which may undermine the long-term effectiveness of RDI activities, and could not be conducive to support the desired shift to a mission-based approach.

City of Tomorrow

The City of Tomorrow (CiT) programme builds on the “Building of Tomorrow” programme that ran until 2013. The CiT programme commenced in 2013 and has since funded 113 research projects for about EUR 40 million. The programme reflects the new energy systems-oriented approach of RDI by moving from the earlier programme of targeting individual zero energy and plus energy buildings to clusters of high-efficiency buildings and eventually to zero/plus energy districts. The first innovation laboratory was launched within the CiT programme.

In addition to putting energy at the centre of city planning and deploying green building technologies, the CiT is centred on the introduction of smart energy and transport systems. KLIEN plans to provide about EUR 100 million until 2025 for smart energy systems. This programme is closely linked to the smart cities project that is set to receive a total of EUR 120 million funding until 2025.

Flagship Region Energy

The Flagship Region Energy was launched in 2018 and focuses on the efficient interaction of energy production, consumption, system management and storage, and provides funding to test integral solutions in real time. The Flagship Regions Energy aims to bring projects closer to the market by, for example, creating innovation partnerships and to rollout green finance schemes (Flagship Project 8 of #mission2030) in the model regions.

Three regions in Austria have been selected as three thematically different test cases for innovation. In the first, green energy labs are set up to test smart grids and sector coupling in the eastern part of Austria, which has the highest population concentration and the highest share of installed variable renewable energy. A key research area is how to best use digitalisation to deliver customer-oriented solutions.

The second flagship region aims to further strengthen collaboration with industry through the “New Energy for Industry” (NEFI). NEFI is an innovation network of science, technology providers and companies to demonstrate pathways towards the decarbonisation of industry that is central to the transformation of the energy system in Austria. NEFI’s vision is to achieve the decarbonisation of industrial processes entirely through technology developed in Austria. NEFI received seed funding of approximately EUR 12 million from KLIEN and raised an additional EUR 24.5 million of private funding, for a total of 10 projects spread-out across Austria, including industrial waste heat utilisation and storage technologies.

The third flagship region focuses on hydrogen, a new RDI priority for Austria given its large potential in the electricity, industry and transport sector. The aim is to demonstrate the viability of a shift to an energy system largely based on hydrogen. There are about 20 players in the Austrian hydrogen market and the sector has reached a level where the creation of a sample regulatory framework becomes desirable as a next step to prepare for reaching the market introduction state. In co-operation with the government, a consortium of hydrogen industry players is planning to develop a mock regulatory system that would outline how the framework of a hydrogen market could look while ensuring market coupling. This is a good example of how the three regions create synergies among each other and use new innovative instruments like sandboxes to test market potential.

The Flagship Region Energy will be implemented over eight years, with a total budget of EUR 120 million until 2021 provided by KLIEN. Over the period to 2025, the government expects a total investment volume above EUR 400 million, with more than 220 participating industry and science partners.

Monitoring and evaluation

Austrian energy RD&D programmes are subject to a multi-level evaluation and assessment process. All programmes are obliged to undertake an *ex ante* evaluation that is part of the basic scoping document. It is usually based on the expected outcome of the programme, for example, a reduction of energy consumption or strengthening the competitiveness of Austria’s RD&D institutions.

Programmes are also evaluated using an input- and an output-oriented approach. The input-oriented evaluation is based on annual contract obligations and expenditure levels, not on budget data. An annual report has been published since 1974. The report allows creating and checking policy goals; monitoring the relationship between sectoral spending

levels and Austria's strategic RD&D priorities; monitoring the split between funding for basic and applied research, experimental development and demonstration; and first-of-its-kind demonstration projects (FMTIT, 2019b). For the first time, the 2018 report included gender-aggregated data, a welcome addition in line with Austria's membership in the IEA Technology Collaboration Programme on Clean Energy Education and Empowerment (C3E TCP) (see the section on "International collaboration" below). The report analysed 210 projects and found that 30 were led by women (14%), representing a share of 16.5% of total funding. The share of women responsible for the technical or scientific part of the work in each project is 13%. One interesting finding was that the share of female project leaders is significantly higher in renewables, buildings and smart cities than in other RD&D areas (FMTIT, 2019b).

Austria also undertakes annual output-oriented evaluations that focus on the market penetration of clean energy technologies covering bioenergy, solar (PV and thermal), heat pumps and wind (FMTIT, 2019c). The 2018 report identified increasing competition between the different renewable technologies, but concluded that the current market penetration is not sufficient to reach Austria's energy and environmental goals for 2030 and 2050 (see Chapter 1). The report found that of all the technologies analysed, only wind power and heat pumps showed a larger uptake in 2018 compared to 2017. Reaching long-term targets will require a combination of enhanced deployment for mature technologies (e.g. PV, wind) and more innovation in emerging technology areas (e.g. hydrogen, advanced heat pumps) (FMTIT, 2019c). It might be beneficial for policy from identifying pressing innovation versus deployment gaps in each sector and in line with the country's policy goals. Ensuring adequate funding for both was equally identified as a key requirement in the 2018 evaluation.

However, despite the higher than average public expenditure on overall RD&D, the Austrian energy innovation landscape has room for improvement. A 2017 review by the European Commission found scope to improve the output-to-input ratio of all RD&D programmes. This gap is impeding the desired shift of Austria's economy towards a more innovative and high-tech economy. The study identified the need for a stronger innovation dimension in applied RD&D programmes that tend to be strongly driven by engineering dimensions. Among other factors, the study cited administrative and regulatory barriers as holding back a stronger focus on innovation (EC, 2018).

International collaboration

Austria is actively pursuing and further expanding its international RD&D collaborations to support the national priorities set out under the #mission 2030 and the ERIS 2017.

IEA technology collaboration programmes

Austria is a very active participant in the IEA technology collaboration programmes (TCPs). It is a member of 21 out of a total of 38 TCPs, which is 5 more than at the time of the last in-depth review in 2014 (Table 10.1). Austria's participation in the TCPs is particularly strong in groups relating to energy end-use technologies, in line with the country's overall RD&D strategy. Austria also serves as Vice Chair of the IEA Working Party on Energy End-Use Technologies and the IEA Working Party on Renewable Energy Technologies.

Table 10.1 Austrian government participation in technology collaboration programmes by TCP group, December 2019

Thematic area	Number of TCPs with Austrian participation
End-use technologies	11
Renewables and hydrogen	6
Fossil fuels	3
Cross-cutting	1
TOTAL	21

Austria pays special attention to disseminating the results of its participation in the IEA TCPs to the national RD&D community, and it has created a dedicated web-based platform and twitter account.⁴ In addition, a biennial “IEA networking event” brings together all Austrian IEA participants. In 2018, the Austrian Energy Agency carried out a noteworthy study exploring linkages between RD&D public spending in IEA member countries and activities undertaken by the IEA TCPs, excluding TCPs related to fusion power (Egglar, Indinger and Zweib, 2018). The purpose of the study was to identify possible gaps and overlaps within Austria’s participation in TCPs and to assess communication and collaboration among TCPs and between TCPs and the IEA working parties. Among the key findings of the analysis was that the work of the TCPs strongly feeds into policies and legislation, and also supports testing and standardisation. An important output of the FMTIT study is the visualisation and database that are available as an open source and can be accessed at www.nachhaltigwirtschaften.at. The IEA commends Austria for this initiative.

Engagement through other international partnerships

Austria joined the MI in 2018 as a sign of its commitment to accelerate RDI of energy technologies for the clean energy transition and with the intention to further align national RDI efforts with activities under the MI. The country is committed to double its direct RDI funding for low-carbon energy technologies in the next five years. Austria rightly takes pride in the fact that its private sector was closely involved in the decision about joining the MI through a dedicated “MI Export Advisory Board” consisting of industry representatives and international energy experts.

Austria participates in three MI Innovation Challenges:

- IC#1 Smart Grids
- IC#7 Affordable Heating and Cooling in Buildings
- IC#8 Renewable and Clean Hydrogen.

In May 2019, Austria hosted the first “Mission Innovation Austria Week”. The purpose of the event was to present Austria as an active partner of MI, and to showcase Austria’s innovation leadership in certain fields, including solar PV for off-grid electricity access, local energy communities and municipal contributions to energy systems transformation, in line with Austria’s own policy goals. The week also focused on innovation activities for hydrogen from renewable sources, which is a key priority in Austria. The event also included a Smart Cities Day, again a major focus area of Austria’s RD&DI priorities.

⁴ <https://nachhaltigwirtschaften.at/en/iea> and @IEAforschungAT.

Austria is not a member of the Clean Energy Ministerial, but participates in two Clean Energy Ministerial-related initiatives through its membership in the IEA TCPs on “Smart Grids Action Network” and “Clean Energy Empowerment and Education”.

Austrian RDI stakeholders have actively participated in Horizon 2020, the EU framework programme for RD&D. As of August 2019, Austrian entities had received EUR 114.7 million in funding under the energy programme; or 3.5% of total energy funding under Horizon 2020 (FFG, 2019). This is a higher share than that of Austria’s overall funding received under Horizon 2020 at 2.8%, underlining the competitiveness of Austria’s energy research community and the importance given to energy RDI in the country.

Box 10.1 A four-pillar approach to successful energy innovation systems

Recent IEA work offers a four-pillar approach aimed to support government efforts in assessing the effectiveness of national innovation systems. Innovation processes are complex and may be influenced by a broad variety of factors, such as policy action, sectoral spillovers, macroeconomic fundamentals, the domestic “ease of doing innovation” or regional specificities. Designing a successful technology innovation ecosystem requires several components, including, but not limited to, public funding for energy research, development and demonstration (RD&D). As new innovation strategies are being implemented, decision makers may benefit from taking a systemic approach to energy innovation policy making, and should ideally aim to cover all four of the following core functions of innovation systems.

- **Resource push:** Technology innovation requires a sustained flow of resources for RD&D activities, both financial and in terms of human capital. In addition, RD&D activities should target specific innovation gaps and priorities that have been collectively identified by innovation stakeholders.
- **Knowledge management:** New product development requires the underlying generation of high-value knowledge, which may be codified and protected under intellectual property regimes, in the energy sectors, but also other relevant sectors that may spill over energy technologies. Strong domestic and international networks facilitate this knowledge creation.
- **Market pull:** To reach consumers, emerging technologies require market incentives that are aligned through the entire innovation value chain, from early-stage R&D to demonstration and deployment in niche markets, as well as market signals that show the technology can be profitable.
- **Socio-political support:** Beyond that of innovation stakeholders, policy makers need to be aware of the perspectives of citizens, relevant industry actors and international partners. Ultimately, an emerging technology may not make it to markets if it does not achieve broad socio-political buy-in.

Policy makers may choose from a broad range of possible tools and incentive mechanisms to support the development of one or more of these components. These policies need to be consistent with one another (e.g. funding levels for RD&D need to be consistent with market incentives under other industrial policies), aligned with broader national policy goals, and should be tracked over time to monitor progress.

Source: IEA (2019b).

Assessment

Since 2017, Austria's new Energy Research and Innovation Strategy has sought to shift the RD&D focus to a systems perspective and the integrative role of innovation processes, illustrating policy and decision makers' aspirations to take a more systemic approach to energy innovation. In fact, the key objectives of the ERIS are to reduce carbon emissions in line with climate goals and to place the country as an innovation leader in the energy field. The strategy itself is firmly integrated into Austria's #mission2030, with two flagship projects dedicated to RDI activities (see Chapter 1). These elements suggest that Austria's energy innovation strategy seeks to steer RD&D activities towards national policy goals, and to ensure they are consistent with broader regulations and priorities beyond the energy sector.

The strategic orientation of Austria's ERIS is on later stages of technology development, and it will thus be necessary to strike a balance between funding basic research to maintain and encourage talent in the sector and supporting more demonstration projects to accelerate market uptake of emerging technologies and seek greater innovation value for the money spent on RD&D. In recent years, Austria has observed a significant increase in the rejection rate of positively evaluated basic research applications due to funding constraints, as the budget envelope remained relatively stable. With the focus shifting to demonstration projects, it is advisable to provide innovation stakeholders with adequate funding certainty and medium-term strategic visibility, such as with multi-year budgets and extended periods for which project finance is made available to facilitate longer lasting projects. Recent illustrations of such multi-year planning for the 2020-30 period may provide Austrian policy and decision makers with valuable insights as new innovation strategies are being implemented.

Austria's total spending on RD&D is about 3.5% of GDP, one of the highest shares among IEA and EU member countries. Since 2010, Austria has invested around EUR 140 million annually on energy RD&D. Half of the budget is spent on energy efficiency, which has received the largest shares of public energy RD&D spending since 2009. Surprisingly, spending on renewables has been decreasing since 2016, while expenditures for basic research, energy system analysis and other activities classified as "other cross-cutting technologies and research" reached an all-time high in 2018. Since 2010, the share of public expenditures on energy RD&D in Austria has been about 0.04% of GDP, putting the country in the category of so-called "strong innovators".

While Austria can claim a place among "strong innovator countries" that invest in RD&D above the average of IEA and EU member countries, it is currently not obtaining the desired innovation output and outcomes towards a more knowledge-based and innovative economy. Further efforts are required to modernise the existing industrial structure and regulatory barriers and to increase appreciation of and support for entrepreneurs, which could otherwise discourage talents to venture into this area. Applied R&D programmes are often engineering-driven, a strength of the Austrian economy; thus, innovations tend to develop incrementally, rather than as high-impact, breakthrough innovation, demonstration and market penetration. The ERIS seeks to address some of the identified weaknesses, which is illustrated by recent initiatives to facilitate market penetration: innovation labs, sandboxes and pre-commercial procurements are all steps in the right directions.

Austria follows a multi-level evaluation process that sets a good example for other countries. With the ongoing shift towards innovation, the established evaluation methodology may need to be adjusted. For example, an evaluation process of innovation activities would arguably focus on emerging technologies. Austria's annual evaluations should aim to provide analysis and/or guidance related to Austria-specific energy innovation gaps versus deployment needs. It could also be considered to include indicators such as cost curves for emerging technologies, the number of successful demonstration projects and high-value patent counts.

Austria has a well-functioning institutional and funding framework for RD&D. KLIEN is the major funding arm for public RDI and spends its largest budget share on energy. It is expected to increasingly focus on making new technologies market ready and supporting the market penetration of innovative renewable technologies. The strategy is to start by supporting RD&D, then to accompany the project to the market penetration phase, during which the share of public funding decreases and the share of private funding typically increases. The private sector already has excellent participation in energy innovation activities in Austria, and it has successfully leveraged public funding to unlock additional resources. This provides a solid base for moving forward, as private sector participation generates additional knowledge and provides feedback from market actors' perspective, which can feed back into future policy design.

The energy storage programme is a good example of a project that was successfully accompanied from basic research to building up demand for storage, and that is now rolling out at state and district level. This is a sensible approach; however, it will be important to maintain a balance in the allocation of funds between energy research programmes focused on different stages of technology development.

Austria is a keen participant in international RD&D collaboration, in close alignment with the national RD&D priorities set in the ERIS and under #mission2030. Since the last in-depth review in 2014, Austria has joined five more IEA TCPs, and with its current membership in 21 out of the 38 TCPs, ranks 11th among IEA members. This is a major accomplishment, especially in light of Austria's relatively small population size.

Austria joined the MI in 2018, expressing intention to further accelerate RDI for energy technologies and to showcase its innovation leadership in key areas. Under the MI, Austria is committed to double its direct RD&D funding for clean energy technologies by 2021. This increase in funding is necessary, as Austria is committed to support a new set of comprehensive activities across the innovation phase and to rollout additional funding instruments.

Recommendations

The government of Austria should:

- ❑ Continue to ensure that funding from the Climate and Energy Fund is aligned with the ambitious climate and energy policy objectives.
- ❑ Consider moving from an annual to a multi-year budget and improve planning reliability for project funding while intensifying the monitoring and information sharing of the supported projects.

- Increase the integration between RD&D and existing and new market introduction programmes, such as innovation labs, regulatory sandboxes and pre-commercial procurement, to shorten the time to market of clean energy technologies.
- Ensure that adequate funds are made available at all required stages of technology development, from early-stage R&D to demonstration and market introduction programmes with a focus on innovation.
- Enhance current efforts to stimulate private sector uptake of low-carbon energy innovation activities, learning from existing programmes and recent initiatives that seek to build public-private co-operation in key technology areas, such as hydrogen.
- Continue to engage in international collaboration through bilateral and multilateral platforms such as Mission Innovation and IEA technology collaboration programmes to maximise impact and disseminate results of national RDI efforts.

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ANNEX A: Institutions

The **Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology** (BMK in its German acronym) is the main body responsible for energy matters at the federal level. Created in early 2020, it is tasked with creating the framework for Austria's infrastructure from rail and road, to water and air, to telecommunications and technology development. The BMK is also responsible for collecting oil data.

The **Ministry of Finance** is also involved in energy policy matters and is responsible for the state budget and tax policies. The **Federal Ministry of Education, Science and Research** is actively involved in developing the government research, technology and innovation strategy.

Energy policy, as all other policies, is formulated and implemented in close co-operation with the social partner organisations, i.e. organisations representing important groups of society (employers, employees, agriculture), and in dialogue with non-governmental organisations and the public.

As a federal republic, the **nine Austrian provinces** also play an important role in designing and implementing energy policy. The federal Constitution allocates responsibilities to either the federal level (e.g. energy taxation, energy statistics, energy metering, energy supply emergency regulations, support schemes for renewable energies, biofuels) or to both the federal level and the provincial level (e.g. electricity, gas, district heating, energy conservation, subsidies, prohibition of nuclear power). Provincial governments have responsibility for policy making within their provinces for land use and zoning, and setting building codes, among others. In the area of energy efficiency, the federal government and the provinces are authorised to adopt laws. The provinces are in charge of setting building laws and planning within their provinces and for renewable energies in buildings.

Both at the federal and the provincial level, the responsible public bodies make use of the expertise of so-called "energy agencies" – mainly non-profit organisations dealing with energy efficiency and renewable energies. The **Austrian Energy Agency** was established by the federal government and the provinces to promote clean energy use in the country, and it is the independent national energy efficiency monitoring body since 2014. It also evaluates the qualifications of energy service providers and regularly reports on the status of the energy service companies market.

Since 2011, **E-Control** is the independent regulatory body in the energy sector and is entrusted by law with monitoring, accompanying and, if necessary, regulating the liberalisation of the Austrian electricity and gas markets and the day-to-day operations of those markets. It also collects statistical data to fulfil its own tasks and to provide other governmental institutions with the means to perform theirs. E-Control is also responsible for issuing guarantees of origin for renewable energy and dispute settlements in the gas and electricity sectors. E-Control plays an important role in Austria's smart grid rollout. The **Austrian Competition Authority**, in co-ordination with E-Control, is the government body responsible for enforcing competition law in Austria.

The **Environment Agency Austria** is the authority of the federal government in Austria for environmental protection and environmental control. It was founded in 1985 pursuant to the Federal Act on Environmental Control as a federal government institution attached to the Ministry for Sustainability and Tourism.

The **Climate and Energy Fund (KLIEN)** was established in 2007 by the federal government to support the implementation of its climate strategy. It is owned by the Republic of Austria, represented by the BMK. The strategies of the Austrian government in the areas of research and technology, climate protection and energy provide the essential foundations that are reflected in KLIEN's programmes.

The federal government launched the programme for climate-friendly mobility management "**klimaaktiv mobil**" in 2004 to provide active support for Austria's cities, municipalities and regions, and businesses and civil society in the transformation towards a clean low-emission mobility of tomorrow. klimaaktiv mobil supports measures focusing on mobility management, including alternative vehicles and e-mobility with renewable energy, cycling, intelligent multimodal mobility, innovative mobility services and eco-driving.

Austrian Power Grid AG, the major Austrian transmission system operator, prepares a network development plan every year for a ten-year period. The plan has to be approved by E-control. The **Vorarlberger Übertragungsnetz GmbH** is the transmission system operator for the province of Vorarlberg that only has limited connections with the rest of Austria. It prepares its own network development plan, which must be approved by the regulator E-Control, but Austrian Power Grid consolidates both plans into the integrated network development plan.

On 1 June 2017, **Austrian Gas Grid Management (AGGM)** assumed responsibilities as Austria's market and distribution area manager following approval by E-Control. The AGGM is also responsible for drawing up a co-ordinated network development plan once a year, in consultation with the transmission system operators. The plan must be approved by the E-Control. **Gas Connect Austria** and **TAG** are the two certified independent transmission operators in the gas sector, as Austria does not have a single countrywide gas grid. **The Central European Gas Hub** is the virtual gas market trading point.

OMV is Austria's largest energy sector company and is active in upstream oil and gas, import of crude oil, mineral oil products imports and exports, refining of oil products, gas imports, gas storage, oil and gas wholesale, distribution and retail, and gas storage.

Oesterreichs Energie is the industry association representing companies that generate more than 90% of Austria's electricity and operate the Austrian transport and distribution networks.

Statistik Austria is, among others, responsible for the data submission to the International Energy Agency and the preparation of the national energy balances.

The **Association of Gas and District Heating Supply Companies** is the independent, legally commissioned representative for Austria's natural gas and district heat industries.

The **Austrian Council for Research and Technology Development** advises the federal government on research, technology and innovation matters.

ANNEX B: Organisations visited

Review criteria

The Shared Goals, which were adopted by IEA Ministers at their 4 June 1993 meeting in Paris, provide the evaluation criteria for the in-depth reviews (IDRs) conducted by the International Energy Agency (IEA). The Shared Goals are presented in Annex D.

Review team and preparation of the report

The IDR team visited Austria from 12-17 May 2019. The review team met with government officials, energy suppliers, market participants, interest groups, consumer representative associations, research institutions, and other organisations and stakeholders. This report was drafted based on the information obtained during these meetings, the team's preliminary assessment of Austria's energy policy, the Austrian government's responses to the IEA energy policy questionnaire, and information on subsequent policy developments from the government and private sector sources. The members of the team were:

IEA member countries

Mr. Marcos Pelenur, New Zealand (team leader)

Ms. Briony Bowe, United Kingdom

Mr. Risto Leukkunen, Finland

Ms. Ursula Mumpro, Germany

Mr. Martin Michel Switzerland

Mr. Benedikt Klauser, European Union

International Energy Agency

Mr. Aad van Bohemen

Mr. Peter Journeay-Kaler

Mr. Oskar Kvarnström

Ms. Dagmar Graczyk (senior country analyst)

The team is grateful for the co-operation and assistance of the many people it met with during the visit. Thanks to their kind hospitality, openness and willingness to share information, the visit was highly informative, productive and enjoyable.

The team wishes to express its gratitude to Dr. Michael Losch, Director General for Energy of the Federal Ministry of Climate, Environment, Mobility, Innovation and Technology, for his personal engagement in the meetings and for hosting our visit. The team is also grateful to Mr. Jürgen Streitner, Director for Energy Policy and Energy Intensive Industries, and Ms Sarah Neumann, Division for Energy Policy and Energy Intensive Industries, both from the Federal Ministry for Climate, Environment, Mobility, Innovation and Technology for their

tireless efforts and professionalism in planning and organising the review visit and their patience and diligence in supporting the team throughout the review process.

The review was prepared under the guidance of Mr. Aad van Bohemen, Head of the Energy Policy and Security Division, IEA. Ms. Dagmar Graczyk managed the review and wrote the report, with the exceptions of Chapters 8 and 9. Mr. Peter Journeay-Kaler drafted Chapter 9 and Mr. Oskar Kvarnström wrote Chapter 8. Mr. Shuto Fukuoka contributed extensively to Chapter 5. Mr Oskar Kvarnström, Ms. Lilli Lee and Ms. Michelle (Seo Kyung) Kim prepared and drafted the sections relating to energy data in each chapter. Helpful comments, chapter reviews and updates were provided by the following IEA staff: Mr. Heymi Behar, Mr. Pharoah Le Feuvre, Mr. John Dulac, Mr. Armin Mayer, Ms. Sara Moarif, Ms. Tiffany Vass, Mr. Simone Landolina, Mr. Simon Bennett, Mr. Jean-Baptiste le Marois, Mr. Greggely Molnar and Ms. Randi Kristiansen.

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Organisations visited

- Alliance of the Environmental Movement
- Aspern Smarty City Research (ASCR)
- Association of Austrian Electricity Companies (Österreichs Energie)
- Association of Gas and District Heating Companies (FGW)
- Austrian Chamber of Commerce
- Austrian Chamber of Labour
- Austrian Compost and Biogas Association
- Austrian Consumers' Association
- Austrian Energy Agency
- Austrian Gas Grid Management AG (AGGM) – independent gas system operator
- Austrian Institute of Technology
- Austrian Petroleum Industry Association (Chamber of Commerce)
- Austrian Power Grid AG (APG)
- Central European Gas Hub AG (CEGH) – part of OMV, runs virtual trading point and has registered members
- Climate and Energy Fund
- Dienstleister Energieeffizienz und Contracting Austria (DECA)
- E-Control
- Energienetze Steiermark GmbH (distribution system operator)
- Environmental Umbrella Organisation
- EVN Netze (distribution system operator)
- Federal Ministry of Finance

- Federal Ministry for Sustainability and Tourism¹
- Federal Ministry for Transport, Innovation and Technology
- Federation of Austrian Industries
- Gas Connect Austria GmbH (Gas Connect Austria is responsible for marketing gas transportation capacity, building and operating gas transit pipelines, and providing and marketing the transmission capacity required by the domestic market.)
- Global 2000
- Green Electricity Clearing and Settlement Agent (OeMAG Abwicklungsstelle für Ökostrom AG)
- Green Energy Lab
- Institute for Healthy and Ecological Building
- Johannes Kepler Universität Linz (Energie Institut)
- Land Salzburg (energy efficiency)
- Netz Burgenland GmbH (distribution system operator)
- Netz Niederösterreich GmbH (distribution system operator)
- New Energy for Industry (NEFI innovation network)
- OMV (oil and gas production, transmission, and renewable energy)
- RAG Austria AG
- Renewable Energy Austria (Erneuerbare Energie Österreich)
- Statistik Austria
- SOLID GmbH (Solarinstallation + Design)
- Stadt Wien (energy efficiency)
- Trans Austria Gasleitung
- Umbrella Organisation Energy-Climate Protection (Austrian Chamber of Commerce)
- Verbund
- Wienenergie GmbH
- World Wildlife Fund

¹ Since January 2020, areas of responsibilities covered by several federal ministries have been merged into the newly created Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology.

ANNEX C: Energy balances and key statistical data

Energy balances and key statistical data

	Unit: Mtoe						
SUPPLY	1973	1990	2000	2010	2016	2017	2018
TOTAL PRODUCTION	7.9	8.1	9.8	12.0	12.3	12.3	11.7
Coal	1.0	0.6	0.3	-	-	-	-
Peat	-	-	-	-	-	-	-
Oil	2.6	1.2	1.1	1.1	0.8	0.7	0.7
Natural gas	2.0	1.1	1.5	1.4	1.0	1.0	0.9
Biofuels and waste ¹	0.7	2.5	3.2	5.8	6.3	6.3	6.0
Nuclear	-	-	-	-	-	-	-
Hydro	1.6	2.7	3.6	3.3	3.4	3.3	3.2
Wind	-	-	0.0	0.2	0.5	0.6	0.5
Geothermal	-	0.0	0.0	0.0	0.0	0.0	0.0
Solar/other ²	..	0.0	0.1	0.2	0.3	0.3	0.3
TOTAL NET IMPORTS³	13.8	17.1	18.6	21.2	20.4	21.5	21.0
Coal Exports	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Coal Imports	3.1	3.2	3.1	3.4	2.9	3.1	2.7
Coal Net imports	3.0	3.2	3.0	3.4	2.9	3.1	2.7
Oil Exports	0.1	0.6	1.5	2.2	2.7	2.7	3.1
Oil Imports	9.8	10.2	12.4	13.9	14.0	14.1	14.9
Oil Int'l marine and aviation bunkers	-0.1	-0.3	-0.6	-0.7	-0.8	-0.8	-0.8
Oil Net imports	9.6	9.4	10.4	11.1	10.5	10.6	10.9
Natural gas Exports	-	-	0.0	4.1	5.8	4.5	4.3
Natural gas Imports	1.3	4.5	5.3	10.2	11.9	11.5	10.8
Natural gas Net imports	1.3	4.5	5.3	6.1	6.1	7.0	6.5
Electricity Exports	0.4	0.6	1.3	1.5	1.7	2.0	1.6
Electricity Imports	0.3	0.6	1.2	1.7	2.3	2.5	2.4
Electricity Net imports	-0.1	-0.0	-0.1	0.2	0.6	0.6	0.8
TOTAL STOCK CHANGES	-0.2	-0.3	0.2	0.9	0.4	-0.1	0.2
TOTAL SUPPLY (TPES)⁴	21.5	24.9	28.6	34.0	33.0	33.8	32.8
Coal	3.9	4.1	3.6	3.4	3.0	3.1	2.7
Peat	-	-	-	-	-	-	-
Oil	12.1	10.4	11.7	12.3	11.5	11.6	11.7
Natural gas	3.3	5.2	6.6	8.1	7.1	7.8	7.4
Biofuels and waste ¹	0.7	2.5	3.1	6.3	6.6	6.6	6.2
Nuclear	-	-	-	-	-	-	-
Hydro	1.6	2.7	3.6	3.3	3.4	3.3	3.2
Wind	-	-	0.0	0.2	0.5	0.6	0.5
Geothermal	-	0.0	0.0	0.0	0.0	0.0	0.0
Solar/other ²	-	0.0	0.1	0.2	0.3	0.3	0.3
Electricity trade ⁵	-0.1	-0.0	-0.1	0.2	0.6	0.6	0.8
Shares in TPES (%)							
Coal	18.0	16.5	12.6	9.9	9.2	9.2	8.3
Peat	-	-	-	-	-	-	-
Oil	56.4	41.6	40.9	36.3	34.9	34.2	35.5
Natural gas	15.4	21.0	23.0	23.9	21.5	23.0	22.5
Biofuels and waste ¹	3.3	10.1	11.0	18.4	19.9	19.5	18.8
Nuclear	-	-	-	-	-	-	-
Hydro	7.5	10.9	12.6	9.7	10.4	9.8	9.9
Wind	-	-	-	0.5	1.4	1.7	1.6
Geothermal	-	0.0	0.1	0.1	0.1	0.1	0.1
Solar/other ²	-	0.1	0.2	0.5	0.9	0.9	0.9
Electricity trade ⁵	-0.6	-0.2	-0.4	0.6	1.9	1.7	2.3

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	1990	2000	2010	2016	2017	2018
TFC	16.6	19.8	23.5	27.6	27.7	27.9	27.6
Coal	2.3	1.4	0.9	0.5	0.5	0.5	0.4
Peat	-	-	-	-	-	-	-
Oil	10.0	8.8	10.4	11.0	10.8	10.9	11.0
Natural gas	1.4	3.0	4.3	5.1	5.0	5.1	5.0
Biofuels and waste ¹	0.7	2.2	2.5	4.0	4.1	4.1	3.8
Geothermal	-	0.0	0.0	0.0	0.0	0.0	0.0
Solar/other ²	-	0.0	0.1	0.2	0.2	0.2	0.2
Electricity	2.2	3.7	4.4	5.1	5.3	5.4	5.4
Heat	-	0.6	1.0	1.6	1.7	1.8	1.7
Shares in TFC (%)							
Coal	14.1	7.2	3.9	1.7	1.7	1.7	1.6
Peat	-	-	-	-	-	-	-
Oil	59.9	44.7	44.0	40.1	39.1	38.9	39.9
Natural gas	8.7	15.3	18.1	18.6	18.2	18.3	18.1
Biofuels and waste ¹	4.2	11.0	10.6	14.6	14.7	14.6	13.9
Geothermal	-	0.0	0.0	0.0	0.0	0.0	0.0
Solar/other ²	-	0.1	0.3	0.6	0.7	0.6	0.6
Electricity	13.1	18.6	18.8	18.7	19.3	19.4	19.6
Heat	-	3.1	4.3	5.8	6.3	6.5	6.1
TOTAL INDUSTRY⁶	6.4	6.8	7.7	9.3	9.4	9.2	9.5
Coal	0.8	0.7	0.7	0.4	0.5	0.4	0.4
Peat	-	-	-	-	-	-	-
Oil	3.3	1.9	1.9	2.0	1.8	1.6	1.8
Natural gas	1.3	2.0	2.4	2.9	2.9	3.0	3.0
Biofuels and waste ¹	0.0	0.6	0.8	1.5	1.5	1.5	1.5
Geothermal	-	-	-	-	-	-	-
Solar/other ²	-	-	-	-	-	-	-
Electricity	1.0	1.5	1.8	2.2	2.4	2.4	2.5
Heat	-	0.1	0.1	0.2	0.2	0.3	0.3
Shares in total industry (%)							
Coal	11.8	10.5	8.6	4.4	4.8	4.8	4.5
Peat	-	-	-	-	-	-	-
Oil	51.5	27.6	24.7	21.6	19.0	17.3	19.0
Natural gas	20.0	29.0	31.0	31.5	31.4	32.4	32.0
Biofuels and waste ¹	0.5	9.0	10.9	15.8	16.3	16.6	15.7
Geothermal	-	-	-	-	-	-	-
Solar/other ²	-	-	-	-	-	-	-
Electricity	16.2	22.8	23.2	24.0	25.9	26.3	26.0
Heat	-	1.2	1.6	2.7	2.6	2.7	2.8
TRANSPORT⁴	3.9	4.8	6.5	8.2	8.7	8.8	8.9
OTHER⁷	6.3	8.1	9.4	10.1	9.6	9.8	9.2
Coal	1.5	0.7	0.2	0.1	0.0	0.0	0.0
Peat	-	-	-	-	-	-	-
Oil	3.0	2.5	2.5	1.8	1.4	1.5	1.3
Natural gas	0.1	1.0	1.7	2.0	1.8	1.8	1.7
Biofuels and waste ¹	0.7	1.6	1.6	2.1	2.0	2.1	1.9
Geothermal	-	0.0	0.0	0.0	0.0	0.0	0.0
Solar/other ²	-	0.0	0.1	0.2	0.2	0.2	0.2
Electricity	1.0	1.9	2.4	2.6	2.6	2.7	2.7
Heat	-	0.5	0.9	1.3	1.5	1.6	1.4
Shares in other (%)							
Coal	23.4	8.6	2.6	0.7	0.2	0.2	0.2
Peat	-	-	-	-	-	-	-
Oil	48.4	30.3	26.2	18.1	14.7	14.9	14.5
Natural gas	2.3	11.9	18.5	19.7	19.2	18.7	18.3
Biofuels and waste ¹	10.4	19.2	17.4	20.4	20.9	21.0	20.4
Geothermal	-	0.0	0.1	0.1	0.1	0.1	0.1
Solar/other ²	-	0.2	0.7	1.6	1.9	1.8	1.9
Electricity	15.6	23.3	25.1	26.2	27.5	27.4	29.0
Heat	-	6.5	9.5	13.3	15.6	15.8	15.5

Unit: Mtoe

DEMAND							
ENERGY TRANSFORMATION AND LOSSES	1973	1990	2000	2010	2016	2017	2018
ELECTRICITY GENERATION⁸							
Input (Mtoe)	4.9	7.2	8.2	10.2	9.6	10.1	9.6
Output (Mtoe)	2.7	4.2	5.1	5.8	5.6	5.8	5.6
Output (TWh)	30.9	49.3	59.9	67.9	65.3	67.4	65.0
Output shares (%)							
Coal	10.3	14.2	11.3	9.9	6.1	5.8	5.6
Peat	-	-	-	-	-	-	-
Oil	14.1	3.8	2.8	1.9	1.5	1.3	1.1
Natural gas	14.3	15.7	13.1	21.1	13.0	16.2	15.3
Biofuels and waste ¹	0.7	2.4	2.8	7.5	8.4	8.3	8.7
Nuclear	-	-	-	-	-	-	-
Hydro	60.6	63.9	69.9	56.5	61.2	56.8	57.9
Wind	-	-	0.1	3.0	8.0	9.7	9.3
Geothermal	-	-	-	-	-	-	-
Solar/other ²	-	-	-	0.1	1.7	1.9	2.2
TOTAL LOSSES	4.7	5.1	5.0	6.4	5.4	5.9	5.2
of which:							
Electricity and heat generation ⁹	2.2	2.3	1.9	2.5	2.0	2.2	2.0
Other transformation	1.4	0.8	1.1	1.2	1.3	1.4	1.1
Own use and transmission/distribution losses ¹⁰	1.2	2.0	2.0	2.8	2.1	2.3	2.1
Statistical differences	0.1	0.0	0.0	-0.0	-	0.0	-0.0
INDICATORS	1973	1990	2000	2010	2016	2017	2018
GDP (billion 2015 USD)	158.28	240.63	311.19	362.42	389.93	399.58	409.25
Population (millions)	7.59	7.68	8.01	8.36	8.74	8.80	8.84
TPES/GDP (toe/1000 USD) ¹¹	0.14	0.10	0.09	0.09	0.08	0.08	0.08
Energy production/TPES	0.37	0.33	0.34	0.35	0.37	0.37	0.36
Per capita TPES (toe/capita)	2.83	3.24	3.57	4.07	3.78	3.84	3.72
Oil supply/GDP (toe/1000 USD) ¹¹	0.08	0.04	0.04	0.03	0.03	0.03	0.03
TFC/GDP (toe/1000 USD) ¹¹	0.10	0.08	0.08	0.08	0.07	0.07	0.07
Per capita TFC (toe/capita)	2.19	2.57	2.94	3.30	3.17	3.17	3.12
CO ₂ emissions from fuel combustion (MtCO ₂) ¹²	53.8	56.2	61.8	68.3	61.7	64.1	61.5
CO ₂ emissions from bunkers (MtCO ₂) ¹²	0.3	0.9	1.7	2.1	2.3	2.3	2.5
GROWTH RATES (% per year)	73-90	90-00	00-10	10-15	15-16	16-17	17-18
TPES	0.9	1.4	1.7	-0.7	0.9	2.2	-2.8
Coal	0.3	-1.3	-0.6	-0.9	-6.6	2.6	-12.3
Peat	-	-	-	-	-	-	-
Oil	-0.9	1.2	0.5	-1.7	1.7	0.4	0.9
Natural gas	2.7	2.3	2.1	-3.3	3.6	9.2	-4.9
Biofuels and waste ¹	7.6	2.3	7.2	0.9	0.2	0.2	-6.0
Nuclear	-	-	-	-	-	-	-
Hydro	3.1	2.9	-0.9	-0.6	7.6	-4.2	-1.7
Wind	-	-	40.4	18.5	8.2	25.6	-8.1
Geothermal	-	20.1	3.4	-	-	17.1	-2.4
Solar/other ²	-	16.3	9.9	8.8	5.2	4.6	4.4
TFC	1.0	1.8	1.6	-0.4	2.5	0.9	-1.1
Electricity consumption	3.1	1.9	1.5	0.4	1.4	1.4	0.3
Energy production	0.2	1.9	2.0	0.0	2.4	0.6	-5.5
Net oil imports	-0.1	1.0	0.7	-0.9	-0.6	0.8	2.9
GDP	2.5	2.6	1.5	1.1	2.1	2.5	2.4
TPES/GDP	-1.6	-1.2	0.2	-1.8	-1.3	-0.2	-5.1
TFC/GDP	-1.4	-0.8	0.1	-1.5	0.4	-1.5	-3.6

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.

Footnotes to energy balances and key statistical data for Austria

1. Biofuels and waste comprise solid biofuels, liquid biofuels, biogases, and industrial and municipal waste. Data are often based on partial surveys and may not be comparable between countries.
2. Other includes ambient heat used in heat pumps.
3. In addition to coal, oil, natural gas and electricity, total net imports also include biofuels and waste.
4. Excludes international marine bunkers and international aviation bunkers.
5. Total supply of electricity represents net trade. A negative number in the share of total primary energy supply (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, combined heat and power, 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 10% for geothermal and 100% for hydro, wind and solar photovoltaic.
10. Tonne of oil equivalent per thousand USD at 2015 prices and exchange rates.
11. "CO₂ emissions from fuel combustion" have been estimated using the IPCC Tier I Sectoral Approach methodology from the *2006 IPCC Guidelines*. Emissions from international marine and aviation bunkers are not included in national totals.

ANNEX D: 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 in Paris, France.)

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

ANNEX E: Glossary and list of abbreviations

Acronyms and abbreviations

AGGM	Austrian Gas Grid Management AG
APG	Austrian Power Grid
AWP	Austria-Wien pipeline
BMK	Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology
CEGH	Central European Gas Hub
CHP	Co-generation heat and power
CiT	City of Tomorrow
CNDP	Co-ordinated network development plan
CWE	Central West Region
DC	District cooling
DH	District heating
DSO	Distribution system operator
ERIS	Energy Research and Innovation Strategy
ESD	Effort Sharing Decision
ESR	Effort Sharing Regulation
ETS	Emission Trading System
EU	European Union
EV	Electric vehicle
GDP	Gross domestic product
GHG	Greenhouse gas
HGV	Heavy-good vehicle
HHI	Herfindahl-Hirschmann Index
IEA	International Energy Agency
KLIEN	Climate and Energy Fund
LULUCF	Land use, land-use change and forestry

MI	Mission Innovation
NCCC	National Climate Change Committee
NDP	Network development plan
NECP	National Energy and Climate Plan
NEFI	New Energy for Industry
NESO	National Emergency Strategy Organisation
OECD	Organisation for Economic Co-operation and Development
OIB	Austrian Institute for Construction Engineering Österreichisches Institut für Bautechnik
P2G	Power to Gas
PCI	Project of common interest
PPP	Purchasing power parity
PV	Photovoltaics
RD&D	Research, development and demonstration
RDI	Research, development and innovation
TAG	Trans Austria Gas
TAL	Trans-Alpine
TCP	Technology collaboration programme
TFC	Total final consumption
TPES	Total primary energy supply
TSO	Transmission system operator
UFI	Domestic Environmental Support Scheme
VAT	Value-added tax
VTP	Virtual trading point
WAG	West Austria Gas
WAM	With additional measures
WEM	With existing measures

Units of measure

bcm	billion cubic metres
GW	gigawatt
kb/d	thousand barrels per day
km	kilometre
ktoe	kilotonne of oil equivalent
kV	kilovolt
mb	million barrels
Mt	million tonnes
MtCO₂-eq	million tonnes CO ₂ equivalent
Mtoe	million tonnes of oil equivalent
MW	megawatt
PJ	petajoule
TJ	terajoule
TWh	terawatt hour
USD	United States dollar (currency)

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Energy Policy Review

The International Energy Agency (IEA) regularly conducts in-depth peer reviews of the energy policies of its member countries. This process supports energy policy development and encourages the exchange of international best practices and experience. This report on Austria discusses the energy challenges facing the country and recommends possible solutions to help it achieve a secure and sustainable energy future.

Austria's new government, which assumed office in January 2020, is committed to achieving carbon neutrality by 2040 at the latest – 10 years earlier than the ambition set by the European Union. This will require Austria to substantially enhance decarbonisation efforts across all energy sectors. As in many other countries, decarbonising heat and transport is challenging. In fact, Austria's emissions growth since 2014 is largely driven by the increase in final energy consumption in the buildings and transport sectors.

Austria has impressive capacities for innovation and is an international best practice case in terms of leveraging public and private funding in this area. It will be important that the country uses this strength to address the challenges ahead. In this report, the IEA provides a range of energy policy recommendations to help Austria smoothly manage the transition to a smart, flexible and sustainable energy system.