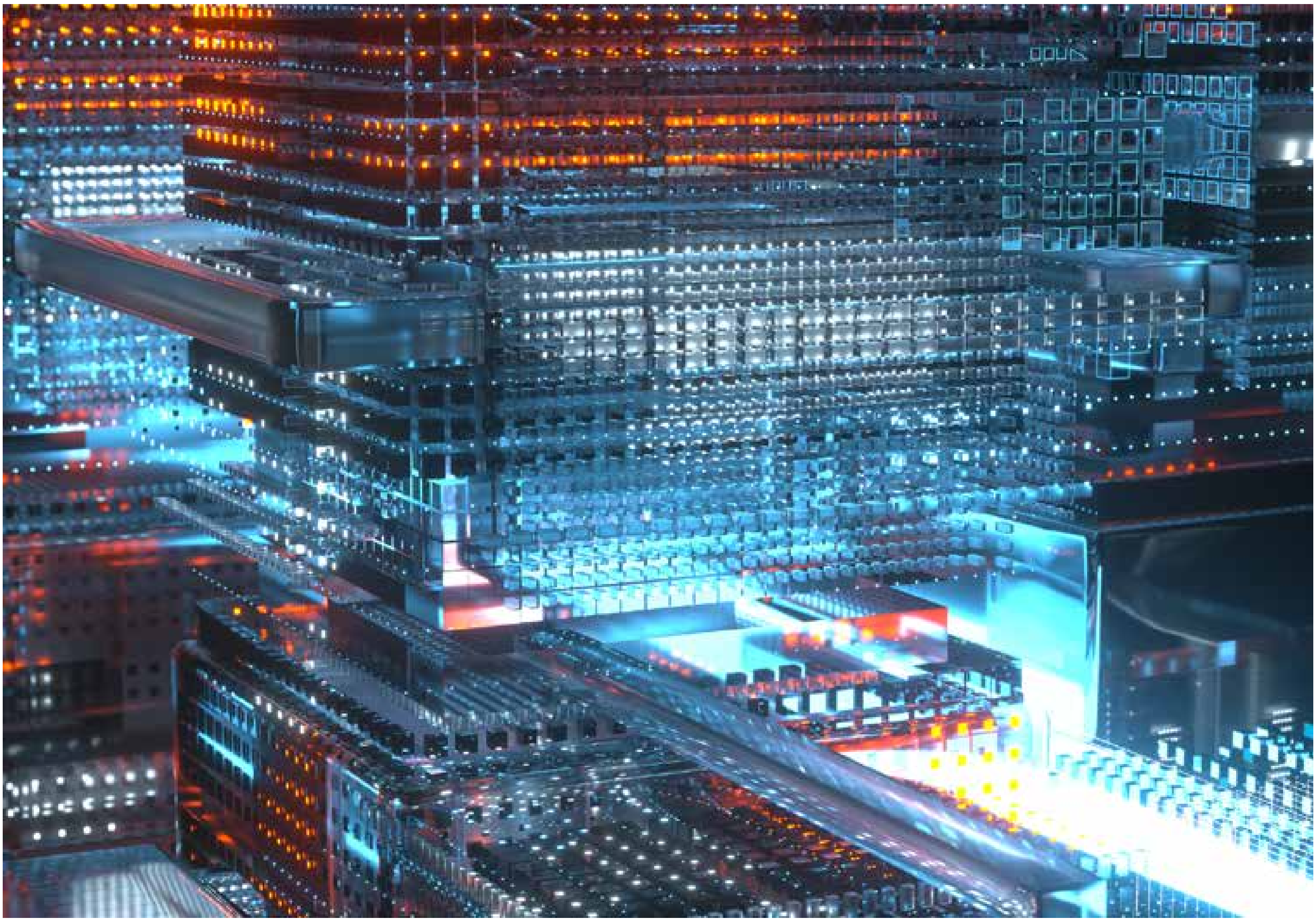
Insight Report

Fostering Effective Energy Transition
2020 edition

May 2020



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Preface

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The World Economic Forum Platform for Shaping the Future of Energy and Materials, with the support of its global community of diverse stakeholders, serves to promote collaborative action and exchange best practices to foster an effective energy transition. The annual benchmarking of energy systems across countries has enabled tracking the speed and direction of their energy transition and identifying opportunities for improvement. The transformation of the energy system over the past decade, although slower than required to achieve the objectives of the Paris Agreement to combat climate change, has been significant. But this hard-earned momentum now risks being lost, as the ongoing COVID-19 pandemic continues to cause economic and social damage.

The COVID-19 pandemic is unprecedented in its scale and speed in recent times, and it has the potential to redefine economic, political and social aspects relevant to the energy transition. It has forced society to change and relinquish valuable commodities and freedoms to collectively address this global outbreak. An effect of similar magnitude is required for a successful energy transition. Beyond the uncertainty over its long-term consequences, it has unleashed cascading effects in real time. Compounded disruptions from the erosion of almost a third of global energy demand, delayed or stalled investments and projects, uncertainties over the employment prospects of millions of energy-sector workers, in addition to unprecedented oil price volatilities and subsequent geopolitical implications have created a perfect storm for energy markets. The new Earth 2.0 that will emerge after COVID-19 will be a “new normal”, but many fundamental challenges will still exist. Chief among them is the imperative to collectively work towards an effective and inclusive energy transition.

This report highlights the key findings from the Energy Transition Index (ETI) 2020, part of the World Economic Forum Fostering Effective Energy Transition initiative. The ETI builds on its predecessor, the Energy Architecture Performance Index (EAPI), establishing fact-based insights to support decision-makers in their pursuit of a roadmap for a secure, sustainable, affordable and inclusive future energy system. The ETI does not only benchmark countries on their current energy system performance, but also provides a forward-looking lens as it measures their readiness for the energy transition. The unforeseen risks uncovered by the current global environment make a strong case for strengthening the energy transition fundamentals – characterized as enablers for energy transition readiness. However, energy systems across countries are unique to local circumstances, the economic structure, socio-economic priorities, and countries will adopt multiple pathways to pursue an effective energy transition.

Through these efforts, the World Economic Forum encourages the sharing of best practices and the use of its platform for effective public-private collaboration to facilitate the energy transition process in countries around the world.

Executive summary

The year 2020 marks the beginning of the "decade of delivery" on energy transition. The ongoing COVID-19 pandemic has put a stop to business as usual, setting off a chain of events disrupting all sectors – including energy. The current status of the energy transition and progress in multistakeholder collaboration have been slow to achieve and costly to build, and efforts must be made to ensure the clock is not reset. Resilience, in economic, financial, regulatory and infrastructure terms, is a crucial prerequisite for an effective energy transition.

This report presents the findings from the Energy Transition Index (ETI) 2020, summarizing insights on countries' energy system performance and their energy transition readiness. The indicators reflect trends in the global energy transition leading up to 2020. The circumstances were radically transformed in the first few months of 2020 due to compounded disruptions from COVID-19. Analysing the drivers of progress in the past can offer lessons for accelerated recovery in the near future.

Countries are transforming their energy systems, but the improvements are not consistent across countries or over time.

- Of the 115 countries monitored, 94 countries have improved their composite ETI score over the past six years. These nations represent more than 70% of the global population and 70% of global CO_2 emissions from fuel combustion.
- Maintaining steady progress on the energy transition is a challenge for all countries. Of the 115, only **Argentina**, **Bulgaria**, **China**, the **Czech Republic**, the **Dominican Republic**, **India**, **Ireland**, **Italy**, the **Slovak Republic**, **Sri Lanka** and **Ukraine** have made consistent and measurable progress on their energy transition over the past six years.
- The world's largest energy consumers differ in their energy transition trajectories. Emerging demand centres like **India** and **China** show strong and steady improvement, while scores for **Brazil**, **Canada**, **Iran** and the **United States** are either stagnant or declining.
- Fuel importing countries continue to outperform fuel exporting countries, as the gap between their average scores increased. The key parameters of differentiation are environmental sustainability, access to capital and investment in new energy infrastructure, and political commitment to the energy transition.

The gap between average ETI scores for countries in the top quartile and the rest is gradually narrowing, reflecting growing global consensus on the priorities and speed of the energy transition.

- **Sweden** leads the rankings table for the third consecutive year, followed by **Switzerland** and **Finland**. **France** and the **United Kingdom** are the only G20 countries in the top 10. The list of top 10 countries has been roughly the same over the past six years, highlighting the robustness of their energy transition roadmaps.
- Countries in the bottom quartile are gradually narrowing the gap with countries in the top quartile. While this illustrates that emerging economies are slowly moving the needle on their energy transition, it also highlights the ceiling of incremental gains from the current set of policies and technologies in advanced economies, raising the urgency for breakthrough and radical measures.
- Energy transition readiness improved across countries, mainly due to an increased level of political commitment and better access to capital and investment. Sustained progress requires a similar momentum along other enablers, such as human capital preparedness, robust institutional frameworks and innovative business environments. **Colombia**, the **Czech Republic**, **Hungary**, **Kenya**, **Morocco**, **Thailand** and the **United Arab Emirates** have achieved substantial gains on their transition readiness, by targeting improvements along multiple enablers.

Economic development and growth

- Prior to the precipitous decline in the second quarter of 2019, wholesale natural gas prices had increased in all regions except North America since 2016, undermining the competitiveness of heavy industries and the replacement of coal in power generation. Infrastructure and supply chain constraints as well as different price determination mechanisms were contributing factors.
- An increasing number of countries are adopting cost-reflective energy pricing, as 82% of the countries that improved their ETI scores over the past six years also reduced pre-tax energy subsidies. However, pricing instruments are yet to tackle the rising externalities associated with energy production and consumption, such as global warming, health risks, traffic congestion and road accidents.
- The affordability constraints of electricity and heating in advanced economies are compounded by the combined effects of above-average tariffs and high per capita consumption levels, highlighting the importance of energy efficiency.

Energy access and security

– Building upon substantial gains in energy access over the past two decades, energy access programmes need to be redesigned to prioritize accessibility to a diverse range of energy services, energy-enabled community services, affordable and efficient appliances, and the quality and reliability of the electricity supply.

– Economic inequality and energy poverty are mutually reinforcing, there being a strong correlation between the two. Energy consumption levels within and between countries are highly unequal. Countries need to leverage natural advantages to bridge the gap, tapping into resources with more uniform distribution, especially renewable sources of energy.

– Energy security and reliability implications from frequent and widespread extreme weather events, and an increasing vulnerability to cyberthreats, call for resilience in physical and digital energy infrastructure.

Environmental sustainability

– Although political commitment, public engagement and investor attitudes towards environmental sustainability continue to advance, average scores and gaps between countries remained lowest on this dimension. This implies the continued prioritization of economic and social considerations above environmental sustainability.

– Global CO_2 emissions from fuel combustion remained flat in 2019. However, methane emissions from natural gas production increased, as North American shale gas operations accounted for more than half of global methane emissions. A mix of affordable technology options, mandates and emission pricing instruments are required to control methane emissions, recognizing the need to maintain the competitiveness of natural gas against coal.

The rhythm and momentum of the energy transition will potentially be impeded by the COVID-19 pandemic. Cascading effects have led to an unprecedented energy demand and price shocks, and the reallocation of public funds and private investment towards healthcare, social security and business continuity. While necessary measures must be taken to protect lives and livelihoods, the risks to the future of the human civilization from climate change remain, with important lessons to be learned.

– The current environment of compounded shocks is a simulation of the scale of potential disruption from climate change, offering a grim reminder of the urgency of action. The energy transition needs a similar sense of urgency and global cooperation, rooted in scientific evidence and endorsed by all stakeholders.

– Disruptions are the new normal. In the past two decades, multiple public health crises, military escalations, recessions and international trade disputes have threatened global stability at frequent intervals. The disruptions brought about by the COVID-19 pandemic constitute unmatched economic instability fuelled by compounded disruptions from demand destruction, an oil production surplus and the rise of populism that are further enabled through what seems to be challenges in international cooperation. Energy policies need to be long term in scope, with a robust design and resilient recovery mechanisms.

– Stimulus packages and policies to mitigate the economic fallout resulting from COVID-19 can help leapfrog the inertia of carbon lock-in by prioritizing policy responses that minimize additional costs for businesses and consumers, and place job creation at the heart. Allocating stimulus money towards large-scale new energy infrastructure, such as carbon capture, utilization and storage, clean hydrogen and grid modernization, can create multiplier effects in economic growth and employment.

– Low fuel prices and falling consumer demand in advanced economies offer opportunities to initiate structural economic transformation and diversification in emerging economies and fuel exporting countries, which could prove challenging otherwise in normal circumstances.

1. Introduction

Economic development and growth: The global economy is entering its most uncertain phase in living memory, as COVID-19 has challenged the current economic order like never before. Additionally, the year 2019 saw an abnormal level of street protests across the world.[1] Among the many reasons for the mass mobilization at this unprecedented scale, contributing factors included economic inequality and high costs of living. The adaptation costs of climate change and the energy transition can widen these rifts as they pose systemic risks to the financial system – both in terms of physical risks to capital and infrastructure, and transition risks from disorderly mitigation strategies.[2] **Stakeholders from across the world reiterated the importance of sustainable economic growth[3] at the World Economic Forum Annual Meeting 2020 in Davos-Klosters.**

In early 2019, average oil prices were higher than the year before,[4] contributing to increasing investments in capital projects and R&D for clean energy technologies. The beginning of 2020, however, was volatile for the energy sector, due to price and demand shocks from the COVID-19 pandemic. The coming years could prove to be a very uncertain time for energy markets and, given that fuel exports are 19% of international trade and a large source of income for many countries, the situation could lead to further geopolitical shifts, as recently evidenced in the OPEC+ manoeuvres. The sharp decline in industrial activity, transportation services and household consumption has stoked fears of a recession, prompting governments to launch stimulus measures to support the economy and society. Ongoing and planned projects may experience capital constraints, leading to delays. As governments act to ensure economic growth through needed measures, the trade-offs can affect the speed of the energy transition. Emerging economies are particularly at risk, as their export-oriented growth model requires growing consumer demand in advanced economies. The lower oil price environment also hinders the competitiveness of energy efficient alternatives, electric vehicles and batteries. **These developments confirm the mutually reinforcing links between energy transition and economic growth – as much as energy transition is a factor in economic growth, sustained economic growth is needed for the energy transition.**

Energy access and security: The share of natural gas in the energy mix grew, due to demand from power generation and the continued increase in global trade in liquefied natural gas (LNG) for the fifth consecutive year. This raises new energy security constraints, as natural gas is geographically more concentrated than oil, and the supply chain infrastructure is insufficient. The geopolitical balances of energy were dynamic, as the United States established itself as an oil exporter to 31 countries in 2019, and the world's largest energy consumers discussed forming an oil buyers' alliance.[5]

The front lines of energy security are evolving. The year 2019 was marked by extreme weather events, as tropical storms and wildfires in various parts of the world exposed infrastructure vulnerabilities and caused widespread and frequent power outages. Incidences of cyberattacks on the electricity infrastructure are rising, with recent incidences in India,[6] the EU[7] and the United States,[8] which emphasize the urgent need to act quickly to avoid potential large-scale disruptions. Additionally, the low-carbon energy transition has prompted countries to lock in their competitive advantage by securing supplies to materials such as lithium, cobalt and rare earth metals, leading to a high degree of concentration in terms of the control, refining and export of these materials.[9]

Environmental sustainability: The year 2019 marked a step change on environmental sustainability. The emissions from the energy sector remained flat,[10] even as global GDP grew by 2.3%.[11] Global spending on renewable energy continued to increase,[12] as the share of electricity from renewable sources increased substantially in multiple countries. The share of electricity produced by coal is expected to have declined by 3% in 2019[13] – the largest annual drop on record – primarily due to large-scale thermal power plant shutdowns in the EU and United States. The trend in electrification continued, as investment in the power sector was higher than in oil and gas supply for the fourth consecutive year.[14]

The environmental sustainability agenda received a major boost from the financial sector, as an increasing number and different kinds of asset managers looked to reduce their carbon exposure, leading to divestments totalling more than $14 trillion to date.[15] An increasing number of non-finance private-sector organizations, including international oil companies, are actively working towards their pledged carbon neutrality goals. Total green bonds and loans issued globally increased 49% year-on-year to an all-time high of $255 billion.[16] The U.S. Business Roundtable redefined the purpose of a corporation to include serving all stakeholders, reflecting a strong move towards environmental, social and governance (ESG) principles in the allocation of capital.[17] At the same time, countries and subnational jurisdictions across the world have either declared or are working towards net-zero emissions targets. The demand from civil society for faster responses to climate change and decarbonization has increased, as climate protests have intensified across the world.

The strong momentum and commitment from varied stakeholder groups are necessary, especially as the consequences of climate change become increasingly apparent. The last five years have been the warmest on record, and scientists warn some climate change tipping points might already have been passed.[18] **Countries need to significantly raise their level of commitment towards environmental sustainability, leveraging diverse policies, technologies and financing options.**

The year 2020 marks the beginning of a "decade of delivery" on energy transition and climate change. However, given the massive mobilization of government and private-sector resources to mitigate the spillover effects of the COVID-19 pandemic, the energy transition momentum risks slowing down in the short term, unless the economic recovery supports the country-specific energy transition priorities. The domino effect triggered by the pandemic has affected every sector – including energy – leading to price and demand shocks, and potentially influencing the pipeline of projects, investment and R&D in the near future. **This emphasizes the systemic dimensions of the energy transition, as it is not limited to linear shifts in fuel mix or production technology; rather, it both influences – and is influenced by – different parts of the economy and society.**

The COVID-19 pandemic serves as a sobering reminder of the need for increased robustness and resilience in policy-making for the energy transition. This is the latest in a series of similar global disruptions over the past two decades, including extreme weather events and rising waves of populism, such that the volatilities define a new normal. **Policies will need added robustness and resilience to maintain the course, pre-empting risks from future disruptions.**

2. Framework

The Fostering Effective Energy Transition initiative, facilitated by the World Economic Forum, aims to accelerate the speed of the global energy transition by promoting the adoption of effective policies, corporate decisions and public-private collaboration for the transition to a secure, sustainable, affordable and inclusive future energy system. The Energy Transition Index (ETI), a part of this initiative, establishes and disseminates a fact-based framework to foster greater understanding of the state and readiness of energy systems across countries for this transition.

The ETI 2020 is a continuation of the annual energy system benchmarking series published by the World Economic Forum. Previously published as the Energy Architecture Performance Index (EAPI) series from 2013 to 2017, the framework was revised to reflect the interdependencies of energy system transformation with macroeconomic, political, regulatory and social factors that determine a country's readiness for transition.

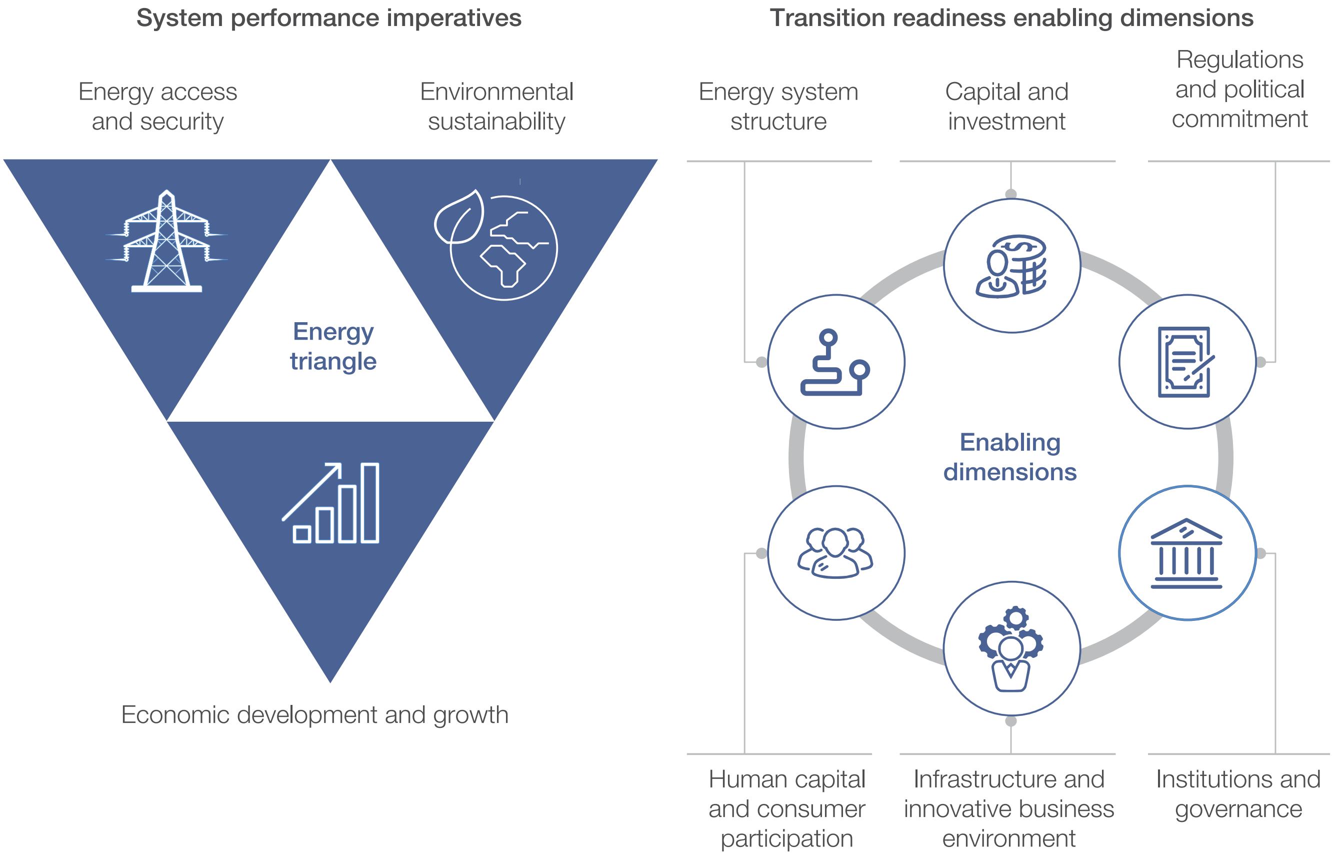
The ETI framework consists of two parts: current energy system performance and the enabling environment for the energy transition (Figure 1). System performance provides an assessment of countries' energy system related to their delivery in three key priorities: the ability to support economic development and growth, universal access to a secure and reliable energy supply, and environmental sustainability across the energy value chain. The objective of energy transition in a country should be to deliver simultaneously across these three priorities, thereby maintaining a balanced "energy triangle". However, countries approach energy transition from different starting points and unique socio-economic characteristics, and hence prioritize objectives for energy transition that reflect country-specific circumstances. Such priorities may include expanding access to modern energy services, meeting a rising energy demand, modernizing energy system infrastructure, providing employment, reducing environmental footprints of energy-sector activities, etc. While countries will inevitably choose a diverse set of short-term objectives, pursuing the long-term goal of achieving a balanced "energy triangle" can support the choice of appropriate policies and instruments, and help the synchronization of efforts across countries and the maintenance of a steady course on the global energy transition.

Progress on a country's energy transition will be determined by the extent to which a robust enabling environment can be created. This includes strong political commitment, a flexible regulatory structure, a stable business environment, incentives for investments and innovation, consumer awareness and the adoption of new technologies, among other factors. Energy transition is not restricted to linear shifts in the fuel mix or the substitution of production technologies that can be unilaterally achieved by policies or innovation or investments. Rather, the social, economic and technological systems that are connected to the energy system need to co-evolve[19] to shape the transition.[20]

The ETI benchmarks the state of the energy transition in 115 countries. These countries constitute 90% of the global population, 93% of global total energy supply and 98% of global nominal GDP. The ETI is a composite score of 40 indicators, sourced from reliable international data providers to ensure comparability across countries and consistency over time. The indicators are standardized and grouped together to derive scores for higher order dimensions (Figure 1), which are equally weighted to obtain scores for the system performance and transition readiness sub-indices. The composite ETI score is the average of these two sub-indices.[21]

In addition to summarizing insights from the ETI 2020 scores, this report also examines the evolution of the global energy transition since 2015. Scores for the ETI composite, sub-indices and dimensions were back-casted prior to 2018 for a consistent group of 115 countries. Six years may not be long enough to study transitions, but given the speed of new policy announcements, increasing volumes or investments, and technology deployments, this time frame provides useful insights into the effectiveness and sufficiency of the efforts and the roadblocks that may lie ahead.

Figure 1: Energy Transition Index framework



Source: World Economic Forum

Energy transition definition

An effective energy transition is a timely transition towards a more inclusive, sustainable, affordable and secure energy system that provides solutions to global energy-related challenges, while creating value for business and society, without compromising the balance of the energy triangle. While a long-term vision and objectives are necessary, remaining flexible in a dynamic environment is critical. Given the complexity and scale of the energy system, which includes different fuel sources, technologies for extraction and conversion, and end-use sectors, an effective energy transition needs to balance the priorities of diverse stakeholder groups. The World Economic Forum Fostering Effective Energy Transition initiative offers a platform to establish a common understanding among all stakeholder groups on the end-state of the energy transition, necessary imperatives, market and policy enablers, and the resulting human impact.

Table 1: Energy Transition Index 2020 results

Rank	Country name	2020 ETI Score[2]	System Performance	Transition Readiness
1	Sweden	74.2%	79%	69%
2	Switzerland	73.4%	77%	70%
3	Finland	72.4%	71%	74%
4	Denmark	72.2%	69%	76%
5	Norway	72.2%	81%	63%
6	Austria	70.5%	70%	71%
7	United Kingdom	69.9%	72%	68%
8	France	68.7%	74%	64%
9	Netherlands	68.0%	68%	68%
10	Iceland	67.3%	74%	61%
11	Uruguay	67.0%	75%	59%
12	Ireland	66.9%	69%	65%
13	Singapore	65.9%	67%	65%
14	Luxembourg	65.1%	62%	68%
15	Lithuania	65.1%	71%	59%
16	Latvia	64.9%	69%	60%
17	New Zealand	64.6%	73%	57%
18	Belgium	64.5%	65%	64%
19	Portugal	64.2%	69%	59%
20	Germany	63.9%	64%	64%
21	Estonia	63.3%	64%	63%
22	Japan	63.2%	64%	63%
23	Slovenia	63.1%	66%	60%
24	Spain	62.9%	67%	59%
25	Colombia	62.7%	72%	54%
26	Italy	62.0%	68%	56%
27	Costa Rica	61.9%	72%	52%
28	Canada	61.7%	67%	56%
29	Chile	61.1%	65%	57%
30	Israel	60.8%	66%	56%
31	Hungary	60.7%	66%	55%
32	United States	60.7%	66%	56%
33	Slovak Republic	60.5%	66%	55%
34	Malta	60.4%	65%	56%
35	Romania	59.9%	68%	52%
36	Australia	59.7%	66%	54%
37	Croatia	59.7%	66%	54%
38	Malaysia	59.4%	64%	55%
39	Peru	59.2%	69%	49%
40	Panama	58.9%	66%	52%
41	Georgia	58.8%	61%	57%
42	Czech Republic	58.5%	61%	56%
43	Paraguay	58.4%	68%	49%
44	Azerbaijan	58.1%	67%	49%
45	Ecuador	58.1%	72%	45%
46	Cyprus	58.0%	63%	53%
47	Brazil	57.9%	69%	46%
48	Korea, Rep.	57.7%	59%	57%
49	Brunei Darussalam	57.0%	66%	48%
50	Mexico	56.5%	64%	49%
51	Morocco	56.5%	61%	51%
52	Albania	56.5%	63%	50%
53	Thailand	56.3%	61%	51%
54	Qatar	56.1%	60%	52%
55	Sri Lanka	55.8%	65%	46%
56	Argentina	55.8%	68%	44%
57	Philippines	55.3%	62%	49%
58	El Salvador	55.3%	61%	50%
59	Greece	55.0%	63%	47%
60	Armenia	54.9%	60%	49%
61	Bulgaria	54.2%	59%	49%
62	Montenegro	54.2%	55%	53%
63	United Arab Emirates	54.0%	56%	52%
64	Namibia	53.6%	54%	53%
65	Vietnam	53.5%	57%	50%
66	Ghana	53.2%	59%	47%
67	Turkey	53.1%	57%	49%
68	Bolivia	53.0%	64%	42%
69	Poland	52.9%	57%	48%
70	Indonesia	52.4%	61%	44%
71	Dominican Republic	52.4%	59%	46%
72	Republic of Moldova	52.4%	61%	43%
73	Oman	52.1%	54%	50%
74	India	51.5%	54%	49%
75	Jamaica	51.5%	54%	49%
76	Guatemala	51.2%	58%	45%
77	Trinidad and Tobago	50.9%	58%	44%
78	China	50.9%	50%	52%
79	Kenya	50.6%	47%	54%
80	Russian Federation	50.5%	63%	38%
81	Tajikistan	49.8%	49%	51%
82	Jordan	49.8%	46%	53%
83	Algeria	49.1%	61%	37%
84	Egypt, Arab Rep.	49.1%	52%	46%
85	Honduras	49.0%	51%	47%
86	Saudi Arabia	48.7%	54%	43%
87	Bangladesh	48.4%	54%	43%
88	Kazakhstan	48.3%	59%	38%
89	Tunisia	48.2%	53%	43%
90	Bahrain	48.1%	46%	51%
91	Cambodia	47.8%	49%	47%
92	Tanzania	47.4%	47%	48%
93	Kuwait	46.9%	52%	42%
94	Pakistan	46.6%	46%	47%
95	Nepal	46.3%	45%	47%
96	Nicaragua	46.1%	50%	42%
97	Ethiopia	45.9%	47%	45%
98	Zambia	45.7%	47%	45%
99	Botswana	44.7%	45%	44%
100	Serbia	44.3%	50%	39%
101	Iran, Islamic Rep.	43.5%	55%	32%
102	Ukraine	43.3%	50%	37%
103	Bosnia and Herzegovina	43.2%	47%	39%
104	Senegal	43.1%	39%	47%
105	Kyrgyz Republic	42.7%	42%	43%
106	South Africa	42.7%	47%	38%
107	Zimbabwe	42.6%	41%	45%
108	Mongolia	42.1%	45%	39%
109	Mozambique	42.0%	47%	37%
110	Benin	41.5%	41%	42%
111	Venezuela	41.2%	55%	27%
112	Cameroon	41.0%	40%	42%
113	Nigeria	40.5%	46%	35%
114	Lebanon	38.5%	36%	41%
115	Haiti	36.0%	35%	37%

- Advanced Economies
- Commonwealth of Independent States
- Emerging and Developing Asia
- Emerging and Developing Europe
- Latin America and the Caribbean
- Middle East, North Africa and Pakistan
- Sub-Saharan Africa

For the ETI 2020 methodology, see the methodology addendum at the end of this report. Country figures are rounded to full PPT, but exact figures are used to determine rankings. Therefore, countries with the same ETI scores may have different rankings.

Note 1: The Energy Transition Index benchmarks countries on the performance of their energy system, as well as their readiness for transition to a secure, sustainable, affordable, and reliable energy future. ETI 2020 score on a scale from 0 to 100%.

Note 2: ETI 2020 score on a scale from 0% to 100%.

Source: World Economic Forum

3. Overall results

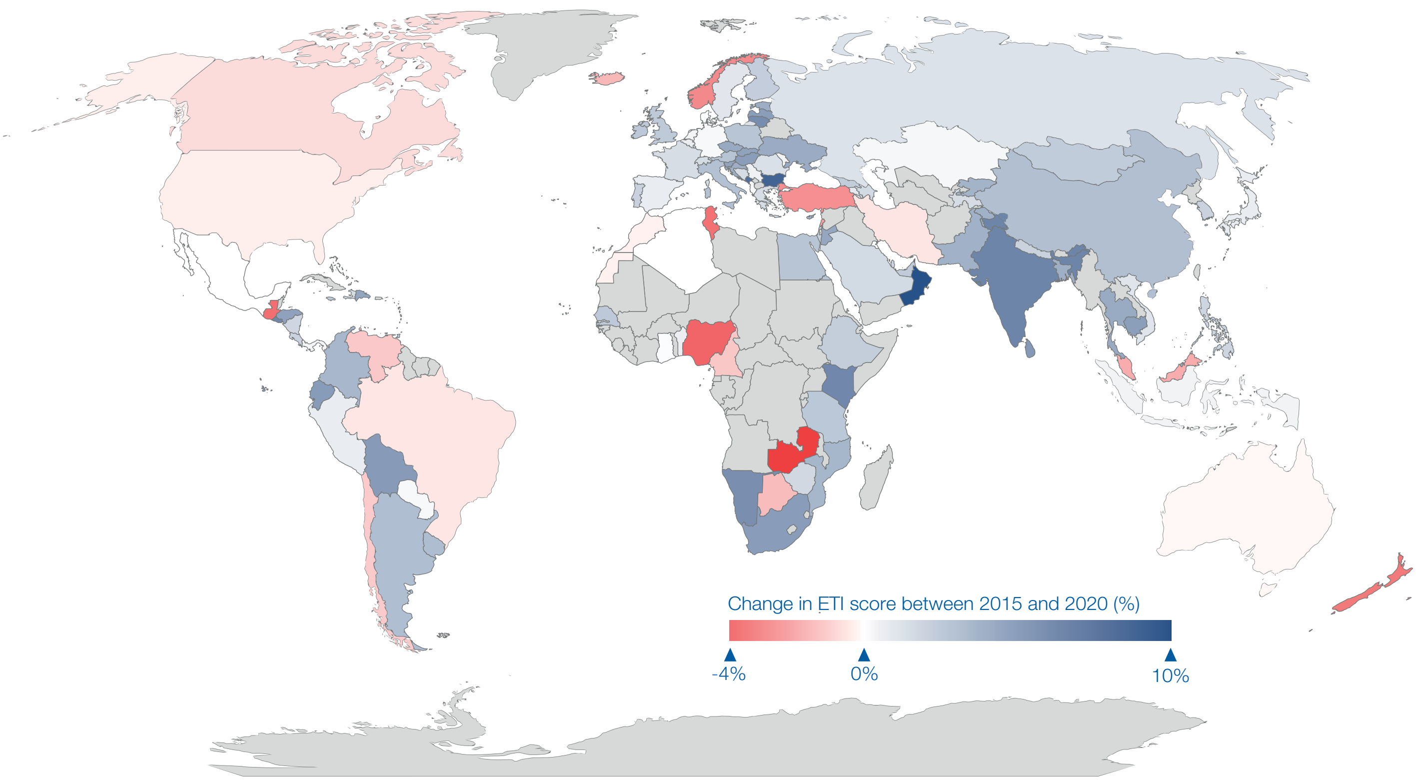
The ETI benchmarks countries on their energy system performance and their readiness for a fast and effective transition. Countries are scored along 40 indicators on a scale of 0 to 100.[22] Countries scoring the global maximum on a given indicator are assigned a score of 100 on that indicator.

Given the systemic and interdisciplinary nature of the energy transition challenge, country scores on different ETI indicators depend on factors such as natural resource endowments, geography and climate, population, the level of socio-economic development and path dependencies of legacy energy systems. Moreover, country scores on some ETI indicators are determined by factors beyond the scope of national decision-making, such as energy market volatilities, the emerging regulatory landscape in trading partners, global financial market sentiments and international climate change frameworks. Hence, no country scores 100 on the ETI.

The global average ETI score for 2020 is 55.1 out of 100. While this indicates the first year-on-year decline in the global average ETI score since 2015 with 55% of the countries registering declines, the medium-term trends are positive. Figure 2 shows countries' ETI score progression between 2015 and 2020, providing insights into the evolution of energy transition trajectories across the countries. More than 80% of the countries, representing 70% of the world population, have increased their ETI score over the past six years. Notably, progress among the world's 10 largest energy consuming countries has been mixed. Emerging centres of demand such as China and India show strong improvement, while the trend has been moderately positive in Germany, Japan, the Russian Federation and South Korea. On the other hand, the ETI scores of Brazil, Canada, Iran and the United States were either stagnant or declining.[23] Figure 3 shows G20 countries' wide range of comparative performance on the ETI, while they consume 75% of the global total energy supply. **This attests to the overall positive trajectory of the global energy transition, although progress is not smooth and pockets of underperformance exist**.

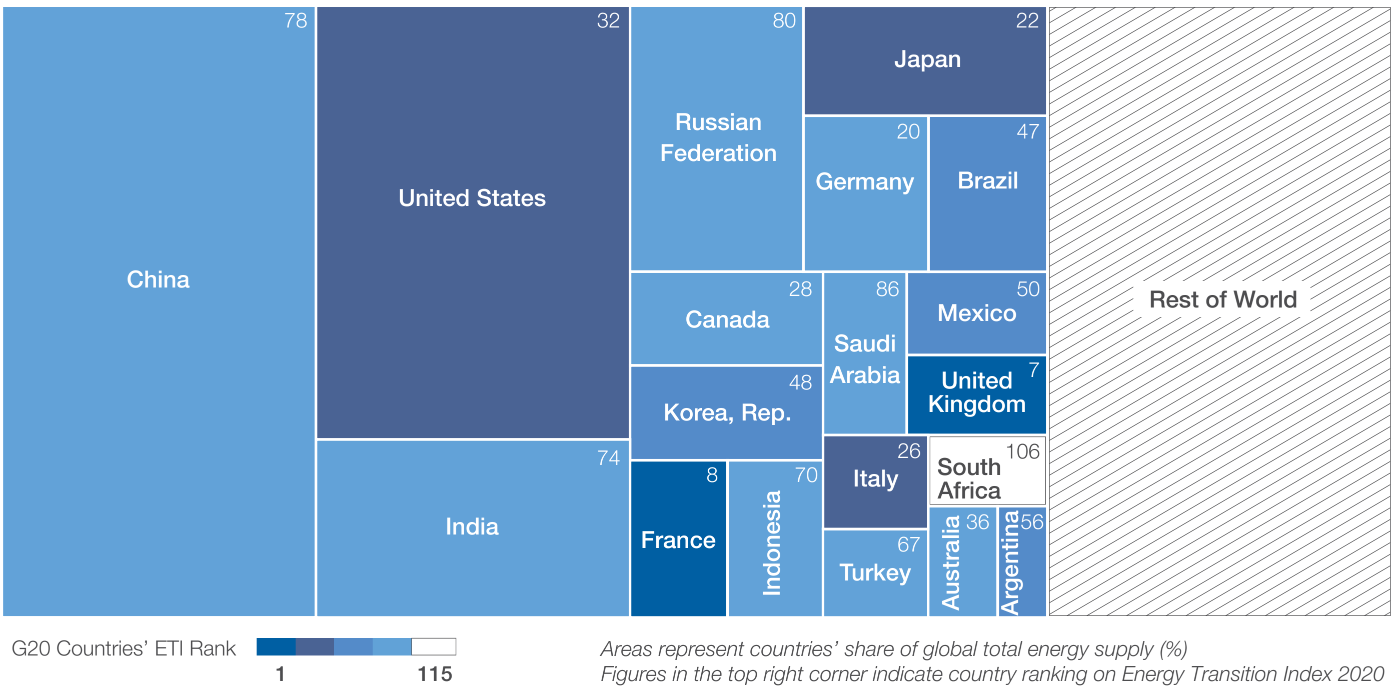
The list of top 10 countries on the ETI 2020 remains similar to last year's results, with **Sweden** leading the global ranking for the third consecutive year, followed by **Switzerland** and **Finland**. Among the world's 10 largest economies, only the **United Kingdom** and **France** feature in the top 10. While the diversity among the top 10 countries in terms of pathway adopted for their energy transition is significant, they share common attributes, such as reducing the level of energy subsidies, enhancing energy security by reducing the reliance on imports, achieving gains in energy intensity of GDP, and increasing the level of political commitment by pursuing aggressive energy transition and climate change targets. However, the annual incremental gains achieved by the highest ranked countries appear to be plateauing. The average ETI score for countries in the top 10 percentile has been constant since 2015. Leading countries play a critical role in the global energy transition, by highlighting best practices that inform the development of roadmaps for other countries. **This implies that incremental gains from the current set of policies and technologies might be limited, and the need for radical and breakthrough ideas is urgent.**

Figure 2: Countries' change in Energy Transition Index score, 2015-2020



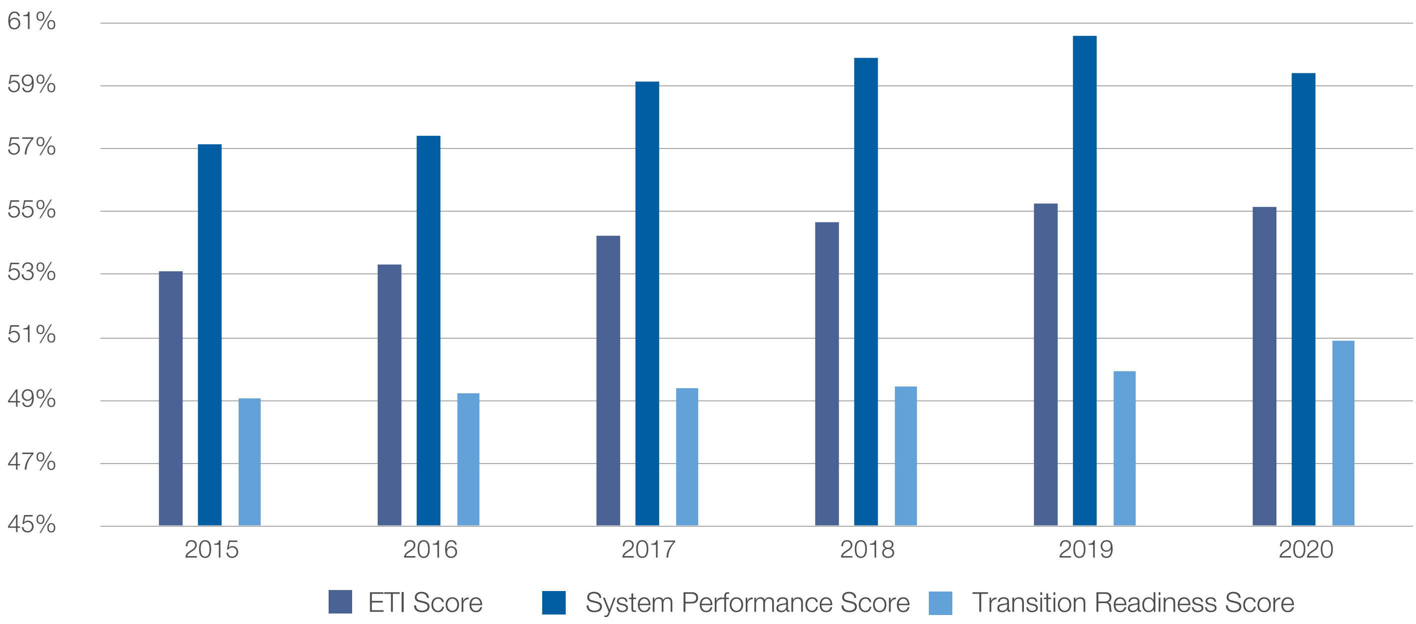
Source: World Economic Forum

Figure 3: G20 countries' Energy Transition Index 2020 ranking and share of global total energy supply, 2017



Sources: World Economic Forum and IEA, *World Energy Balances 2019*

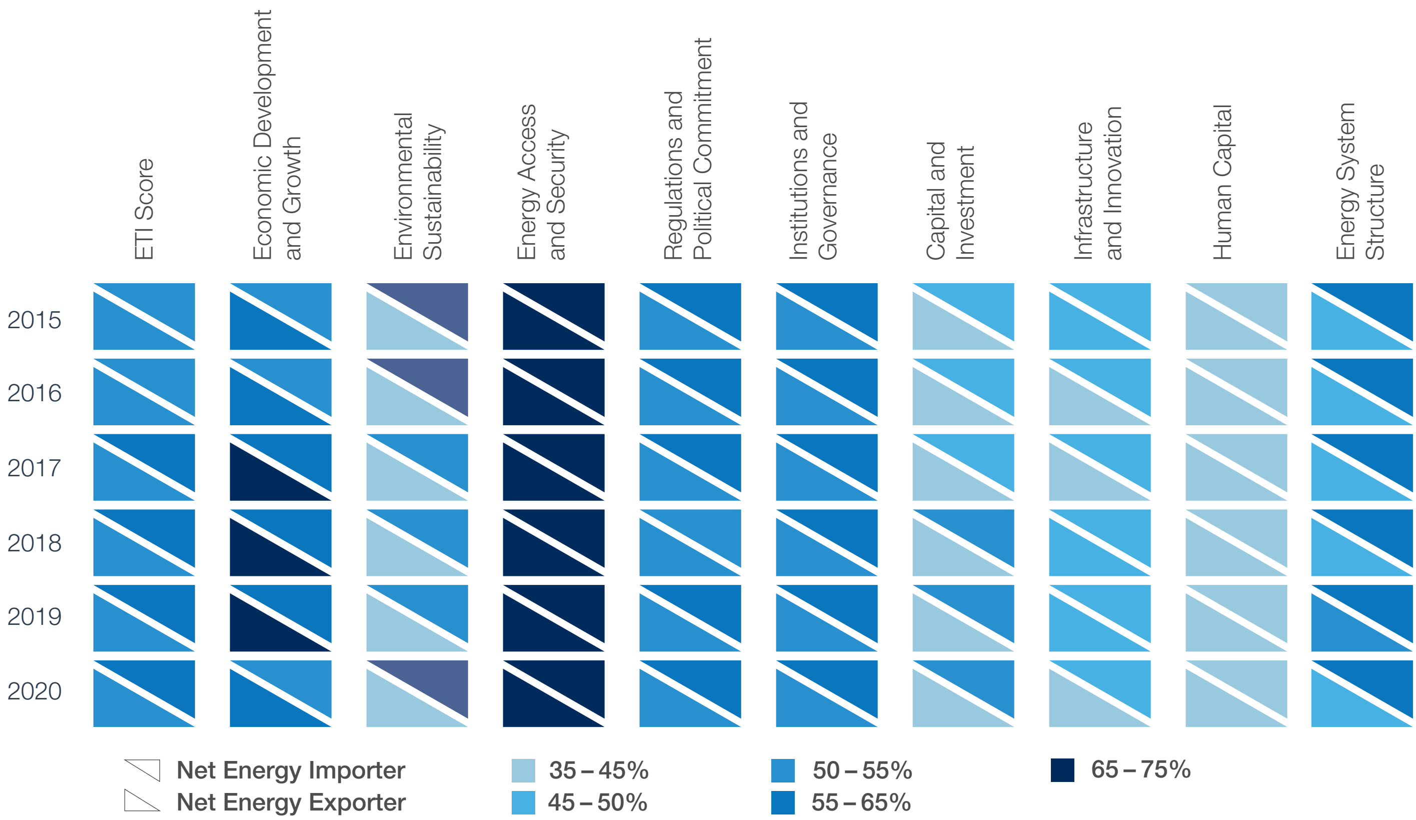
Figure 4: Global average Energy Transition Index and sub-index scores, 2015-2020



Source: World Economic Forum

On average, the ETI score improvement has been higher for energy importing countries than for fuel exporting countries, leading to a substantial increase in the gap between their average scores. A comparative analysis of these two groups (Figure 5) indicates that fuel exporting countries perform better on the energy sector's contribution to economic development and growth, and comparably on energy access and security. Access to domestic reserves at affordable prices and the critical role of energy in the economic structure are contributing factors. However, fuel importing countries outperform them on the key parameters of environmental sustainability, political commitment to the energy transition, and access to capital for investment in new energy infrastructure. This is likely due to the additional pressure on energy importers to improve on energy security by prioritizing domestically available renewable sources of energy.

Figure 5: Average scores on Energy Transition Index dimensions for net energy importers and exporters, 2015-2020



Source: World Economic Forum with energy import data from IEA, *World Energy Balances 2019*

4. Sub-index and dimension trends

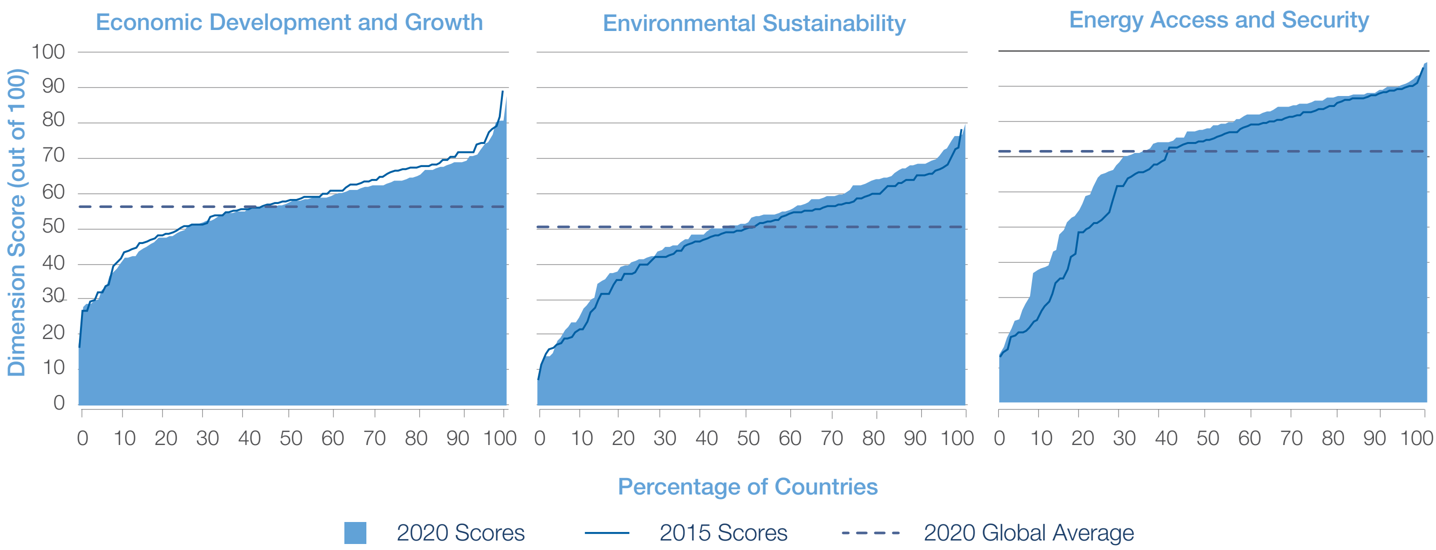
4.1 System performance

Energy is a critical enabler of modern economy and society. Regardless of the economic structure and socio-economic priorities of countries, the domestic energy sector has strong forward and backward linkages in a nation's economy. The energy sector uses outputs from a variety of industries, spurring demand for products and services such as capital equipment, metals and mining, manufacturing, procurement, construction, and engineering and design. At the same time, energy is an intermediate input for most industrial sectors and services,[24] in addition to addressing final demand for lighting, heating, cooking and transportation. Hence, it is critical for countries to ensure an abundant and secure provision of modern forms of energy at affordable prices to maintain an optimal level of economic activity and provide better quality of life to their citizens. The system performance component of the ETI measures the extent to which the energy system in a country contributes towards the three key priorities: economic development and growth, energy access and security, and environmental sustainability.

Over the past six years, 75% of the countries have increased their scores on the system performance dimension. The global average scores for system performance increased successively each year from 2015 to 2019, before declining year-on-year between 2019 and 2020 (Figure 4). The year-on-year decline is primarily driven by rising natural gas prices for importing countries leading up to 2019, and the emerging evidence on externalities as associated with energy-sector activities. Figure 6 shows scores for the system performance dimensions, with country scores sorted from minimum to maximum for the years 2015 and 2020.

The global average score for environmental sustainability in 2020 remains the lowest among the three dimensions. However, 75% of the countries have improved on this dimension between 2015 and 2020, by approaching the challenge from multiple angles, including technology mandates and equipment labelling, carbon pricing, retiring coal plants ahead of schedule, and redesigning electricity markets to integrate renewable energy sources. Progress on the environmental sustainability of the energy system has been particularly challenging among fossil fuel exporting countries.

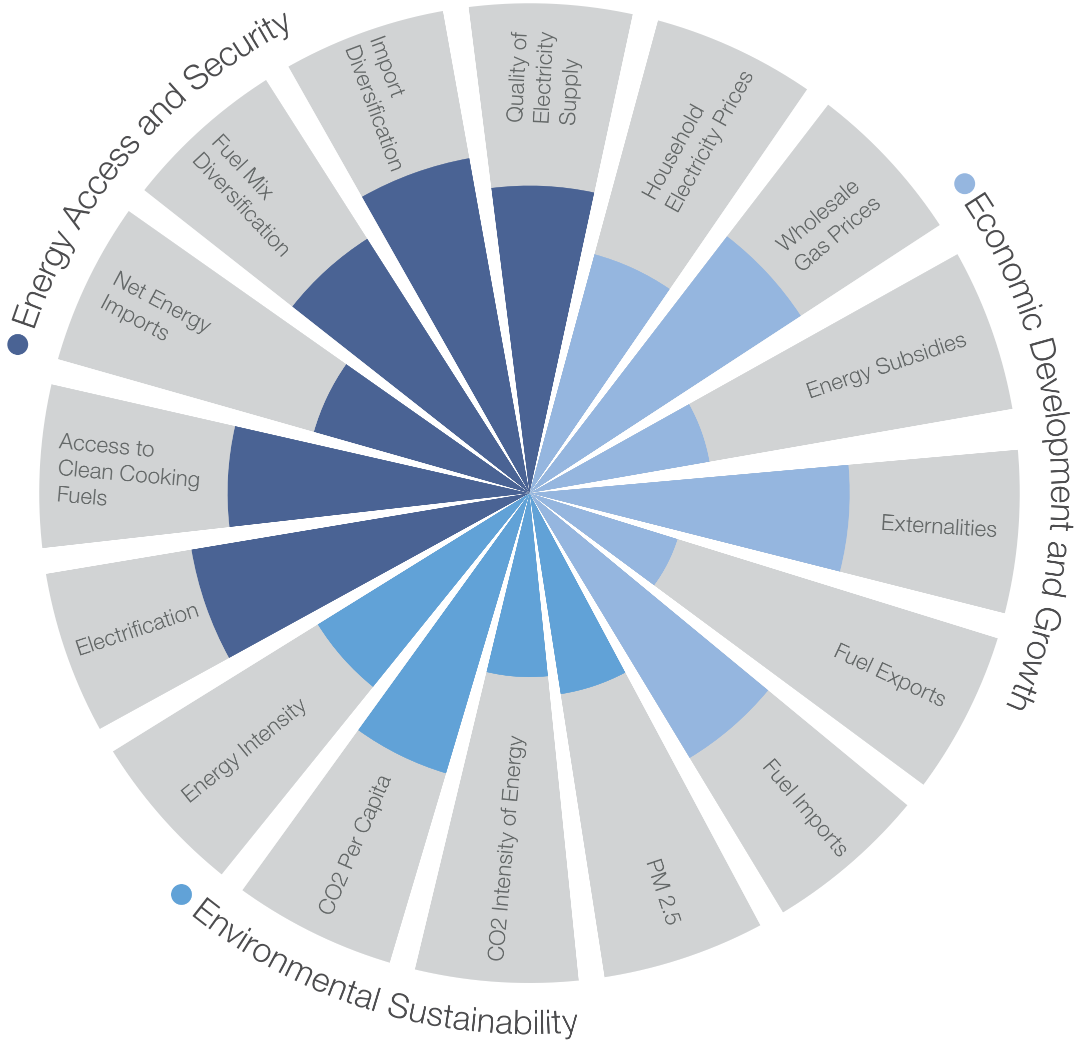
Figure 6: System performance dimension scores, 2015 and 2020



Source: World Economic Forum

The energy access and security dimension continues to exhibit the highest global average score, with 80% of the countries having achieved progress between 2015 and 2020. Large-scale programmes targeting access to electricity in South and South-East Asia and the further diversification of import counterparts among energy importing countries have been primary contributors to strong global progress on energy access and security. However, as the dimension's profile in Figure 6 shows, **the gap between the top and bottom performers on this dimension is the highest of the three dimensions.**

Figure 7: Scores on system performance sub-index indicators, Energy Transition Index 2020 (scaled from 0 to 100)



PM2.5 – Fine particulate matter air pollutant
Source: World Economic Forum

4.1.1 Economic development and growth

Global GDP increased from $50 trillion in 2000 to $82 trillion in 2018 (constant 2010 $),[25] representing a 60% increase. Keeping pace with economic growth, global energy demand increased by 40%, from 10,000 million tonnes of oil equivalent (Mtoe) to 14,000 Mtoe[26] over the same period. At the same time, the per capita consumption of energy rose steadily, even as the population increased from 6 billion people worldwide in 2000 to more than 7.5 billion in 2018.[27] To support economic growth and maximize social welfare, it is essential for countries to ensure access to abundant and diverse forms of energy at affordable prices.

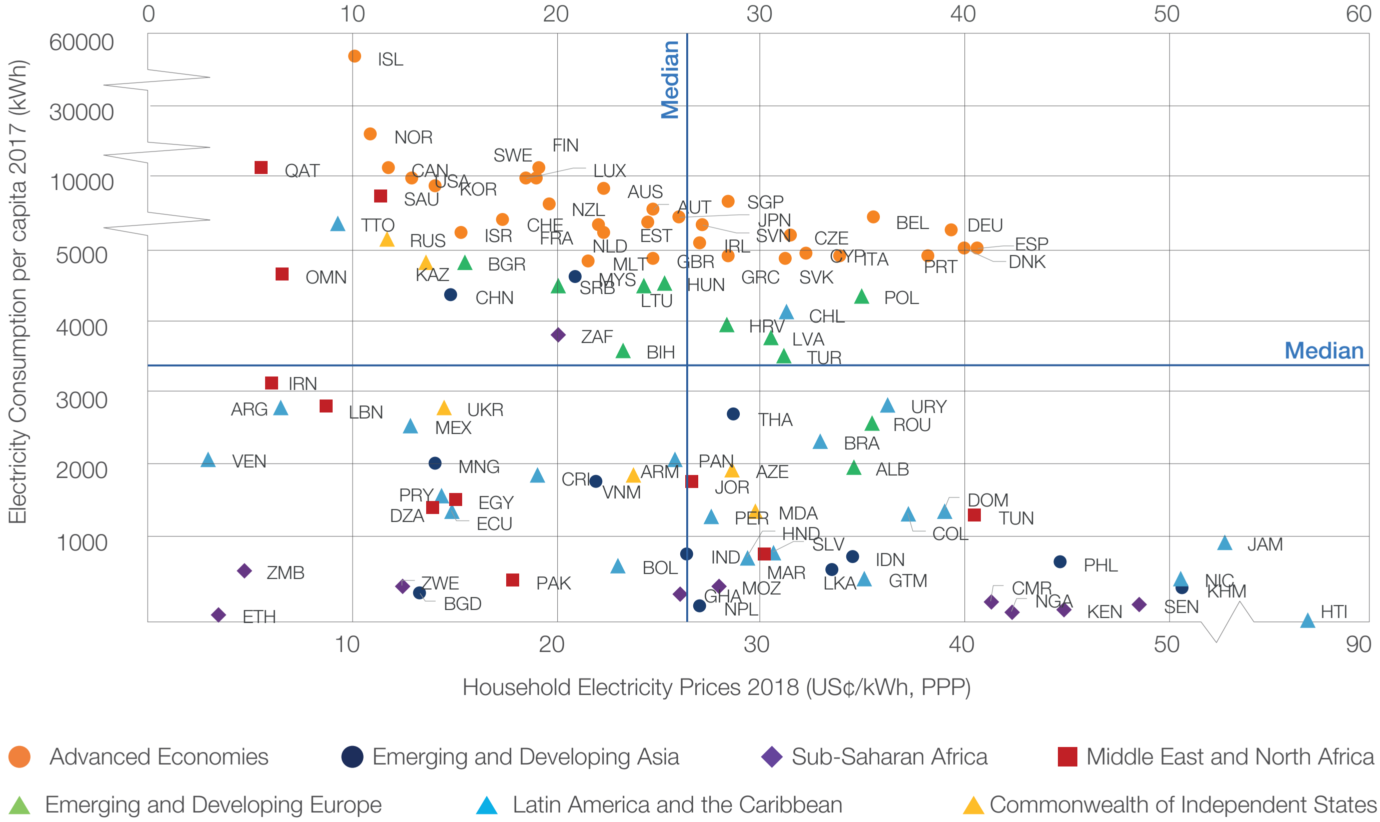
The economic development and growth dimension indicates the energy sector's overall contribution to a country's economy, and how well the energy system is positioned to ensure the cost competitiveness of the industry as an intermediate input, and the affordability to households in final consumption. **The global average score for this dimension has declined over the past year, effectively erasing the gains made since 2015** (Figure 6).

Until the recent systemic shocks from factors such as trade tensions, military interventions and the COVID-19 pandemic, the past decade saw one of the longest economic expansions in history. However, the results were mixed for fuel exporting countries, which remained sensitive to energy market volatilities, the evolving policy landscape in fuel importing countries, and technology-enabled energy productivity gains.

Over the past six years, the fuel exporting countries saw a greater decrease in scores on the economic development and growth dimension of the ETI than the importing countries.

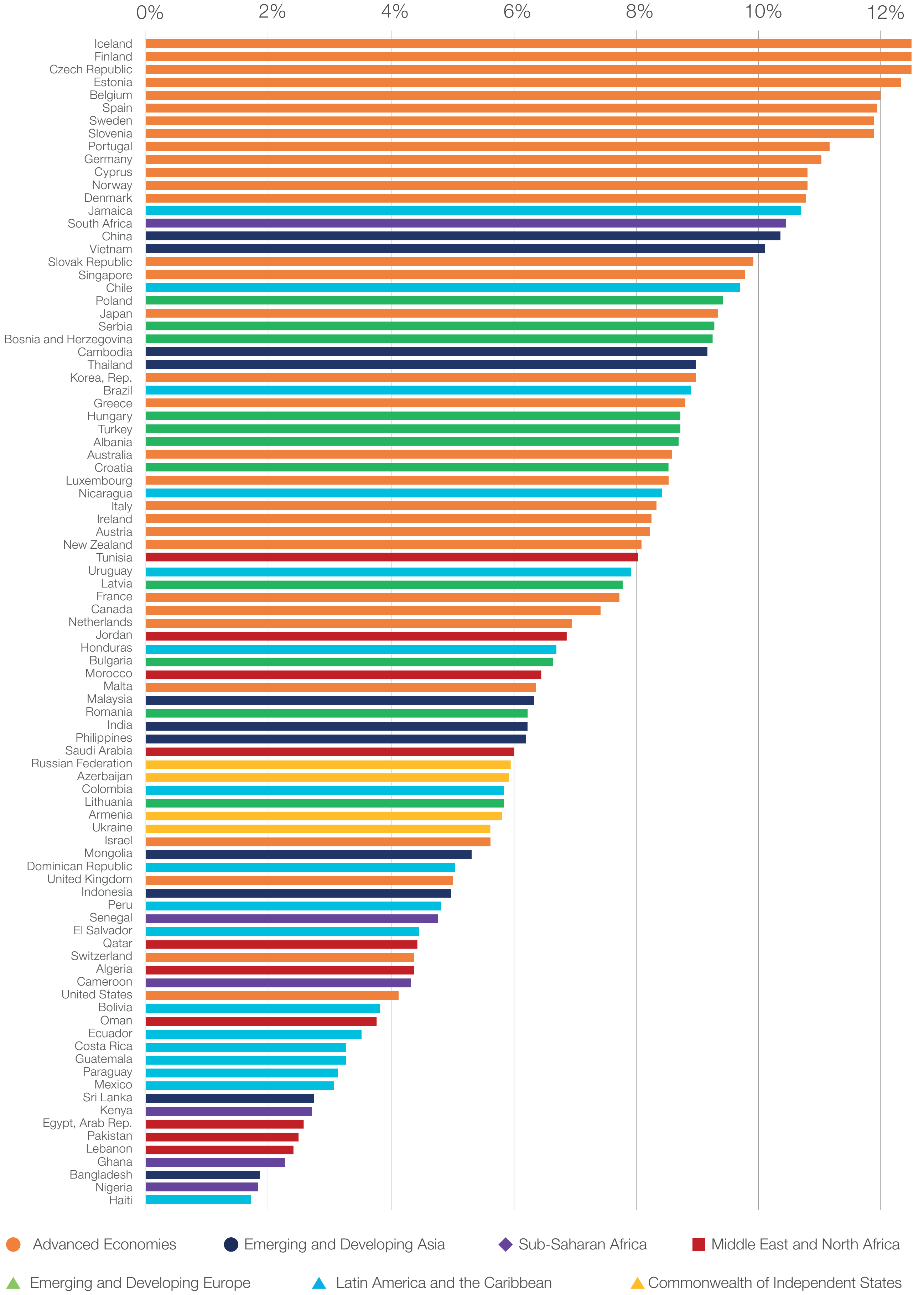
The affordability of energy services for households depends upon not just energy tariffs, but also per capita consumption levels, household expenditures and disposable income. Focusing on the cost of electricity, Figure 8 shows that Advanced Economies and Emerging and Developing Europe countries have high per capita electricity consumption, which is expected to further increase with the rising share of electricity in final demand. While household electricity tariffs in these countries are comparable to those in the rest of the world (in purchasing power parity (PPP) terms), the affordability challenge remains severe as high consumption levels imply a higher share of utility bills in domestic expenditure. Figure 9 indicates the disproportionately higher share of electricity bills[28] (annual, PPP) in household final consumption expenditure for Advanced Economies and countries from Emerging and Developing Europe. Emerging economies from Sub-Saharan Africa and South Asia face an affordability challenge of a different nature. While per capita consumption levels are low due to limited access to electricity, the retail electricity tariffs are among the highest in the world (in PPP terms). For these countries, the affordability challenge is exacerbated as fixed costs are spread across a narrower consumer base, given commercial losses and less than universal electrification. **The affordability constraint is a risk to the energy transition, as it affects the relative competitiveness of fuels and technologies and may lead to sub-optimal decision-making, by locking in fuels that might be more competitive but less environmentally sustainable.**

Figure 8: Household electricity tariffs (US¢ 2018, PPP) vs per capita* electricity consumption (kWh)



*Based on total electricity consumption (does not consider segmentation by final demand category).
Sources: World Economic Forum with data on 2018 household electricity tariffs from Enerdata, and on per capita electricity consumption from IEA, "Data and statistics" 2017

Figure 9: Average household electricity bills* as percentage of private final consumption expenditure per capita, 2018 (current international $, PPP)



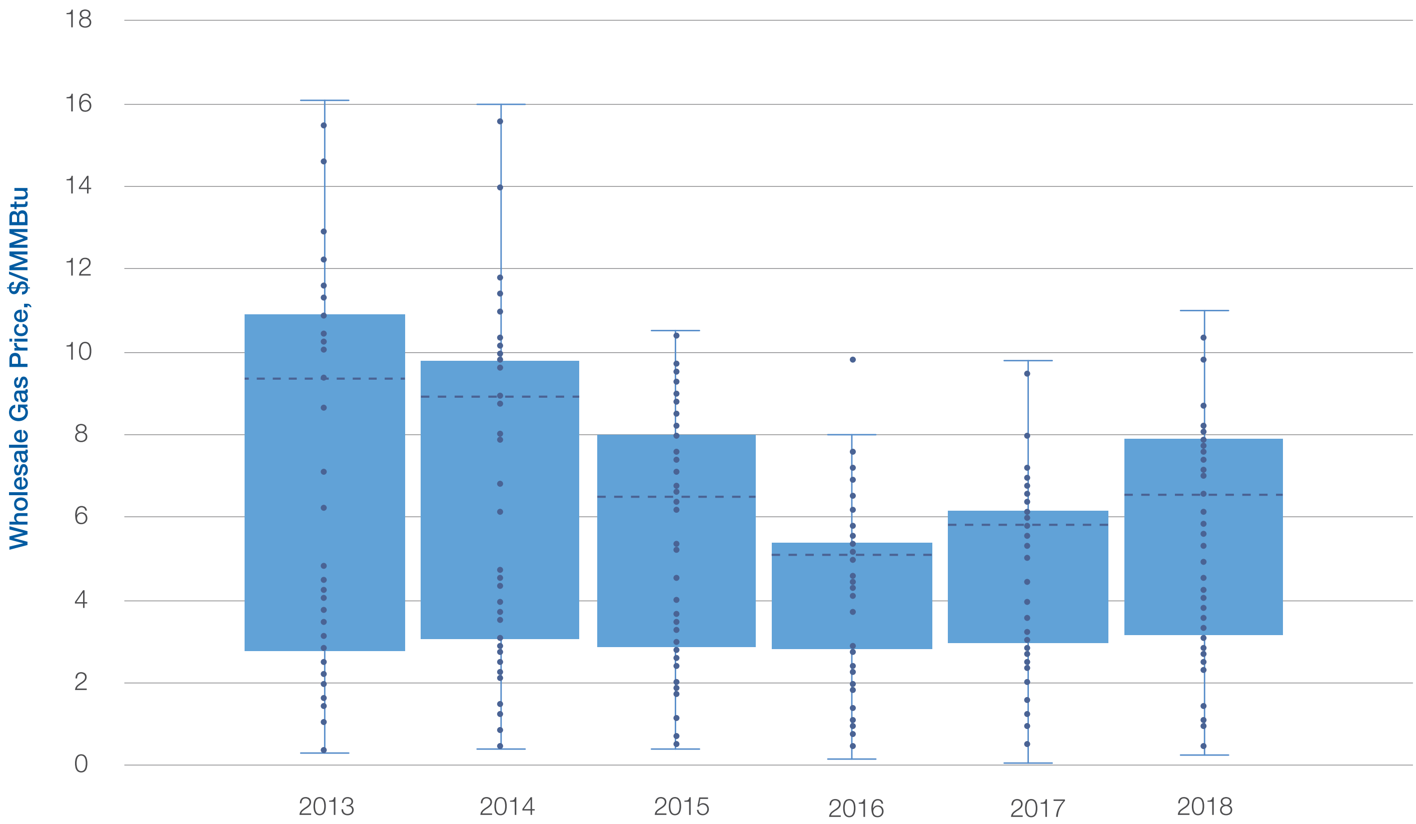
*Calculated based on overall energy consumption (does not consider segmentation by final demand category)

Sources: World Economic Forum with data on 2018 electricity tariffs from Enerdata; on per capita energy consumption from IEA, "Data and statistics" 2017; and on private final consumption expenditure from the World Bank, "Households and NPISHs [Non-profit institutions serving households] final consumption expenditure, PPP (current international $)", https://data.worldbank.org/indicator/NE.CON.PRVT.PP.CD

Global energy demand increased by 2.9% in 2018, with natural gas contributing to 40% of this growth.[29] Prior to the price and demand shock resulting from the COVID-19 pandemic in 2020, wholesale natural gas prices had increased across the world except in North America[30] over the past two years (Figure 10). The cost competitiveness of natural gas is critical for industrial growth, as well as to replace more carbon-intensive fuels in power generation. As shown in Figure 7, the global average score (scaled from 0 to 100) for the indicator on wholesale gas prices is the lowest among the indicators of the economic development and growth dimension, which indicates high variability in the landing costs of natural gas across countries. Different price determination mechanisms, energy subsidy levels, underinvestment in mid-stream infrastructure and high costs along the LNG supply chain[31] are limiting factors in the cost competitiveness and security of gas supply. Given the recent oil market volatilities, **the uncertain supply and demand outlook for 2020 presents an opportunity for importing countries to improve their industrial competitiveness and increase price transparency**.

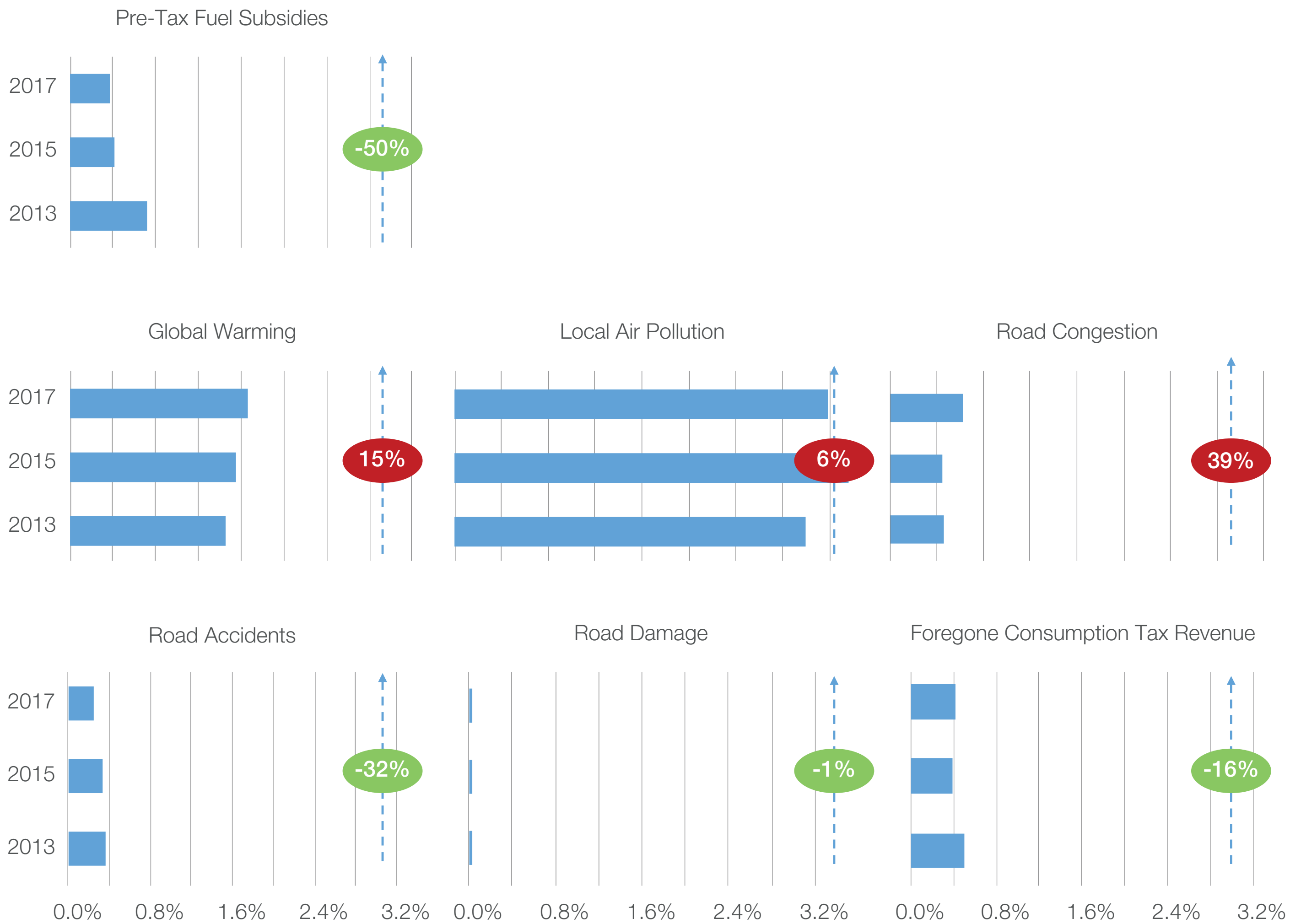
Policy-makers frequently use energy subsidies to address social and distributional objectives for households and the competitiveness of industries. However, evidence suggests poorly targeted energy subsidies end up benefiting wealthy consumers, incentivizing overconsumption, distorting price signals, and inhibiting investment in renewable energy and energy efficiency.[32] Pre-tax energy subsidies, which indicate the difference between the actual price paid by consumers and the full cost of supply, have progressively declined over the years. Sustained low oil price environments (as compared to a decade earlier) and efforts on fuel price reform in many countries are contributing factors. This trend is supported by the ETI analysis, **as 82% of countries that have improved their ETI scores over the past six years have also decreased their pre-tax energy subsidy levels.**[33] However, consumption subsidies are only a small fraction of total post-tax subsidies, which include such externalities as air pollution, global warming, health risks, traffic congestion and accidents. Between 2013 and 2017, the unpriced externalities associated with global warming, local air pollution and road congestion steadily increased (Figure 11), especially in emerging economies.[34]

Figure 10: Wholesale natural gas prices, 2013-2018



Source: International Gas Union, *Wholesale Gas Price Survey 2019 edition*

Figure 11: Pre-tax and post-tax energy subsidy components, 2013, 2015 and 2017 (percentage of nominal GDP)



Source: World Economic Forum based on International Monetary Fund, "Global Fossil Fuel Subsidies Remain Large: An Update Based on Country-Level Estimates", 2019

4.1.2 Environmental sustainability

The environmental sustainability dimension of the ETI focuses on emissions footprints of energy supply as well as demand. The past year can be considered as a critical landmark in the energy transition. The social pressures for accelerated decarbonization intensified, as evidenced by widespread youth climate protests. Many countries announced net-zero emissions ambitions, and critical policy instruments such as the European Green Deal gathered momentum. Central banks echoed similar ambitions, citing the systemic risk to financial systems from climate change,[35] and an increasing number of financial-sector organizations declared goals to divest from carbon-intensive investments. Between 2015 and 2020, more than 70% of the countries have improved their score on this dimension, with 30% improving it by more than 5 percentage points. The top 10 countries in the ETI rankings have improved on both per capita energy consumption as well as per capita CO2 emissions over the years. However, Figure 6 shows that this dimension has the lowest global average scores and the minimum spread between high and low performers of the three dimensions. **This suggests that while progress has been made on environmental sustainability, improvement remains contingent on addressing the economic and social priorities of the energy system.**

Global energy-related CO_2 emissions plateaued in 2019 after two years of consecutive growth,[36] in part due to a decrease in energy intensity of GDP in advanced economies, and slower energy demand growth in China and India. From a sectoral lens, electricity generation led the emissions reductions, as renewable energy capacity and utilization increased across countries, and natural gas replaced coal as the primary fuel.[37] While the United States has led emissions reductions from power generation by switching from coal to natural gas, the transition has been accompanied by high levels of methane emissions. More than half of global methane emissions last year came from North American shale oil and gas production.[38] Given the high global warming potential of methane as compared to CO_2, it threatens to erode the gains made on environmental sustainability over the years. **In view of the importance of natural gas in the energy transition, technologies and regulations to mitigate methane emissions should be deployed urgently.**

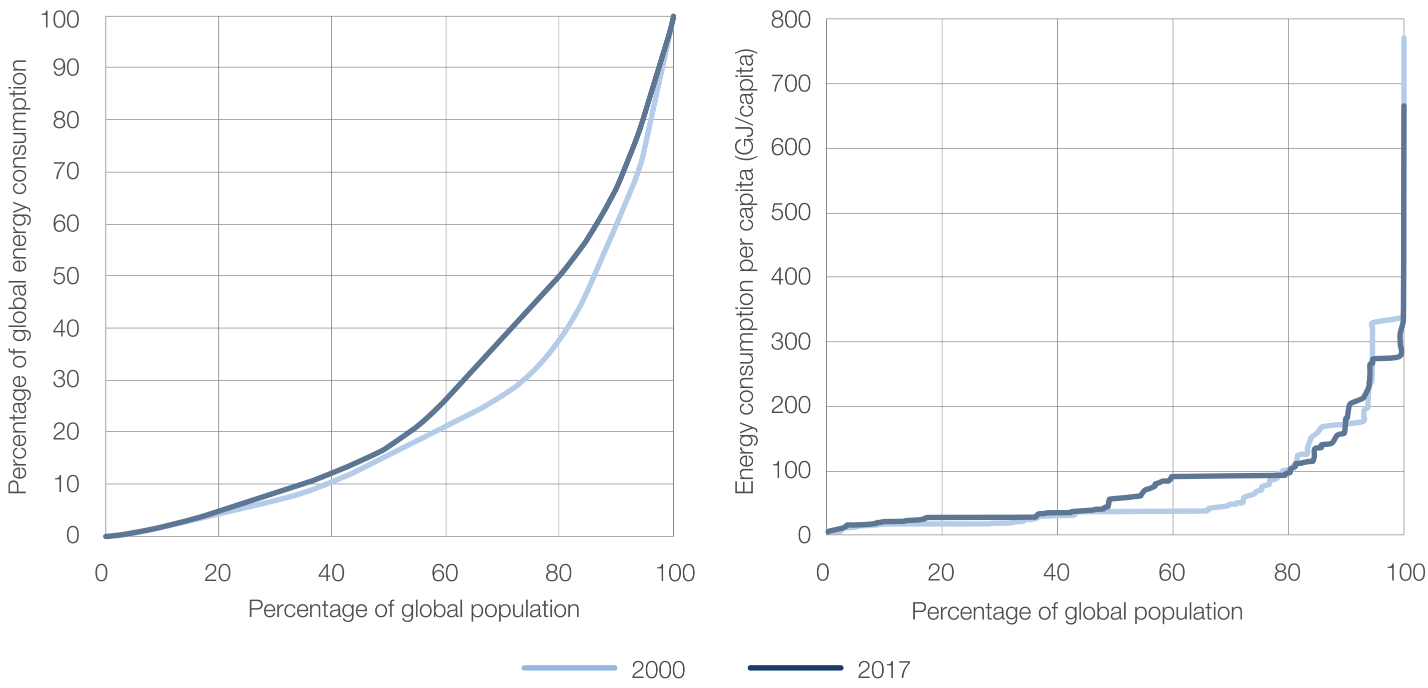
The environmental sustainability of energy systems is highly sensitive to recent developments, with the possibility of lingering effects of oil price volatility and the COVID-19 pandemic in the medium term. While annual emissions might decline due to the slowdown in industrial activity, aviation and surface transportation, they should not be mistaken for gains made from structural transformation or policy measures. As governments act to maintain economic growth and employment, and companies reallocate investments to ensure business continuity, the environmental sustainability agenda could lose momentum. Potential consequences include delays and capital constraints in renewable energy projects, the lack of incentives to pursue energy efficient alternatives, a targeted fiscal stimulus to carbon-intensive sectors, among others. Countries' economic growth priorities have been a contentious issue in the energy transition, and these fault lines could be harder to navigate in a slow or declining economic growth scenario. **Stakeholders need to be conscious of the long-term objectives of the energy transition and adjust short-term priorities accordingly.**

4.1.3 Energy access and security

Global average scores and improvement over time remain highest for the energy access and security dimension. **More than 80% of the countries have improved on this dimension since 2015**. While Advanced Economies and fuel exporting countries display high scores due to existing infrastructure and domestic reserves, respectively, the highest improvements on this dimension come from countries in Emerging and Developing Asia and to a lesser extent in Sub-Saharan Africa, due to large-scale and sustained electrification programmes and improved economics of decentralized electricity systems.[39] However, evidence is mounting that although measuring energy poverty through a binary definition of access to electricity or clean cooking fuels might be easy to track and communicate, it does not necessarily capture its true extent.[40] Electricity is considered as a proxy for all forms of energy, which may not be fungible. Energy input for services such as lighting, heating and refrigeration, mobility, process heating and mechanized agriculture are different. **Energy access programmes need to be redesigned, prioritizing considerations such as the diversity of energy services available to households for productive use, access to energy-enabled community services, the distribution of energy consumption within countries, and the quality and reliability of supply**.

While energy poverty might be an infrastructure or "access" issue in developing countries, it is an affordability concern[41] in developed countries, which is exacerbated by pervasive economic inequality.[42] Consensus is lacking over the definition of energy poverty, including the basket of basic energy services and the minimum amount of each service needed. Consequently, energy poverty manifests in diverse forms, unique to country-specific circumstances. Globally, the inequality in energy consumption between countries appears to be decreasing, but large gaps remain. Specifically, the changes in energy consumption per capita for countries at the upper and lower ends of the scale have been marginal (Figure 12). Across all countries, the top 10% income group consumes 20 times more energy than the bottom 10%.[43] To some extent, the inequality in energy consumption levels between countries might be natural, due to the distribution of conventional energy resources. **Given the more uniform distribution of renewable sources, particularly solar and wind energy, orienting economies towards renewable energy can help bridge inequality in energy consumption per capita and improve energy security.**[44]

Figure 12: (left) Energy consumption vs population, (right) Energy consumption per capita vs population, 2000 and 2017



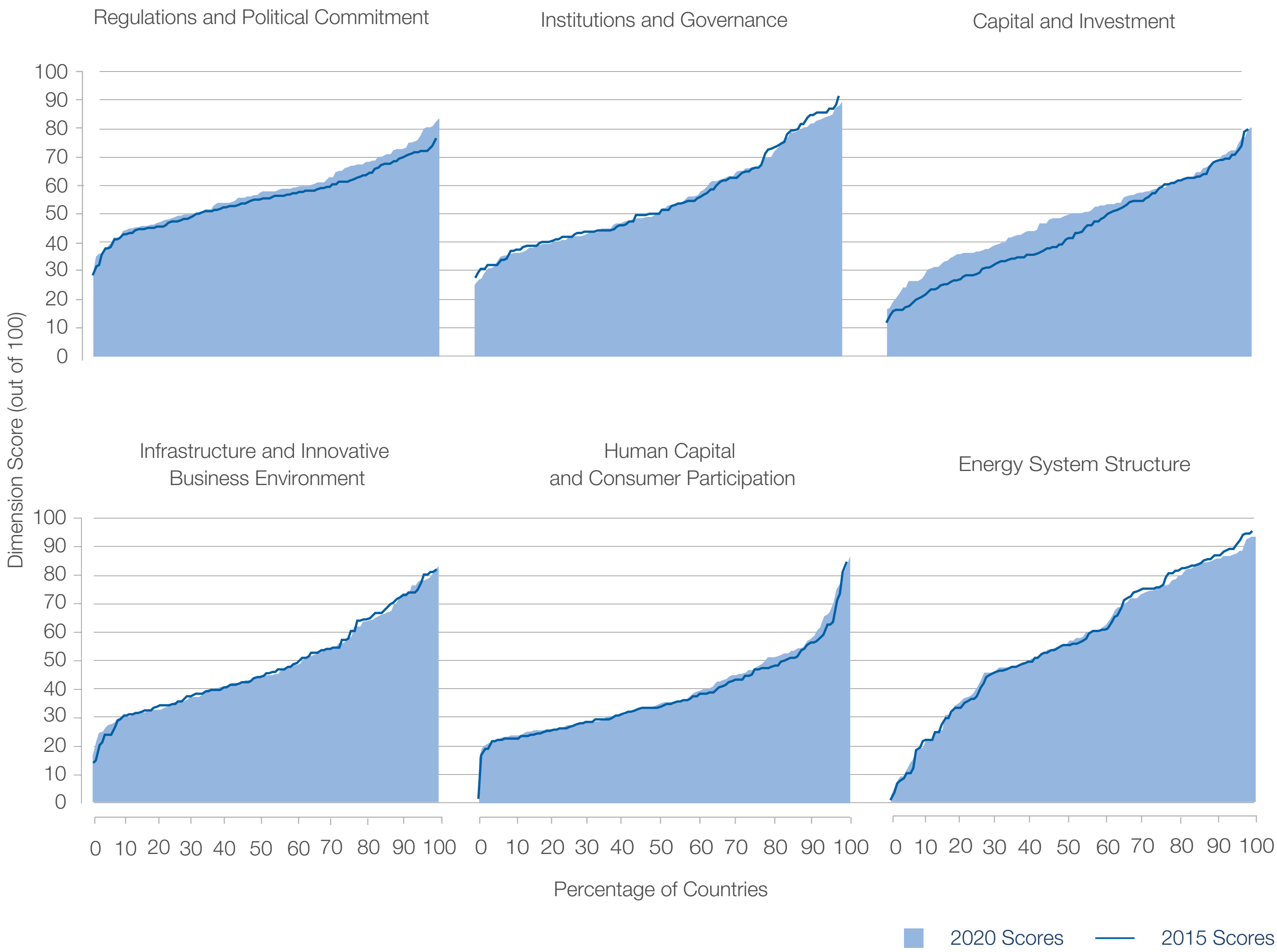
Sources: IEA, *World Energy Balances 2019*; World Bank population data

4.2 Transition readiness

The energy system's ability to deliver on the imperatives described in the preceding sections depends on the presence of an enabling environment for the energy transition, measured in the ETI framework by the transition readiness sub-index. Energy transition readiness is captured by the stability of the policy environment and the level of political commitment, the investment climate and access to capital, the level of consumer engagement, the development and adoption of new technologies, etc. Some of these factors are beyond the scope of the energy system but nevertheless determine the effectiveness and future trajectory of energy transition in a country. As shown in Figure 4, **the global average transition readiness score has increased each year since 2015, indicating a gradual improvement in the enabling environment across countries.**

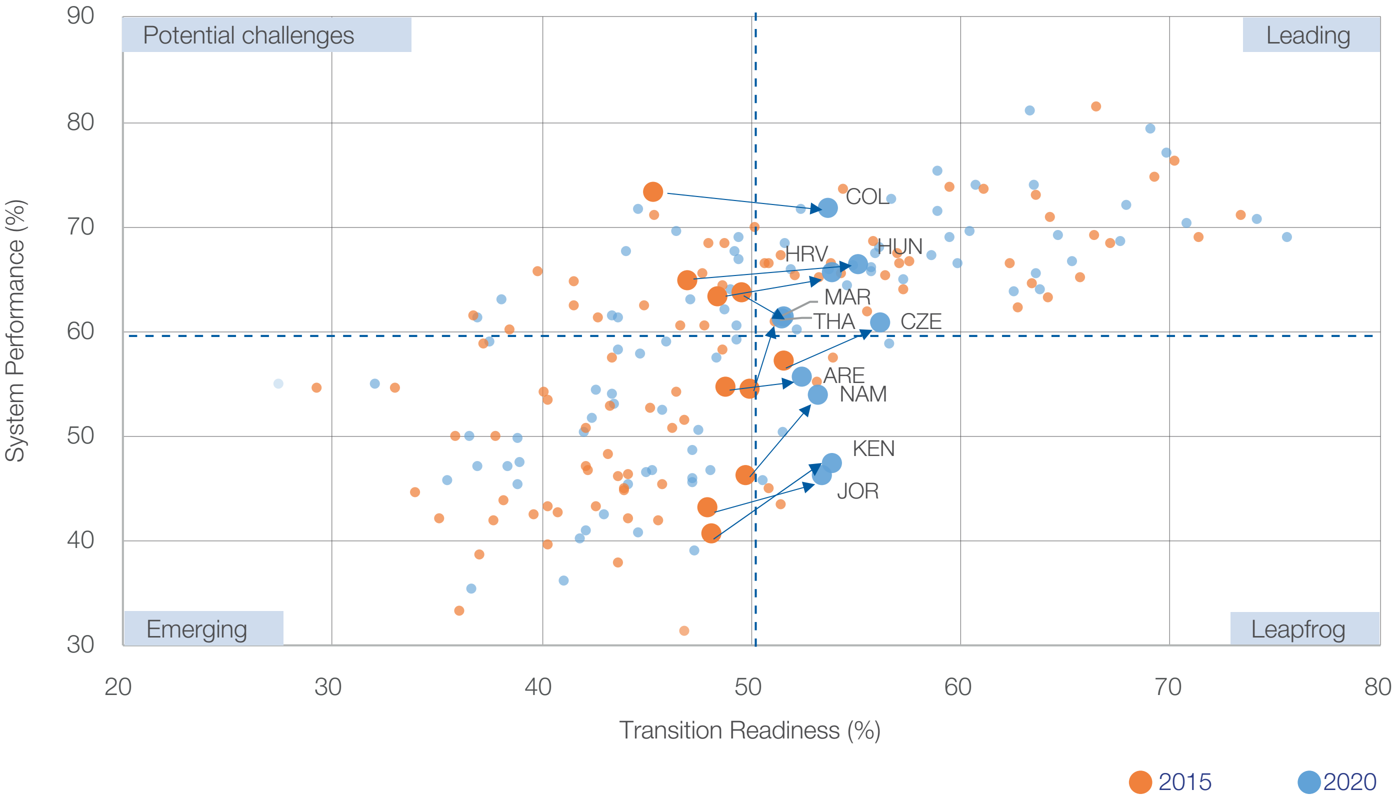
Despite the overall improvement in the global average score for transition readiness, progress is not proportionate across the different enabling dimensions. Enablers such as the robustness of the institutional framework, human capital preparedness and an innovative business environment require structural changes and are inherently slow moving due to inertia in social and technological systems. **A majority of the countries have improved their energy transition readiness by targeting better access to capital and investment and increasing the level of political commitment** (Figure 13). Countries with a robust enabling environment are more likely to sustain well performing energy systems. The ETI data corroborates this, as advanced economies score highly on both the system performance and transition readiness sub-indices. Moreover, a robust enabling environment also allows countries to better navigate the complexities of the energy transition. Figure 14 shows 10 countries that have made substantial progress on transition readiness between 2015 and 2020. While these countries have adopted diverse pathways to improve their readiness, **they have simultaneously improved on multiple enablers, underscoring the importance of a systemic approach to energy transition**.

Figure 13: Transition readiness dimension scores, 2015 and 2020



Source: World Economic Forum

Figure 14: Shift in Energy Transition Index scores for select countries, 2015 and 2020



Source: World Economic Forum

Overall, the capital and investment and regulations and political commitment enablers show maximum improvement, increasing by 12% and 6%, respectively, over the past six years, supported by technological improvements and public engagement, and capitalizing on the economic expansion leading up to 2019. However, the environment has shifted fast in the wake of compounded disruptions from the COVID-19 pandemic, potentially straining the bandwidth of investors and policy-makers to pursue long-term plans for energy transition with the same sense of urgency. The energy system has withstood recurring disruptions over the past few decades. While some of these conditions, such as extreme weather events like wildfires and tropical storms, and mixed reactions to carbon prices or environmental legislation, have been localized to countries or industry sectors, the current environment constitutes a perfect storm of compounded disruptions, touching every corner of the planet.

The cascading effects of the COVID-19 pandemic, immediately following prolonged international trade disputes, have brought the global economy to a grinding halt – sending shockwaves through the energy markets. As countries and companies rapidly reallocate resources to protect lives and livelihoods, their immediate priorities may shift away from energy transition and climate change. **The era of compounded disruptions is a litmus test for the energy transition, asserting the importance of the twin objectives of robustness and resilience.** Robustness in policy design implies institutional and political characteristics remaining functional at a desired level during external shocks, and resilience indicates the need for systems and processes to identify “black swan” events and to be prepared to address them when they occur.[45]

5. Imperatives for the energy transition

As the world becomes more interconnected, society becomes increasingly susceptible to compounded disruptions that reverberate globally. The beginning of 2020 has demonstrated the scale and impact of a global contagion and, subsequently, what these exogenous shocks can do to the systems in place. Viruses are spreading faster and wider, wildfires are intensifying, hurricanes are causing more damage, the global financial system is more leveraged and vulnerable. Even our infrastructure is sensitive to cyberattacks from abroad. How our climate and energy imperatives in this era of unprecedented shocks are managed remains to be seen, but it is critical not to lose sight of long-term goals that could easily be overshadowed by short-term priorities.

5.1 Regulations and political commitment

While governments around the world are scrambling to deal with the fallout from the COVID-19 pandemic, the oil shock and financial market volatility, maintaining focus on the energy transition and climate change is essential. The effects of the COVID-19 pandemic and climate change are similar in terms of their global scale, the exponential growth of their impacts, the need for decisive action, the importance of scientific evidence, the risks to all parts of the economy, and the existential threat to the less affluent sections of society. Moreover, as is the case with COVID-19, it is only through concerted societal action that the primary objective of "bending the curve",[46] in this case of emissions, can be achieved. Furthermore, effective actions that withstand the test of time require a comprehensive approach to decision-making that results in long-term, stable and ambitious policy actions.

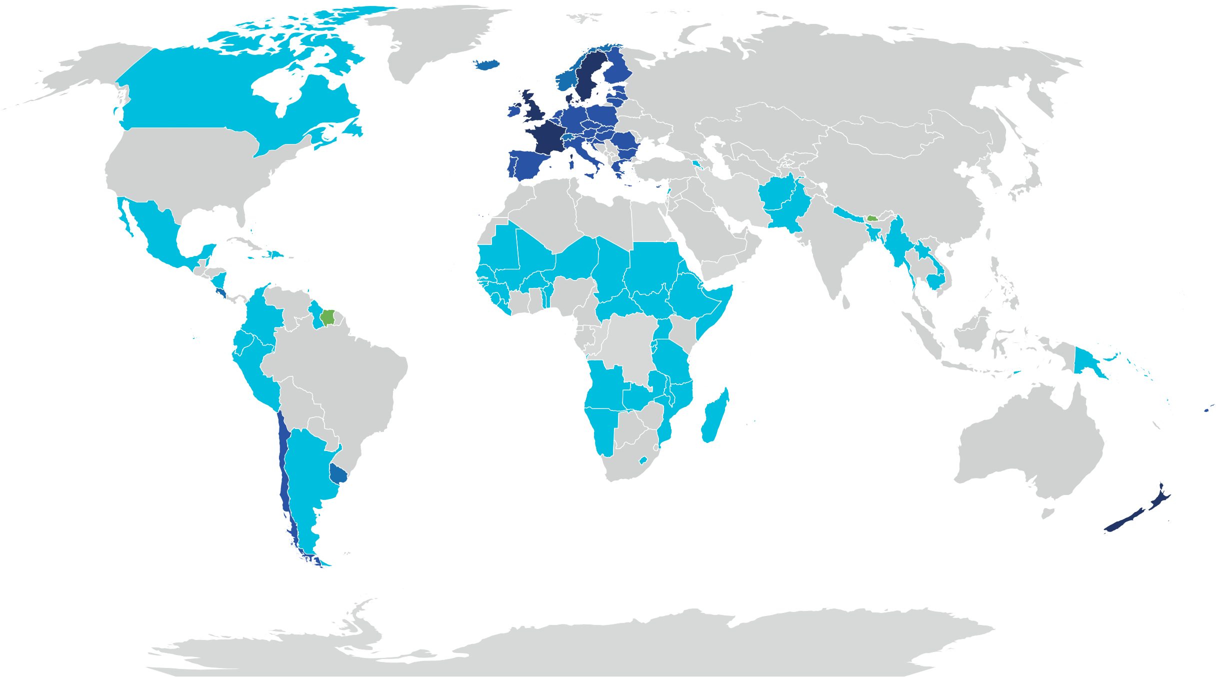
Current policies and countries' pledges could lead to global warming of more than 3°C by 2100,[47] well above the emissions pathways consistent with the Paris Agreement's long-term goal. According to the latest UNEP *Emissions Gap Report*, countries must increase their nationally determined contributions threefold to achieve the goal of below 2°C, and fivefold for 1.5°C.

The climate change policy landscape has been moving in the right direction, although the response requires additional pace and coordination across nations. In the past few years, many countries have declared, or are currently considering, ambitious net-zero emissions goals. However, the world's largest energy consumers or greenhouse gas emitters – including Australia, Brazil, China, India, the Russian Federation, Saudi Arabia and the United States – are yet to declare such targets (Figure 15). For many analysts, such recent developments as the rising coal plant capacity in China[48] and the weakening of fuel economy standards in the United States[49] raise concerns over the level of political commitment to the energy transition.

The near-term prospects of multilateral cooperation appear bleak, with the postponement of the COP26 UN climate change conference in Glasgow due to the COVID-19 pandemic. In the current context, unilateral action by countries,[50] including those where simultaneous gains for the energy transition and the health emergency could be achieved, should be sought. For example, the bailout package of the American automotive sector in 2009 in the aftermath of the financial crisis required compliance with more stringent fuel economy standards.[51] To encourage governments to raise the level of ambition for the energy transition and environmental goals, it is important to consider the following:

– **Net-zero emissions commitments need consistent definition, tangible roadmaps and milestones**. Although the cumulative emissions and energy consumption of countries with net-zero ambitions remain a small proportion of the total (Figure 15), the concept of "net zero" has different interpretations. Factors such as the choice of greenhouse gases, the treatment of offsets and negative emission alternatives, boundaries for accounting emissions, and target starting points and timelines can have different implications for establishing adaptation and mitigation roadmaps, including the speed and scale of the energy transition. Terms such as "carbon neutral", "climate neutral", "net zero", "zero emissions" or "decarbonization" have been used interchangeably,[52] leading to ambiguity in setting milestones and monitoring progress. As more and more countries step forward to declare their commitments, net-zero targets need a consistent definition.

Figure 15: Status of net-zero emissions targets across countries



Net Zero Target Status	Share (%) of Global Total Energy Supply, 2017	Share (%) of Global Total Nominal GDP, 2017	Share (%) of Global CO2 Emissions from Fuel Combustion, 2017
Achieved	~0%	~0%	~0%
In Law	3.8%	8%	2.3%
Proposed Legislation	8.7%	15%	7.8%
In Policy Document	0.5%	1.5%	~0%
Under Discussion	7.8%	6.9%	6%
Uncovered	79.3%	68.7%	84%

Sources: Energy & Climate Intelligence Unit, "Net Zero Tracker, Net Zero Emissions Race", February 2020, https://eciu.net/netzerotracker; Total energy supply: IEA, *World Energy Balances 2019*; Nominal GDP: World Bank, "GDP (current US$)", 2019, https://data.worldbank.org/indicator/NY.GDP.MKTP.CD; Global CO_2 emissions from fuel: Global Carbon Atlas, 2020, http://www.globalcarbonatlas.org/en/content/welcome-carbon-atlas

– **A sector-specific approach, gradual implementation and distributional considerations are critical for success where carbon pricing mechanisms are established.** So far, implemented or scheduled carbon pricing instruments account for 20% of global greenhouse gas emissions.[53] At COP25 in Madrid, parties failed to agree on regulations and frameworks for carbon markets. One of the reasons was the regressive nature of carbon taxes and the challenges to trade competitiveness that could arise from carbon leakage. Evidence suggests that leakage risks are restricted to sectors exposed to international trade and not to sectors with local boundaries, such as power generation, transportation and buildings.[54] Carbon pricing, if accompanied by targeted fiscal support to sectors vulnerable to a loss of competitiveness from carbon leakage, could be more effective. Gradually increasing the carbon price floor to an optimal level, as implemented in Canada,[55] can mitigate the economic consequences by allowing business more time to adjust smoothly. Finally, to avoid a disproportionate effect on the cost of living of households in the lower-income bracket, carbon pricing should include revenue recycling mechanisms[56] for progressive taxation.

– **Incentives and regulations can increase the coverage of corporate commitments to climate action.** Actions by corporations can make a significant difference, especially in countries where national targets are yet to be determined. An increasing number of companies have declared net-zero emissions targets, doing so to respond to consumer preferences, gain a competitive edge and future proof their business. By and large, however, corporate commitments come from large global organizations, many with end-consumer-facing business models, operating in low abatement cost sectors (though not all). Organizations that are small or medium sized, in hard-to-abate sectors or with less end-consumer interaction would benefit from more effective incentives and regulations to commit to transforming their businesses in line with Paris Agreement targets.

Raising the climate change ambition

By Christiana Figueres, Founding Partner, Global Optimism, United Kingdom

The COVID pandemic has coincided in 2020 with the necessary climate turning point, the point at which greenhouse gas (GHG) emissions must begin their steady decline in order to avoid the worst impacts of climate change. **We know that greenhouse gases will drop this year due to the worldwide economic paralysis, but that is by no means good news due to the high humanitarian price we are paying.** It is also not the approach anyone would take to addressing climate change.

To be effective, the decarbonization of the economy needs to be pursued in a planned and constructive manner, having overwhelmingly beneficial effects for society and the economy. That is precisely the potential silver lining in the health crisis. We now have no option but to rebuild our economy, and that rebuilding can be thoughtfully designed to both provide millions of jobs in the short term, as well as strengthen the resilience of the economy in the long term. But we have to take those decisions now.

The scientific evidence is clear about anthropogenic influences on climate change, and there is limited time for action. Over the next 10 years, we must halve our GHG emissions output by drawing down a staggering amount of carbon now concentrated in our atmosphere from coal, oil and gas combustion, deforestation and commercial agriculture.

This 10-year transformation will put us on track to limit the temperature rise to 1.5ºC, enabling humanity to adapt as best we can to the challenges of our changing climate and to ultimately survive and prosper.

The impacts manifesting as a result of our inaction to date have been shocking: this year's bushfires in Australia, the floods in Indonesia and the locust swarms in East Africa have been deeply painful. Leaders are waking up to what is at stake.

As we have learned from the health pandemic, to be effective in the face of risks, governments must be decisive. Once governments choose to pursue the necessary emissions cuts and restoration of nature, and their commitments are incorporated into improved pledges under Paris, the post-2020 Biodiversity Framework and domestic policies, the door of resilience and possibility will be flung open.

Demands for governments to follow such a path are surging. Whether it's protestors in the streets, legal action, or appeals from health professionals, investors, unions and non-profits, the momentum behind the climate movement is unstoppable. Demands for leaders to act on the scientific imperative are driven by outrage and fear for the future, but they're also inspired by the undeniably desirable outcomes of such action: the clean air imperative, the health imperative, the energy independence imperative, the economic imperative, the resilience imperative, the social and intergenerational justice imperative and the jobs imperative, all stacked up on each other, mutually reinforcing, and pointing in the same direction.

The fossil fuel and big agriculture industries were, in their nascency, driven by noble imperatives as well, but the unintended consequences, so damaging to our planet and our health, are now well documented. The time is over for justifying policies and subsidies that enable such damage to continue. We now have the understanding, the technology and the capital to forge a different path. A path full of opportunity, excitement and benefit, and the ways forward – already under pursuit by many – are laid out in this excellent report.

Technology alternatives to fossil fuels are rapidly maturing and ready to scale, and finance is already shifting in favour of the great decarbonization. At the time of writing, US$39 trillion of the world's annual gross domestic product (GDP), or around 49%, is being generated in jurisdictions with an actual or proposed net-zero target. That includes 121 nations which have either set or proposed or are currently discussing a goal to cut their carbon emissions down to net zero in or before 2050. Carbon pricing has been implemented or scheduled for over 20% of global GHG emissions across 40 national jurisdictions. The challenge now is less about the direction of travel and more about speed.

But if we are to unlock faster progress in the energy transition, which we must, we will have to put our minds to it. We have to intentionally choose it. We now have first-hand experience of shattering impacts worldwide. As we also bear witness to the devastating impacts of climate change on our homes and communities across the globe, we can clearly see what a deteriorated future will mean for our children. Delaying any further is unconscionable. We must choose to increase our ambition, to increase our emissions cuts, and to increase our efforts to protect biodiversity.

As the world turns its attention to the recovery we must ignite, we must commit to rising to the increasing global risks in a timely fashion. It is a commitment to ourselves, to each other and, above all, to all those whose destiny depends on us.

5.2 Capital and investment

The global energy transition will require trillions of dollars in investment from private corporations and national governments in the coming decade, but enormous amounts of capital have already been flowing into the sector. As technology improvements result in greater efficiencies and reduced costs, investors can put money more reliably into emission-reduction opportunities without relying on government programmes and subsidies for commercial viability. Capital inflows into renewable energy projects will likely slow in 2020, given financial market volatility and the COVID-19 pandemic. Depending on how deep the financial uncertainty goes, corporations and individual investors may not be ready for investment. Additionally, with oil prices cratering and potential trade barriers or tariffs, some technologies may fall behind on cost competitiveness. That said, it is important for companies and investors to see government interest and stability in policies to advance the energy transition in light of the global turmoil. With this stability and vision, investors will be able to remain confident in their investments irrespective of short-term shocks.

In developing countries, renewable energy projects continue to face headwinds, due to higher levels of financial risk and investment costs that can put strain on the competitiveness of projects. Bankability and financing are among the main issues for lagging progress in renewable development.[57] In the years 2010 to 2019, $2.6 trillion was invested in renewable energy (excluding hydro) globally. Of this amount, $1.3 trillion was invested in solar, with wind close behind at $1 trillion, and biomass and waste-to-energy lagging at $115 billion. China overall was the biggest investor, with $758 billion invested in renewable energy throughout the decade.[58] Despite the push and substantial investment from countries across the globe, several countries continue to ramp up coal plant construction to fuel growth, thereby diminishing their readiness for a comprehensive energy transition.

Globally, many financial vehicles are being used to encourage growth and development. Among them, ESG investments are rapidly growing, with $31 trillion invested in ESG worldwide. ESG criteria are a set of standards for a company's operations that socially conscious investors can reliably use to screen investments. They are guidelines and imperatives around which companies shape their business practices, as increasingly more companies are recognizing the need to focus not just on bottom line economics but also on corporate processes and culture.

Figure 16: UN 2030 Agenda for Sustainable Development definitions[59]

Principles of Governance	Planet	People	Prosperity
The definition of governance is evolving as organizations are increasingly expected to define and embed their purpose at the centre of their business. But the principles of agency, accountability and stewardship continue to be vital for truly "good governance".	An ambition to protect the planet from degradation, including through sustainable consumption and production, sustainably managing its natural resources and taking urgent action on climate change, so that it can support the needs of the present and future generations.	An ambition to end poverty and hunger, in all their forms and dimensions, and to ensure that all human beings can fulfil their potential in dignity and equality and in a healthy environment.	An ambition to ensure that all human beings can enjoy prosperous and fulfilling lives and that economic, social and technological progress occurs in harmony with nature.

Source: World Economic Forum, "Toward Common Metrics and Consistent Reporting of Sustainable Value Creation", 2020

Despite these new guidelines for doing business and the consumer demand for companies to do better, there is a lack of clarity on exactly how companies and funds are fulfilling their social and environmental commitments. In the absence of consistent and robust reporting, consumers and investors are unable to reliably evaluate companies based upon their social or environmental impact. In conjunction with the leading accounting firms, the World Economic Forum proposed metrics (under consultation) that could help identify universal disclosures that encourage companies to demonstrate both viability and sustainable business practices (Figure 16). The goal is to establish a more formal, widely accepted international accounting standard for ESG. To date, funding for ESG has increased by 34% since 2016 and has also shown resilience amid the asset price collapse post COVID-19.

Another incentive for "green development" in the energy transition has been the green bond. First issued in 2008 by the World Bank, the green bond defined criteria that were eligible for its support, which helped to provide transparency and confidence for investors who wanted to put their money in a company that was contributing positively to society or reducing its impact on the environment. The issuance of green bonds grew by $255 billion in 2019, but it also has its setbacks.[60] Namely, a major part of fulfilling climate goals by 2020 is the ability to finance decarbonization methods for carbon-intensive industries, such as mining, utilities and transportation, industries that the green bond does not find compliant. By allowing these "brown" industries access to capital, many believe the gap between climate goals and actual progress can be reduced.

For projects that aren't captured through these large funds, bankability continues to be a primary issue, particularly in emerging economies. Regulatory uncertainty, project delays and political or social instability can make it too risky for investors to put money into projects for fear of incompletion or lack of viability. Strong policy and trustworthy institutions can help alleviate these concerns, but robust contract enforcement and a positive investment climate are necessary. As investors develop more trust, both in the projects themselves and the funds that are supporting them, the energy transition will become increasingly more viable.

Capital and investment may be one of the biggest challenges in 2020/2021 given the global upheaval from the COVID-19 pandemic and the financial markets. Facilitating capital into energy projects is critical and can be supported by:

1. Providing defined criteria and transparency for ESG funds and qualifying corporations

2. Ensuring political will and policy stability to improve investor confidence in renewable energy projects in developing countries

3. Broadening financial vehicles to include industries that may not qualify for green bonds but need to offset their carbon emissions

Sharing the burden of decarbonization

By Kenneth Rogoff, Thomas D. Cabot Professor of Public Policy and Professor of Economics, Harvard University, USA

It is hard to imagine any way forward on global warming that does not centrally feature placing a uniform global price on carbon emissions. Global, because today emerging markets account for the lion's share of emissions growth. Uniform, because the cost of carbon emissions is roughly the same no matter what country the source, and having substantially different prices in different countries will lead to widespread distortions. Having a price on carbon is important to incentivize producers and consumers to conserve carbon-intensive activities, and to incentivize innovation and investment. The challenges are many, from developing clear technical standards to persuading rich-country citizens to change their lifestyles.

However, a major piece of any solution has to involve buy-in from emerging markets and developing countries, where emissions growth is greatest (particularly out of Asia) and where energy needs in many quarters are often desperate. In Africa, only 43% of people have access to electricity, versus 87% worldwide. So far, most of the political discussion in advanced economies has focused on how to decarbonize at home without recognizing that this will do little good if pollution continues unabated elsewhere. Indeed, the debate has many parallels to discussions of inequality in most advanced economies, which reflect a legitimate need to achieve greater income equality within rich countries, but pay only cursory attention to the rest of the world, which is by and large vastly poorer. For the inequality debate, the disconnect sometimes seems hypocritical. For dealing with global warming, if rich countries continue to ignore the needs of the rest of the world, it could prove catastrophic.

It is high time to think about building global institutions to help facilitate the necessary transfer of resources and technologies from high-income to low-income countries, and to get serious about how to finance them. There are many possible approaches, but a practical one is to start a World Carbon Bank that will serve both to facilitate transfers, but also house technical expertise, and to provide a platform so that country governments can share experiences and best practices.

From an administrative point of view, I have in mind a framework parallel to the World Bank and International Monetary Fund, with their emphasis on having outstanding technocratic staff and the use of "mission technology", both honed for providing policy advice. Importantly, however, the financing for the World Carbon Bank must come in the form of outright aid and not simply subsidized loans. At the same time, the likely scale of the aid will be far greater than the annual cost of the existing institutions. As for the early projects of a World Carbon Bank, probably none is higher priority than helping sharply scale back the use of coal in Asia.

Phasing out coal is far more challenging for Asia than for Europe and the US, in part because coal plants in advanced economies are already nearing the end of their life cycle and in part because coal is plentiful. Of course, for this reason, carbon capture technologies also have to be a leading option.

Admittedly, the political economy of a World Carbon Bank would be challenging. Rich countries, many in the midst of populist uprisings, need to be persuaded that dramatic changes are needed for future generations. COVID-19 has now forced a reallocation of resources and will likely continue to do so until normalcy is restored. Programmes for aid must be resistant to gaming because countries could exaggerate their plans to build new coal plants. And there is the question of how to transfer new technologies to emerging markets without simply bidding up prices for monopoly innovators, so that in effect most of the financial aid intended for emerging markets ends up in the pockets of wealthy private entrepreneurs. These are challenges but, with thoughtful design, it should be possible to overcome them.

To be clear, eligibility for World Carbon Bank aid would ultimately require that countries buy in to instituting a carbon tax at the global level. Alternative approaches to raising the price of carbon are possible, and it is true that various rationing schemes have proven more politically palatable in domestic politics. However, centuries of experience with international trade agreements underscore that price mechanisms are much more transparent and straightforward to monitor.

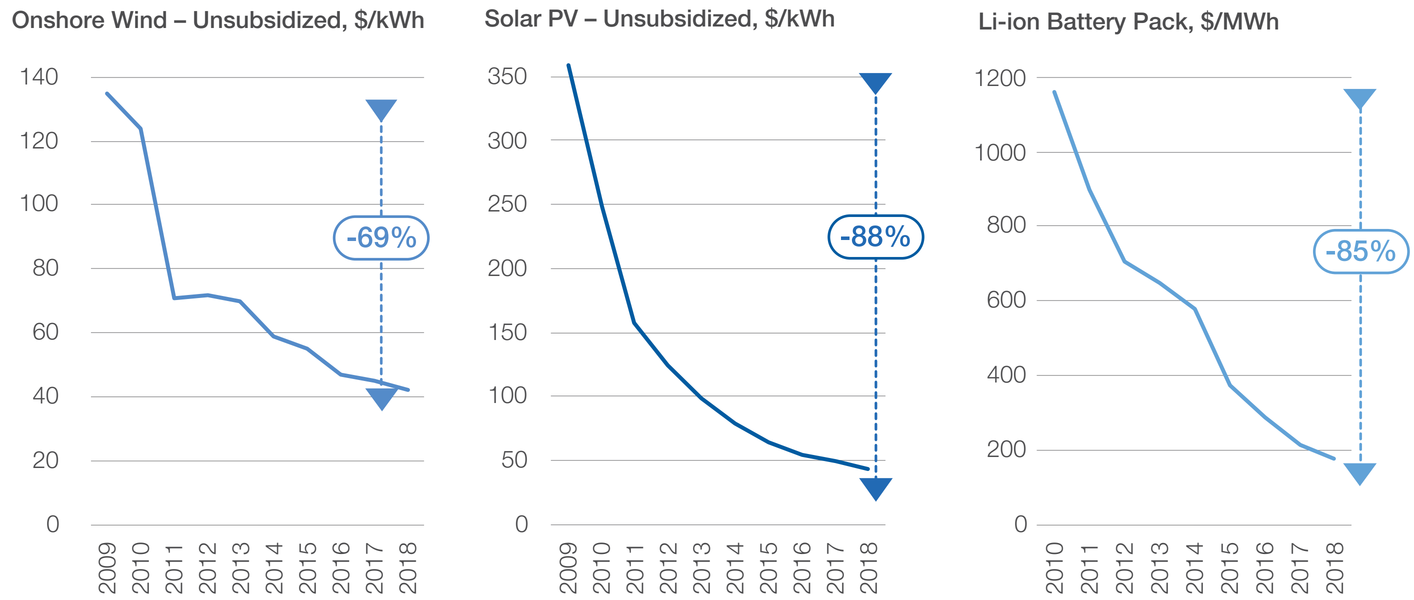
It should be mentioned that Europeans aim to incentivize emerging markets with the stick of a border adjustment tax, imposed on countries that do not institute a carbon tax/price at the European level. This is far from adequate, however, first because it may simply redirect trade and production, but perhaps more importantly because developing countries will likely see this as a trade war. The US and Europe have been responsible for most of the carbon build-up to date and still have far higher carbon emissions per capita. For them to say they will stabilize or slightly reduce their high per capital emissions, but developing countries should just accept that they cannot follow the same energy-intensive development path, is a recipe for unsustainable political frictions. Any plan, including a border tax plan, needs to support carbon-reduction adaptation in emerging markets, and any plan needs a technocratic framework for implementing the politically agreed solution.

There is no single comprehensive solution to global warming, but a global carbon tax is the nearest thing. And it will be meaningless to try to enforce one without enthusiastic participation from major emerging markets such as India and China. A World Carbon Bank is a logical step forward.

5.3 Innovation and infrastructure

Innovation is a prerequisite for change and has been a critical catalyst for the world adopting less carbon-intensive processes in energy, manufacturing and technology. The past three decades have seen significant advances in energy technology. Progress has been particularly strong in the costs and efficiency of solar photovoltaics (PV), onshore wind turbines and lithium-ion batteries (Figure 17). In 2019, global solar capacity was 593 GW[61] and onshore wind capacity reached 650 GW,[62] while energy storage capacity climbed to 175 GW in 2018.[63] While policies have enabled this progress, they are still lagging for hard-to-abate industrial sectors and negative emission technologies.

Figure 17: Levelized cost of energy for onshore wind, solar PV and lithium-ion batteries, 2009-2018



Sources: Lazard, "Levelized Cost of Energy and Levelized Cost of Storage 2018", 8 November 2018, https://www.lazard.com/perspective/levelized-cost-of-energy-and-levelized-cost-of-storage-2018; BloombergNEF, "A Behind the Scenes Take on Lithium-ion Battery Prices", 5 March 2019, https://about.bnef.com/blog/behind-scenes-take-lithium-ion-battery-prices

As an immediate response to the COVID-19 pandemic, governments and businesses have sharply adjusted their near-term priorities to mitigate the economic consequences. There could be immediate consequences for infrastructure development and R&D. Governments are focused on responding to the healthcare crisis through fiscal and monetary measures, ensuring access to essential goods and services, and supporting monetary policy. Similarly, as also seen in the aftermath of the global economic recession of 2008-2009, corporations could either reduce their R&D investments or shift focus to short-term low-risk projects.[64] While the shape of the subsequent economic recovery is being debated,[65] investment in innovation and infrastructure will be an essential catalyst in emerging from the economic crisis. It can be an opportunity to accelerate structural shifts by integrating long-term concerns in short-term policy packages, orienting them towards sectors that offer higher economic and societal returns. This includes investing in green infrastructure, encouraging research and development, and upgrading the skills of workers.[66]

– **Investing in long-term infrastructure during economic crises can be a powerful vehicle to drive further economic development and generate employment**. Inertia from legacy energy infrastructure and the prohibitive costs of modernization have been key barriers to accelerating the energy transition. The lack of sufficient grid capacity and interconnections have led to the curtailment of renewable energy sources in multiple countries, thereby affecting their competitiveness. Similarly, lacking infrastructure for production and distribution is a key constraint in realizing the potential of the hydrogen economy. At the same time, investment in LNG infrastructure can be a catalyst in decarbonizing the power sector, especially in countries where coal continues to be the primary fuel. While the selection of priority areas for energy infrastructure development might differ across countries, the development can help address the objectives of economic recovery, job creation and the energy transition, and help the economy recovery faster and more sustainably.

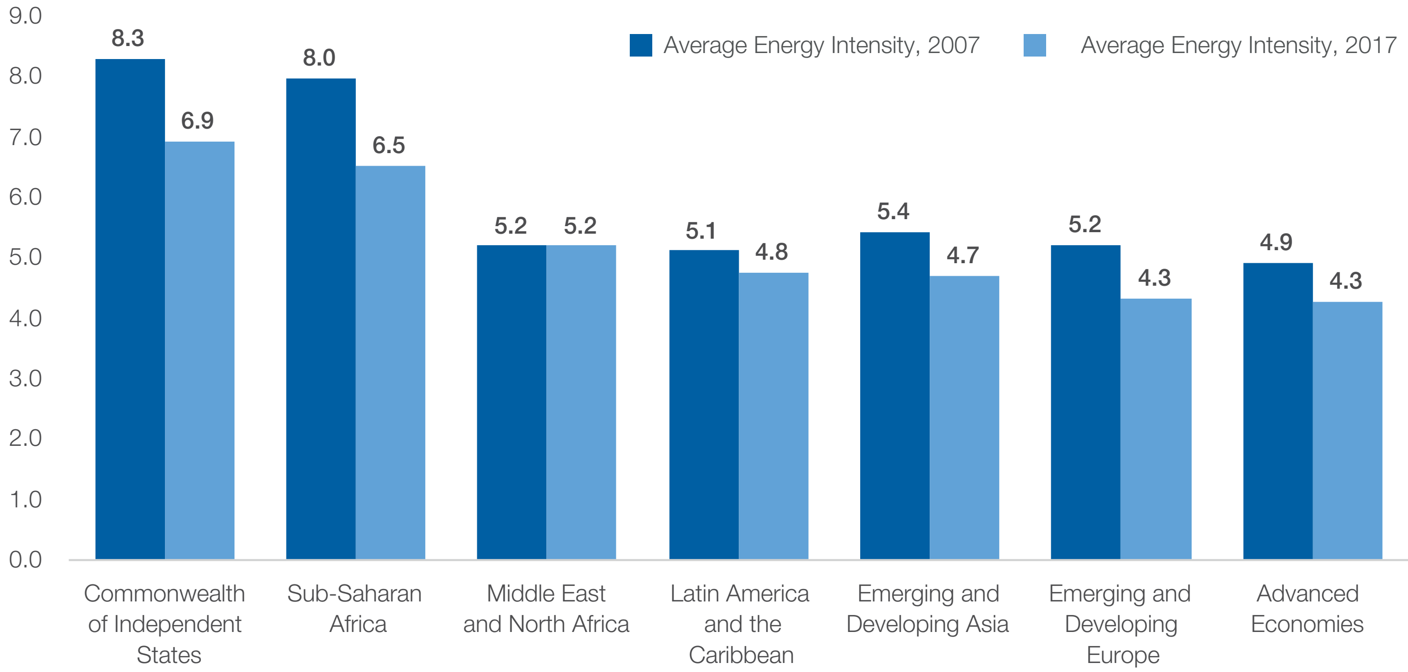
- **The economic rationale is strong for continuing to invest in innovation in the current economic climate.** Evidence from an analysis of public investment in R&D in Germany during the economic crisis of 2008-2009 indicates spillover effects on production, value-add and employment worth twice the initial investment.[67] Moreover, foregone innovation investments have a cumulative effect on the future trajectory, by reducing the pool of future opportunities.[68] While the progress on solar PV, onshore wind and energy storage have been remarkable over the past decade (Figure 17), a wide array of technologies will need to be matured at a faster rate. Deploying public R&D investments into ideas that appear to be moonshots given the current state of R&D, such as nuclear fusion, advanced energy storage chemistries and large-scale economical solutions for hard-to-abate sectors (heating, aviation, shipping, heavy industries), can deliver high innovation dividends.

- **Human capital development** is **necessary to reap the innovation dividend.** The economic shock from the COVID-19 pandemic and resulting energy market fluctuations have already led to large-scale lay-offs. The availability of trained workers is critical for energy transition, especially in areas requiring high-skilled talent such as R&D in energy technology. Effects on R&D investment during times of economic crisis can weaken the availability of talent for future R&D activities, and exposure to long-term unemployment can lead to the gradual depletion of skills due to low exposure to technology. This is also relevant for emerging economies, where technology transfer is a key component in the development and diffusion of new technologies. Countries with higher human capital have been able to maximize the spillover effects of technology transfer and foreign investment in clean energy R&D.

5.4 Economic structure

The energy intensity of countries, a measure of the ability of an economy to convert energy units used into GDP, depends on income levels, industrial structure, efficiency standards, urbanization, etc. In 2016, on average, a 1% increase in GDP per capita was accompanied by a 0.7% increase in per capita primary energy supply.[69] Decoupling economic growth from energy consumption, and hence from carbon emissions from fuel combustion, has been an ambitious policy goal. Reducing energy intensity is key in a country's decarbonization strategy as it means that economic growth is met through less energy-intensive activities which, in turn, results in less emissions from the energy system (assuming a certain carbon intensity of energy consumption/production).

Figure 18: Average energy intensity (GJ/$GDP PPP, 2011) for regional clusters, 2007 and 2017

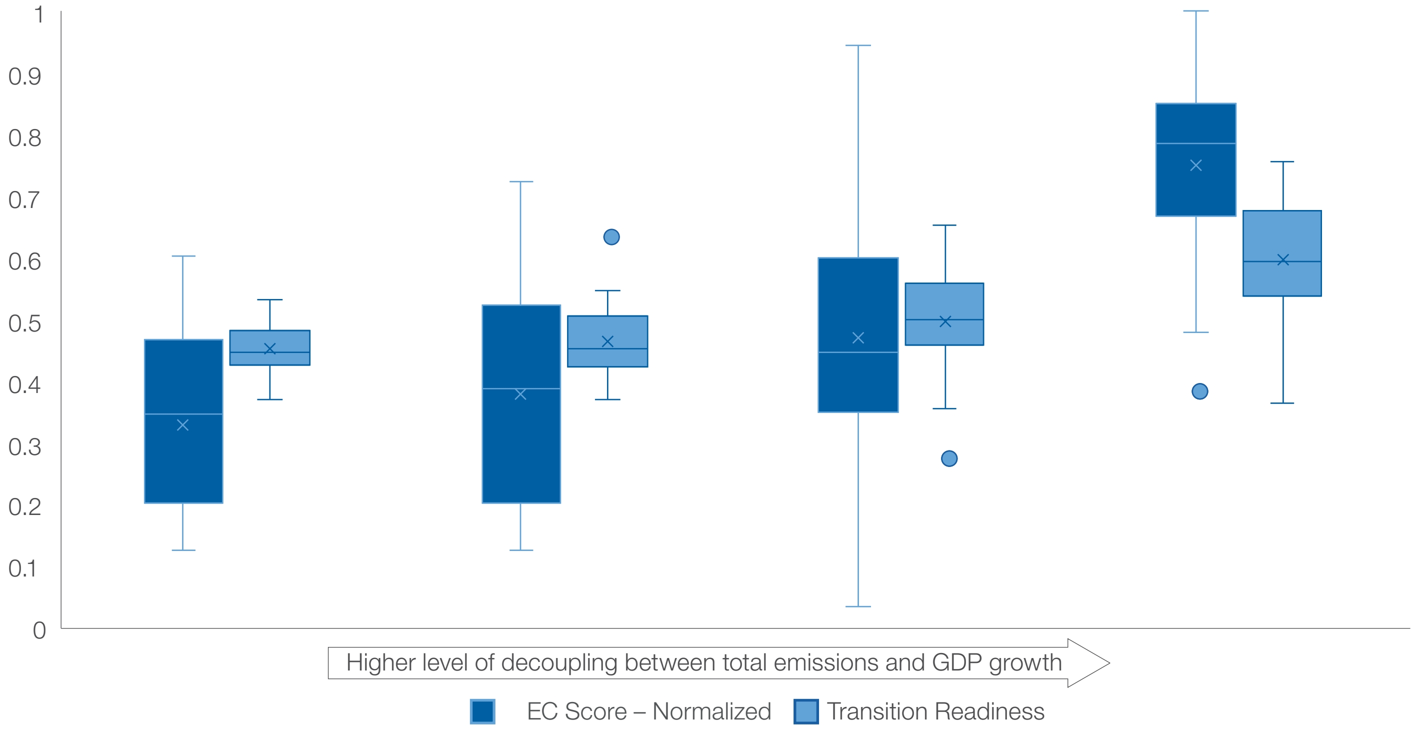


Source: IEA, *World Energy Balances 2019*

Figure 18 shows the average energy intensity for the 115 countries in the ETI, by regional classification. Some high-income countries have managed to decouple the energy consumption and total carbon emissions from economic growth, by shifting the structure of their energy system and the economy as a whole. Transforming the structure of the energy system requires a mix of supply- and demand-side interventions, to shift the installed base of technologies in energy production and final demand towards low-carbon alternatives. On the other hand, shifts in the economic structure imply diversifying economic activities to reduce dependence on fossil fuels and changing the composition of a country's productive output to higher value-add and complex sectors. Complex economies generate a larger share of GDP from knowledge-intensive products, characterized by sophistication and specialization. **While an increase in economic complexity leads to a short-term increase in emissions, evidence from multiple countries shows a decline in emissions in the long run.**[70] Moreover, a higher level of economic complexity is also associated with lower levels of unemployment.[71] This is particularly relevant for emerging economies, where energy-intensive sectors like agriculture and extractives employ significant portions of the workforce, and economic growth relies to a large extent on the demand for consumer goods in developed economies. Notwithstanding the importance of basic activities to produce essential items, substantial productivity and efficiency gains can help emerging economies transition to higher complexity activities.

– **Countries with higher levels of economic complexity are better prepared for the energy transition.** Figure 19 illustrates that a higher level of decoupling between emissions and economic growth[72] is associated with both a higher degree of economic complexity[73] and transition readiness (as measured in the ETI). The capabilities leading to increasing levels of economic complexity in countries are largely similar to the enablers for energy transition, indicating the synergies between structural economic transformation and effective energy transition. In addition to the traditional economic growth model with capital and labour inputs, structural transformation can be accelerated though capabilities such as human capital development, physical and digital infrastructure, and a robust institutional framework with rule of law, property rights, etc.[74]

Figure 19: Transition readiness and economic complexity index scores vs level of decoupling of emissions and GDP growth



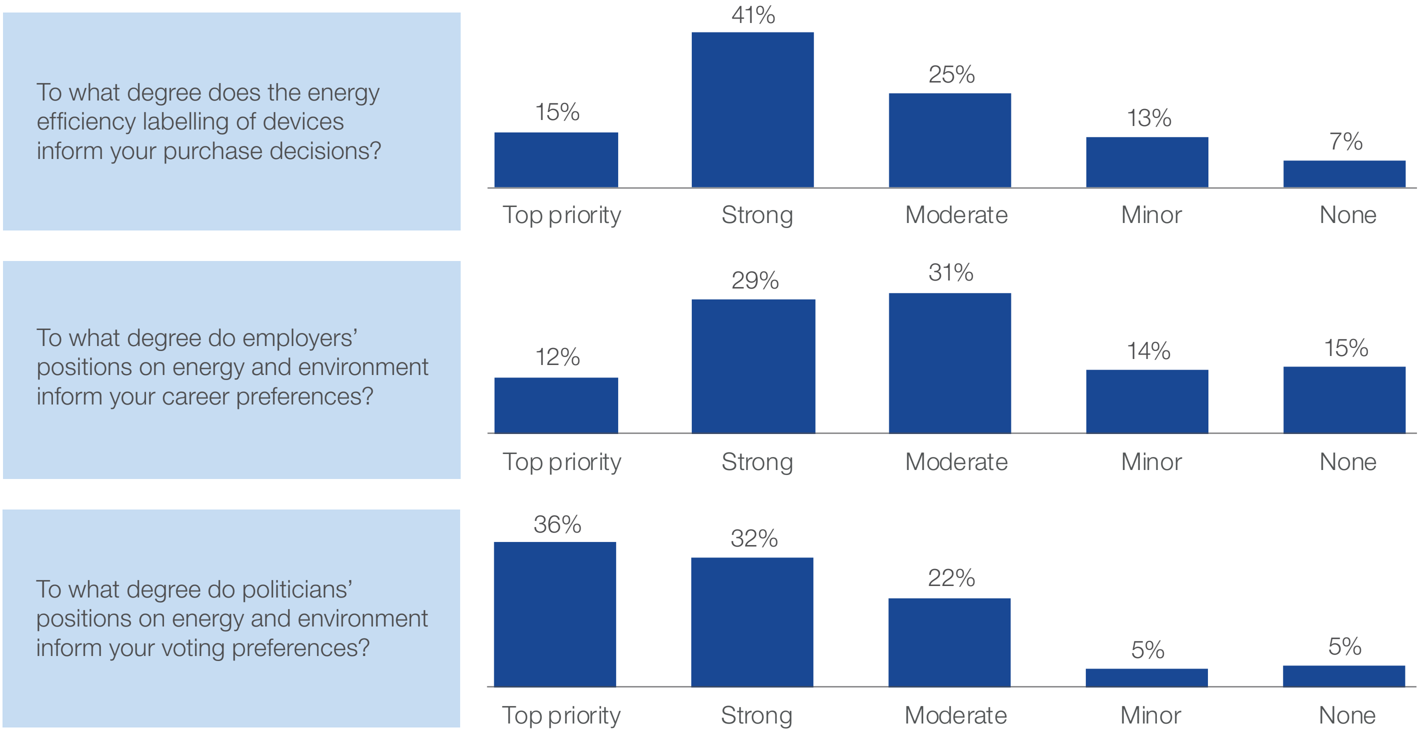
Sources: Economic complexity from the Atlas of Economic Complexity, Harvard University, https://atlas.cid.harvard.edu/, and Transition Readiness from the World Economic Forum

– **The Fourth Industrial Revolution offers countries an opportunity to leapfrog into economic growth while achieving productivity gains, but urgent measures must be taken**. Emerging growth areas such as in artificial intelligence and the internet of things are not widespread, especially in developing countries. Considering the future economic growth potential and the necessary economic transformation in emerging economies to achieve energy transition and climate change mitigation, new international cooperation mechanisms are required (e.g. technology transfer, capacity building, etc.) to accelerate the progress of the Fourth Industrial Revolution.

5.5 Consumer engagement

Effectively engaging society on the energy transition requires careful consideration on two key aspects. First, energy transition can exacerbate existing socio-economic inequalities, unless the costs and benefits of policies and regulations are distributed appropriately. The recent spike in protests in many countries against fuel price hikes or different forms of carbon taxes underscores the importance of consumer acceptance for these types of policies. The COVID-19 pandemic is an example of the disproportionate risks from systemic shocks to vulnerable segments of society; people unable to work remotely, dependent on public transportation or living in high occupancy dwellings have been at higher risk of contagion. The relative economic cost is also higher for workers in the informal sectors. Second, given the ubiquity of energy consumption in products and services used in daily life, decisions made by end-consumers are critical for the success of any country's energy transition strategy. As with most habits, customs or lifestyles, a behavioural "lock-in" can be hard to counteract when environments need to change. The COVID-19 pandemic, despite being a human and economic tragedy, has resulted in sharp decreases in emissions from industrial activity and transportation. However, experience from previous systemic shocks, such as the financial crisis of 2008 and the oil embargo of the 1970s, indicates that emissions tend to spike in the aftermath, as industrial activity regains normalcy. Sustained behavioural transformation could offer a silver lining, as remote working arrangements might gain popularity, high-emission long-distance travelling could reduce drastically, and people may choose to prioritize responsible consumption in terms of both quality and quantity.

Figure 20: Selected survey responses from "Youth Perspectives on Energy Transition" (n = 150)



Source: World Economic Forum

- **Youth perspectives on energy transition strongly favour faster and decisive action**. A survey conducted among the World Economic Forum's Global Shapers community, comprised primarily of students and young professionals from across the world between the ages of 18 and 30, revealed that most of the respondents favour the strong prioritization of energy and environmental issues in decision-making. More than half reported prospective politicians' positions on energy and environment as a top or strong priority in voting decisions (Figure 20). Other aspects of individual decision-making such as career choices and purchasing decisions exhibit similar trends, though to a lesser degree. This is consistent with the rapid escalation of climate change activism worldwide among youths.

- **Easy access to understandable information on carbon footprints can drive consumer participation**. Energy efficiency labelling on appliances has been a key factor in accelerating innovation and the adoption of more efficient alternatives, especially in daily use appliances such as electric bulbs, refrigerators and air conditioners. Similarly, given the energy footprints across a wide range of consumer products, the uniform labelling of products based on their energy or environmental footprints can be instrumental in accelerating the adoption of sustainable and efficient alternatives, while creating growth opportunities for more sustainable products and brands. Although not an easy task given the challenges to adopt consistent carbon intensity measurement and reporting mechanisms, and the political components in international trade, research suggests that providing information on footprints that is easy to convey and understand is an effective tool. It serves as a reminder to consumers of their values and preferences when making purchasing decisions, prompting them to make choices more consistent with their values.[75] Specifically, labelling with additional information on durability and reparability for consumer durables could be a key driver in promoting the circular economy.

- **Consistent, transparent and fact-based communication is necessary to engage all stakeholders in an effective energy transition**. Keeping the members of the public well informed and educated about the energy transition is critical to secure their buy-in and engagement. However, there are conflicting narratives on the progress of the energy transition[76] depending on the choice of metrics, starting points, timelines, etc. As decision-makers consider these narratives to determine the efficacy of current actions and prioritize next steps, the discourse can be self-fulfilling. The experience of the COVID-19 pandemic emphasizes the importance of heeding scientific evidence at the right time, to avoid the risks from delayed actions. Only through a fact-based exchange can stakeholders identify the right destination, imperatives and enablers of the energy transition.

Political support for the energy transition

By David Victor, Professor, University of California, San Diego (UCSD), USA

Consumer acceptance is essential to sustainable energy transitions, especially in these hard economic times caused by the global pandemic. Consumers, of course, ultimately pay for whatever happens in the energy system. They are also constituents whose interests – reflected in many ways from voting to protest to other forms of political support and opposition — shape what is feasible. For too long, analysts have been imagining clever energy transitions that can solve many problems of environmental sustainability, such as climate change and water scarcity, without paying enough attention to political sustainability. Consumers sit at the centre of that political equation.

One thing that is clear about consumer behaviour is that people are often highly sensitive to visible changes in price. That's particularly evident in the politics of fuel pricing, which can be treacherous. Even as political leaders have found multiple ways of adopting costly policies in many sectors of the economy, anything that conspicuously raises fuel prices must be treated with political caution. The "yellow vests" movement in France is but one example. Fuel riots in Iran and consumer pressure against climate policies in the United States are others.

In all these cases, consumer reactions are a blend of many different factors — the yellow vests movement, for example, isn't simply about the cost of a carbon tax but also about the cost of living in rural areas and the peripheral feeling of being left behind while elites at the centre, in Paris, push the country in new directions. But the fact that fuel prices become the weapon for protest makes politicians skittish, and that makes politically sustainable energy transitions hard to organize.

This political wariness of creating visible costs from policy has been particularly evident to reformers of fossil fuel subsidies. For decades it has been known that subsidy reform is one of the most cost-effective ways to reduce emissions and get market signals aligned in energy markets. For decades, politicians have learned that subsidy reform is hard – in part because special interests are tightly co-mingled with consumer wariness about change. Working with a team of experts from the World Bank, leading economist Gabriela Inchauste and I published a study in 2017 that looked closely and systematically at the politics of subsidy reform and found that successful reform strategies require politically strategic choices. They must figure out which interest groups can be taken on and also how to keep broad public acceptance of reform. Reform, nearly always, is not across-the-board following elegant, simple principles of economic policy design, but a kind of sausage-making that must navigate political obstacles and create political allies.

Lurking in all this are important matters of justice. Subsidies and other forms of price controls are often cloaked in the logic that they help the poor. (Gabriela and I found that, for the most part, these subsidies benefit richer consumers.)

Often those who pay the most have a hard time organizing and expressing their political voice, which is why careful attention to consumer impacts is so important. The political system, on its own, won't ensure a just transition. Many elements of the energy transition that are most exciting and urgent, such as deep decarbonization and the creation of distributed prosumers around power grids, are unlikely to be free or even cheap. Policies that can make the energy transition align with the goals of social justice will have many dimensions, including worker retraining and re-employment. At the centre, however, will be active policies to manage the cost impacts on consumers who are the least well off economically.

Technology will be pivotal. On the one hand, technological change has made it easier to segment markets and to tailor services exactly to the people who can pay. Those innovations have the potential to erode the social contract that has guided much of modern energy supplies — for example, the idea that every household should have access to a reliable power grid at reasonable cost. On the other hand, technologies such as smart cards and modern control systems have made it easier to target the benefits of subsidies and other energy policies to the households that need them most. Technology and markets, on their own, won't ensure a just transition.

On every front, then, policy is essential to steering the energy transition. In a global economic crisis, with lots of potential for massive reform and restructuring, it is particularly important to focus on how policies affect consumers and what they are willing to support politically. It can help ensure that energy transitions are just and reasonable — and effective at delivering what society wants from its energy systems.

> **"For too long, analysts have been imagining clever energy transitions that can solve many problems of environmental sustainability, such as climate change and water scarcity, without paying enough attention to political sustainability. Consumers sit at the centre of that political equation."**

6. Conclusion

The ETI 2020 analysis indicates gradual progress on the energy transition over the past six years. A majority of countries have made varying degrees of progress on the three dimensions of the energy triangle: economic development and growth, environmental sustainability, and energy access and security. The lack of consistent progress in many countries, however, highlights the challenges in navigating the complexity of the energy transition. The gaps between the top performers and the rest have been steadily decreasing, mainly due to rising levels of political commitment and improving access to capital for investment in emerging economies. This also highlights the need for transformative and breakthrough solutions to unlock the next wave of substantial gains for advanced economies.

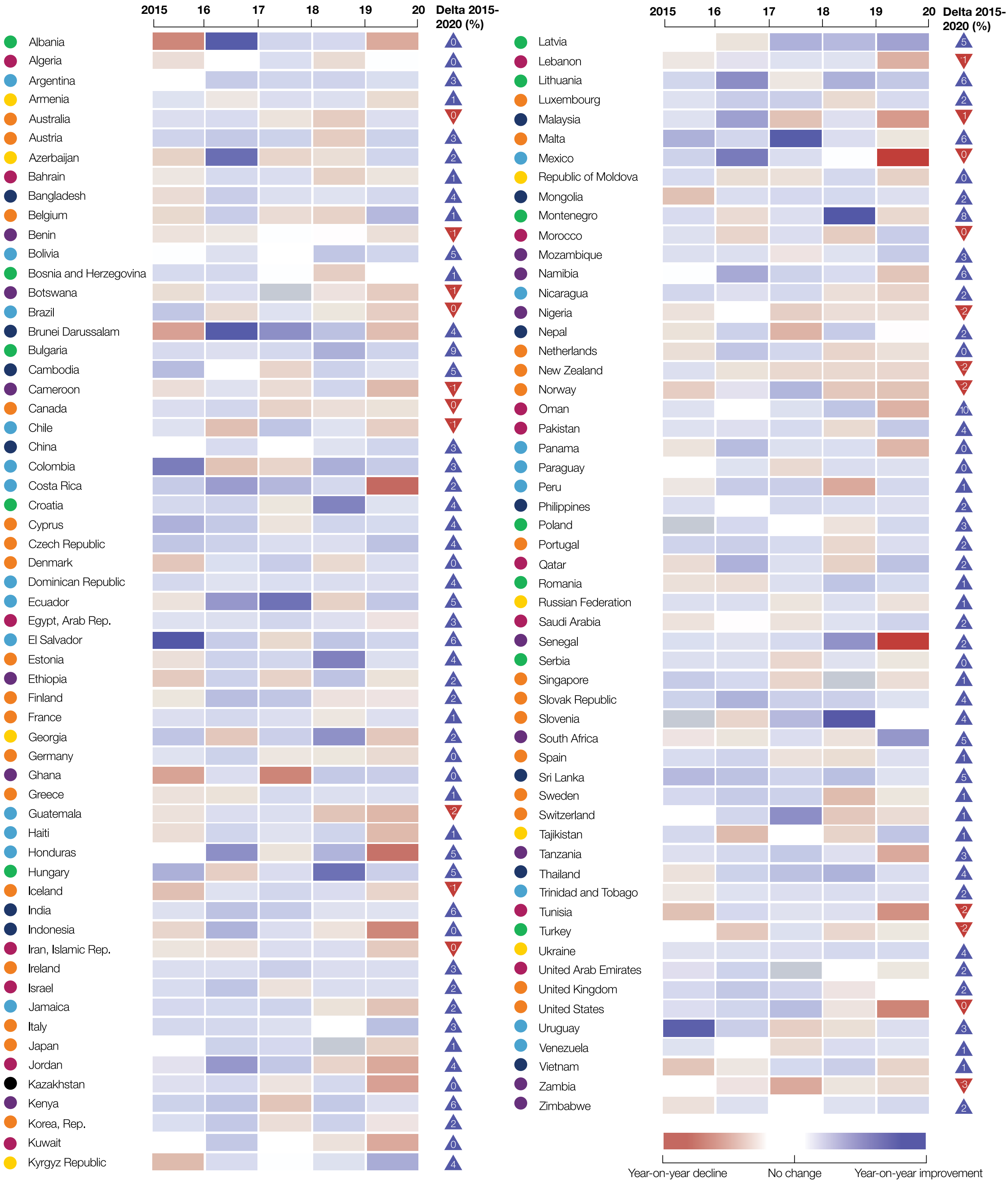
Going forward, new challenges are likely to emerge on the economic development and growth pillar of the energy triangle. Apart from budgetary implications on oil exporting countries, the low energy price environment could lead to constraints on investment and R&D, potentially affecting the pipeline of new technologies necessary for the energy transition. Energy access and security, despite being the pillar with higher scores and progress, is being tested from the widespread and frequent disruptions caused by extreme weather events. The rapidly unfolding repercussions of the COVID-19 pandemic across the energy system illustrate the need for resilience – not just in physical infrastructure and cyberspace – but also in energy transition policies, roadmaps and international cooperation mechanisms.

The energy system has strong forward and backward linkages in a modern economy, and shocks in the energy demand and supply outlook will create ripple effects across the interlinked industries and services. With the current uncertain short-term outlook, the imperatives highlighted in this report can help create the right fundamentals for accelerated recovery. While certain industries or countries might stand to gain in the short term from a low energy price environment, efforts towards the long-term goal of a transition to a sustainable, secure, affordable and inclusive future energy system should be maintained.

As countries act to control the economic and social consequences of COVID-19, the situation today could provide an opportunity to leapfrog into the energy transition. Applying economic stimulus to areas such as energy infrastructure modernization, research and development, and human capital development can deliver long-term sustainable economic growth, while also achieving step change in the energy transition. Policy-makers, private-sector entities, civil society groups and consumers will play a critical role in this process – highlighting the importance of a common understanding of the priorities among all stakeholder groups, and increased multistakeholder collaboration at the national, regional and global levels.

Appendices

1. Annual Energy Transition Index score differences, 2015-2020



- Advanced Economies
- Commonwealth of Independent States
- Emerging and Developing Asia
- Emerging and Developing Europe
- Latin America and the Caribbean
- Middle East, North Africa and Pakistan
- Sub-Saharan Africa

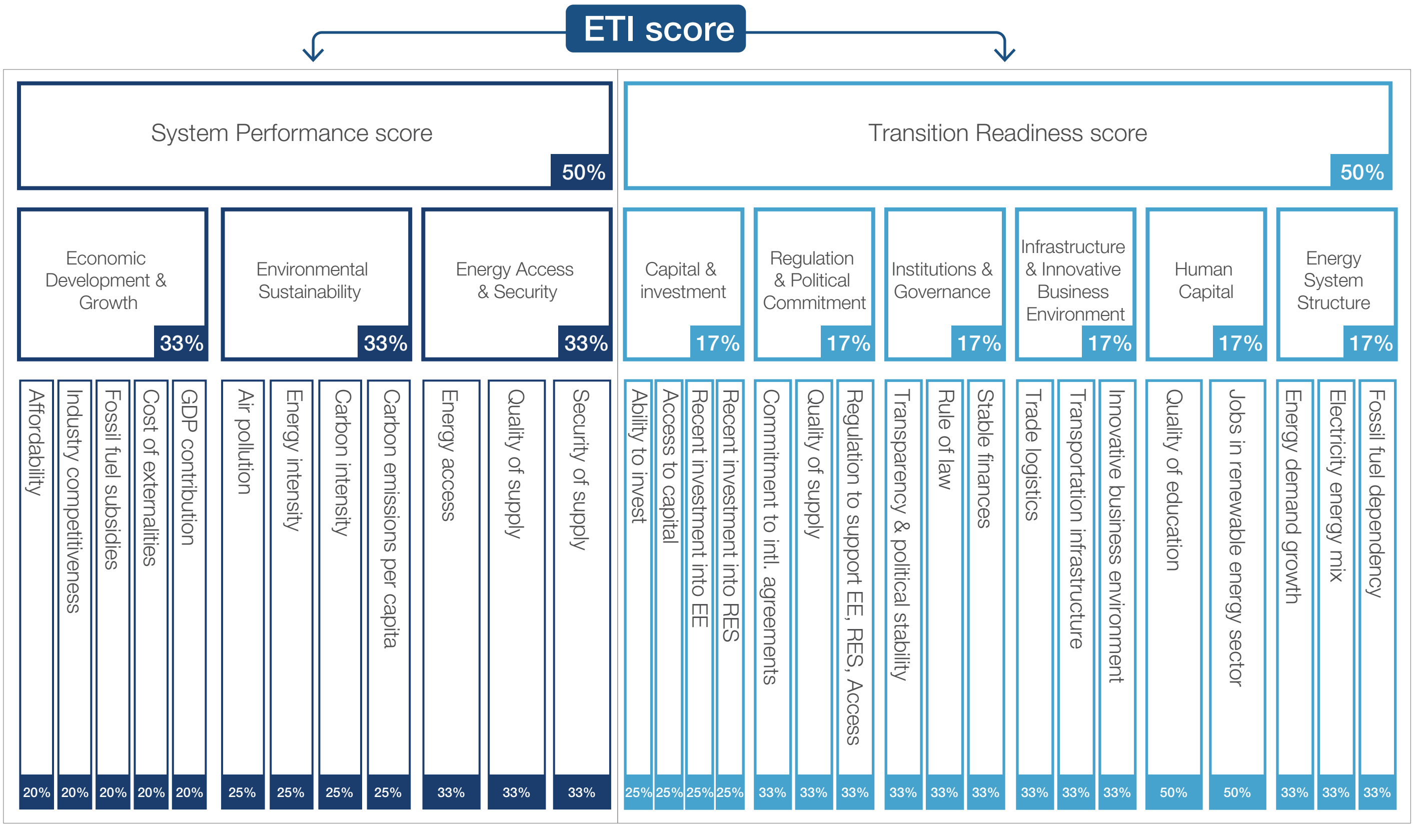
Note: The Energy Transition Index benchmarks countries on the performance of their energy system, as well as their readiness for transition to a secure, sustainable, affordable, and reliable future energy system. ETI 2020 scores on a scale of 0 - 100.

Source: World Economic Forum

2. Methodology

The framework for the ETI, the classification of indicators in dimensions and their respective weights are summarized in Figure 21:

Figure 21: Energy Transition Index dimensions and variables



Details on the selection, aggregation and normalization of indicator data and the data sources can be found in Singh et al., “The energy transitions index: An analytic framework for understanding the evolving global energy system”, *Energy Strategy Reviews*, vol. 26, 2019.
Source: World Economic Forum

Addendums on the methodology

– The indicators for ETI 2020 represent the trends leading up to (and including) 2019. Time lags differ across indicators, given that the ETI sources data from more than 20 international data providers. For the trend analysis, ETI composite and dimension scores were back-casted for the consistent group of 115 countries. Countries with more than a threshold number of missing indicators in a dimension were excluded.

– Historical data for some indicators was revised at the source (e.g. the PM2.5 data published by the World Bank). In such cases, historical scores and rankings were recalculated with updated data for the trend analysis.

– The availability of technology indicator in the infrastructure and innovative business environment dimension was dropped due to the unavailability of updated data, and the indicator weight was redistributed among the remaining indicators in the dimension on infrastructure and innovative business environment.

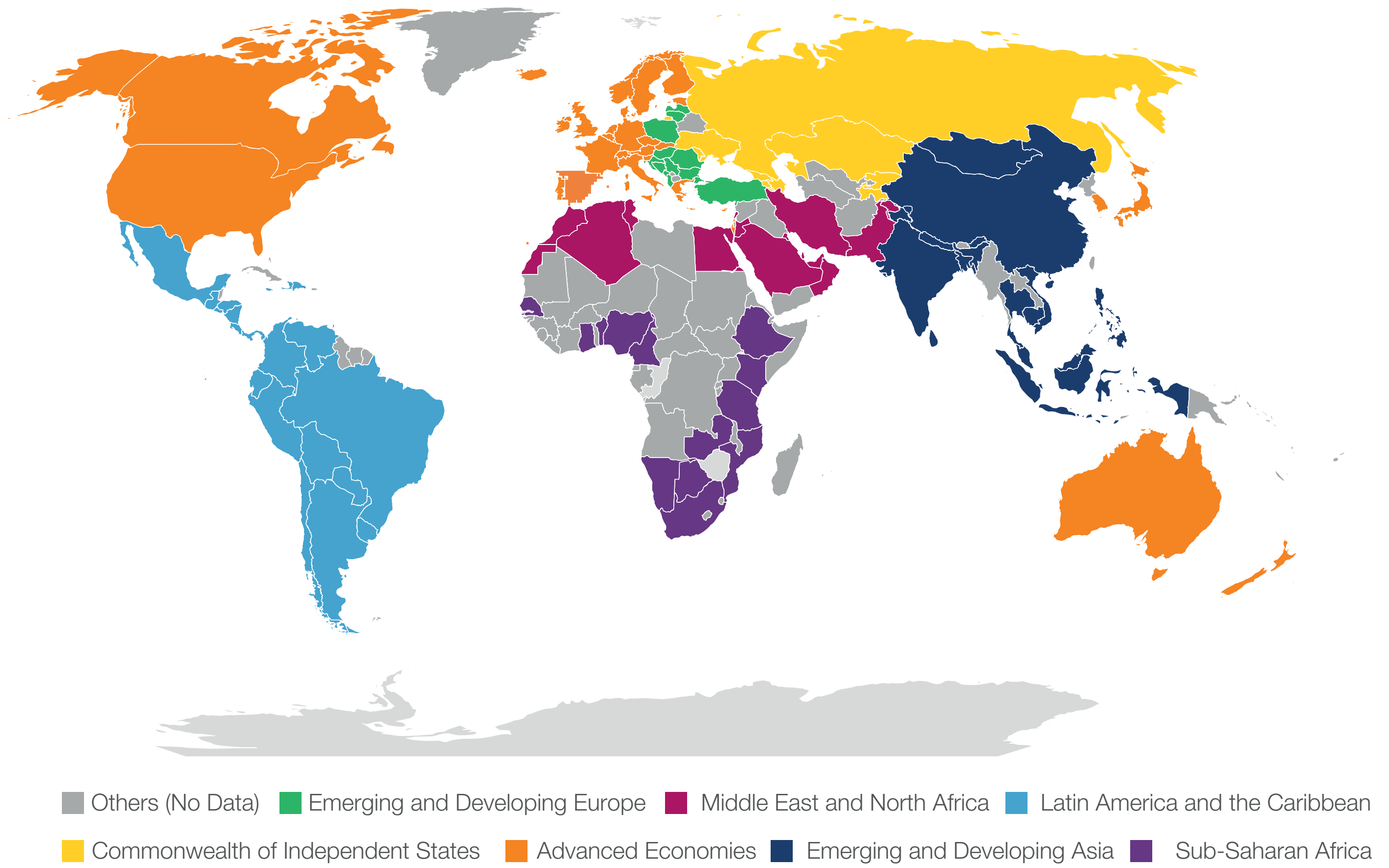
– Indicators are arithmetically scaled between minimum and maximum threshold values and standardized on a scale of 0 to 100 for aggregation, with the exception of certain highly volatile variables. The following variables were transformed to control their sensitivity in the composite scores, while maintaining the effect of their direction and magnitude in the comparative analysis across countries:

  - Cost of externalities (as % of GDP): Logarithmic transformation
  - New renewable capacity addition (as % of total power generation capacity) and jobs in clean energy (as % of total labour force): Previous year scores + 0.1 x (current year score - previous year score)

– Change in data source:

  - Access to clean cooking fuel: Tracking SDG7, The Energy Progress Report – Downloads – Datasets – “Section 7.1.2 Clean Fuels and Technologies for Cooking Dataset” (Source: World Health Organization 2018), https://trackingsdg7.esmap.org/downloads
  - Share of renewable energy sources in power generation: IEA, *World Energy Balances 2019*, https://www.iea.org/reports/world-energy-balances-2019
  - Share of coal in power generation: IEA, *World Energy Balances 2019*
  - Share of hydroelectricity in power generation: IEA, *World Energy Balances 2019*

3. Regional classification



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Source: World Economic Forum

Contributors

Data partners

Climate Action Tracker, Enerdata, Fitch Ratings, Heritage Foundation, International Energy Agency, International Gas Union, International Monetary Fund, International Renewable Energy Agency, Moody's, PBL Netherlands Environmental Assessment Agency, Standard & Poor's, Transparency International, UN SEforALL, UN Statistics Division and UNCTADstat, World Bank Group, World Health Organization, World Trade Organization

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