

# Clean Energy Transitions Programme (CETP)



Annual Report 2018



March  

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2019



## Message from the Executive Director

At our 2017 International Energy Agency (IEA) Ministerial Meeting, a new “IEA family” emerged that is truly representative of global energy. This new IEA family of countries now accounts for over 75% of global energy use, up from 40% in 2015. At the same time, the Chair’s Summary from the 2017 Ministerial noted the “overarching sentiment [that] energy transitions are driving forces for increased economic growth, enhancing energy security, promoting robust and resilient energy systems as well as benefiting local environmental and global climate objectives.”

It was perfectly natural then that – on the margins of the 2017 Ministerial – the IEA launched our Clean Energy Transitions Programme (CETP) to accelerate global energy transitions, to help fulfil our 2017 Ministerial Mandates and to strengthen our overall IEA family.

Today, as the CETP completes an impactful inaugural year (which is detailed in full in this report), we look back with pride at the strengthened partnerships and concrete results with India, the People’s Republic of China, Indonesia, Brazil, Mexico and South Africa, among others. Along with providing cutting-edge technical support to major emerging economies, the CETP is producing tangible benefits for the entire IEA family through improved global data, closer strategic and technical co-operation, and a stronger multilateral platform to learn from one another.

Our CETP efforts would not have been possible without the leadership of the 13 IEA supporting Members – the United Kingdom, Sweden, Denmark, Germany, the European Commission, the Netherlands, Switzerland, Canada, Japan, Italy, Finland, New Zealand and Australia. Your trust, leadership and partnership are giving the IEA an unprecedented opportunity to help accelerate global energy transitions and to strengthen the IEA family, all at the same time. And we are doing our best within the IEA Secretariat to ensure the greatest impact possible, and that our efforts are both effective and efficient.

As the CETP moves into its second year, we will continue leveraging our Agency’s full capabilities and strengths. During 2019, additional support from our IEA Members will allow us to further increase our engagement with existing priority countries as well as to support new clean energy transitions efforts in Africa and Southeast Asia. We also look forward to further strengthening partnerships with a wide variety of multilateral organisations and bilateral work programmes.

Thank you again to all of our supporters and partners for giving us this unique opportunity for the IEA to better play a global role in helping to reduce carbon emissions and air pollution, to ensure universal access to energy, and to improve lives and livelihoods. We are always eager to receive additional suggestions for how we can play an even more impactful role going forward. Please send us your feedback at [cetp@iea.org](mailto:cetp@iea.org).



## Acknowledgements

The CETP would not have been possible without both the partnership of our priority countries and regions, and the support of 13 IEA Member governments – the United Kingdom, Sweden, Denmark, Germany, the European Commission, the Netherlands, Switzerland, Canada, Japan, Italy, Finland, New Zealand, and Australia. Thank you all for your leadership and partnership.

This *CETP Annual Report 2018* was prepared by the Programme's co-ordination team (César Arreola, Suzanne Sansade, Megha Sud and Emi Bertoli) within the Strategic Initiatives Office, led by Dave Turk. Inputs were provided by a wide number of colleagues working throughout the IEA on CETP efforts. In particular, the CETP co-ordination team would like to thank all work stream leaders and their respective teams: Duncan Millard (data and statistics); Brian Motherway and Mel Slade (energy efficiency); Paolo Frankl and Simon Mueller (electricity); Laura Cozzi, Aad van Bohemen, Andrew Prag and Sara Moarif (policy advice and modelling); Timur Guel (sectoral work); Simone Landolina and Simon Bennett (innovation); and Aya Yoshida and Rebecca Gaghen (global relations).

Top IEA leadership has guided efforts under the CETP throughout – Fatih Birol (Executive Director); Paul Simons (Deputy Executive Director); Keisuke Sadamori (Director of Energy Security and Markets); Mechthild Worsdorfer (Director of Sustainability, Technology and Outlooks); and Claire Bouteille (Chief Management Officer). Special thanks are also due to colleagues in the IEA Corporate Services who have provided support to the CETP, notably, Jeremy Lagelee, Ruth Fishwick, Yvonne Ozoux and Nathalie Collin.

# Table of contents

<b>Executive summary</b> .....	<b>5</b>
CETP origin and approach .....	5
CETP highlights from 2018 .....	5
Support and structure of CETP .....	6
Report's purposes .....	7
Conclusion.....	7
<b>Overview of the Clean Energy Transitions Programme</b> .....	<b>8</b>
Set-up .....	8
Work stream highlights in 2018.....	8
Governance .....	10
Work with major emerging economies .....	11
CETP pillars .....	13
CETP efforts in 2019 and beyond .....	16
Additional IEA resources .....	20
<b>Main 2018 activities by country</b> .....	<b>21</b>
Brazil .....	22
China.....	27
India .....	35
Indonesia.....	45
Mexico .....	50
South Africa .....	56
Global activities .....	60
Regional activities .....	65
<b>References</b> .....	<b>70</b>
<b>Abbreviations and acronyms</b> .....	<b>71</b>

## List of figures

Figure 1.	Governance of the CETP across the IEA Secretariat .....	10
Figure 2.	CO <sub>2</sub> emissions from fuel combustion under the New Policies Scenario: 2017 versus 2040 .....	11
Figure 3.	2018 CETP activities by work stream.....	12
Figure 4.	2018 CETP activities by geographic scope.....	13
Figure 5.	2018 and 2019 expected CETP activities by work stream.....	17
Figure 6.	Decomposition of the six major emerging economies' final energy use, 2000-17 (left) and sectoral contribution to efficiency gains (right) .....	31
Figure 7.	Installed capacity (left) and electricity generation (right) of selected regions, 2000/2017 .....	32
Figure 8.	Average solar and wind sanctioned project sizes have increased .....	41
Figure 9.	Installed capacity by source in India in the NPS .....	42
Figure 10.	Energy savings by sector in Mexico, Efficient World Scenario versus NPS*.....	53
Figure 11.	Growth in energy demand and income per capita in G20 countries .....	62
Figure 12.	Energy intensity of different transport modes.....	64
Figure 13.	Select countries (including Thailand), regions and states listed by VRE penetration and integration phase, 2016 .....	68
Figure 14.	World electricity consumption for space cooling in the Baseline and Efficient Cooling Scenarios and energy savings in 2050 by country/region .....	68

## List of boxes

Highlights of 2018 CETP activities in Brazil .....	22
Highlights of 2018 CETP activities in China .....	27
Highlights of 2018 CETP activities in India.....	35
Highlights of 2018 CETP activities in Indonesia .....	45
Highlights of 2018 CETP activities in Mexico .....	50
Highlights of 2018 CETP activities in South Africa .....	56

## List of tables

Table 1.	Key statistics from Brazil .....	23
Table 2.	Key statistics from China .....	28
Table 3.	Key statistics from India .....	36
Table 4.	Key statistics from Indonesia .....	46
Table 5.	Key statistics from Mexico .....	51
Table 6.	Key statistics from South Africa .....	57

## Executive summary

Launched in November 2017, the IEA Clean Energy Transitions Programme (CETP) is an ambitious effort to accelerate global clean energy transitions. The programme provides independent, cutting-edge support to governments whose energy policies will significantly influence the prospects for – and the speed of – the global transition towards more sustainable energy production and use.

Priority countries include Brazil, the People’s Republic of China (hereafter, “China”), India, Indonesia, Mexico and South Africa, as well as other IEA Association countries and key regions such as Southeast Asia, Latin America and Africa. Year 1 (2018) not only experienced a series of meaningful and ambitious successes (outlined throughout this report), but it also underscored the even greater potential for real-world impact in 2019 and beyond.

### CETP origin and approach

The CETP aims to more fully leverage the IEA’s all-of-technologies expertise – built up over 40-plus years – to help reduce global greenhouse gas (GHG) emissions, achieve universal access to electricity and substantially reduce air pollution. Specific areas of focus were chosen in a disciplined manner – in other words, where does the IEA have strengths and capabilities that can materially make a difference in the real world? Six work streams were prioritised: i) data and statistics; ii) energy efficiency; iii) electricity; iv) policy advice and modelling; v) sectoral work; and vi) innovation.

Specific work programmes were created by iterative consultations with each priority country. The IEA was able to build upon long-standing relationships (including at the minister level and above) and to listen to what key challenges each country is facing in its own clean energy transitions. The IEA’s independent and credible all-of-energy expertise has particularly resonated.

### CETP highlights from 2018

Key successes for CETP efforts in its inaugural year include more than 2 500 people trained; more than 20 high-level exchanges (ministers and other high-level decision makers); 22 major analyses conducted or enhanced by CETP; and a wide variety of ambitious, real-world impact, including:

- **Brazil** – informing policy discussions by sharing global experiences on national energy efficiency auctions, market tools and policy design; efforts to assess the impact of a growing share of variable renewables on energy planning and procurement; and an emerging effort on energy innovation.
- **China** – a thorough review of power sector reform (including publication of a major report in October 2018); expanding collaboration on China’s emissions trading system (ETS), especially the interaction of the ETS with complementary energy and climate policies; efforts to inform China’s long-term energy transitions strategy; and extensive training in energy efficiency and renewables statistics.
- **India** – extensive collaboration and trainings to improve energy data (involving more than 14 government agencies and 20 of 29 Indian states); a first-ever Energy Efficiency

in Emerging Economies Training Week in India (involving 106 officials from 22 state governments and think tanks); tracking and mapping of energy innovation investment and policies across all key ministries; four regional workshops on power system transformation involving 185 energy professionals; joint analysis with an Indian think tank on clean energy investment and financing trends; and groundwork for an in-depth review (IDR) of India's energy policies.

- **Indonesia** – strengthening the framework of energy efficiency policies, with a focus on the industry sector; extensive efforts with the Data and Information Centre (PUSDATIN) and others in the Ministry of Energy and Mineral Resources (MEMR) to improve data quality and coverage; and analysis of renewables costs.
- **Mexico** – finalising a review and assessment of the status of energy efficiency and the Internet of Things; exchanges on energy efficiency data and indicators, and on the benefits of energy efficiency in schools and hospitals; and collaboration on regional trading of capacity and electricity.
- **South Africa** – providing support to the Department of Energy in the development of a cross-agency energy and GHG reporting system; and energy efficiency efforts focused on policy monitoring and target setting.
- **Global/regional efforts** – global efforts included various joint learning and knowledge exchange efforts, especially on statistics and energy efficiency; cross-cutting innovation enhancement; two G20 reports, including one on *Energy Transitions in G20 countries*; Southeast Asia efficiency training involving 220 professionals from government, industry and academia; Southeast Asia clean energy investment and finance training for over 100 policy makers; and Latin America-focused efforts on improving energy statistics, energy efficiency and systems integration of renewables.

Year 1 of the CETP saw a concentration of efforts in Asia – India (19%) and China (17%). During 2019, it is expected that work in other key partner countries (Brazil, Indonesia, Mexico and South Africa) and regions (Africa, Latin America and Southeast Asia) will increase. Building upon the successful experiences of the Energy Efficiency in Emerging Economies (E4) Programme, the efficiency work stream represented roughly 38% of overall CETP efforts, followed by policy advice and modelling (24%) and electricity (15%).

## Support and structure of CETP

The CETP is supported by 13 IEA Member governments – the United Kingdom (GBP 8 million; ~EUR 9 million); Sweden (50 million kronor; ~EUR 5.2 million); Denmark (25 million kroner; ~EUR 3.4 million up to 2020); Germany (EUR 1.33 million, from a total pledge of EUR 6 million); the European Commission (total pledge of EUR 3.5 million); the Netherlands (EUR 600 000 in 2018 with a total pledge of EUR 2.6 million); Switzerland (1 million francs; ~EUR 857 000 up to 2021); Canada (625 000 Canadian dollars [CAD]; ~EUR 412 000, with a total pledge of CAD 1 million); Japan (EUR 480 000 in 2018); Italy (two-year junior professional officer working at the IEA); Finland (EUR 45 000); New Zealand (EUR 10 000); and Australia.

The CETP's overall strategy is informed by a Funders Strategy Group, which allows supporters to engage in an ongoing, strategic conversation. Within the IEA Secretariat, the CETP is set up horizontally, with each work stream led by the respective IEA division with subject matter expertise, along with support by respective IEA country officers. A central CETP co-ordination team helps to ensure efficient and effective operation across the entire programme.

In addition to directly benefiting priority countries (and their citizens), CETP activities have also benefited the entire IEA family and overall global energy analysis. The CETP has allowed the IEA



to better reflect and incorporate accurate depictions of emerging economies' energy systems into a wide variety of IEA analysis, including the *World Energy Outlook (WEO)* and various market reports. CETP efforts are also creating a wide variety of public knowledge goods – improved data, statistics, trends and analysis – that will help increase global understanding of clean energy transitions. Work under CETP is also providing a variety of mutually beneficial opportunities for the IEA family to learn from one another.

## Report's purposes

This full inaugural CETP report serves two primary purposes:

First, it outlines in much greater detail CETP efforts in 2018. Of particular note, country-specific mini-reports begin on page 21. It is hoped that each of these country-specific summaries will provide a useful summary of the key energy transition challenges, goals and opportunities faced by each priority country as well as a full summary of CETP activities from 2018.

Second, the report also looks ahead to CETP efforts in 2019 and beyond, where we will see IEA capacities further increase, especially in data and statistics, electricity and sectoral work. The year 2019 will also see additional focus on further enhancing partnership a wide variety of other critical actors (IEA Members, regional counterparts, local agencies and organisations, and other international groups).

## Conclusion

In 2018, the CETP got off to a very promising start, but one needs only to look at the latest statistics to know that much work remains. 2018 witnessed the most-ever CO<sub>2</sub> emissions released into our shared atmosphere – a 1.7% increase over 2017's then-record level. And while 2018 saw a record number of people gain access to electricity globally, roughly 992 million people remain without this basic human necessity.

Building off its inaugural successes, the CETP looks forward to further enhancing the IEA's ability to play as helpful a role as possible in accelerating global clean energy transitions. Our world depends on all of us being successful.

# Overview of the Clean Energy Transitions Programme

## Set-up

On 7 November 2017, the United Kingdom, Sweden, Denmark, Germany, the European Commission, the Netherlands, Switzerland, Canada, Japan, Italy, Finland, New Zealand, and Australia joined to launch the IEA Clean Energy Transitions Programme (CETP). The CETP leverages IEA Members' clean energy commitment and the unparalleled, all-of-energy expertise of the IEA to better support and help accelerate global clean energy transitions, particularly in major emerging economies.

Launch of the CETP in November 2017



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The CETP is providing cutting-edge technical support to governments whose energy policies will significantly influence prospects for, and the speed of, a global transition towards more sustainable energy production and use. The Programme aims for reductions in GHG emissions in line with the objectives of the Paris Agreement and countries' own targets, enhancing energy access and reducing air pollution. Priority countries include Brazil, China, India, Indonesia, Mexico and South Africa, as well as other IEA Association and priority countries as well as regions where the Programme can have high impact. The transformative outcomes sought by the CETP entail close collaboration with governments to achieve effective collaboration driven by each priority country's objectives. This is being achieved through iterative discussions, workshops and exchanges, and in accordance with joint work programmes.

The CETP is supported by 13 IEA Member governments – the United Kingdom (GBP 8 million; ~EUR 9 million); Sweden (50 million kronor; ~EUR 5.2 million); Denmark (25 million kroner; ~EUR 3.4 million up to 2020); Germany (EUR 1.33 million, from a total pledge of EUR 6 million);

the European Commission (total pledge of EUR 3.5 million); the Netherlands (EUR 600 000 in 2018 with a total pledge of EUR 2.6 million); Switzerland (1 million francs; ~EUR 857 000 up to 2021); Canada (625 000 Canadian dollars [CAD]; ~EUR 412 000, with a total pledge of CAD 1 million); Japan (EUR 480 000 in 2018); Italy (two-year junior professional officer working at the IEA); Finland (EUR 45 000); New Zealand (EUR 10 000); and Australia.

## Work stream highlights in 2018

Substantive activities under the Programme are organised in six work streams. Key 2018 activities included:

1. **Data and statistics:** Examples of activities launched in 2018 include the participation in national statistics working groups or committees (India, Mexico); providing technical assistance to enhance energy data (India, Indonesia); developing workshops and trainings on energy efficiency indicators, renewable statistics, etc. (China, Mexico); launching e-learning courses, webinars and training videos on a range of subjects such as energy efficiency indicators, essentials for policy makers and fundamentals for statistics (Brazil, China, Mexico).
2. **Energy efficiency:** Activities included Energy Efficiency in Emerging Economies Training Weeks (global, Southeast Asia, India); workshops and webinars on digitalisation, multiple benefits and buildings among others (Brazil, Mexico, South Africa, Southeast Asia, Latin America); support the review and improvement of policy frameworks and reporting frameworks on industrial energy efficiency (Indonesia, South Africa); sharing international experience with market based instruments for energy efficiency (Brazil); and analyses of energy service company (ESCO) market development (China).
3. **Electricity:** Engagement covered trainings and workshops on flexible power systems, investment and finance; grid integration and cross-border trading (Brazil, India, Mexico, Southeast Asia); tailored analyses including on financing and investment environment (India), power system optimisation (PSO), distributed systems, system integration, cost of renewables, power sector reform, and power trade and auctions (Brazil, China, India, Indonesia, Southeast Asia).
4. **Policy advice guidance and modelling:** Activities carried out during 2018 included tailored analyses on the alignment of an ETS with energy policies (China); contributing to long-term energy transitions strategies (China); enhancement of modelling capability (Southeast Asia, China); improvement of analytical tools such as the Sustainable Energy Scenario; and efforts focused on the air pollution/climate nexus (global).
5. **Sectoral work:** Examples of 2018 work include support to the Electric Vehicles Initiative (EVI), co-ordinated by the IEA, to accelerate the deployment of electric vehicles (EVs); supporting national policy processes on energy-efficient cooling through review and analytical input (China and India); developing a new assessment on the state of play of hydrogen; and promoting sustainable biofuels.
6. **Innovation:** Activities included enhanced engagement with governments to understand local needs and priorities (Brazil, India); cross-ministry workshops and webinars on research, development and demonstration (RD&D) tracking for the public and private sectors (Brazil, India); and review and analysis of local innovation ecosystems (India).

## Governance

The CETP works horizontally across the IEA Secretariat, co-ordinating a number of inter-related projects led by different IEA divisions and units. All activities are also supported by country desk officers located in the Office of Global Energy Relations. The figure below shows the broad distribution of the roles pertaining to the CETP within the IEA Secretariat:

Figure 1. **Governance of the CETP across the IEA Secretariat**



IEA senior management and the CETP Steering Group, which includes Division Heads from across the Agency, guide the work under the Programme. This Group provides strategic guidance and oversees allocations for the different work streams under the Programme. Efforts in all work streams are supported by a central CETP co-ordination team, located in the IEA Strategic Initiatives Office. The co-ordination team is responsible for ensuring overall quality control, strategic management, fundraising, dissemination of key messages, information exchange, co-ordination and reporting. This team is supported by the Office of the Legal Counsel, Human Resources and the Financial Administration team. The CETP co-ordination team can be reached at [cetp@iea.org](mailto:cetp@iea.org).

The CETP is also extensively supported by the Office of Global Energy Relations (GER), which manages outreach and relationships with key emerging economies. Country desk officers within GER have facilitated the organisation of events and meetings, monitored satisfaction with implementation of the Programme in priority countries, and kept track of evolving needs and objectives. The work of this office has been facilitated by the hiring of in-country co-ordinators, particularly in India and Indonesia, and energy efficiency co-ordinators (Indonesia and Mexico), and by the IEA liaison office in China. As the CETP work expands during 2019, additional local

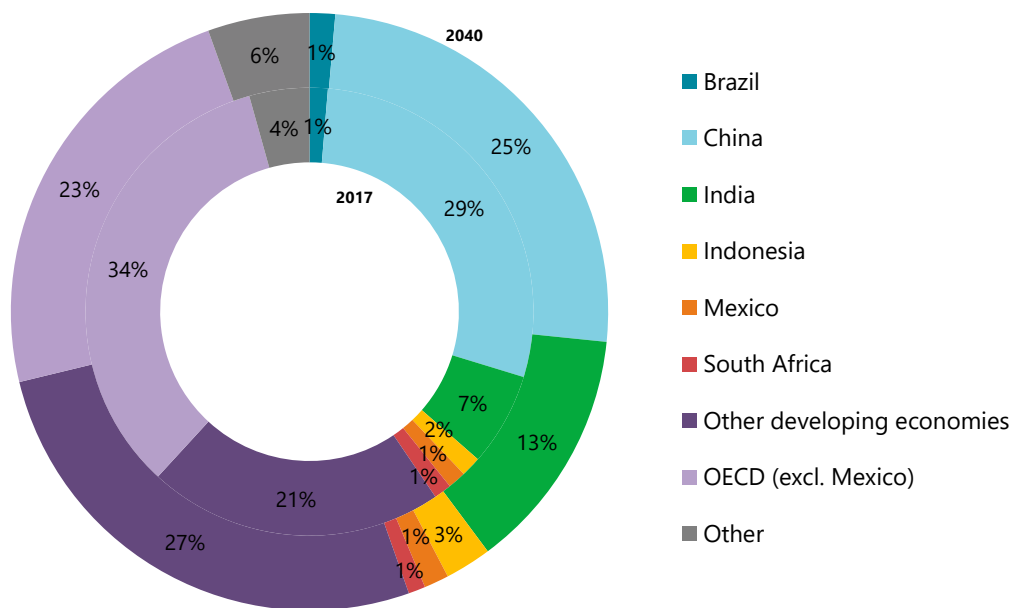
co-ordinators are being considered to support IEA teams in other countries, such as Brazil and South Africa.

CETP’s strategy is also supported by bilateral discussions with supporters and by the Programme’s Funders Strategy Group. This group allows supporters to engage in an ongoing, strategic conversation about the Programme’s development and implementation. These discussions ensure that IEA efforts are complementary to other bilateral and multilateral collaborations.

## Work with major emerging economies

Under the CETP, the IEA is carrying out a range of collaborative activities including analytical work; technical co-operation, training and joint learning exchanges; and strategic dialogues in Brazil, China, India, Indonesia, Mexico and South Africa, as well as other IEA Association and priority countries and regions. As shown in the figure below, emerging economies currently represent 66% of carbon dioxide (CO<sub>2</sub>) emissions from fuel combustion, and it is expected they will encompass roughly 70% by 2040. If our world is to meet its sustainable development targets, clean energy transitions in major emerging economies will be one of the keys. (It is also important to note that per capita emissions in many of these countries are very small compared with developed economies.)

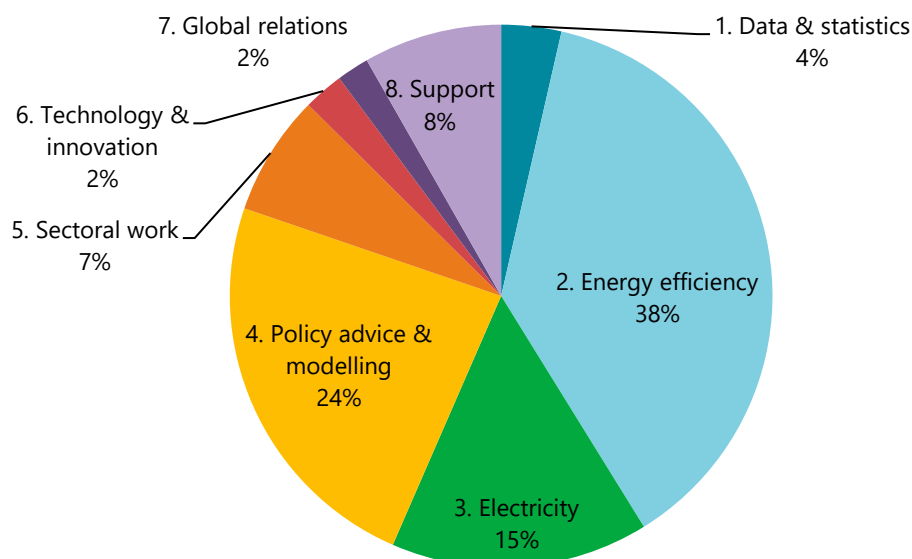
Figure 2. CO<sub>2</sub> emissions from fuel combustion under the New Policies Scenario: 2017 versus 2040



Source: IEA (2018a). All rights reserved.

During its first year of full operation, work supported under the CETP built upon the successful experiences of the E4 Programme (Phase 1 – 2014-17). As such, energy efficiency activities represented a large share of total activities for 2018 CETP efforts (the second phase of the E4 Programme started in 2018 as part of the CETP). Work under the electricity and the policy advice and modelling work streams followed. The Programme also collaborated with other institutions and local agencies – and these provided a range of in-kind contributions such as meeting and event venues, other support for event organisation and staff time to work in collaborative projects leading to produce greater efficiencies and impact.

Figure 3. 2018 CETP activities by work stream



Note: These figures are estimated projections and are provided for information purposes only. Formal financial reports will continue to be provided in established and agreed formats to Member countries via the Committee on Budget and Expenditure and to individual donors via financial reports.

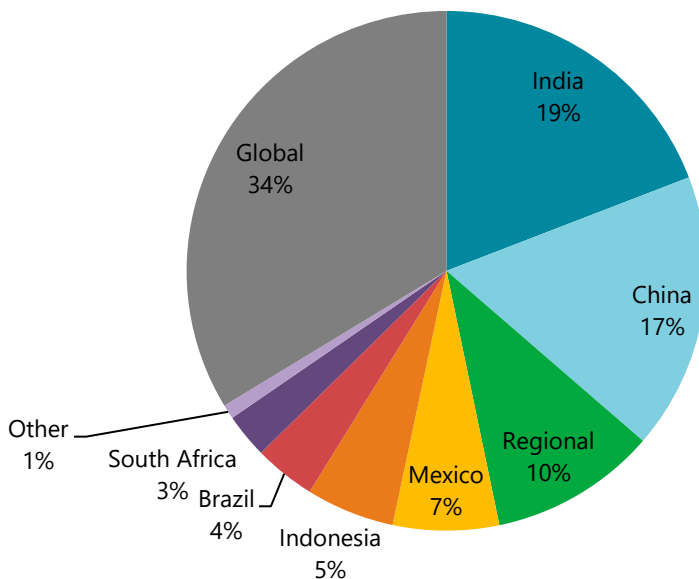
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With support from the CETP, the IEA engaged with relevant stakeholders working on energy-related issues in eight emerging economies and two main regions (Southeast Asia and Latin America). The CETP also fostered the exchange of human resources, allowing for two secondees and an intern from these countries to contribute to substantive IEA analysis during 2018. Joint learning and knowledge exchanges (including online activities) involved over 2 500 participants, 30% of which were women; overall, their satisfaction level with activities was above 90%. More than 30 training events were organised, facilitating the exchange of knowledge and experiences on seven different topics related to clean energy transitions.

In addition, the CETP supported the enhancement of ongoing publications (12 reports relevant to clean energy transitions) as well as analysis tailored to emerging economies' specific needs (10 reports, papers and knowledge products, including translations of relevant online courses). The latter outputs were developed with contributions from institutions based in eight countries.

In terms of geographic distribution of CETP-supported work, year 1 saw a concentration of activities in Asia, both in terms of countries where work was conducted, as well as in terms of regional engagements (including with the Association of Southeast Asian Nations [ASEAN]). During 2019, it is expected that work in Brazil, Indonesia, Mexico and South Africa and in the overall African and Latin American regions will gain further momentum.

Figure 4. 2018 CETP activities by geographic scope



Note: These figures are estimated projections and are provided for information purposes only. Formal financial reports will continue to be provided in established and agreed formats to Member countries via the Committee on Budget and Expenditure and to individual donors via financial reports.

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## CETP pillars

Overall work with priority countries on clean energy transitions has focused on three key pillars: i) high-level engagement and collaboration; ii) supporting joint learning and knowledge exchanges to formulate and implement policies; and iii) enhancing knowledge and evidence for policy making and implementation.

### High-level engagement and collaboration

The IEA has engaged in more than 20 high-level exchanges with relevant stakeholders in emerging economies. The IEA Executive Director and senior management continued reaching out to emerging economies and meeting with key decision makers (ministers, chief executive officers [CEOs], etc.) in countries such as China, India, Indonesia and South Africa. Institutional relationships were also strengthened through formal collaboration agreements, for example, Memorandums of Understanding (MoUs) signed between the IEA and the National Development and Reform Commission and the Ministry of Ecology and Environment, respectively, in China.

Across CETP work streams, respective work plans and priorities for collaboration are developed in consultation with key ministries and institutions in priority countries to ensure engagement and buy-in starting at the programming phase. The IEA also reflects and responds to frequent requests it receives from priority countries to conduct specific pieces of work or contribute to policy processes.

During 2018, through the CETP, the IEA also managed to expand its reach, networks and impact by engaging with additional entities in eight countries. New entities now engaging with the IEA include ministries or line agencies working on innovation in India and Brazil; think tanks and universities in China and India; and industry groups and associations working on topics such as bioenergy, energy services and energy efficiency in several countries. This work has allowed the

Agency to secure ownership of planned activities under the CETP as well as appropriate partners for their development.

Together with a range of institutions, over 30 technical exchanges in CETP priority countries were organised across a range of themes related to energy efficiency, system integration of renewables and several other topics in key emerging economies. The IEA is grateful for the co-operation and support of priority countries, which often contributed their own financial and human resources to make these exchanges and events a success. Examples include the Bureau of Energy Efficiency (BEE) of India sending out invitations to all Indian states in the name of its Director General and sponsoring the venue for the India Energy Efficiency in Emerging Economies Training Week, and the Mexican Ministry for Energy (SENER) hosting all workshops organised in Mexico City.

In order to allow a co-ordinated and collaborative development of activities, the CETP also facilitated seven Funders Roundtables in emerging economies as well as four Funders Strategy Group Meetings in Paris. The Funders Roundtables organised in China, Brazil, India and Indonesia have allowed all CETP partners to better co-ordinate activities on-the-ground. The Funders Strategy Group meetings in Paris have further facilitated co-ordination as well as feedback that can enrich overall CETP plans and strategic outlook.

Under this pillar, the CETP has also fostered engagements with priority countries by facilitating human resources exchanges from China and India. These have proven to be valuable in two ways: i) improved understanding of emerging economies energy contexts; and ii) strengthened relationships with key partners.

## Joint learning and knowledge exchanges

A large portion of work under the CETP in 2018 was dedicated to supporting joint learning and knowledge exchanges to formulate and implement policies towards clean energy transitions. In 2018, the IEA delivered training to over 2 500 people through CETP-related activities. These activities focused on topics relevant to each country's development pathways and led to the transfer of knowledge and new abilities that will facilitate their clean energy transitions. Overall, participants have expressed over 90% satisfaction with these activities.

Topics in which the CETP facilitated joint learning and knowledge exchanges included: cross-border energy and capacity trading between Mexico and the United States; low-carbon transition in the power sector in India; long-term climate mitigation framing and methodologies in China; power system flexibility in Indonesia; efficient cooling in Latin America; clean energy investment and finance in Southeast Asia; and energy efficiency as well as data and statistics for a global audience. Overall, more than 30 training events or workshops were held under the CETP covering topics under all work streams.

## Enhancing knowledge and evidence

Throughout the year, the IEA continued working on enhancing knowledge and evidence for policy making and implementation in emerging economies under the CETP. The IEA leveraged the high-level engagement and the joint learning and knowledge exchange activities previously described to reach twin goals: producing analytical outputs that are tailored to the particular needs and contexts of emerging economies; and to continue enriching IEA reports with data and insights from emerging economies to enhance energy knowledge globally.

Evidence of this collaboration includes tailored outputs produced with and for emerging economies such as the [Clean Energy Investments Trends](#) paper, produced jointly with the Council



on Energy, Environment and Water (CEEW) in India, and the report [Power Sector Reform in China: An International Perspective](#), which was co-authored by the National Energy Administration (NEA) of China. Other relevant outputs include the [Thailand Renewable Grid Integration Assessment](#) and the Indian [Power Sector Low-Carbon Strategy for Renewable Energy Integration](#) prepared with the National Institution for the Transformation of India (NITI) Aayog.

IEA reports and knowledge products enhanced or supported by the CETP (and relevant to energy transitions issues for emerging economies) in 2018, include the [WEO 2018](#), [World Energy Investment 2018](#), [The Future of Cooling](#), [Renewables 2018](#) market report, [Tracking Clean Energy Progress](#) web page and the [Energy Efficiency 2018](#) market report, for which an [Abridged Chinese Version](#) was also developed. Furthermore, the [WEO 2018](#) was not only supported by resources from the CETP, but also benefited from a secondment from CEEW that enriched the report's deep dive into India's electricity sector.

Finally, the CETP also supported the two reports developed in the framework of the Agency's participation in the G20: [Energy Transitions In G20 Countries: Energy Transitions Towards Cleaner, More Flexible and Transparent Systems](#) and [Energy Transitions in G20 Countries: Energy Data Transparency and Market Digitalisation](#).

### Selected IEA 2018 publications



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## Value for IEA Members / global public goods

CETP-supported activities benefited IEA Members and global energy efforts in multiple ways beyond the direct benefits of major emerging economies transitioning more swiftly towards clean energy (and all the resulting reductions in GHG emissions and air pollution).

First, the collaboration with local institutions in emerging economies (and human resources exchanges with those countries) allowed the IEA to better reflect and incorporate accurate depictions of their own energy ecosystems. These enhanced data and statistics are not only useful to the priority countries themselves, but to many other countries and stakeholders throughout the world. Enhanced data also improves key IEA pieces of analysis. The *WEO 2018* and the *Energy Efficiency 2018* market report are just some of the IEA assessments that incorporated this local knowledge and information, and were accordingly enhanced.

Second, the CETP created public knowledge that can specifically shed light on global clean energy transitions challenges and opportunities. For example, increased analysis and better analysis allow the IEA to better assess specific aspects of the energy sector, as in *The Future of Cooling* report.

Third, the work under the CETP is helping the IEA fulfil its 2017 Ministerial Mandates, including helping operationalise the concept of an “IEA family” that includes all the world’s key energy countries. CETP efforts are also critical towards the IEA becoming a global clean energy hub and to help improve overall global energy security and sustainability.

Fourth, CETP activities are allowing the IEA to deepen relationships with ministries and organisations that are key to energy transitions but not traditional IEA interlocutors. The Indian Ministry of Science and Technology is an example from the innovation work stream.

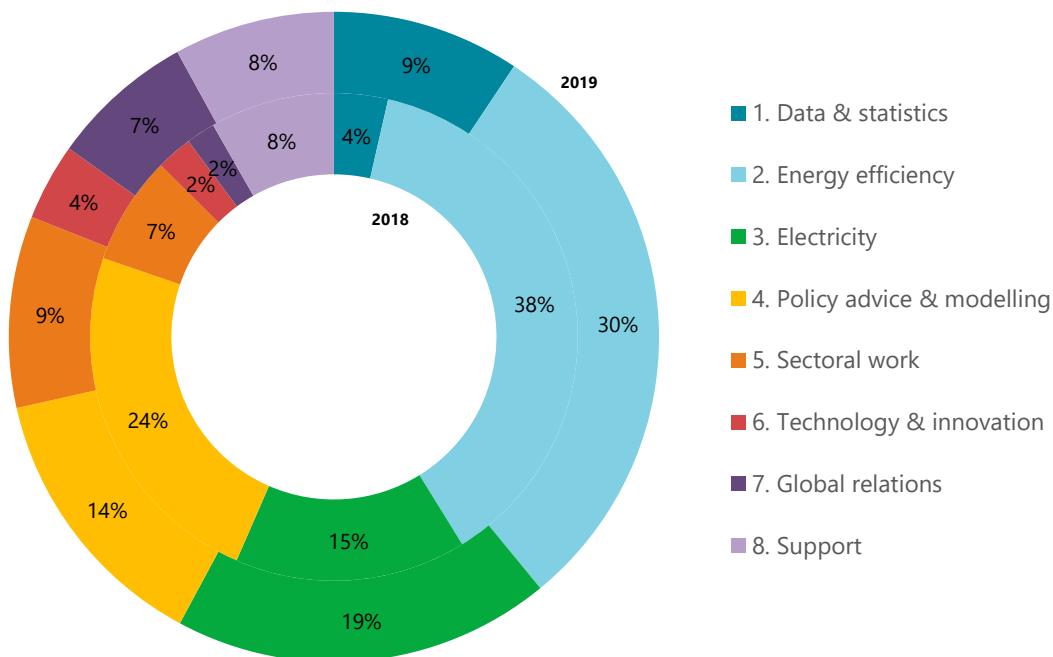
Finally, the expertise and relationships gained by the IEA through engagements supported by the CETP allow a richer and more robust platform for sharing best practices and lessons from around the world (to the benefit of all countries in the IEA family). For instance, the increased knowledge gained on system integration of renewables from work in India is providing valuable insights for work in France. Lessons learned from the design of energy efficiency policies and digitalisation in Mexico can inform similar efforts in a wide range of other member countries.

## CETP efforts in 2019 and beyond

As the capacity of the IEA to deliver is further enhanced and partnerships reinforced with priority country institutions and stakeholders, work in 2019 will see a significant ramp-up. Areas in which activities will be particularly strengthened include data and statistics, electricity and sectoral work. In addition, the ability of country desk officers to support all work streams will be expanded through the anticipated use of local contractors in Brazil and South Africa and for regional work with the African Union Commission (AUC) and African Energy Commission (AFREC). Additional capacity will also be increased in Paris focusing on three key regions (Latin America, Southeast Asia and Africa).

Overall work will continue to be focused on Asia, with India, China and Indonesia in the lead and increased regional work with ASEAN. During 2019, the CETP will also see an increase in activities related to Africa through anticipated contributions for work in that region. Finally, energy efficiency work in Brazil and Mexico will continue, and further collaboration on energy technology innovation in Brazil is planned. The figure below shows the distribution of activities by work stream in 2018 and efforts planned for in 2019.

Figure 5. 2018 and 2019 expected CETP activities by work stream



Note: These figures are estimated projections and are provided for information purposes only. Formal financial reports will continue to be provided in established and agreed formats to Member countries via the Committee on Budget and Expenditure and to individual donors via financial reports.

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### 2019 enhancements and plans by work stream

Key activities to be further developed in 2019 include the following:

- 1. Data and statistics:** Further translation and dissemination of manuals, training videos, courses in multiple languages; new data collection and energy statistics training events; tailored support to India, Indonesia and South Africa to solve the main data issues and gaps; additional high-level energy statistics training workshops for emerging economies; expansion of monthly electricity statistics reports and database to include Association countries; and overall development and enhancement of co-operation with emerging economies on the building and improvement of national energy balances including demand-side data and broader clean energy statistics.
- 2. Energy efficiency:** Joint learning, exchanges and engagement with key energy efficiency stakeholders to improve their capabilities to design and implement effective energy efficiency policies and share best practices; analyses to improve the evidence base for policy making through trend and impact analysis; improving energy demand data and/or energy efficiency indicators; further work on energy efficiency in buildings, with a particular focus on developing building code roadmaps; cooling energy efficiency work for ASEAN and China; and work on ESCO market development and other market mechanisms.
- 3. Electricity:** State-level power system transformation workshops with India; analytical work for the China power system transformation; renewable integration analysis in ASEAN; joint learning, knowledge exchanges and technical workshops on renewable energy integration at the regional and country levels; enhancing data and modelling capabilities; leading the power system flexibility campaign 21st Century Power Partnership (21CPP)/Clean Energy

Ministerial (CEM); continue mapping of financing for power sector investments in India; and training on enablers for clean energy investments for ASEAN policy makers.

4. **Policy advice and modelling:** Work on climate impacts modelling in energy; analytical work on updated material risks to the energy sector due to climate change; work on impacts of hydrological variability on hydropower production and implications for power market design; deeper analytical work on the power sector's structure implications for China's national ETS; analytical work with additional focus countries for analysis of energy, environment and climate policy integration into coherent policy packages; enhance and inform capabilities to enhance air pollution and energy analysis; analytical work on long-term modelling; analysis and engagement focused on Africa clean energy transitions; in-depth review (IDR) of India's energy policies; and tailored global knowledge products for G20 countries.
5. **Sectoral work:** Engagements and discussions with the Global Environment Facility (GEF) and United Nations Environment Programme (UNEP) to ensure support for GEF projects in countries, as well as to incorporate the private sector; definition of next steps for deep dive on Indian context as follow-up to *Global Iron and Steel Technology Roadmap*; work on China cooling and to start buildings and construction regional roadmaps series; analysis of the value chain from production, transport and storage to the various uses of hydrogen in terms of costs and potentials; and policy evaluation and recommendations to accelerate growth of sustainable bioenergy in focus countries.
6. **Innovation:** Deepening collaborations with Brazil and India is the priority for 2019, with dedicated staff to lead this work. Anticipated key deliverables include: best practice workshops on energy innovation tracking; thorough mapping of the Indian energy research and development (R&D) system to be published as part of the IEA energy policy review of India; new tools for tracking R&D spending in both India and Brazil; sharing of best practices between countries, including between emerging economies and IEA countries; continuing work to communicate the benefits of rigorous analysis and monitoring of energy RD&D efforts and their integration into energy policy, with increased engagement with countries such as China and Mexico; pursuing new engagements with diverse partners (from the innovation ecosystems); enhancing multilateral engagement through Technology Collaboration Programmes (TCPs) and assisting countries to take a co-ordinated, strategic approach to innovation partnerships such as MI.

## 2019 CETP activities in Africa

In addition to the work presented above, the CETP will greatly enhance work in Africa in 2019 and beyond. Specifically, efforts will focus on accelerating the achievement of Sustainable Development Goal No. 7 (SDG 7) and producing up-to-date and cutting-edge knowledge and analysis on clean energy transitions in selected African emerging economies and regions through a devoted contribution from the Netherlands and others. Activities to be supported will include high-level policy engagement and technical papers.

The first of the high-level events will be an IEA-AUC Ministerial Summit, "Powering Africa's energy future", on 12 June 2019 in Addis Ababa. Other events will be hosted in representative countries to cover specific energy transitions in regions such as North Africa, Sahel and the Horn of Africa. The aim of these high-level engagement events, which will focus on issues such as investment, regulation, electricity access, clean cooking, renewables integration and efficiency, will be to provide operational solutions to accelerate clean energy transitions and achieve SDG 7.

The events will also enable the exchange of views and best practices among ministries, companies and experts.

The first of the IEA reports will be a *WEO* special focus on Africa in 2019. Additional reports will focus on the key challenges and opportunities for the fast-growing African energy sector and serve as guides for discussions on policies, investment needs and technology priorities for the achievement of Agenda 2030 and Vision 2063.

## Lessons learned and overall 2019 CETP enhancements

The first year of the CETP has produced several lessons that will be incorporated into CETP operations in 2019 and beyond. Key factors that have led to a successful year 1 included: i) the ability of the IEA to build on long-standing relationships with priority countries and to listen to what key challenges each country is facing in its own clean energy transitions; ii) the capacity of the Agency to convene a wide variety of partners (including IEA Members, regional counterparts, local agencies and organisations, and other international groups); and iii) the IEA's independent and credible all-of-energy expertise.

In year 2 and beyond, the CETP will further strengthen:

- In-country co-ordination: enhancing on-the-ground co-ordination with stakeholders, improving recognition and leveraging as well syncing with other efforts.
- Information sharing: enhancing communication (website, webinars, newsletter and annual report); continued engagement in strategic discussions and feedback.
- Capacity: improve capacity and efficiencies across the IEA, including on training and knowledge exchanges.
- Benefits to all IEA Members: ensuring work in each priority country provides better data, global insights and lessons for all IEA Members; expanding multilateral exchange opportunities.
- Holistic solutions: increased co-ordination of overall IEA engagements to take better advantage of the IEA's all-of-energy expertise to ensure the Programme provides more systems-oriented, holistic solutions which will increase the Programme's impact and allow the IEA to leverage its capacity to perform real-world, long-term analysis.
- Partnerships: enhancing existing and creating new partnerships with different actors such as bilateral development agencies, the World Bank, regional development banks, United Nations (UN) agencies, non-governmental organisations (NGOs) and foundations, the private sector, experts, and organisations from priority countries.<sup>1</sup>

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<sup>1</sup> Including institutions such as the African Development Bank, Asian Development Bank, ASEAN Secretariat, Children's Investment Fund Foundation, European Climate Foundation, European Investment Bank, French Development Agency, German Corporation for International Cooperation, GEF, Inter-American Development Bank, Prosperity Fund, UN Development Programme, UNEP, UN Industrial Development Organization and the World Bank Group.

## Conclusion

Overall, the IEA Secretariat is very pleased with the progress of the CETP in 2018 and reiterates its thanks to funders and partners for supporting this Programme. The IEA Secretariat looks forward to enhancing efforts further in 2019 along the lines outlined in this section and through ongoing conversations – all in the hope that the IEA can help countries to reduce carbon emissions and air pollution, to ensure universal access to energy and to improve countless lives around our world.

## Additional IEA resources

Through the CETP and beyond, the IEA has developed a whole set of data, analyses, tools and reports that can help support transitions to clean energy systems. A list highlighting a few of these outputs (with weblinks) and other products mentioned throughout the report can be found below:

- [World Energy Outlook 2018](#)
- [Tracking Clean Energy Progress](#)
- [Tracking Energy Transitions](#)
- [World Energy Investment 2018](#)
- [Renewables 2018](#)
- [Energy Efficiency 2018 and Abridged Chinese Version](#)
- [Sustainable Development Goal 7](#)
- [Energy and Gender](#)
- [Global energy and CO<sub>2</sub> status report](#)
- [The Future of Cooling](#)
- [Global EV Outlook 2018](#)
- [Climate Change](#)
- [Energy Access](#)
- [Statistics](#)
- [Innovation work](#)
- [Technology Collaboration Programmes](#)
- [Electric Vehicles Initiative](#)
- [Contribution to the Talanoa Dialogue](#)
- [Policies and Measures Databases](#)
- [2018 global status report: Towards a zero-emission, efficient and resilient buildings and construction sector \(English and other languages\)](#)
- [Status of Power System Transformation 2018](#)
- [Power Sector Reform in China: An International Perspective](#)
- [Thailand Renewable Grid Integration Assessment](#)
- [Energy Transitions in G20 Countries: Energy Transitions Towards Cleaner, More Flexible and Transparent Systems](#)
- [Energy Transitions In G20 Countries: Energy Data Transparency and Market Digitalisation. clean energy investments trends](#)
- [Power Sector Low-Carbon Strategy for Renewable Energy Integration](#)

## Main 2018 activities by country

The CETP collaborates extensively with six key emerging economies (Brazil, China, India, Indonesia, Mexico and South Africa) where successful energy transitions will be of global importance due to their size, economic and demographic growth, and energy production, consumption and emissions profiles. Along with these priority countries, the Programme also seeks to address issues and deploy activities with other countries and at a global and regional scale.

The following sections present highlights of 2018 CETP activities in each of the priority countries, as well as energy, environment, economic and social statistics. These include energy data for 2017 as well as energy demand by 2040 based on the two key scenarios developed by the IEA under the *WEO*: the New Policies Scenario (NPS) and the Sustainable Development Scenario (SDS). The NPS “incorporates existing energy policies as well as an assessment of the results likely to stem from the implementation of announced policy intentions”, while the SDS “outlines an integrated approach to achieving internationally agreed objectives on climate change, air quality and universal access to modern energy”.<sup>2</sup>

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<sup>2</sup> *World Energy Outlook* scenarios available at: [www.iea.org/weo2018/scenarios/](http://www.iea.org/weo2018/scenarios/).



## Brazil

### Highlights of 2018 CETP activities in Brazil

- Informing national policy discussions by sharing global experiences on energy efficiency auctions, market tools and policy design.
- Exchange of energy efficiency-related knowledge and experiences through development of **webinars on several energy efficiency topics** with a range of Brazilian partners. For instance, a webinar on the multiple benefits of energy efficiency co-hosted by the Energy Research Office (EPE) and Ministry of Mines and Energy (MME) was attended by 140 participants from Brazil and 18 other countries.
- Partnership on developing metrics to **assess power system reliability**. This work is tailored to the Brazilian context of growing shares of variable renewable energy (VRE) in a system with large amounts of reservoir hydro, and included a closed-door session with participants from EPE in November 2018.
- Collaboration on **market-based instruments for energy efficiency** including a workshop held in Rio de Janeiro in August 2018 with participation from 40 government experts and stakeholders.
- Collection of data and information on **space cooling** for the IEA Global Exchange (including for the Kigali Tracker), and for the expected review of EPE projections for space cooling.
- On 1 February 2019, the IEA became Facilitator for the Biofuture Platform, which was created and is being led by Brazil.

## Context

Brazil accounts for almost one-third of the energy production and almost half of the total final energy consumption in Latin America. While the country has one of the cleanest electricity systems in the world, its non-energy-related GHG emissions make it the largest GHG emitter in Latin America. Significant potential for further emissions reduction remains. According to the SDS, energy-related emissions in 2040 could be more than halved compared with current trends, preventing over 300 million tonnes of CO<sub>2</sub> emissions per annum. Moreover, the country's energy system is expected to face growing challenges with rapidly rising energy demand. Total primary energy demand (TPED) has doubled in Brazil since 1990, led by strong growth in electricity consumption and in demand for transport fuels on the back of economic growth and a growing middle class.



**Table 1. Key statistics from Brazil**

Energy demand (Mtoe) 2017e	285		Modern renewable share in total final energy consumption, 2016	42.4%
Energy demand (Mtoe) 2040	<b>NPS</b> 391	<b>SDS</b> 320	Mean annual exposure to air pollution (PM2.5), 2017	12.8 µg/m <sup>3</sup>
CO <sub>2</sub> emissions (Mt) 2017e	428		Energy intensity measured in terms of primary energy and GDP, 2016	0.10 toe/ USD 1 000 (2010)
CO <sub>2</sub> emissions (Mt) 2040	<b>NPS</b> 495	<b>SDS</b> 266	CO <sub>2</sub> /GDP PPP (kgCO <sub>2</sub> /2010 USD), 2016	0.10
<b>Economic and social statistics</b>				
Total GDP (billion 2010 USD), 2016	2 248		Population (million), 2016	208
Compound average annual GDP growth rate (2000-17)	2.3%		Population compound average annual growth rate (2000-17)	1%
GDP PPP (billion 2010 USD), 2016	2 853		Proportion of population with access to electricity, 2017	>99%

Notes: Mtoe = million tonnes of oil equivalent; Mt = million tonnes; PM2.5 = particulate matter less than 2.5 micrometres in diameter; µg/m<sup>3</sup> = micrograms per cubic metre; GDP = gross domestic product; toe = tonnes of oil equivalent; PPP = purchasing power parity; kgCO<sub>2</sub> = kilogrammes of carbon dioxide.

Total final energy consumption is a variable defined primarily for tracking progress towards target 7.2 of the Sustainable Development Goals. It incorporates total final consumption by end-use sectors but excludes non-energy use. It excludes international marine and aviation bunkers, except at world level. Typically this is used in the context of calculating the renewable energy share in total final energy consumption (Indicator 7.2.1 of the Sustainable Development Goals), where total final energy consumption is the denominator. Modern renewable excludes traditional use of biomass.

Sources: IEA (2018a), IEA databases, OECD databases. A special country analysis of Brazil was included in the [WEO 2013](#).

Brazil has been making significant strides in meeting key energy challenges. A concerted policy effort has yielded almost universal access to electricity across the country. Energy efficiency improvements in Brazil since 2000 allowed the country to prevent an additional 5% in energy use in 2017. Nearly 45% of primary energy demand is met by renewable energy, making Brazil's energy sector one of the least carbon-intensive in the world. Hydropower for electricity generation and biofuels for industrial and transport uses are the main renewable sources. Large hydropower plants account for around 80% of domestic electricity generation, giving the electricity system a great deal of operational flexibility. However, continued expansion of hydropower is increasingly constrained by the geographical remoteness and environmental and social sensitivity of a large part of the remaining resource. Reliance on other sources for power generation is currently low but growing, notably in the cases of natural gas, wind and bioenergy. Brazil is also a pioneer in establishing a system of contract auctions, providing a mechanism to encourage investment in new generation and transmission capacity and to diversify the power mix.

Along with the large share of renewable sources in its energy mix, Brazil is a global leader on biofuels. Brazil has encouraged large-scale sugar cane ethanol production and use of ethanol for road vehicles since the 1970s. As a result, the country is a world leader in ethanol use and production. The drivers for biofuel demand and policy interest in facilitating biofuel production and use remain strong. The RenovaBio programme, which is expected to come into force in 2020, aims to stimulate the production of biofuels and provides fiscal incentives and targets for the reduction of emissions. At the international level, Brazil was one of the main promoters of the 20-member Biofuture Platform in 2016 to support international co-ordination on advanced low-carbon fuels.

### Biofuture Platform event at the 24th Conference of the Parties



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## Clean energy transition targets

Brazil's Nationally Determined Contribution (NDC) lays down an economy-wide target to reduce GHG emissions by 37% below 2005 levels by 2025, with an "indicative target" of 43% by 2030. This makes Brazil the first major developing country to put forward an absolute emissions reduction goal. Further, the share of renewables is to be increased to 45% of TPED. The share of sustainable biofuels is targeted to reach at least 18% of TPED. This will equate to over 50 billion litres of fuel ethanol demand and will require accelerated production growth in the near future. There is also a target to diversify the renewables mix away from an overdependence on hydropower. The share of non-hydro renewables is to be increased to 28-30% of TPED and 23% of power supply. Additionally, energy efficiency is expected to play a significant role in reducing energy consumption under the National Energy Efficiency Plan, which has set the goal of reducing electricity consumption 10% by 2030 compared with the growth projected in the National Energy Plan 2030. This is equivalent to cumulative energy savings of 107 terawatt-hours (TWh) from 2010 to 2030 (IEA, 2018b). The country's national innovation strategy to 2022 targets research and technological development in energy supply chains, especially biofuels, to strengthen competitiveness and diversify the energy mix.

## IEA and Brazil

The IEA has been working closely with Brazil since 2006. Key joint achievements prior to the CETP included the joint publication of the [Global Hydropower Technology Roadmap](#) and the Special Section on Brazil in the [WEO 2013](#). Brazil participates in five TCPs.

In October 2017, Brazil activated Association status with the IEA, laying the foundation for informed, sustained co-operation. The CETP is providing an opportunity to carry out strategic work on energy transitions based on the country's priorities, including energy efficiency, innovation and energy technology development, and electricity. Collaboration is also taking place on harmonising data collection on energy statistics and balances in Brazil and all other Latin

American and Caribbean countries. In addition, Brazil's recognised expertise in bioenergy, hydro and other forms of clean energy provides a good basis to develop solutions for global energy challenges. The country's experience in managing renewable resources in its energy mix can contribute to IEA discussions on a broadened concept of energy security. Brazil has also pioneered the use of auctions for long-term contracts for renewable energy, a model that is now successfully applied as best practice worldwide.

## 2018 CETP activities in Brazil

A broad range of work was carried out under the CETP this year and is expected to further ramp up in 2019.

### Energy efficiency

During 2018, co-operation on energy efficiency focused on supporting policy priorities through dialogue and sharing relevant international experiences. The IEA engaged with policy makers and stakeholders in person and through a series of webinars. Engagements included:

- A workshop in Rio de Janeiro on international experiences with market-based instruments for energy efficiency.
- Webinars focused on Brazil and co-sponsored with the Mexican Ministry of Energy (SENER) targeting a broader Latin American audience. These included "Perspectives on the multiple benefits of energy efficiency", co-hosted by the EPE and MME, which shared evidence of the numerous benefits that energy efficiency can deliver to households, businesses and the energy system, such as increased productivity, reduced subsidies and improved air quality. Other webinars included the "Special report on efficient cooling: Considerations for Latin America" and one on the *Energy Efficiency 2018* market report.<sup>3</sup>

In 2018, the IEA also undertook an energy efficiency data mapping and analysis project to enable a deeper analysis of Brazil in the IEA [Energy Efficiency 2018](#) market report and the IEA [World Energy Investment 2018](#) report (this project was carried out in co-operation with Mitsi Projetos).

The IEA also sponsored five participants from Brazil to take part in the Energy Efficiency in Emerging Economies Training Week held in Paris on 14-18 May 2018.

### Electricity

IEA work on electricity transitions in 2018 mainly supported Brazil in tailored approaches to renewable energy integration and the related implications in terms of power system planning. CETP support allowed the hosting on 22 November 2018 of a closed-door session organised in collaboration with EPE on the sidelines of the Clean Energy Ministerial Days event on integration of renewables (see paragraph "2018 CETP activities in Latin America" for additional details). The event focused on metrics to assess Brazil's power system reliability and on future needs in terms of market design. Given the specific characteristics of Brazil's electricity generation, the session focused on power system reliability in a system with a large amount of reservoir hydro.

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<sup>3</sup> EPE is the entity supporting MME with studies and research on energy planning covering electricity, oil, natural gas and its derivatives, and biofuels.

## Sectoral work

In 2018, the IEA collected data on space cooling in Brazil for the IEA Global Exchange (including for the Kigali Tracker). Brazil also participated in the regional webinar “IEA special report on efficient cooling: Considerations for Latin America” (see paragraph “2018 CETP activities in Latin America” for additional details).

On 1 February 2019, the IEA took over from Brazil the role of the Facilitator of the Biofuture Platform (for further details, see “Global activities” section).

## Innovation

Collaboration on energy R&D policy with Brazil got off to a good start in 2018. A key activity – which will be continued during 2019 – is to contribute to the development of a national strategy for energy R&D in Brazil, as well as of a roadmap for its implementation. Two work streams are currently under development: i) support for the creation of a national strategy and tool for tracking energy technology innovation spending; and ii) a peer review on energy R&D policy.

On 26 October 2018, a first webinar presented the IEA methodology for R&D data collection, with the participation of seven Brazilian institutions, including three ministries, which introduced their needs and expectations. The content of the webinar was very positively received by participants. The participation and enthusiasm of stakeholders from a range of Brazilian institutions – including EPE, the Centre for Management and Strategic Studies (CGEE) and the Ministry of Foreign Affairs (Itamaraty) – will be valuable to scaling up activities during 2019. In addition, the 2019 project to assist Brazil in tracking energy technology innovation spending has synergies with other relevant work in the region and beyond.

## China

### Highlights of 2018 CETP activities in China

- Review the **power sector reform in China** (the largest power sector in the world). An IEA report on [Power Sector Reform in China: An International Perspective](#) was launched in October 2018. The analysis is focussed on the mechanics and recent developments of China's power sector, and attempts to channel to Chinese policy makers international experiences relevant to implementation of current Chinese power sector reforms.
- Contribution to the preparation of China's **long-term low-carbon energy transitions strategy** through partnership with National Development and Reform Commission, National Energy Administration, Ministry of Ecology and Environment and others. This included co-organisation of a workshop on China's mid-century strategy for climate mitigation in March 2018. The IEA brings its integrated approach to energy challenges and expertise in scenario development to this collaboration.
- Providing insights and analysis on China's national **Emissions Trading System (ETS)** as it relates to ongoing power sector reform and other low-carbon policies on energy conservation, renewable energy, and control of coal supply and consumption. The Chinese ETS is set to form a key element of the multilayered policy approach to driving toward sustainable energy transition.
- Co-operation on **energy efficiency and renewable statistics**, including a workshop jointly organised with the China National Bureau of Statistics (NBS) in Beijing in May 2018. The workshop gathered 100 statisticians from China national and provincial statistics offices and saw the official launch of the IEA Mandarin translation of videos on statistics training.
- Analysis on **space cooling and ESCO market development**, based on a strong framework for collaboration with the National Development and Reform Commission (NDRC) to accelerate progress on energy efficiency as reflected in an MoU signed in October 2018.

### Context

China has played a central role in defining the global energy landscape over the last several decades, becoming the world's largest consumer and producer of energy. Given its high overall energy consumption and its reliance on coal, China produces around 28% of global emissions. The power system is the country's largest source of CO<sub>2</sub> emissions, accounting for 40% of total national emissions, and 11.1% of global emissions.

China has made huge strides in energy efficiency and is also the world's leading investor in renewable energy, with the greatest renewable energy capacity and representing 36% of global projected renewables growth in the medium term (to 2021). The trajectory of development of the Chinese energy sector will continue to be influential in shaping global trends, including the speed and depth of global clean energy transitions.

The scale of clean energy deployment in China, technology exports and outward investment makes it a key determinant of momentum behind global low-carbon transition. The IEA New Policies Scenario shows that one-third of the world's new wind power and solar photovoltaics (PV) will be installed in China by 2040. The country also will also account for more than 40% of

global investment in EVs and a quarter of the projected rise in global gas demand. While China remains a towering presence in coal markets, IEA scenarios suggest that coal use peaked in 2013 and is set to decline by almost 15% by 2040.

China is now entering a new phase of development. Energy demand growth has slowed remarkably with structural changes, including a transition towards a more services-based economy. There is a strong emphasis on moving towards a more diversified and cleaner energy mix to address challenges related to air quality, energy security and climate change. Efficiency gains in China's industry and service sectors and residential sector saved more than 10 exajoules (EJ) in energy consumption in 2017, equivalent to the final energy consumption of Germany.

On the supply side, coal's share in the power mix has already declined from 81% in 2007 to 65.5% in 2017, while energy needs are increasingly met by hydro, nuclear, natural gas, wind and solar PV resources. Today, China has the largest installed capacity of land-based wind power and solar PV globally. The IEA NPS shows that installed low-carbon capacity, led by hydropower, wind and solar PV, will continue to grow rapidly and make up 60% of total capacity by 2040. By 2040, the cost of generating electricity from new solar PV will also become lower than the projected operating costs of existing coal-fired power plants. These developments will have major implications both domestically and internationally, and go hand in hand with the power market transformation that is under way.

**Table 2. Key statistics from China**

Energy and environment statistics				
Energy demand (Mtoe) 2017e	3 051		Modern renewable share in total final energy consumption, 2016	8.4%
Energy demand (Mtoe) 2040	<b>NPS</b> 3 858	<b>SDS</b> 2 968	Mean annual exposure to air pollution (PM <sub>2.5</sub> ), 2017	53.5 µg/m <sup>3</sup>
CO <sub>2</sub> emissions (Mt) 2017e	9 255		Energy intensity measured in terms of primary energy and GDP, 2016	0.15 toe/ USD 1 000 (2010)
CO <sub>2</sub> emissions (Mt) 2040	<b>NPS</b> 9 054	<b>SDS</b> 3 248	CO <sub>2</sub> /GDP PPP (kgCO <sub>2</sub> /2010 USD), 2016	0.50
Economic and social statistics				
Total GDP (billion 2010 USD), 2016	9 505		Population (million), 2016	1 379
Compound average annual GDP growth rate (2000-17)	9.1%		Population compound average annual growth rate (2000-17)	0.5%
GDP PPP (billion 2010 USD), 2016	19 450		Proportion of population with access to electricity, 2017	>99%

Notes: For WEO data China is People's Republic of China including Hong Kong.

Sources: IEA (2018a), IEA databases, OECD databases. A special report on China was prepared in 2017 ([WEO 2017 Special Report: China](#)).

## Clean energy transition targets

China's overarching strategy of creating a more sustainable and inclusive growth pattern has been elaborated in successive party and government meetings. In 2016, China's submission of its NDC to the UN Framework Convention on Climate Change undertook to make "best efforts" to achieve peak emissions before 2030. This includes a commitment to achieve a 20% share for non-fossil fuels in primary energy consumption by this date. Strong actions and policies have been put in place to accelerate efforts on energy efficiency, renewables, development of key technologies and reform of important markets. The IEA works closely with Chinese counterparts in all these

areas. The next stage in policy development includes assessment of the 13th Five-Year Plan (2016-20), and the framing and then disaggregation of targets for the 14th Five-Year Plan (2021-25). We are also entering an important period during which Chinese policy makers will consider potential development and reform trajectories to 2035 and 2050.

## IEA and China

The IEA's relations with China date back to a Memorandum of Policy Understanding in the Field of Energy in 1996. Since then, the IEA has established in-depth bilateral co-operation with China on a wide range of subjects, including energy security, energy statistics, energy markets (including renewables, energy efficiency, coal, oil and gas), energy technology, industry, buildings and transportation. China participates in 22 TCPs.

China became one of the first countries to activate Association status with the Agency in 2015. In the same year, the IEA held the first-ever Emergency Response Exercise in China, and the third IEA Unconventional Gas Forum was convened in Chengdu. While fostering direct links with the Agency's primary counterparts, the NEA, work with other agencies such as the Ministry of Science and Technology (MOST), the NBS and the NDRC has become increasingly frequent following the first official visit by the Executive Director of the IEA in September 2015. The IEA has been working closely with China in its endeavour towards a more sustainable energy economy including through work on technological R&D, energy efficiency, renewable energy and higher-quality statistics. Several IEA publications now include a chapter or section on China. Moreover, the *WEO 2017* carried a special focus on China's energy sector transformation, and the [Energy Efficiency Market Report 2016](#) presented a special focus on energy efficiency in China. In February 2017, the IEA and China solidified ties by signing an extensive three-year work programme, which includes work on energy policy analysis, joint learning and data exchange.

Following the opening of a liaison office in Beijing in 2017, the co-operation between the IEA and China was further strengthened in 2018, encompassing a wide range of topics and seeing an enhanced engagement of key stakeholders involved in China's energy transition and energy sector reforms. These efforts have been greatly strengthened under the CETP. These strong ties were reflected in the organisation of joint side events at the China Pavilion since the 21st Conference of the Parties (COP21) (and including during the 24th Conference of the Parties [COP24], which took place in Katowice in December 2018).

## 2018 CETP activities in China

The CETP has provided an opportunity to build on the existing relationship with China through a wide range of strategic activities covering data and statistics, energy efficiency, renewable energy, and power system optimisation (PSO) and policy advice. The trajectory of China's energy transition will have a profound impact on global markets, trade and investment flows, technology costs, and the achievement of shared global goals. Below is an overview of recent and ongoing work in China under the CETP.

### Data and statistics

IEA work supported joint learning and knowledge exchanges on energy efficiency and renewables statistics, culminating in a workshop jointly organised with the NBS in Beijing from 23-25 May 2018. The workshop gathered around 100 statisticians from China national and



provincial statistics offices, as well as international participants.<sup>4</sup> Overall, the training provided a constructive platform for dialogue with the NBS on renewable and energy efficiency statistics, as well as for sharing experience and challenges from different countries on data collection, including IEA Members sharing their best practices.<sup>5</sup>

During the workshop, the IEA announced the launch of its Chinese language statistics training videos on YouTube and Youku. The NBS decided to include IEA training videos as part of their intranet training material.

### IEA and China NBS hold training workshop on energy statistics



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## Energy efficiency

Co-operation on energy efficiency focused on strengthening institutional relationships, joint research, policy dialogue and sharing relevant international experiences. Engagements included:

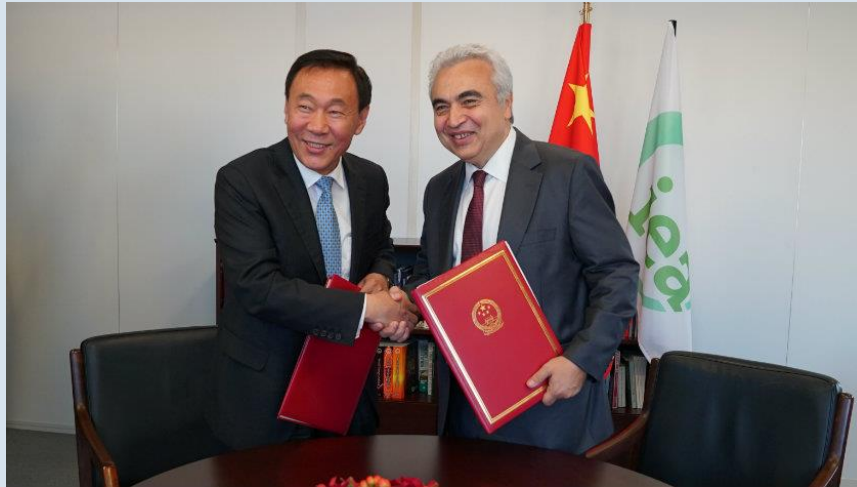
- Signing of MoU between the NDRC and the IEA to strengthen collaboration between the two agencies on energy efficiency. This was endorsed at a high level on both sides, with the MoU being signed by NDRC Vice Chairman Zhang Yong (minister-level) and the IEA Executive Director on 12 October 2018. The MoU encompasses four areas of collaboration: i) policy dialogue; ii) joint research; iii) experience sharing; and iv) capacity building.
- Development of the [Abridged Chinese Version](#) of the [Energy Efficiency 2018](#) market report with China's Council for an Energy Efficiency Economy. The IEA launched the report at the China Energy Economy Forum to an audience of over 200 policy makers and representatives from industry and academia.
- Kick-off of work with the ESCO Committee of the China Energy Management Conservation Association to jointly develop new analyses and insights on recent ESCO market development in China, including changing policy context, innovative business models, application of digital technologies and financing.

<sup>4</sup> Representatives of the China Electricity Council, the NDRC and the China National Renewable Energy Centre attended the workshop, in addition to statisticians from Indonesia, Lao PDR, Malaysia, Pakistan, the Philippines and Thailand.

<sup>5</sup> Austria and the United States joined the IEA delegation.



**Mr Zhang Yong, Vice Chairman of the NDRC and Dr Fatih Birol, IEA Executive Director**

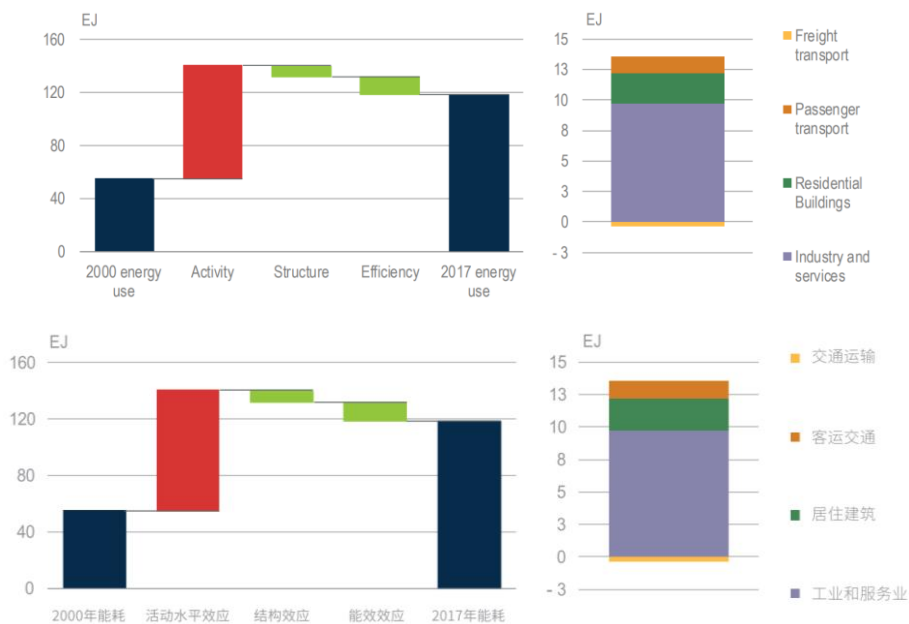


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As part of broader efforts to improve energy efficiency data and indicators, the IEA undertook an extensive data mapping and analysis project across all E4 countries to support improved analysis for the IEA [Energy Efficiency 2018](#) market report and the IEA [World Energy Investment 2018](#) report (in China this project was carried out by the Energy Research Institute of the NDRC).

The IEA also sponsored three participants from China to attend the Energy Efficiency in Emerging Economies Training Week in Paris on 14-18 May 2018, and various other IEA events, such as the annual "Global conference on energy efficiency".

**Figure 6. Decomposition of the six major emerging economies' final energy use, 2000-17 (left) and sectoral contribution to efficiency gains (right)**

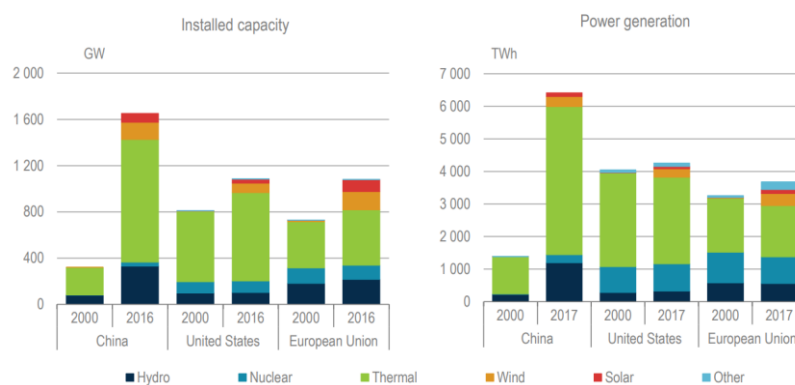


Sources: IEA (2018b) and (2018c).

## Electricity

The extensive IEA work on electricity transitions in China is built around co-operation with the NEA and is tailored to China’s specific needs and requests. During 2018, IEA efforts focused on PSO, renewable energy integration and related implications in terms of power system planning. A secondee from the NEA also contributed to the analyses performed under this work stream. The IEA conducted a deep review of reform efforts and challenges across selected aspects of the power system in China. Such activity also aggregated international experiences that can provide insights to Chinese policy makers in their efforts towards an efficient, secure and sustainable power system. This work led to the [Power Sector Reform in China: An International Perspective](#) publication, launched on 18 October 2018 during the main session of the International Energy Transitions Forum in Suzhou in front of an audience of several hundred participants.

Figure 7. Installed capacity (left) and electricity generation (right) of selected regions, 2000/2017



Source: IEA (2018d). All rights reserved.

Furthermore, the IEA contributed to the improvement of existing understanding on integrating cleaner sources of generation into smarter energy systems, thanks to a project on distributed energy systems with the NEA. Trust built with the NEA under this collaboration also led to the start of work on PSO in 2018 with different government departments from the NEA and the NDC. The final project deliverable, [China Power System Transformation: Assessing the Benefit of Optimised Operations and Advanced Flexibility Options](#), was published in February 2019. The IEA presented key findings of this project at a workshop in Beijing on 26 February 2019. There were more than 50 participants from government, international organisations, research institutions and embassies at the workshop including high-level representatives from NEA, SGCC and EPPEI.

The CETP also supported increased dialogue and exchanges through the participation in high-level and technical fora. These included the World Bank workshop “Knowledge exchange on renewable energy grid integration” in Xining on 25-26 September 2018 and the “Power system transformation” session of Suzhou Forum on International Energy Transitions in Suzhou on 19 October 2018.

The fruitful relations built with local stakeholders allowed for a very successful joint launch of the IEA [Renewables 2018](#) market report and the China National Renewable Energy Centre’s *China Renewable Energy Outlook* in Beijing on 25 November 2018. Over 50 participants from government, research institutes and embassies joined the launch, including representatives of the NDRC and NEA. The launch event exceeded expectations in terms of impact and positive media coverage. The NEA expressed several times very positive comments on the IEA and on

IEA-NEA collaboration, highlighting that it was one of the premier sources of information for Chinese policy makers on global energy trends and policies.

## Policy advice and modelling

Policy advice and modelling work during 2018 focused on providing China with long-term support on energy transitions and was organised under two main projects. The first was aimed at improving interactions between policies affecting energy transition objectives, with an emphasis on how the ETS aligns with energy policies.<sup>6</sup> Building from a request from Vice Minister Xie Zhenhua to the IEA Executive Director in late 2017 – and taking full consideration of the momentum for China’s ETS implementation over the coming years – the IEA welcomed the opportunity to work with the Department of Climate Change (DCC) at the Ministry of Ecology and Environment (MEE) to support the implementation of China’s national ETS. To this purpose, in 2018, the IEA Environment and Climate Change Unit hosted a first secondee from the DCC.

In August 2018, the IEA delivered a first report highlighting key findings and challenges from international ETS experiences relevant to the China national ETS. IEA experts have been participating in several workshops organised by China on this topic.<sup>7</sup> In line with the continued co-operation during 2018, the MEE invited the IEA to organise, together with other entities, the official high-level side event on China’s ETS at the Chinese Pavilion during COP24.

The second project involves engaging with a range of stakeholders in China including the NDRC and NEA and contributing to the preparation of China’s long-term low-carbon energy transitions strategy, bringing an integrated IEA approach to energy challenges and expertise in scenario development. The IEA co-organised a workshop on the mid-century strategy for climate mitigation framing and methodologies, which took place in Beijing 27-28 March, and participated in a second workshop hosted by NDRC on 24 January 2019. The IEA Chief Modeller participated in both workshops. During these missions, the IEA team met with officials from the NDRC, NEA and MEE. In addition, Chinese experts from China Energy Investment Corporation also participated in the [WEO 2018](#) electricity workshop held on 24 April 2018.

As a recognition of the positive co-operation on climate change, an MoU was signed with the MEE in July 2018. The main areas of focus include the ETS work as well as long-term low-carbon scenario analysis; air quality; carbon capture, utilisation, and storage (CCUS); the multilateral climate change process and issues; exploring international best practices; financing and investment; resilience; and technology innovation.

## Sectoral work

IEA activities under this work stream comprise CCUS, bioenergy and cooling.

On CCUS, work under the CETP mainly involved exchanges with relevant institutions in China, such as the NDRC, MOST, the Administrative Centre for China's Agenda 21 (ACCA21), the National Centre for Climate Change Strategy and International Co-operation (NCSC). In addition, the IEA contributed to the Coal Industry Advisory Board Associates Meeting, hosted by China,

<sup>6</sup> The announcement of China’s national ETS in December 2017 represents a major milestone in the global development of carbon pricing and carbon markets. The national ETS aimed to be one of the major policies in Chinese climate change governance to deliver effective long-term emissions reductions in line with the Paris Agreement and China’s Ecological Civilisation vision. The policy will be a key driver of China’s energy system transformation and will support scaling up China’s climate finance. In addition, China’s national ETS will encourage other emerging and even developing economies to consider and to implement carbon-pricing policies. Its success will facilitate climate negotiations on international co-operation and future potential international carbon markets.

<sup>7</sup> Global Climate Action Summit in San Francisco in September, International Carbon Action Partnership (ICAP) -GIZ-Sinocarbon ETS training in Haikou, and Asia-Pacific Forum on Low-Carbon Technology in Changsha in October.

and to the Asia Pacific (APAC) Global Carbon Capture and Storage Forum 2018 and members meeting in Shanghai (for further details, see "Global activities" section).

On bioenergy, the CETP supported the IEA and Biomass Energy Industry Promotion Association (BEIPA) of China in the co-organisation of an International Symposium on Biomass Clean Energy Utilisation in Beijing on 28 November 2018, part of a broader series of international exchanges on biomass energy. This event brought together over 150 prominent national policy makers, industrialists and international experts to chart the future of bioenergy in China. The event focused on the potential role of bioenergy, relevant bioenergy support policies and market development both in China and abroad, and the use of waste and progress in advanced biofuels and thermochemical processes in China. This activity will serve as a basis to expand IEA support to China on bioenergy throughout 2019.

The CETP also supported IEA's participation in other international exchange events organised by BEIPA on biomass energy. These included a high-level meeting with BEIPA in Beijing on 27 November, and the Bioenergy Conference held in Hengshui on 26 November 2018. In the latter, the IEA gave introductory remarks and participated in the opening ceremony of the construction of the Hengshui international biogas city. The conference involved over 120 participants from industry, government and the media. IEA participation also received coverage from provincial media through two interviews with an audience of several million people. Further engagement on bioenergy includes the participation in the "Taiyuan energy low-carbon development forum" in Taiyuan from 16-18 September.

On space cooling, the IEA is collaborating with Tsinghua University, Energy Foundation China and the China National Institute for Standardisation (CNIS) in reviewing and undertaking analysis on potential savings from implementing higher minimum energy performance standards for space cooling equipment and controls. A first workshop was co-hosted by the IEA, Tsinghua University and Energy Foundation China on 18 September 2018 in Beijing, bringing together some of the largest air-conditioning manufacturers in China and policy makers in a productive dialogue. The IEA is also working to collect space cooling data and information for the IEA Global Exchange (including for the Kigali Tracker). On the same subject, the IEA contributed to the "Twinning workshop on energy efficiency and climate-friendly refrigeration and air-conditioning" that took place on 11-12 April in Beijing.

## India

### Highlights of 2018 CETP activities in India

- **Improving energy data** through IEA participation in cross-ministerial working groups, which include more than 14 government agencies.
- Two major training weeks in India in December 2018. The first on **Energy Statistics and Building an Energy Balance**, co-organised with NITI Aayog and gathering 90 participants, 30 from the Central Government and 60 from 20 (of the 29) states. The second was the first-ever **country-focused Energy Efficiency in Emerging Economies Training Week** and involved 106 energy efficiency officials from 22 state and local governments as well as think tanks.
- In-depth work on addressing challenges related to **power system transformation**. In 2018 this included a series of four regional workshops and a national workshop organised by the IEA and NITI Aayog, with support from the Asian Development Bank (ADB), in April 2018. The workshops saw a combined participation of 185 energy professionals who discussed regional challenges of integrating variable renewables in power systems in India.
- **In-depth review of India's energy policies**, which entailed extensive engagement with key government and non-government energy decision-makers. The report will be released in 2019 and will provide a basis for identifying further opportunities for collaboration on key areas of energy policy in India.
- Enhanced co-operation with the Ministry of Science and Technology (MST) on **energy technology innovation**. Following an MoU signed between the IEA and the MST, a joint cross-ministerial innovation roundtable was organised in New Delhi in December 2018 to build a shared understanding of how best to improve energy RD&D tracking, policy good practice and innovation partnerships.
- Continuous engagement through various **high-level exchanges** in India. The Executive Director visited India twice in 2018 and met with multiple ministers, the CEO of NITI Aayog and several other key actors.

## Context

India is rapidly moving to the centre stage of global energy markets. The population of the country has increased by more than 100 million since 2010, and GDP has grown at an annual average rate of nearly 7% during this time. This continuing economic and demographic growth along with the structural trends of rapid urbanisation and growth in the manufacturing sector are contributing to a steep expansion of energy demand. Total electricity demand grew by around 7.7% per year between 2010 and 2017 and is projected to double by 2040. While the share of renewables in the energy mix is increasing, coal remains the backbone of the Indian power sector, accounting for over 70% of generation. India's energy mix will have global implications, including through its energy-related GHG emissions. In the IEA NPS, India will produce around 4.7 gigatonnes (Gt) of CO<sub>2</sub> emissions by 2040 as compared with only 2.4 Gt in the SDS. Today, India emits 2.0 Gt per year (IEA, 2018a).

Despite this rapid growth in energy demand, per capita electricity consumption in India is among the lowest in the world. At present, India's population of 1.3 billion consumes only about 6% of

global energy. Along with energy access, poor air quality and unreliable power supplies are key challenges related to the country's energy sector. Furthermore, India's growing dependence on fossil fuel imports, which account for around half of its energy consumption, raises energy security concerns. The transition of India's energy system will play a central role in deciding the country's ability to mitigate GHG emissions, increase energy access, reduce air pollution and enhance energy security.

**Table 3. Key statistics from India**

Energy and environment statistics				
Energy demand (Mtoe) 2017e	898		Modern renewable share in total final energy consumption, 2016	10.5%
Energy demand (Mtoe) 2040	<b>NPS</b> 1 880	<b>SDS</b> 1 358	Mean annual exposure to air pollution (PM <sub>2.5</sub> ), 2017	90.2 µg/m <sup>3</sup>
CO <sub>2</sub> emissions (Mt) 2017e	2 195		Energy intensity measured in terms of primary energy and GDP, 2016	0.11 toe/ USD 1 000 (2010)
CO <sub>2</sub> emissions (Mt) 2040	<b>NPS</b> 4 738	<b>SDS</b> 2 447	CO <sub>2</sub> /GDP PPP (kgCO <sub>2</sub> /2010 USD), 2016	0.30
Economic and social statistics				
Total GDP (billion 2010 USD), 2016	2 465		Population (million), 2016	1 324
Compound average annual GDP growth rate (2000-17)	7.2%		Population compound average annual growth rate (2000-17)	1.4%
GDP PPP (billion 2010 USD), 2016	7 905		Proportion of population with access to electricity, 2017	87.5%

Sources: IEA (2018a), IEA databases, OECD databases. A special report on India was prepared in 2015 ([WEO 2015 Special Report: India Energy Outlook](#)).

## Clean energy transition targets

There is strong political will in India to move towards a more sustainable energy sector, reflected in ambitious targets to scale-up renewable energy. The country has set itself a target of 175 gigawatts (GW) renewable energy capacity by 2022, which will help to meet its NDC commitment to have 40% of total capacity to be non-fossil by 2030. India has made good progress meeting this target, having increased its renewables capacity to over 70 GW in 2018. The target is supported by implementation measures such as land designated for solar development and renewable purchase obligations. India was the fourth-largest country in terms of new installed solar PV capacity in 2016 and remains the fourth-largest wind market globally in cumulative capacity.

The Indian NDC also includes the target of reducing emissions intensity of GDP by 30-35% of 2005 levels by 2030. India has a long-standing Energy Conservation Act, enacted in 2001 and amended in 2010, and a comprehensive portfolio of policies and programmes, most notably its Perform, Achieve and Trade (PAT) scheme, standards and labelling programme, and a recently revised Energy Conservation Buildings Code for commercial buildings and a newly launched Energy Conservation Buildings Code for residential buildings.

Since 2000 around half a billion people have gained access to electricity in India, and the country is on track to achieving the target of universal household electricity access by the early 2020s. In 2018, the goal of providing electricity to every village in the country was met ahead of schedule.

Since 2015, India has also shown strong engagement under MI and is seeking to double governmental and/or state-directed clean energy RD&D investments over five years.

Pressing challenges related to integration of variable renewables in the power sector, improving the financial health of the power distribution sector, mobilising finance for clean energy investments and energy efficiency, among others, still need to be addressed.

## IEA and India

The IEA and India benefit from a long, ongoing bilateral relationship built on co-operation in a broad range of areas, including energy security, statistics, efficiency, market analysis and technology. India participates in 11 TCPs.

India joined the IEA as an Association country in March 2017. Co-operation with the country dates back as early as 1998 with the signing of the Declaration of Co-operation covering issues related to energy security and statistics. The NITI Aayog and the IEA signed a Statement of Intent to enhance co-operation across a number of issue areas, including forecasting and data, in 2016. The IEA and India also have long-standing relationships with the BEE under the Ministry of Power and other ministries.

A key result of this relationship has been the inclusion of data and insights on the Indian energy sector in IEA analysis of the global energy system. For instance, the [WEO 2015](#) featured a special report on India's energy outlook and the [WEO 2018](#) contains a deep dive into the Indian electricity system as part of its electricity focus. Also in 2018, analysis on India was included in several key IEA reports including [World Energy Investment 2018](#), the [Energy Efficiency 2018](#) market report, [The Future of Cooling](#) and [The Future of Rail](#).

The year 2018 saw a steady stream of high-level engagement between India and the IEA. The IEA Executive Director visited New Delhi twice during the year to meet with the three key energy ministers, as well as the CEO of NITI Aayog and senior officials at the Ministry of External Affairs. On the second visit, the Executive Director was introduced by the Power Minister and given the honour of delivering the prestigious Darbari Seth lecture for 2018. The Deputy Executive Director and other Directors also visited New Delhi to launch key IEA publications and participate in flagship Indian events. The Director General of the International Solar Alliance, the first treaty-based international organisation headquartered in India, visited the Executive Director to discuss enhanced collaboration with the IEA.

## 2018 CETP activities in India

Under the CETP, the relationship between India and the IEA has strengthened through close collaboration with key stakeholders in the energy sector. There has been great willingness shown across government and non-government partners in India to work with the IEA, resulting in substantive contributions and joint work across all CETP work streams. Reflecting this deepening and increasingly collaborative relationship, two local CETP consultants have been engaged to provide extensive on-ground support and enable growing IEA work in India under the CETP. They work closely with local partners including government agencies, think tanks and private-sector stakeholders and provide logistical and analytical support to IEA teams.

## Data and statistics

Under the CETP, the IEA is working closely with various ministries involved with energy in India to improve energy data under a joint initiative with NITI Aayog on its energy data management system. This is aimed at identifying the energy data gaps through insights collected from all the

stakeholders involved in energy data management to make short-term and longer-term recommendations to bridge such gaps.

In March 2018, the IEA undertook the first detailed discussion with India on the country's energy data and its organisation, achieving agreement among ministries to work on data gap analysis, review of data collection surveys, and training and joint learning activities (first focused on the Central Statistics Office). The IEA Chief Statistician and officials from the IEA Data Centre undertook a mission to New Delhi in March 2018 to understand the state of energy statistics, the stakeholders involved, the plans under way and how the Agency could contribute effectively to improving energy data in India. With support from NITI Aayog, the IEA team met and had discussions with 14 ministries/organisations involved with energy data collection and management.<sup>8</sup> Following the initial consultations, new cross-ministry working groups on supply and demand data were established to better co-ordinate work on data collection and sharing across ministries with the IEA as a member in an advisory role.<sup>9</sup> The IEA participated in most meetings of the cross-ministerial groups (in person or by video call). The IEA will continue working closely with NITI Aayog and stakeholders on how to implement the conclusions of the working groups and sub-groups in 2019.

As part of these efforts to improve energy data in India and develop joint learning and knowledge exchanges, the IEA and NITI Aayog organised a training week on Energy Statistics and Building an Energy Balance in India in December 2018. The training week was conducted in New Delhi for government and non-government officials involved in collection, compilation and dissemination of energy data in their respective organisations, and comprised a four-day detailed training for national officials, and a one-day workshop for states officials. Issues discussed included key energy data gaps, data availability, challenges in energy data collection and compilation in India and ways to address them, and the role of various stakeholders at the national and state levels. This event gathered approximately 90 participants, with about 60 representing 20 of the 29 states of India.<sup>10</sup> Building on the training, participants expressed interest in further collaborative activities with stakeholders responsible for energy data in the states to further harmonise processes for data collection. Following the training, NITI Aayog reiterated the interest to continue collaboration with the IEA; suggested next steps include conducting energy data workshops at state and regional levels, for the five regions of the country.

In addition to these substantial activities, the opportunity was taken to engage delegates from India through participation in the 16th IEA Energy Statistics Course held from 8-12 October 2018 in Paris. Four representatives from MOSPI, the PPAC and the CEA participated.

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<sup>8</sup> These included: NITI Aayog, Ministry of Statistics and Programme Implementation (MOSPI), Ministry of Petroleum and Natural Gas (MoPNG), Petroleum Planning and Analysis Cell (PPAC), Ministry of New and Renewable Energy (MNRE), Ministry of Road Transport and Highways, Ministry of Railways, Ministry of Micro, Small & Medium Enterprises, Coal Controllers Organisation, Central Electricity Authority (CEA), BEE, Indian Space Research Organisation (ISRO), Department of Atomic Energy, CEEW and the Prayas Energy Group.

<sup>9</sup> These working groups are divided into four sub-groups of fuels (oil and gas, renewables, coal, electricity) and four sub-groups covering specific demand sectors (agriculture, transport, industry, buildings).

<sup>10</sup> The participants represented different ministries (MoPNG, MNRE, Ministry of Coal, Ministry of Power [MoP], MOSPI, etc.), associated government agencies (CEA, PPAC, etc.), industry associations and major think tanks working in the energy sector in India. The workshop witnessed a participation of around 30 representatives from Central Government, associated agencies and think tanks. On 4 December, a special forum was organised for the officials from the state governments (including departments of agriculture, transport, urban development and energy), since much of the work regarding data collection, aggregation and compilation happens at the state level.



### Workshop on energy statistics with India



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The IEA Energy Data Centre (EDC) also took this opportunity to hold productive side meetings with participants regarding data collection to help focus the above-mentioned training held in New Delhi in December 2018.

## Energy efficiency

In 2018, the main areas of work included joint learning and knowledge exchanges on energy efficiency for state and local governments and space cooling (see paragraph on sectoral work).

Within the E4 Programme, the IEA organised its first-ever country-focused joint learning and knowledge exchange event for state and local governments in close collaboration with BEE in New Delhi from 10-13 December.

The partnership with BEE was critical in ensuring participation of the states. Consequently, more than 100 energy efficiency professionals, primarily comprising delegates from 22 Indian state governments, participated in the training. Representatives of four CETP Funders – the European Commission, Germany, Switzerland and the United Kingdom – contributed to this training by participating in a panel discussion around the lessons learned through international energy efficiency experiences. The IEA also sponsored two participants from India to take part in the Energy Efficiency in Emerging Economies Training Week held in Paris on 14-18 May 2018.

As part of a broader effort to improve energy efficiency data and indicators across E4 economies, the IEA has also been undertaking an energy efficiency data mapping and analysis project in India. This activity enabled a focus on India in the IEA [Energy Efficiency 2018](#) market report and the IEA [World Energy Investment 2018](#) report.

### Participants at the India Energy Efficiency in Emerging Economies Training Week



Source: Sanjeev Narula, Liberty News Pictures

## Electricity

Extensive work has been under way under the CETP on addressing the challenges of integrating variable renewables in power systems in India. As a part of these efforts, the IEA and NITI Aayog, with support from the ADB, convened a series of workshops in April 2018 focused on power system transformation to deliver India's ambitious renewable energy targets. Regional workshops were held in Chennai (Southern region), Pune (Western region), New Delhi (Northern region) and Kolkata (Eastern/ North-Eastern regions). These events brought together stakeholders to identify regional trends and challenges, exchange global best practices and discuss technological, economic and regulatory issues.<sup>11</sup> The outcomes of regional workshops were discussed and finalised in the national workshop on 20 April in New Delhi, which provided the foundation for the further work in these areas by stakeholders and will inform policy analysis and planning.<sup>12</sup>

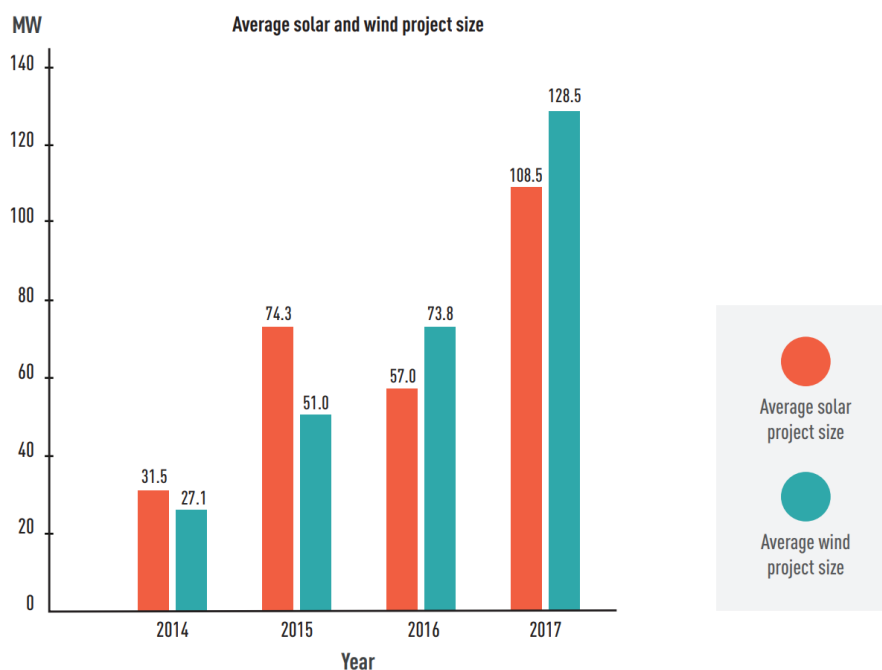
In 2018, the CETP also commenced a project in collaboration with the CEEW to assess clean energy investment trends, with a focus on renewables and the power sector. This project is aimed at providing stakeholders a practical guide for understanding the current clean energy investment environment in India and how the evolution of regulations and risks impact where finance is flowing (and where it is not). In June 2018, IEA and CEEW published a first joint paper [Clean Energy Investment Trends: Evolving Investment Landscape for Grid-Connected Renewable](#)

<sup>11</sup> In particular, the role of regional system operation co-ordination, the regional role of transmission, interconnection, distribution, grid-connected and off-grid renewables, flexible thermal power plant operation, and time-based flexibility solutions such as demand response and storage for future electricity systems were discussed.

<sup>12</sup> This report ([www.niti.gov.in/content/workshop-report-2018-indian-power-sector-low-carbon-strategy-renewable-energy-integration](http://www.niti.gov.in/content/workshop-report-2018-indian-power-sector-low-carbon-strategy-renewable-energy-integration)) was launched in New Delhi in July 2018 in the presence of the Deputy Executive Director of the IEA and the Additional Secretary for Energy, NITI Aayog, and was provided to relevant ministries and authorities including the Ministry of Power, the CEA and the Central Electricity Regulatory Commission. NITI Aayog took the opportunity to express appreciation for the substantial contribution to the project from the IEA and agreed to continue collaboration in 2019, including through joint learning and knowledge exchange activities at the state level focused on market design and regulation for power system flexibility and financial viability of distribution companies.

[Energy Projects in India](#).<sup>13</sup> The analysis focused on the changing market landscape in the form of market concentration in investment decisions for solar and wind generating capacity; trends relating to the management of land acquisition and evacuation infrastructure risks and the role of solar parks; changes in average sanctioned solar and wind project sizes over time; and the evolution of off-takers for solar and wind projects from 2014 to 2017.

Figure 8. **Average solar and wind sanctioned project sizes have increased**



Note: MW = megawatts.

Source: [IEA/CEEW \(2018\)](#).

The IEA also completed a joint project with the CEEW analysing the employment impacts of clean energy transitions in emerging economies with a focus on gender aspects. The project focused on the rooftop solar sector of India as a first case study. The IEA and the CEEW conducted a survey of key rooftop solar companies to identify women's participation in the workforce across the value chain and the challenges female employees face working in the sector. The project also assesses companies' effort to improve the gender balance and make policy recommendations to encourage and enable companies to advance actions. The results of the analysis were published on the IEA website as an independent, [online report](#) in February 2019.

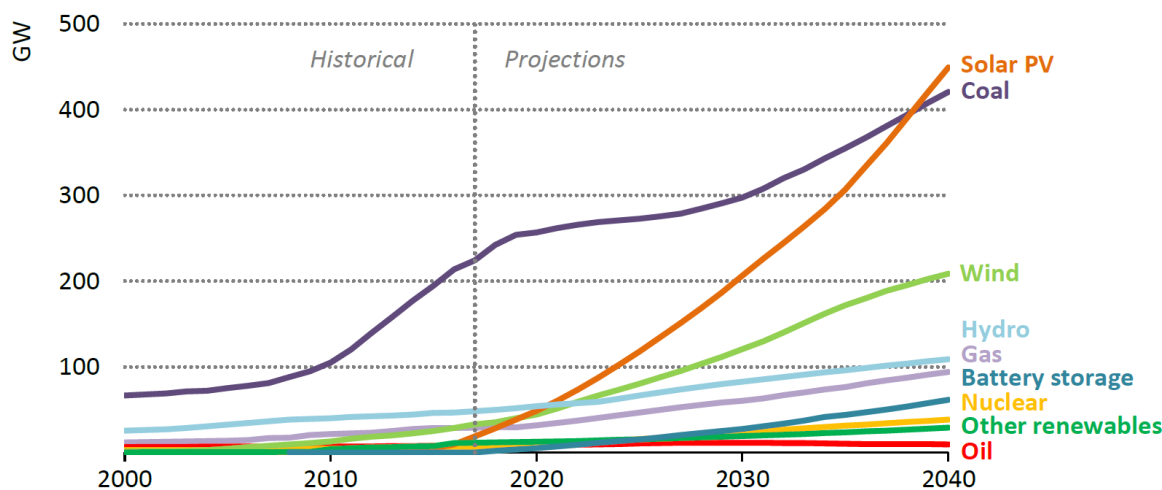
## Policy advice and modelling

In order to support the first-ever electricity sector focus in the [WEO 2018](#) (including the section on the power sector in India), the CETP facilitated the participation of a secondee from CEEW.

<sup>13</sup> The report ([www.ceew.in/publications/clean-energy-investment-trends](http://www.ceew.in/publications/clean-energy-investment-trends)) was launched in June 2018 at the CEEW Renewable Energy-Dialogue conference in New Delhi in the presence of the IEA Director (Acting) of Sustainable Technology and Outlooks. Findings were also presented at the 2nd Global RE-Invest in October 2018 at a plenary session attended by more than 200 participants including panellists such as the Chair of the Indian Renewable Energy Development Agency (IREDA), Global Head of Renewables at Yes Bank, the Head of the Energy Sector Management Assistance Program at World Bank, former Chair at State Bank of India, the India head at KfW and others. The report was also presented at NITI Aayog along with the *World Energy Investment* report of the IEA in October 2018 followed by a productive discussion on concerns regarding ensuring the financial sustainability of the power mix and the costs and benefits of integration of renewables in the power system.

The secondee worked with the *WEO* team for three months to contribute to this analysis and provided inputs and perspectives on India’s power sector policies and programmes. Along with valuable substantive inputs, this secondment also provided an important means to develop a strong collaborative partnership with this key think tank and enhanced the basis for ongoing partnership. A senior official from NITI Aayog and an expert from The Energy and Resources Institute (TERI) also participated in the [WEO 2018](#) electricity workshop held on 24 April 2018.

Figure 9. **Installed capacity by source in India in the NPS**



Source: IEA (2018a). All rights reserved.

The IEA and India also started working on an in-depth review (IDR) of India’s energy policies to be published in 2019. Discussions with all key energy-related ministries<sup>14</sup> were held in November 2018 to introduce the idea and process of the IDR. This was part of an extensive process of engagement and resulted in very strong participation in the review visit in early 2019, and support to the process at the highest levels of the Indian government. NITI Aayog is providing active and valuable support, including by engaging with all relevant ministries for the review and associated funding.

### Sectoral work

The IEA launched [The Future of Cooling](#), which included analysis on emerging economies such as India, in New Delhi in July at a roundtable convened by BEE and the IEA. The launch coincided with the consultation process for India’s National Cooling Action Plan (NCAP), and it was attended by stakeholders engaged in the development of the plan. The event enabled productive discussions on how to promote energy-efficient cooling in India. There was a strong expression of interest in continuing to work together collaboratively on cooling, including from the Director General of BEE. Following the roundtable, the IEA provided feedback on the NCAP draft. India will continue to be a key country for IEA work on sustainable cooling, as cooling could become the largest contributor to future growth in electricity demand and peak load.

IEA also co-hosted a workshop on “Renewable hydrogen for industry and beyond” with CEEW in New Delhi from 13-15 November 2018. The event made visible IEA work on hydrogen and

<sup>14</sup> Including MoPNG, Ministry of Power, Ministry of Finance, MNRE, Ministry of Coal, MST, and Ministry of Environment, Forest and Climate Change (MOEFCC).

provided an opportunity to bring together key stakeholders in this space in India. Along with making the keynote presentation, IEA staff ran sessions focusing on ammonia, methanol and steel making. The sessions saw participation from both government and industry representatives.<sup>15</sup>

In addition, the IEA [Renewables 2018](#) market report was launched in Delhi in November 2018. Local partners TERI and CEEW jointly arranged the launch event, which took place at TERI headquarters. Senior IEA staff also participated in other high-profile events to highlight work under the CETP, including at Renewables 2018 (CEEW's flagship renewables conference on 29 June 2018 in New Delhi).<sup>16</sup>

CETP also supported India-related work on the report [The Future of Rail](#) (for further details, see "Global activities" section). The global launch of the report took place in New Delhi in January 2019 with the Indian Minister of Railways, the Chairman of the Indian Railway Board and the Executive Director of the IEA. A workshop took place in Paris in September 2018 in preparation for this report and included four speakers from India.

## Innovation

The IEA is supporting the Indian government in delivering its low-carbon energy technology innovation objectives, especially MI commitments, through: i) improved R&D data; ii) improved understanding of the elements of the national energy innovation systems and policy options; and iii) enhanced multilateral collaboration through innovation partnerships. This activity seeks to respond to the information gap on the landscape of existing multilateral efforts on clean energy technologies, and sets out a basic analytical approach for decision makers to prioritise participation in international mechanisms of energy technology collaboration.

This work is supported by strong institutional partnership with the MST. On 30 August 2018, the IEA Executive Director signed an MoU with the MST on enhancing innovation for the clean energy transition in the presence of the Indian Minister for Science and Technology. Under the MoU, both sides agreed to co-operate on RD&D tracking, mapping and policy good practice. The collaboration is currently in the process of undertaking work towards tracking and analysing energy R&D spending in India, convening stakeholders and mapping existing policy environment. The IEA engaged a dedicated consultant to support this work in India in 2018 and is recruiting an in-house official to take forward further innovation-related efforts in 2019.

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<sup>15</sup> Including Reliance Industries, Indian Oil Corporation, Tata Steel, JSW Group.

<sup>16</sup> These panels included senior representatives from IREDA, CEEW, Department of Biotechnology, Avaada Power, National Institute of Solar Energy and TERI among others.



**Dr Harsh Vardhan, Minister for Science and Technology, Dr Renu Swarup, Secretary of the Department of Biotechnology and Dr Fatih Birol, IEA Executive Director**



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On 6 December 2018, the IEA and the MST hosted a joint cross-ministerial roundtable to kick off the collaborative efforts on energy innovation.<sup>17</sup> The event helped develop working relationships among key staff from the IEA and relevant Government of India ministries and to build a common foundation for the ensuing project work to implement the MoU, based on a shared understanding of the state of play and opportunities for progress. The event featured several panels where participants exchanged information about four specific areas of mutual interest:

1. tracking public-sector clean energy R&D spending and the structure of the funding systems in India and comparative examples from other relevant countries
2. methodologies and current/best practices for tracking private-sector clean energy RD&D in India and around the world
3. Indian clean energy RD&D success stories and lessons for policy makers from these success stories
4. partnerships to accelerate innovation, such as MI and IEA TCPs.

A key outcome of the event was for the IEA to improve understanding of India's recent and ongoing efforts to accelerate energy innovation, including what measures, approaches and programmes have been effective and where there is room for improvement and identification of case studies that provide a foundation for further learning. Senior policy makers underlined opportunities to incorporate India's path-breaking innovation work into IEA databases and analysis. Discussions from the event will feed into the innovation chapter of the IEA IDR of India energy policies.

<sup>17</sup> The workshop was attended by around 25 participants with about a dozen key ministries and government agencies concerned with energy innovation including the MST (Department of Biotechnology, Department of Science and Technology, and Department of Scientific and Industrial Research); MoP; MNRE; MoEFCC; BEE; and representatives of several CETP Funder countries (namely the European Commission, Italy, the Netherlands, Sweden, the United Kingdom and the United States), each making informed and supportive interventions.

## Indonesia

### Highlights of 2018 CETP activities in Indonesia

- Support to improve **energy data collection and dissemination** through the development of a work programme with the Ministry of Energy and Mineral Resources (MEMR) Data and Information Centre (PUSDATIN). The focus is on data accuracy and completeness for key fuels and for fuel demand and energy end use.
- Ongoing technical exchange on **power system flexibility** resulting in the co-organisation of a workshop in November 2018 where presenters and participants discussed the role of flexibility options to accommodate variable renewable energy (VRE) integration, including international examples.
- High-level discussions on possible **co-operation on electric vehicles**, including the possibility of establishing a GEF-related project with IEA assistance for supporting EV roll-out.
- Improved **in-country co-ordination** with the engagement of two local consultants involved in the IEA work programme in Indonesia and Southeast Asia.
- **High-level exchanges**, including the IEA Executive Director's official visit to Indonesia in July 2018 to engage in high-level talks with government and industry leaders to discuss IEA-Indonesia relations and the agency's extensive substantive work in the country.

### Context

Indonesia is a resource-rich archipelagic nation with a sizeable population of more than 260 million people – the fourth-largest in the world. It is the largest economy in ASEAN and an active member of the G20 and the Asia-Pacific Economic Cooperation (APEC). The country plays a significant role as both a major energy producer and consumer in regional and international markets. It is the largest coal producer in Southeast Asia (and the fifth-largest globally) and the world's second-largest coal exporter. It is also the largest exporter of gas and liquid biofuels regionally. To 2040, Indonesia is expected to make the second-largest contribution to global coal growth after India. More than 80% of the energy in Indonesia comes from fossil fuels, with coal power plants still the main source of electricity. This predominance of coal in the energy mix contributes to the fact that Indonesia is the third-largest CO<sub>2</sub> emitter in Asia after China and India. Indonesia's CO<sub>2</sub> emissions per unit of energy use are seventh-highest globally, and set to further increase by 2040 unless a rapid clean energy transition is achieved. Coal-fired power and industry also contribute to worsening air quality in the country.

Indonesia is currently exploiting around 5% of its renewable energy capacity, but has great potential for development of renewable energy sources. Indonesia holds around 28 GW or 40% of the world's geothermal reserves, about 32 GW of potential biomass reserves and 75 GW of hydro-energy resources. It also has a considerable solar energy potential of about 1 200 GW of electrical capacity. Indonesia is a significant producer of biofuels and geothermal power, of which the country is the third-largest producer globally. Despite the challenge of connecting energy resources to areas of demand throughout Indonesia's 6 000 inhabited islands, renewable energy could significantly enhance the provision of basic energy needs on isolated islands and rural off-grid areas, as the cost of transporting fossil fuels to far-off islands is high. Maximising renewable

resources will also help strengthen the security of energy supply by reducing dependence on imported oil.

At the same time, Indonesia boasts tremendous potential for improvements in energy efficiency. Energy efficiency improvements since 2000 have offset a remarkable 23% of the impact of growing economic activity, preventing 9% additional energy use in 2017. Adopting cost-effective energy efficiency measures would limit further energy demand and could help avoid 2 EJ of additional energy use and the emissions of 120 million tonnes of CO<sub>2</sub> equivalent (MtCO<sub>2</sub>-eq) by 2040.

The availability of sustainable and sufficient energy will be an important driver of Indonesia's economic and social development. Therefore, managing and meeting demand growth while ensuring the environmental sustainability of energy supplies remain key pillars of its economic and investment policies and strategies. This will require stronger policy planning and implementation, more investment in critical energy infrastructure, and continued movement towards regulated energy markets and cost-reflective pricing.

**Table 4. Key statistics from Indonesia**

Energy and environment statistics				
Energy demand (Mtoe) 2017	238		Modern renewable share in total final energy consumption, 2016	6.9%
Energy demand (Mtoe) 2040	<b>NPS</b> 417	<b>SDS</b> 369	Mean annual exposure to air pollution (PM <sub>2.5</sub> ), 2017	16.7 µg/m <sup>3</sup>
CO <sub>2</sub> emissions (Mt) 2017e	473		Energy intensity measured in terms of primary energy and GDP, 2016	0.08 toe/ USD 1 000 (2010)
CO <sub>2</sub> emissions (Mt) 2040	<b>NPS</b> 904	<b>SDS</b> 444	CO <sub>2</sub> /GDP PPP (kgCO <sub>2</sub> /2010 USD)	0.20
Economic and social statistics				
Total GDP (billion 2010 USD), 2016	1 038		Population (million), 2016	261
Compound average annual GDP growth rate (2000-17)	5.4%		Population compound average annual growth rate (2000-17)	1.3%
GDP PPP (billion 2010 USD), 2016	2 754		Proportion of population with access to electricity, 2017	94.8%

Sources: IEA (2018a), IEA databases, OECD databases. A special report on Southeast Asia was prepared in 2017 ([WEO-2017 Special Report: Southeast Asia Energy Outlook](#)).

## Clean energy transition targets

In support of the Paris Agreement, Indonesia pledged to increase the share of new and renewable energy in primary energy supply to reach 23% by 2025 and 31% by 2050. It also pledged to reduce GHG emissions by 26% from business-as-usual (BAU) level by 2020, and by 29% from BAU by 2030, and by 41% by 2020 with international support. While progress has been made including in the areas such as reforming energy subsidies, energy efficiency and energy data, meeting the goal of 23% of energy supply from renewable sources by 2025 will be a challenge in the absence of a more ambitious and concerted policy push.



## IEA and Indonesia

Indonesia activated Association status with the IEA in 2015. The strong partnership between Indonesia and the IEA was fostered under a Joint Programme of Work that spells out the areas of substantive co-operation between Indonesia and the IEA (including training and joint learning and knowledge exchanges, energy policy analysis, and energy data and statistics) and provides a roadmap for future technical engagement.

The IEA and Indonesia have completed two in-depth reviews of Indonesia's energy policies, in 2008 and 2015. Each review provided a series of recommendations for Indonesia's energy policies. Beginning in 2013, Indonesia and the IEA further enhanced their co-operation by undertaking a review of Indonesia's fossil fuel subsidies. PUSDATIN and the IEA have been working together on enhancing Indonesia's energy data and statistics over several years, which led to the publication of the IEA *Data and Statistics Manual* in Bahasa in 2005.

**Mr Ignatius Jonan, Indonesia's Minister of Energy and Mineral Resources, and Dr Fatih Birol, IEA Executive Director**



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## 2018 CETP activities in Indonesia

Work in Indonesia under the CETP covers an established collaboration on data and statistics, support to enhance energy efficiency, and electricity transformation. There have also been initial requests for the IEA's assistance in developing pilot programmes for EV promotion in Indonesia. Given the expanding collaboration with Indonesia under the CETP, there are now two full-time IEA consultants based in Jakarta to co-ordinate work with local and regional stakeholders. This greatly increases the Agency's capacity to engage in sustained and in-depth work in the region.

### Data and statistics

The IEA is working with PUSDATIN, other directorates in the MEMR and other ministries to improve data quality and coverage by providing technical assistance aimed at enhancing Indonesian energy data and strengthening energy balances. This focuses on data accuracy and

completeness for key fuels – coal, oil and gas (across production, use, trade etc.) – and, importantly, for fuel demand and energy end use. The IEA will also seek to enhance cross-agency collaboration on data over the course of the programme. The IEA delegation met with representatives of several General Directorates: oil and gas, mineral and coal, new and renewable energy and energy conservation (EBTKE) and electricity to acquire a granular understanding of existing and required data and processes. Following this mission, PUSDATIN developed an engagement plan for the IEA to guide co-operation. Furthermore, thanks to the IEA local contractors who collected and translated into English the templates used for data collection at Statistics Indonesia (BPS), the IEA will also work to identify the data already collected that could be used to improve Indonesia's energy statistics and balances.

## Energy efficiency

Under the E4 Programme, the IEA is working with the MEMR to assist in enhancing the effectiveness of existing energy efficiency policies. In 2018, the main focus has been on industry sector efficiency. Engagement included:

- A workshop on industrial energy efficiency and another one on energy efficiency in the buildings sector.
- Commenced a review of regulation in the industry sector and a project to redesign the industry reporting system, which is ongoing.
- Keynote address and presentation of latest IEA analysis, including from the [Energy Efficiency 2018](#) market report and [The Future of Cooling](#), at the Indonesian Energy Efficiency and Conservation Conference and Exhibition.
- Participation of over 100 Indonesian policy makers and energy efficiency professionals in the IEA Southeast Asian Training Week (more details under regional update for Southeast Asia), which took place in Jakarta from 16-20 July 2018 and was co-hosted with the Indonesian MEMR.

The IEA also sponsored four participants from Indonesia to take part in the Energy Efficiency in Emerging Economies Training Week held in Paris held on 14-18 May 2018.

The IEA also undertook a data mapping and analysis project to help support improved analysis for the IEA [Energy Efficiency 2018](#) market report and the IEA [World Energy Investment 2018](#) report and incorporate insights from Indonesia in these reports.

## Electricity

Under the CETP, analysis has begun to assess renewables costs in Indonesia, with aims to provide guidance on key ways to reduce these costs. Future work aims to examine power market reform in Indonesia – providing analysis on ways to conduct reform that enhances power sector functioning, policy frameworks for investment and improvements in the financial sustainability of the system within the current vertically integrated utility model. In support of these activities, the IEA plans to work with PLN, the utility, as well as other local stakeholders from the finance and investment community.

Furthermore, the IEA is supporting the enhancement of capabilities on power system flexibility. In November 2018, the IEA co-organised a workshop with the Institute of Essential Reform (IESR) and Agora Energiewende with the support from the MEMR and PLN. The event drew around 40 participants and targeted PLN and the directorate general of electricity; the main objective of the workshop was to provide knowledge on power system flexibility and the role of flexibility options to accommodate VRE integration, including international examples. There were five sessions with three presenters each (two from Agora and one from the IEA). Based on the interest

generate, there is a plan to organise a two- to three-day workshop/training and analytical work on flexibility by IESR in co-operation with Agora and the IEA in 2019.

At the Indonesia Energy Transition Dialogue Forum, the IEA presented insights on grid planning and operation for high VRE penetration. The high-level forum was held in conjunction with the launch of Indonesia's Clean Energy Forum on 15 November 2018. The main objective of the forum was to introduce the idea of energy transition and techno-economic issues to key stakeholders in the energy sector in Indonesia. Participation in the forum provided visibility to IEA work on electricity transitions, and enabled engagement with other participants of the high-level panel discussion including the Director General of EBTKE, Head of the Fiscal Policy Agency from the Ministry of Finance, and ambassadors of Denmark and the United Kingdom. The forum was organised by IESR with a keynote speech from the Indonesian Minister of Energy and attracted around 200 attendees from public and private sectors, think tanks, NGOs and donors.

## **Sectoral work**

A key priority for MEMR is policy development related to scale-up and promotion of EVs. A number of high-level discussions took place, including in 2018 when IEA support for this activity was discussed during a meeting between the Minister of Energy, Mr Ignatius Jonan, and the IEA Executive Director in July. Since then, senior management in MEMR and the IEA have discussed Indonesia's involvement with IEA work streams on electric mobility and the possibility of establishing a GEF-related project with IEA assistance for supporting EV roll-out.

## Mexico

### Highlights of 2018 CETP activities in Mexico

- Technical exchange on **cross-border trading of electricity and capacity**, with a specific focus on trading between the United States and Mexico. A workshop and seminar were organised in Long Beach, California (with 50 participants), and Mexico City, involving officials from the Mexican government and relevant stakeholders from both countries.
- Comprehensive collaboration on energy efficiency, which included the organisation of **two workshops** on “Multiple benefits and opportunities of energy efficiency in hospitals and schools” and “Energy efficiency indicators and data: Smart tools for smart savings”.
- Sharing expertise on fundamentals on statistics and essentials for policy making with the launch of **two online training courses** on energy efficiency indicators, targeted at statisticians and policy makers.
- Review and assessment of the **status of energy efficiency and the Internet of Things** and co-ordination with local and international stakeholders.

## Context

Mexico is the second-largest economy in Latin America and a major oil producer and exporter. Prospects for further growth in the country’s population, cities and economy are high, especially in comparison with other IEA Member countries. Total energy demand in Mexico has grown by a quarter since 2000 and electricity consumption has grown by half, but per capita energy use is still less than 35% of the average in the Organisation for Economic Co-operation and Development (OECD), leaving scope for further growth. SENER projects power generation to rise from around 300 TWh today to around 470 TWh in 2029. IEA scenarios suggest it could grow past 500 TWh by 2040. The energy mix is currently dominated by oil and natural gas, with oil accounting for around half of the total. A transition to a cleaner energy system in Mexico will therefore play a key role in ensuring that the expected growth is sustainable. Non-fossil fuel power generation, primarily from hydropower and nuclear, currently accounts for one-fifth of the total. Wind power has gained a foothold, with capacity reaching around 3 GW in 2015, but remains far below its potential. The market for solar PV is nascent, but is expected to grow rapidly.

In recent years, Mexico has embarked on a comprehensive reform of the energy sector, aimed at modernising, diversifying and decarbonising the energy system. According to the latest available long-term planning documents, around 65 GW of the projected 100 GW of new capacity to 2040 is set to come from renewable sources. The reforms reorganised the governance of the energy sector with the aim of bringing new players, investment and technology into the power sector to ensure cost-efficient investment into both traditional and low-carbon sources of electricity.

**Table 5. Key statistics from Mexico**

Energy and environment statistics				
Energy demand (Mtoe) 2017	180		Modern renewable share in total final energy consumption, 2016	9.2%
Energy demand (Mtoe) 2040	<b>NPS</b> 235	<b>SDS</b> 184	Mean annual exposure to air pollution (PM <sub>2.5</sub> ), 2017	21.2 µg/m <sup>3</sup>
CO <sub>2</sub> emissions (Mt) 2017	428		Energy intensity measured in terms of primary energy and GDP, 2016	0.09 toe/ USD 1 000 (2010)
CO <sub>2</sub> emissions (Mt) 2040	<b>NPS</b> 482	<b>SDS</b> 311	CO <sub>2</sub> /GDP PPP (kgCO <sub>2</sub> /2010 USD), 2016	0.20
Economic and social statistics				
Total GDP (billion 2010 USD), 2017	1 285		Population (million), 2017	124
Compound average annual GDP growth rate (2000-17)	2.0%		Population compound average annual growth rate (2000-15)	1.2%
GDP PPP (billion 2010 USD), 2017	2 117		Proportion of population with access to electricity, 2017	>99%

Sources: IEA (2018a), *World Energy Outlook 2018*, IEA databases, OECD databases. A special report on Mexico was prepared in 2016 ([WEO-2016 Special Report: Mexico Energy Outlook](#)).

## Clean energy transition targets

In the lead-up to COP21, Mexico became the first emerging economy to submit its Intended Nationally Determined Contribution (INDC) with ambitious targets. Under the mitigation scenario of the INDC, emissions peak in 2026 and are 25% below the BAU level in 2030. Carbon intensity is reduced by 40% between 2013 and 2030. The INDC also includes goals to reduce the emissions of short-lived climate pollutants (SLCPs). Integrating climate policy and air pollution policy brings synergies, as reducing SLCPs has a direct impact on air quality and the health of the population. In line with the emissions profile, the largest emissions reductions are expected to come from the electricity sector (31% of BAU emissions of 202 MtCO<sub>2</sub>-eq, unconditional) followed by the transport sector (18% of 266 MtCO<sub>2</sub>-eq). Smaller reductions are expected in the oil and gas sector (14% of 137 MtCO<sub>2</sub>-eq), manufacturing (5% of 165 MtCO<sub>2</sub>-eq) and agriculture (8% of 93 MtCO<sub>2</sub>-eq). Mexico's GHG emissions per capita are much lower than the IEA average. If Mexico implements its INDC pledge effectively, per capita overall GHG emissions peak around 2025 and are still one of the lowest among the G20.

The energy- and climate-related targets have been given a strong legal basis in Mexico. The General Law on Climate Change (2012) provides the foundation for the country's mitigation and adaptation policies and programmes. The law stipulates that the country should prioritise cost-effective actions that create co-benefits for the population, and seeks a 30% reduction of GHG by 2020 below BAU subject to the availability of financial resources and technology. It also includes a long-term target to reduce GHG emissions by 50% from 2000 to 2050. The law increased Mexico's capability to implement climate policy following a long-term approach, binding future governments. It also includes a target for clean energy sources to provide 35% of electricity supply by 2024. The INDC was developed in consistency with the law's objective of 50% by 2050. The clean electricity target became a more concrete legal obligation under the 2015 Energy Transition Law. Its purpose is to promote sustainable and efficient use of energy, and to gradually increase targets for the share of clean energy in electricity generation by 2024. As part of its strategy to implement the law, Mexico has set the goal of reducing the energy intensity of final consumption by almost 2% annually from 2016 to 2030. The annual target will increase to just

under 4% from 2031 to 2050. The law also requires the development of a national strategy and programme on energy transition to promote cleaner energy sources and technologies.

## IEA and Mexico

Mexico officially became the 30th IEA Member country on 17 February 2018, and its first Member in Latin America. Mexico's energy sector was highlighted and analysed in the first IEA in-depth energy policy review of Mexico in 2017, as well as in the [Mexico Energy Outlook](#) in 2016. As with all Member countries, the IEA Secretariat is working with Mexico to provide technical support on data collection systems.

Work on energy efficiency has been an area of close collaboration since the launch of the E4 Programme in 2014. As in other E4 countries, the IEA has most closely co-operated with the Ministry of Energy, SENER, as well as with the National Commission for the Efficient Use of Energy (CONUEE). Since 2015, a full-time consultant based in Mexico City has been engaged to deepen the relationship with key partners and institutions and to provide extensive on-the-ground support for IEA energy efficiency activities in Mexico.

Mexico is a technology leader in geothermal energy and has been active in ten of the IEA's TCPs for over a decade, including the International Smart Grid Action Network (ISGAN), Advanced Fuel Cells, Greenhouse Gas R&D and Enhanced Oil Recovery TCPs, as well as six renewable energy TCPs.

## 2018 CETP activities in Mexico

Work in Mexico in 2018 focused on energy efficiency, electricity and data and statistics. The CETP work programme in Mexico is expected to significantly ramp up in 2019.

### Energy efficiency

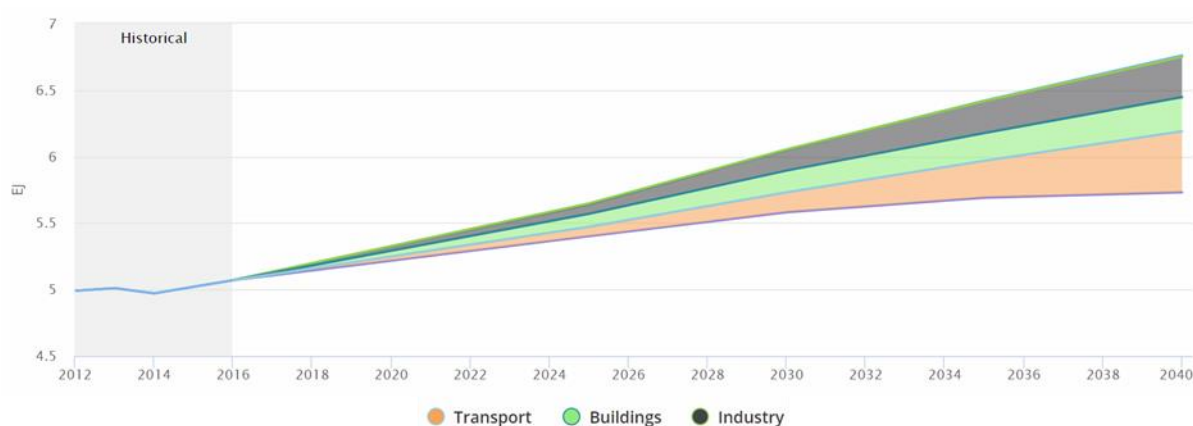
The primary focus on energy efficiency in 2018 was on strategies to advance energy efficiency in buildings, responding to Mexico's policy priorities and to opportunities. The IEA continued to work with SENER, CONUEE and other stakeholders to advance implementation of the Roadmap for Building Energy Codes and Standards, including through a workshop focused on the benefits of advancing energy efficiency in hospitals and schools (described in more detail in the next section). The IEA also co-organised a webinar on "Energy efficiency and digitalisation" with SENER in January 2018, which was attended by over 300 people. Following the webinar, the IEA conducted a review and assessment of the status of energy efficiency and the Internet of Things in Mexico to identify opportunities to advance energy efficiency with the help of digital technologies.

SENER co-hosted two additional webinars for Latin America together with the Brazilian government (MME and EPE): "IEA special report on efficient cooling: Considerations for Latin America" and "*Energy Efficiency 2018* market report".

The IEA also sponsored six participants from Mexico to attend the Energy Efficiency in Emerging Economies Training Week held in Paris on 14-18 May 2018.

Finally, the IEA is engaging in building an international community of energy efficiency practitioners. In September 2018, it organised a reunion in Mexico City of former participants from Mexico to IEA Energy Efficiency in Emerging Economies Training Weeks in Paris and Rio de Janeiro, creating an opportunity to strengthen the network of young professionals working in the sector, as well as to maintain contact with the IEA.

Figure 10. Energy savings by sector in Mexico, Efficient World Scenario versus NPS\*



The Efficient World Scenario, developed by the IEA World Energy Outlook, assesses what the world will look like if between now and 2040, countries implemented all the economically viable energy efficiency potential that is available. Further details available at: [www.iea.org/efficiency2018/#EWS](http://www.iea.org/efficiency2018/#EWS).

Source: IEA (2019). All rights reserved.

## Energy efficiency and data and statistics

As part of a series of engagements with SENER and CONUEE to strengthen co-operation around data and indicators, the IEA launched, on 8 March 2018 in Mexico City, two energy efficiency indicators online training courses. The launch event was very well attended, with participants from SENER, CONUEE, the National Statistical Agency (INEGI) and a number of other institutions. Around 200 people have registered for the courses, focused on fundamentals on statistics and essentials for policy making, through online live streaming. The content of the courses was structured in collaboration with the IEA Energy Data Centre to provide training on IEA methodology also in preparation for the technical workshops organised on 25 and 27 September 2018.

The IEA organised two technical workshops in Mexico City in collaboration with SENER, CONUEE and other statistical bodies, data holders (such as the Energy Regulatory Commission [CRE]) and stakeholders. The first workshop aimed at improving knowledge on multiple benefits and opportunities of energy efficiency in hospitals and schools. It took place on 25 September 2018 and was attended by 47 participants from several ministries (including the federal Ministries of Education and Health), state and city governments, public hospitals, and bilateral and international organisations. Three presenters were invited to share their experiences in Chile, India and the United States. There was a particular interest in experience with implementation of energy efficiency projects, from getting started to ramping up activity over time. The workshop helped to identify areas of interest for further work and collaboration where the IEA can provide value added, such as holding an Energy Efficiency in Emerging Economies Training Week focused on the subnational level.

The second workshop, titled "Energy efficiency indicators and data: Smart tools for smart savings", took place on 26-27 September 2018 and saw the participation of 54 people from several federal ministries and agencies as well as from city and state government, research institutes and international agencies. The purpose of the workshop was to engage participants in a discussion on the importance of energy efficiency indicators and the benefits of good data sharing and analysis to inform and track policy, and to learn from one another and from IEA experience about how to advance data and indicators over time. The workshop was designed to ensure broad participation by key stakeholders working on energy and end-use data across



several institutions. It built on the methodologies presented in the online course to engage more deeply in the process of defining indicators and collecting data on energy consumption in Mexico.

### Energy efficiency in schools and hospitals workshop



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## Electricity

Work under the CETP focused on sharing knowledge and practices to enhance cross-border trading of electricity and capacity and took the form of a US/Mexico workshop and a seminar. The first workshop, focused on cross-border trading of electricity and capacity between Mexico (primarily Baja California) and the United States (primarily California), was co-organised by the IEA and the Electric Power Research Institute (EPRI) on 20 August 2018 in Long Beach, California. The event was attended by 48 participants, including six officials from the Mexican government. The IEA supported travel arrangements for three of them. The work included three main components. The first part focused on modelling of North America, the West and Mexico with different degrees of interconnection and trade, presented by the National Renewable Energy Laboratory (NREL), EPRI and the University of California, Berkeley, and provided a good foundation for discussions. The second component of the workshop focused on energy trading, where the California Independent System Operator (CAISO) presented the US perspective on the Western Energy Imbalance Market (EIM) status and lessons learned, and Mexico's National Energy Control Centre (CENACE) presented the Mexican perspective. Finally, the third part focused on capacity trading both from the US and Mexican points of view, with the latter viewing several potential benefits in introducing such a market mechanism, given the significant long-term capacity needs of Mexico.

The seminar on cross-border trading of electricity and capacity was held on 22 August 2018 in Mexico City, involving 20 representatives from the Mexican government, as well as a speaker from EPRI. Discussions focused on capacity trading and the integration of Mexico with the



Central American Electrical Interconnection System (SIEPAC), creating an occasion to exchange views on the role of regulators and the issue of governance in cross-border exchanges.

Looking forward and given the expected increase in distributed PV generation in the country, work on electricity will also aim at providing an up-to-date perspective of international best practice for the deployment of distributed generation along with methodologies to recognise the costs and benefits of integrating renewables into the electrical system.

### **Sectoral work**

On space cooling, ongoing work is focused on the collection of additional data for the IEA Global Exchange (including for the Kigali Tracker efforts) to have improved understanding of how current policies and technologies affect energy use for cooling.

## South Africa

### Highlights of 2018 CETP activities in South Africa

- Enhanced co-operation culminating in South Africa **joining the IEA family as an Association Partner** in November, becoming the first sub-Saharan African country to institutionalise its engagement with the IEA, a development that marks an important milestone for energy governance in Africa and globally.
- **High-level exchanges** resulting in the Executive Director's official visit to South Africa to meet the Minister of Energy, co-sign the agreement for Association, and strengthen relationships with several national and regional stakeholders.
- Collaboration on **energy efficiency policy monitoring and target setting**.
- Support for the **development of a cross-agency energy and GHG reporting system** to monitor progress towards broader climate policy goals.
- Development of indicators for the industry sector.

### Context

South Africa is a major player in African energy markets, representing the largest energy consumer on the continent, accounting for about half of Africa's electricity capacity and possessing one of the highest electrification rates. South Africa's household electrification programme has resulted in the number of households with access to electricity increasing from 35% in 1994 to over 85% in mid-2017.

The energy mix is dominated by coal with a fleet of ageing coal-fired power plants, followed by oil. There is significant potential to improve energy efficiency and increase the share of renewable energy in the energy mix. South Africa will produce around 3.2 Gt of CO<sub>2</sub> emissions by 2040 in the NPS as compared with only 1.6 Gt in the SDS (estimated current emissions are around 3.4 Gt).

The growth of the South African economy drove a 19% increase in energy use between 2000 and 2017. In particular, output in the industry and services sectors increased by 70%. Structural changes contributed to a 10% increase in energy use during that same period largely due to changes in transport modes and vehicle occupancy. Movement away from energy-intensive sectors partially offset demand increases. Rising economic activity and household incomes, together with enhanced access to modern conveniences, are expected to further boost electricity demand by 1.2% per year to 2030.

Diversification away from coal towards renewables, gas and nuclear sources and a decline in energy intensity are key priorities in a scenario where South Africa meets ambitious economic and social development goals ([IEA, 2014](#)).

**Table 6. Key statistics from South Africa**

Energy and environment statistics					
Energy demand (Mtoe) 2017e	131			Modern renewable share in total final energy consumption, 2016	3.3%
Energy demand (Mtoe) 2040	<b>NPS</b> 138	<b>SDS</b> 100		Mean annual exposure to air pollution (PM2.5), 2017	25 µg/m <sup>3</sup>
CO <sub>2</sub> emissions (Mt) 2017e	415			Energy intensity measured in terms of primary energy and GDP, 2016	0.21 toe/ USD 1 000 (2010)
CO <sub>2</sub> emissions (Mt) 2040	<b>NPS</b> 329	<b>SDS</b> 162		CO <sub>2</sub> /GDP PPP (kgCO <sub>2</sub> /2010 USD), 2016	0.60
Economic and social statistics					
Total GDP (billion 2010 USD), 2016	420			Population (million), 2016	56
Compound average annual GDP growth rate (2000-17)	2.8%			Population compound average annual growth rate (2000-17)	1.4%
GDP PPP (billion 2010 USD), 2016	672			Proportion of population with access to electricity, 2017	84.2%

Sources: IEA (2018a), IEA databases, OECD databases. A special report on Africa was prepared in 2014 ([WEO-2014 Special Report: Africa Energy Outlook](#)).

## Clean energy transition targets

In August 2018, the Department of Energy (DOE) published a draft Integrated Resource Plan (IRP 2018) – the national electricity plan to guide electricity sector investments. This is the first formal update to the IRP in eight years, and targets an increase in generation capacity derived from wind and natural gas, each targeted to increase by 8 GW of capacity, while 5.6 GW will come from solar and 2.5 GW from hydropower. Coal will add 1 GW under the IRP, while the plan incorporates no new-build nuclear capacity.

South Africa is also in the process of drafting its post-2015 NEES as part of its National Development Plan 2030.

## IEA and South Africa

South Africa joined the IEA family as its most recent Association country in November 2018. With the activation of Association, South Africa's energy minister and the IEA Executive Director signed a three-year joint programme of work identifying opportunities for collaboration on energy statistics, energy efficiency, electrification and power system transition, renewables integration, energy innovation, and domestic gas market design. Co-operation between the IEA and South Africa will build on a nearly decade-long relationship shaped by collaboration on three previous joint work programmes (signed in 2011, 2013 and 2015). Entities from South Africa participate in eight TCPs.

### Mr Jeff Radebe, Minister of Energy of the Republic of South Africa, and Dr Fatih Birol, IEA Executive Director



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## 2018 CETP activities in South Africa

In 2018, the IEA focused on relationship building with key partners and counterparts in South Africa to set the stage for more robust implementation of CETP projects from 2019. Substantive work in 2018 focused on energy efficiency in industry and ongoing engagement with South African statisticians on data and modelling, and culminated in Association activation and the signing of the joint work programme. Furthermore, the IEA launched a new Africa-focused chapter to be realised in the years ahead through CETP initiatives and other parallel and complementary IEA programmes across Africa that are being supported by IEA Member countries. Activities under CETP will be scaled up in 2019, and South Africa will be a critical partner to support the IEA's delivery of this ambitious Africa-focused agenda.

### Energy efficiency

Under the E4 Programme, collaboration with South Africa has been focused on energy efficiency policy monitoring and target setting. The Government of South Africa through its NEES, NDC to the Paris Accord and other public statements has expressed a commitment to improving energy efficiency. South Africa has been developing a post-2015 NEES, which will set new energy efficiency targets and establish a monitoring system to track progress against those targets. In relation to the NEES, the IEA is primarily providing support in two areas:

- Contributing to the NEES through review of draft documents.
- Supporting the development of a cross-agency energy and GHG reporting system to monitor progress towards broader climate policy goals. The IEA's contribution is to focus on reporting requirements and indicators for the industry sector.

The IEA also undertook a data mapping and analysis project to help support improved analysis for the IEA [Energy Efficiency 2018](#) market report and the IEA [World Energy Investment 2018](#) report

and incorporate insights from South Africa in these reports. This project was carried out by the Zaron on behalf of E4.

In November 2018 a workshop was carried out to discuss three main subjects: energy data reporting process for large energy users; energy efficiency indicators in selected sub sectors (pulp and paper and automobile); and energy management systems.

The IEA hosted a webinar for the government of South Africa (DOE) on the *Energy Efficiency 2018* market report. The webinar shared the main results of the report and highlighted the energy saving potentials for South Africa under the Efficient World Strategy.

Furthermore, the IEA also sponsored four participants from South Africa to take part in the Energy Efficiency in Emerging Economies Training Week held in Paris on 14-18 May 2018.

Finally, work on the collection of additional data for the IEA Global Exchange (including for the Kigali Tracker efforts) commenced in 2018 with the aim to improve understanding of how current policies and technologies affects energy use for cooling.

## Global activities

As with the country-focused engagements, global-level work under the CETP was carried out with three key pillars of the programme in mind: 1) high-level engagement and collaboration, 2) joint learning and knowledge exchanges to formulate and implement policies, and 3) enhancing knowledge and evidence for policy making and implementation.

### Training, joint learning and knowledge exchanges

Joint learning, knowledge exchanges and technical collaboration continued to represent one of the cornerstones of IEA work with emerging economies in 2018, providing, in particular, a chance to learn how to develop and improve national energy statistics but also allowing exchange of best practices and perspectives sharing amongst policy makers. Under this framework, CETP enabled representatives of emerging economies to take part in IEA training courses and international conferences, namely the Energy Efficiency in Emerging Economies Training Week held in Paris from 14-18 May 2018, Energy Statistics Course from 8-12 October 2018, Energy Efficiency Global Conference, E4 roundtable in October 2018, and Energy Statistics Training and 17th regional Joint Organisations Data Initiative (JODI) Training Workshops jointly organised in Beirut by the IEA, the International Energy Forum (IEF), the UN Economic and Social Commission for Western Asia (ESCWA) and the UN Statistics Division (UNSD) in December 2018 (for further details, see “Regional activities” section).<sup>18</sup> In addition, CETP also made it possible to bring together international experts as trainers and speakers.

The Energy Efficiency in Emerging Economies Training Week has become a flagship event of the IEA E4 Programme. The training week in 2018 was the seventh energy efficiency training week organised by E4 since its inception in 2014. 150 participants from 40 countries completed the training, bringing the total number of participants of Energy Efficiency in Emerging Economies Training Week to over 800. The five-day training programme, including plenary sessions and four parallel sectoral streams (appliances and equipment, buildings, industry, and transport) has been designed to strengthen the knowledge base and hone the skills of energy efficiency policy makers. Each year, representatives from E4 partner institutions take part in the training, strengthening the collaborative relationships with the IEA but also becoming part of an international energy efficiency community. Since the first Energy Efficiency in Emerging Economies Training Week took place in Paris in 2015, it has been expanded to other regions across the world with demand from partners to expand it to Latin America and Southeast Asia.

Furthermore, online training material on energy data and statistics is being translated into Chinese, French and Spanish in order to increase the accessibility and geographical reach of the content.

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<sup>18</sup> The conference took place on 25 and 26 October in Paris. The agenda of the first day included thematic panels on: changes to energy systems, notably through decentralisation and digitalisation; economic and social challenges, and how efficiency can play a role in terms of delivering greater energy security, job creation and development opportunities in both developed and emerging economies; the role of cities and regions in enabling and delivering energy efficiency programmes and policies; and financing energy efficiency. The second day of the conference was dedicated to perspectives on the importance of energy efficiency from different stakeholders from governments, the private sector, international organisations and NGOs.

### Participants from the 7th Energy Efficiency in Emerging Economies Training Week



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## Innovation

In 2018, the IEA began undertaking a cross-agency innovation enhancement effort, starting with the identification of existing gaps and the key RD&D challenges that need to be overcome across all energy technologies and sectors to reach sustainable development goals. This work will be a major deliverable under Japan's G20 presidency and is expected to be released in June 2019. The broader IEA innovation enhancement effort will help improve IEA overall tracking capabilities, include a mapping analysis of international and regional innovation organisations and collaborations (e.g. the Innovation for Cool Earth Forum and Mission Innovation), and enhancement of the IEA's Technology Collaboration Programmes.

## Multilateral co-operation

The CETP enabled relevant multilateral co-operation engagement with a variety of global and regional organisations and initiatives. CETP supported energy dialogue focused on energy transitions, energy access and technology innovation under the G20 in Argentina, by both participating in meetings and creating substantive analytical work. In 2018, the IEA contributed three reports to the G20 discussions covering energy transitions, energy data and digitalisation, and fossil fuel subsidy reform. The first report, [\*Energy Transitions in G20 Countries: Energy Transitions Towards Cleaner, More Flexible and Transparent Systems\*](#), presented a comprehensive tracking of G20 progress in a range of areas related to energy transitions including energy access, system integration of variable energy sources and system flexibility, fossil fuel subsidy reforms, energy efficiency, and related investment and clean energy technologies. The second report, [\*Energy Transitions in G20 Countries: Energy Data Transparency and Market Digitalisation\*](#), described how comprehensive energy data is vital for countries to make the best policy and investment decisions on energy. The OECD and IEA jointly prepared the third report – an update on fossil fuel subsidy reform – at the request of the G20 Energy Transition Working Group. G20 countries recognised the IEA's deep expertise and analysis on the challenges of energy transitions and welcomed these reports. Such G20 successes in 2018 provide a strong foundation for continued IEA analysis towards the 2019 G20 presidency.



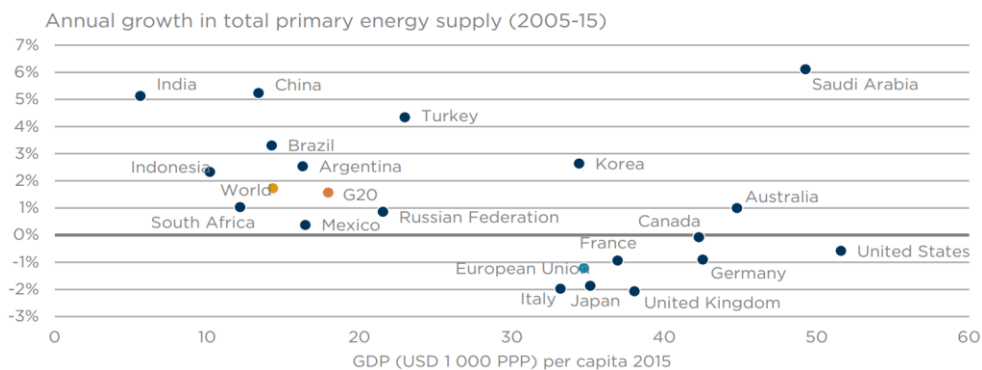
IEA participates in G20 energy ministerial meeting in Argentina



Source: G20 Argentina

CETP supported the participation of the IEA in the meeting of the G20 Energy Transitions Working Group in Buenos Aires. Along with the International Partnership for Energy Efficiency Cooperation (IPEEC) and the International Renewable Energy Agency (IRENA), the IEA set up a specific forum on energy efficiency and renewable energy. CETP also supported IEA's participation in the G20 energy ministerial meeting in San Carlos de Bariloche to discuss and review the various ways to transition to a low-carbon economy. IEA staff delivered a keynote address at the ministerial, providing an overview of the key IEA messages on the future of the energy sector, from oil and gas markets to renewables, GHG emissions and energy access.

Figure 11. Growth in energy demand and income per capita in G20 countries



Source: IEA (2018e). All rights reserved.

Under the CETP, the IEA also contributed to prominent international dialogue on flexibility and grid integration thanks to the participation of the Clean Energy Ministerial (CEM) Advanced Power Plant Flexibility Campaign and to the successor Power System Flexibility Campaign, aimed at deepening the understanding of available flexibility resources, including digitalisation and policy options. The participation in this initiative also resulted in the publication of the report [Status of Power System Transformation 2018 Advanced Power Plant Flexibility](#), jointly prepared with US NREL.



In 2018 the IEA signed a letter of intent for enhanced co-operation with MI, a global initiative of 23 countries – including all of the CETP focus countries – and the European Commission working to accelerate clean energy innovation and seeking to double clean energy RD&D spending over five years. Under CETP, the IEA is fostering collaboration to share lessons learned, reduce duplication of effort, and further build capabilities to collect timely and accurate RD&D data to inform innovation policies and effective partnerships.

Under the CETP, IEA had the opportunity to display work and serve as a voice for the critical role of the energy sector in ensuring sustainability and economic growth at the first Paris Peace Forum (11-13 November 2018). Over the course of the three-day event, the IEA led discussions with a variety of international partners on how to boost technology innovation in energy, foster energy access, and benchmark progress towards the UN Sustainable Development Goals, notably SDG7 on energy. The IEA also presented the Electric Vehicles Initiative (EVI), a programme created in 2010 under the CEM and co-ordinated by the IEA, with the aim of sharing best practices on mobility.

At COP24, CETP advanced discussions on integration of VRE by co-organising with Germany a specific side event highlighting international lessons learned, as well as by participating in panel discussions on renewable energy and to the launch of Global Green Energy Industry Council.

Recognition of the prominent role of the IEA in forwarding international discourse on energy was shown by the proposal of Brazil that the IEA assume the facilitator functions of the Biofuture Platform.<sup>19</sup> Under this arrangement, announced on 10 December during COP24 in Katowice, Poland, the IEA will further strengthen engagement and co-operation with 20 countries worldwide that are seeking to accelerate transition to sustainable low-carbon bioeconomy, including activities of technology and policy analysis, as well as enhanced partnerships during 2019.

## Hydrogen work

Contributions to the CETP have also been instrumental in enabling expanding IEA work on hydrogen, under which the IEA is building up capabilities and analysis for a major report to be delivered to the G20 ministerial in June 2019 as well as additional follow-on work. The IEA participated in the Japanese hydrogen ministerial in Tokyo in October 2018, where the Executive Director of the IEA made a presentation on accelerating and expanding the deployment of hydrogen in the context of clean energy transitions.<sup>20</sup> In 2018, the IEA also helped organise a workshop with the European Commission in Brussels on the potential role of electro-fuels in a decarbonising energy sector.<sup>21</sup> In addition, the IEA also contributed to the deep dive workshop of the Mission Innovation Challenge 8 on renewable and clean hydrogen in Berlin on 17 October 2018. The aims of this first workshop were to identify key barriers in the hydrogen value chain, discuss and develop targets for each barrier, and identify collaboration opportunities and research gaps. IEA efforts on hydrogen were also featured in the 2018 Peace Forum hosted by the French government.

<sup>19</sup> Biofuture Platform is a government-led, multi-stakeholder initiative designed to take action on climate change and support the Sustainable Development Goals by promoting international co-ordination on the sustainable low-carbon bioeconomy.

<sup>20</sup> This mission also included useful meetings with several Japanese hydrogen stakeholders including Toyota, the Institute of Energy Economy Japan, National Institute of Advanced Industrial Science and Technology, Mitsubishi, Technova, Mizuho Information & Research Institute, and Mitsui.

<sup>21</sup> In co-ordination with five IEA TCPs (Bioenergy, Hydrogen, Clean and Efficient Combustion, Advanced Fuel Cells, and Advanced Motor Fuels), as well as the Alternative Renewable Transport Fuels Forum (ART Fuels Forum).

## Space cooling

On space cooling, ongoing work is focused on the collection of additional data for the IEA Global Exchange (including for the Kigali Tracker efforts) to develop an improved understanding of how current policies and technologies affect energy use for cooling. In addition, IEA contributed to multiple “Twinning workshops on energy efficiency and climate-friendly refrigeration”, hosted by UNEP, around the world, including in Botswana, China, Guatemala, Thailand and Turkey. Furthermore, the IEA presented at the workshop organised in Beijing in April.

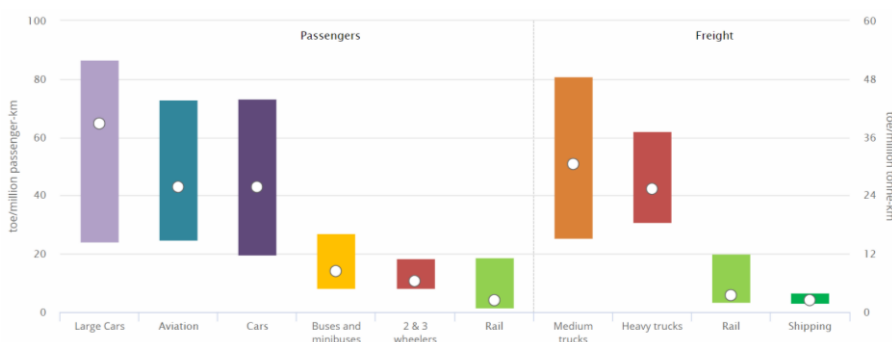
## Carbon capture, utilisation and storage

The CETP is supporting various CCUS efforts, including contributing to high-level international discussion with a main focus in Asia. In 2018, the CETP enabled the IEA to actively participate in a series of multilateral CCUS-related meetings in China. These included the Coal Industry Advisory Board Associates Meeting in March, during which the IEA provided an update on recent CCUS developments, planned work, and held bilateral discussions with national and international entities. The CETP also facilitated the participation of IEA staff at the Annual Asia-Pacific Global CCS Institute Forum in May, with a focus on showcasing the role of CCUS in climate scenarios and the potential in China. Finally, the CETP also supported the CCUS team engagements to develop potential collaborations with other countries in Asia (India, Indonesia) on this topic.

## Transport

The CETP supported the preparation of *The Future of Rail*, a state-of-the-art analysis on the status of the railways sector, as well as the role that it may play in reducing energy use and environmental impacts of the transport sector, including scenarios to 2050. This piece of work is contributing to the advancement of international discourse on the topic and, in particular, it provides a valuable analysis focused on India, drawn thanks to the fruitful co-operation with India’s Ministry of Railways. In fact, as mentioned in the section “2018 CETP activities in India”, the report was launched globally in New Delhi in January 2019 in the presence of the Indian Minister of Railways, the Chairman of the Indian Railway Board and the Executive Director of the IEA.

Figure 12. Energy intensity of different transport modes



Source: IEA (2019a). All rights reserved.

## Regional activities

As with the country-focused and global engagements, regional-level work under the CETP was carried out with the same three key pillars of the programme in mind: 1) high-level engagement and collaboration, 2) supporting joint learning and knowledge exchanges to formulate and implement policies, and 3) enhancing knowledge and evidence for policy making and implementation.

### 2018 CETP activities in Asia

Activities under the CETP were mainly directed at supporting energy efficiency knowledge exchanges and technical collaboration. The IEA and the Indonesian MEMR co-hosted the second Energy Efficiency in Emerging Economies Training Week for Southeast Asia in Jakarta from 16-20 July 2018. The event was the IEA's largest-ever joint learning and knowledge exchange event outside Paris. It brought together 220 energy efficiency professionals from government institutions, industry, academia and supporting organisations across Southeast Asia.

The training week consisted of six parallel courses on energy efficiency in buildings; industry; lighting, appliances and equipment; transport; statistics; and policy and programme evaluation. Each course offered a mix of lectures, interactive discussions and practical exercises aimed to equip participants with knowledge and skills on developing energy efficiency initiatives in their respective countries. The programme also included joint sessions on assessing the potential for energy efficiency, tracking progress, communication campaigns and finance as well as a special focus on valuing the social and economic benefits of energy efficiency measures.

#### Largest-ever IEA Energy Efficiency in Emerging Economies Training Week held in Jakarta



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To reach a wide audience in Southeast Asia regarding energy efficiency and its benefits, the IEA co-organised two webinars with the ASEAN Centre for Energy. The first, focusing on "Perspectives on the multiple benefits of energy efficiency for Southeast Asia", had 54 participants. The second webinar focused on buildings codes.

The IEA also co-organised the first clean energy investment and finance training programme in Southeast Asia under the CETP. Working with the Singapore Energy Market Authority, the IEA

hosted this regional ASEAN training workshop in Singapore (28-30 August 2018). The event was open to participants from across Southeast Asia and consisted of two tracks: i) renewables and the power sector; and ii) energy efficiency.<sup>22</sup> The objective of the programme was to increase knowledge and skills for decision making on policies and regulatory frameworks that mobilise bankable investments in renewables and energy efficiency across the region. The training programme was complemented by the development of a toolkit that provides a range of materials for policy makers in ASEAN countries to use in their day-to-day roles in order to better understand investment needs and options. The training programme was also the first activity under an investment and finance capacity-building roadmap for ASEAN that was developed by the IEA as a key deliverable for Singapore's 2018 ASEAN chairmanship. The programme, toolkit and follow-on capacity-building roadmap were developed in consultation with the World Bank and other financial organisations. The IEA is currently exploring with Singapore a follow-on training or workshop on investment in 2019.

### ASEAN clean energy investment and financing training programme



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The Agency also took the opportunity to contribute to regional events in Asia to reach a wider audience to disseminate some of the wide range of relevant ongoing work in the region. For instance, IEA contributed as the Knowledge Partner to the Asia Clean Energy Forum (4-7 June 2018) organised by the ADB, US Agency for International Development (USAID) and Korean Energy Agency, where the IEA led the energy efficiency track and organised a deep dive workshop on energy-efficient cooling. Moreover, on the important issue of cooling, the IEA participated and contributed to the inaugural ASEAN Cooling Summit in Bangkok and Kigali Cooling Efficiency Program (K-CEP) annual strategy meeting (January 2018), and also presented on market transformation opportunities for Pacific Island countries and tools (Kigali Tracker)

<sup>22</sup> The event saw participation from more than 100 participants from 15 countries. While most participants were from energy ministries, there was strong participation from state-owned utilities and ministries of finance/economy/industry. The training programme featured over ten external experts from Singapore government agencies (Energy Market Authority, Economic Development Board, Infrastructure Asia), the World Bank, private international financial institutions (DBS Bank, Sumitomo Mitsui Banking Corporation [SMBC]), the clean energy industry (Cleantech Solar and Sustainable Development Capital Ltd), the legal community (Eversheds) and global think tanks (CEEW).

during the “Twinning workshop on energy-efficient and climate-friendly refrigeration and air conditioning” hosted by UNEP.

### Dr Fatih Birol delivers the opening presentation at the ASEAN Ministers of Energy Meeting



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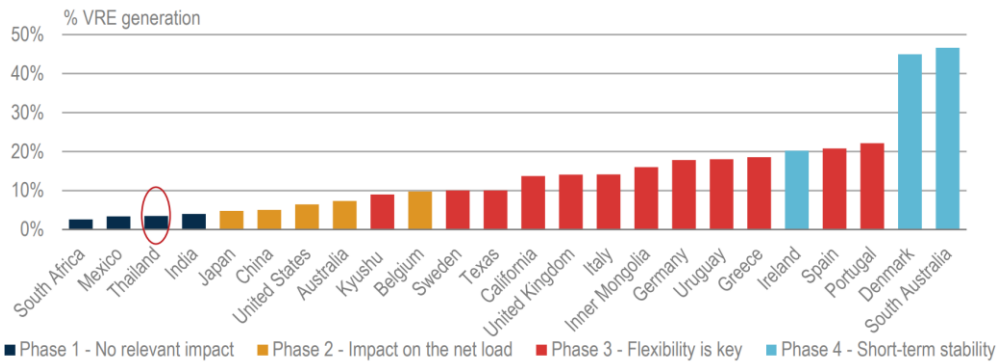
The IEA was also an active participant at the "Grid integration of VRE deep dive workshop" organised by USAID, NREL and the German Corporation for International Cooperation (GIZ), which had around 150 attendees. The IEA contribution included a presentation on the analysis on system integration of variable renewables in Thailand (based on an ongoing project under the CETP) and a presentation on power plant flexibility. The work on system integration in Thailand received high interest from the attendees and representatives from many countries, particularly India, Indonesia and Sri Lanka. The IEA also provided the keynote speech on the role of innovation in clean energy transition and participated in the panel discussion at the opening plenary along with co-chairing in the energy efficiency track of the Forum.

In addition, the IEA highlighted ongoing work on system integration of variable renewables at the World Bank workshop on "Knowledge exchange on renewable energy grid integration" in Qinghai, China (25-27 September 2018). The event combined input from countries in the region including China (both national and Qinghai province), India, Indonesia, Pakistan, the Philippines and Viet Nam, with experience from Australia, Denmark, Spain and the United States, and allowed IEA to provide technical insights to this exchange.

Under the electricity transitions work stream IEA undertook an in-depth assessment of grid integration of renewables in Thailand. The resulting report, [Thailand Renewable Grid Integration Assessment](#), details a comprehensive analysis covering the technical, economic, and policy and regulatory frameworks. The analysis comprises the following key areas: the existing VRE penetration context in Thailand; grid integration of VRE in Thailand's future power system; the technical potential and economic impact of distributed solar PV on stakeholders; and the power sector planning process and system costs. The study also provides recommendations to guide decision making in power sector operation and planning, investment, and policy to support the uptake of VRE in a reliable and cost-effective manner in order to achieve the objectives of Thailand's power sector policies. The final project seminar was held in Bangkok with over 150 participants from the government, energy utilities, research institutions and international organisations.



Figure 13. **Select countries (including Thailand), regions and states listed by VRE penetration and integration phase, 2016**



Source: IEA (2018f). All rights reserved.

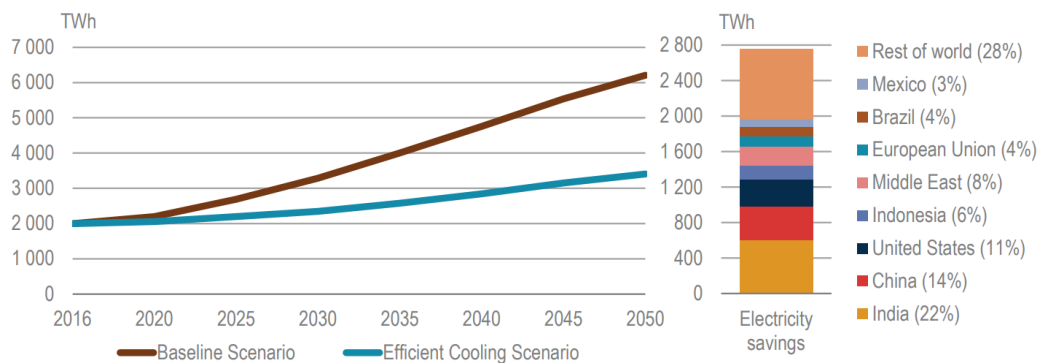
### 2018 CETP activities in Latin America

Under the CETP, IEA regional activities in Latin America were mainly focused on further enhancing global energy statistics, disseminating IEA 2018 reports on energy efficiency that are most relevant for the region, and exchanging views on system integration of renewables and related implications for power system planning. Within the statistics area of work, a series of videos in Spanish have been created, hopefully allowing a broader audience to access material on IEA energy statistics methodology.

On energy efficiency, two webinars were broadcast: one on 25 July 2018, "IEA special report on efficient cooling: Considerations for Latin America", and one on 14 November 2018, "Energy Efficiency 2018 market report", with a focus on Brazil and Mexico. Both webinars were organised and co-hosted with SENER and, for the first time in joint collaboration, the Brazilian MME.

The first webinar, based on the IEA special report [The Future of Cooling](#), was aimed at disseminating scenarios on how to outline a sustainable path to the future of cooling that will allow people to reap the benefits of cooling without straining the energy system or the environment. It also included a review of some energy efficiency potentials for Latin America and Caribbean region, as well as some policy actions to curb cooling-related energy needs. More than 260 participants attended the online event from Brazil, Mexico and other Latin American countries.

Figure 14. **World electricity consumption for space cooling in the Baseline and Efficient Cooling Scenarios and energy savings in 2050 by country/region**



Source: IEA (2018g). All rights reserved.

The second webinar covered the most recent findings from the IEA [Energy Efficiency 2018](#) market report, featuring the Efficiency World Scenario, the Efficient World Strategy, and a special focus on Brazil and Mexico. It included a discussion on the current rate of progress on improving energy efficiency, as well as historic and current trends. Over 350 participants joined the webinar from Brazil, Mexico and other Latin American countries.

The IEA also advanced a Collaboration Agreement (signed in early 2019) with CAF (the Development Bank of Latin America) to co-develop a massive open online course on energy efficiency in buildings. CAF's interest in supporting development of the course came from its sponsorship and participation in the Energy Efficiency in Emerging Economies Training Week held in Rio de Janeiro in November 2017. Negotiations continued through 2018, and the launch of the course is now planned for autumn 2019.

Under the Clean Energy Ministerial Days, a regional workshop on system integration of renewables and implications for power system planning was organised in collaboration with EPE on 21 November 2018 in Rio de Janeiro. The agenda included sessions focused on both supply and demand side, as well as on more specific and innovative approaches related to energy and system planning, modelling, and lessons learned. More than 100 participants had very positive comments on the presentations from experts from the IEA, NREL, the Chilean Ministry of Energy and the Uruguayan Electricity Market Authority, as they allowed comparing Brazil's point of view and current discussions with international best practices.

## 2018 CETP activities in the Middle East and North Africa

The CETP activities in the Middle East and North Africa seek to promote IEA engagement with local stakeholders, including ministries and statistical offices, and to strengthen the position of the IEA as trusted data and analysis provider. In regard to statistics, a series of videos are currently being translated to Arabic and French, and a French version of the *Energy Efficiency Indicators* manuals is under preparation, with the aim of allowing a broader audience to access material on IEA energy statistics methodology.

In addition, as part of the 17th Regional JODI Training Workshop on Energy Statistics, a specific training workshop on energy balances was organised on 13-14 December 2018 in Beirut. This training was hosted by UN ESCWA, with the IEA and other international organisations, including the UNSD and the IEF. More than 30 delegates from 14 countries from the Middle East and North Africa region (and Angola and Nigeria) participated. The training was based on presentations and interactive exercises on the fundamentals of energy statistics, data quality and validation, and energy efficiency. This allowed engagements between the IEA and UNSD to answer practical and technical questions. Starting from the common agreement that energy balances and statistics form the fundamental basis for sustainable energy policy, all participants had the opportunity to learn a new area of energy statistics and expand the context of their respective work.

## References

IEA (International Energy Agency) (2018a), *World Energy Outlook 2018*, IEA, Paris.

– (2018b), *Energy Efficiency 2018*, IEA, Paris

– (2018c), *Energy Efficiency 2018 (Chinese - Abridged)*, IEA, Paris

– (2018d), *Power Sector Reform in China: An International Perspective*, IEA, Paris

– (2018e), *Energy Transitions in G20 countries: Energy Transitions Towards Cleaner, More Flexible and Transparent Systems*, IEA, Paris

– (2018f), *Thailand Renewable Grid Integration Assessment*, IEA, Paris

– (2018g), *The Future of Cooling*, IEA, Paris

– (2019a), *The Future of Rail*, IEA, Paris

– (2014), *Africa Energy Outlook*, IEA, Paris

IEA/Council on Energy, Environment and Water (CEEW) (2018), *Clean Energy Investment Trends: Evolving Investment Landscape for Grid-Connected Renewable Energy Projects in India, 2018*

Photo credits: IEA, unless indicated otherwise.



## Abbreviations and acronyms

21CPP	21st Century Power Partnership
ACCA21	Administrative Centre for China's Agenda 21
ADB	Asian Development Bank
AFD	French Development Agency
AFREC	African Energy Commission
APAC	Asia Pacific
APEC	Asia-Pacific Economic Cooperation
ART Fuels Forum	Alternative Renewable Transport Fuels Forum
ASEAN	Association of Southeast Asian Nations
AUC	African Union Commission
BAU	business-as-usual
BEE	Bureau of Energy Efficiency of India
BEIPA	Biomass Energy Industry Promotion Association (China)
BPS	Statistics Indonesia
CAD	Canadian dollars
CAF	Development Bank of Latin America
CAISO	California Independent System Operator
CCUS	carbon capture, utilisation and storage
CEA	Central Electricity Authority of India
CEEW	Council On Energy, Environment and Water (India)
CEM	Clean Energy Ministerial
CENACE	National Centre for Energy Control (Mexico)
CEO	chief executive officer
CETP	Clean Energy Transitions Programme
CGEE	Centre for Management and Strategic Studies (Brazil)
CIAB	Coal Industry Advisory Board
CNIS	China National Institute for Standardisation
CONUEE	Commission for the Efficient Use of Energy (Mexico)
COP21	21st Conference of the Parties
COP24	24th Conference of the Parties
DCC	Department of Climate Change (China)
DOE	Department of Energy (South Africa)
E4	Energy Efficiency in Emerging Economies Programme
EBTKE	General Directorate of new and renewable energy and energy conservation (Indonesia)
EDC	Energy Data Centre (IEA)
EIM	Western Energy Imbalance Market
EPE	Energy Research Office (Brazil)
EPRI	Electric Power Research Institute
ESCO	energy service company
ETS	emissions trading scheme
EV	electric vehicle

EVI	Electric Vehicles Initiative
G20	Group of Twenty
GDP	gross domestic product
GEF	Global Environment Facility
GER	Office of Global Energy Relations
GHG	greenhouse gas
GIZ	German Corporation for International Co-operation
ICAP	International Carbon Action Partnership
IDR	in-depth review
IEA	International Energy Agency
IEF	International Energy Forum
IESR	Indonesian Institute for Essential Service Reform
INDC	intended nationally determined contribution
INEGI	National Institute of Statistics and Geography (Mexico)
IPEEC	International Partnership for Energy Efficiency Co-operation
IREDA	Indian Renewable Energy Development Agency
IRENA	International Renewable Energy Agency
IRP 2018	Integrated Resource Plan (South Africa)
ISGAN	International Smart Grid Action Network
JODI	Joint Organisations Data Initiative
K-CEP	Kigali Cooling Efficiency Program
MEE	Ministry of Ecology and Environment (China)
MEMR	Ministry of Energy and Mineral Resources (Indonesia)
MI	Mission Innovation
MME	Ministry of Energy and Mining (Brazil)
MNRE	Ministry of New and Renewable Energy (India)
MoEFCC	Ministry of Environment, Forest and Climate Change (India)
MoP	Ministry of Power (India)
MoPNG	Ministry of Petroleum and Natural Gas (India)
MOSPI	Ministry of Statistics and Programme Implementation of India
MOST	Ministry of Science and Technology (China)
MoU	Memorandum of Understanding
MST	Ministry of Science and Technology (India)
NBS	National Bureau of Statistics (China)
NCAP	National Cooling Action Plan (India)
NCSC	National Centre for Climate Change Strategy and International Co-operation (China)
NDC	nationally determined contribution
NDRC	National Development and Reform Commission (China)
NEA	National Energy Administration (China)
NEES	National Energy Efficiency Strategy (South Africa)
NGOs	non-governmental organisations
NITI Aayog	National Institution for the Transformation of India
NPS	New Policies Scenario
NREL	National Renewable Energy Laboratory (United States)
OECD	Organisation for Economic Co-operation and Development
PAT	Perform, Achieve and Trade
PLN	state electricity company (Indonesia)

PPAC	Petroleum Planning and Analysis Cell (India)
PPP	purchasing power parity
PSO	power system optimisation
PUSDATIN	Data and Information Centre at MEMR (Indonesia)
PV	photovoltaic
R&D	research and development
RD&D	research, development and demonstration
SANEDI	South Africa National Energy Development Institute
SDG	Sustainable Development Goal
SDS	Sustainable Development Scenario
SENER	Ministry of Energy (Mexico)
SIEPAC	Central American Electrical Interconnection System
SLCPs	short-lived climate pollutants
SMBC	Sumitomo Mitsui Banking Corporation
TCPs	Technology Collaboration Programmes
TERI	The Energy and Resources Institute (India)
TPED	total primary energy demand
UN	United Nations
UN ESCWA	United Nations Economic and Social Commission for Western Asia
UNEP	United Nations Environment Programme
UNIDO	United Nations Industrial Development Organization
UNSD	United Nations Statistics Division
USAID	United States Agency for International Development
VRE	variable renewable energy
WEO	<i>World Energy Outlook</i>

## Units of measurement

$\mu\text{g}/\text{m}^3$	micrograms per cubic metre
EJ	Exajoules
Gt	gigatonnes
GW	gigawatts
$\text{kgCO}_2$	kilogrammes of carbon dioxide
Mt	million tonnes
$\text{MtCO}_2\text{-eq}$	million tonnes of $\text{CO}_2$ equivalent
Mtoe	million tonnes of oil equivalent
MW	Megawatts
$\text{PM}_{2.5}$	particulate matter less than 2.5 micrometres in diameter
toe	tonnes of oil equivalent
TWh	terawatt-hours

# INTERNATIONAL ENERGY AGENCY

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The IEA examines the full spectrum of energy issues including oil, gas and coal supply and demand, renewable energy technologies, electricity markets, energy efficiency, access to energy, demand side management and much more. Through its work, the IEA advocates policies that will enhance the reliability, affordability and sustainability of energy in its 30 member countries, 8 association countries and beyond.

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