Clean Energy Transitions Programme

Annual report 2020

International Energy Agency

March 2021

Abstract

Since the launch of the Clean Energy Transitions Programme (CETP) in late 2017, the IEA has significantly expanded its work to help accelerate energy transitions in major emerging economies. The CETP is playing a critical role in supporting clean energy transitions, putting sustainable development at the heart of economic recovery measures and further strengthening the IEA family.

The CETP Annual Report 2020 highlights the programme's main activities, presenting major outcomes and areas for further work as well as planned activities for 2021. It also summarises IEA activities related to clean energy transitions at a global level, and introduces new and innovative analyses and resources produced throughout the year.

The report initially provides an overview of the CETP's objectives, then presents highlights of activities and achievements for each priority country (Brazil, the People's Republic of China. India, Indonesia, Mexico and South Africa), each priority region (Africa, Latin America and Southeast Asia), and globally.

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Foreword

2020 was a critical year for the prospects of clean energy transitions worldwide. Since the emergence of the Covid-19 pandemic and ensuing economic crisis, the IEA has led calls for governments to both achieve a sustainable, resilient recovery and address the looming climate crisis.

Throughout this challenging year, the Clean Energy Transitions Programme (CETP) played an important role in ensuring that the task of building a secure and sustainable energy future was strengthened. The programme's activities were adapted to confront the disruption brought by the pandemic while furthering our goal of accelerating clean energy transitions when and where it matters most. Responding to calls from governments, the IEA produced detailed, cost-effective policy options to support sustainable recoveries, explored in detail the impacts of the pandemic on energy markets and systems, and set out near-term actions that could help accelerate clean energy transitions.

Relying on the independent, data-grounded approach and unique expertise of the IEA, the programme continues to be uniquely situated to provide targeted analysis and recommendations even as the crisis affects the energy sector. The IEA has done this through initiatives such as the Global Sustainable Recovery Plan and other efforts such as exploring ways to enhance private-sector investment in transmission in Southeast Asia; identifying ways to attract private power sector investment to fund sustainable recovery in Indonesia; engaging with partners to support clean energy transitions in North Africa; sustained and tailored co-operation to support the design of the Chinese emissions trading scheme in the power sector; and working with India to identify energy efficiency stimulus measures in the country.

Crafting sustainable recovery packages with and for emerging economies presents a once-in-a-lifetime opportunity to help drive the shift towards a cleaner and more inclusive energy future. We can help create millions of jobs around the globe. We can help realise multiple climate, air pollution, health and climate resilience-related benefits.

Never has it been more important to collaborate with key emerging economies. In its three years of existence, the CETP has dramatically expanded the IEA's work to support Brazil, the People's Republic of China, India, Indonesia, Mexico and South Africa – economies that collectively account for close to 45% of CO_2 emissions from fuel combustion and which represent over two-thirds of emissions from developing economies. The programme has also continuously expanded its regional-level work in Africa, Latin America and Southeast Asia – by developing partnerships with major institutions and playing an important convening role.

In July 2020 the IEA held its first Clean Energy Transitions Summit, a major initiative to bridge the gap between climate goals and energy realities. Ministers from countries representing over 80% of the world economy gathered around a

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virtual table with key actors from the private sector and civil society to build an ambitious, real-world "grand coalition" committed to tackling climate change. The discussion included the ministers of the six key emerging economies targeted under the CETP and from countries in targeted regions. Several ministers at the summit thanked the IEA for its CETP assistance; others signalled their plans to increase their support for the programme; and, overall, participants welcomed the success of the IEA's CETP in building trust and providing actionable advice to the world's largest emerging economies on their most consequential clean energy transition challenges. On 31 March we jointly hosted with the UK government the IEA–COP26 Net Zero Summit. This summit focused on the implementation actions necessary to start converting the growing number of net-zero goals into reality (and also informed the preparation of the upcoming IEA Special Report: The World's Roadmap to Net Zero by 2050).

We will also look forward to deepening and expanding the CETP's impact in the decisive months and years to come. My most sincere thanks go to the United Kingdom, Denmark, Italy, Japan, Sweden, the European Commission, The Netherlands, the Agence Française de Développement (AFD), Germany, Switzerland, Canada, Finland, New Zealand and Australia for their essential support and continued involvement. Our shared ambition to turn collective aspirations into hard reality is at the heart of the programme.

Since 2015 the IEA has embarked on an ambitious transformation to become the leading voice in clean energy transitions, with the launch of the CETP being a critical milestone. The deep transformation of energy systems we need to achieve in the next decade is unprecedented in speed and scale. Achieving global net-zero emission goals would notably mean boosting investment in clean electricity by 2030 from USD 380 billion to USD 1.6 trillion by 2030.

With the CETP as a concrete illustration of our collective willingness and capacity to accelerate the pace of change toward the sustainable energy systems of the future, I remain more optimistic than ever about our prospects for success. The agency stands ready to continue supporting the IEA family under the CETP so that we deliver, together, a better energy future.

In closing, I would like to acknowledge former IEA Deputy Executive Director Dave Turk as the inspiration behind the creation of the CETP three years ago and for his tireless efforts ever since, which have made it what it is today. Dave has recently left the IEA to return to the United States to take on even bigger and brighter challenges. We will no longer be sharing adjoining offices, but our friendship will continue from afar and I am convinced his contribution to global clean energy transitions will go from strength to strength.

Dr Fatih Birol

Executive Director

International Energy Agency

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Acknowledgements, contributors and credits

The CETP is made possible by the collaboration and partnership of our priority countries and regions, as well as the support and leadership of IEA member governments and other partners – specifically, the United Kingdom, Denmark Italy, Japan, Sweden, the European Commission, the Netherlands, the Agence Française de Développement (AFD), Germany, Switzerland, Canada, Finland, New Zealand and Australia. Our gratitude goes to them for their support and belief in the CETP.

The CETP Annual Report 2020 was prepared by the programme's co-ordination team (César Arreola and Blandine Barreau) within the Strategic Initiatives Office, and was led by Dave Turk, Deputy Executive Director. Inputs were provided by colleagues throughout the IEA. The CETP co-ordination team would like to thank all work stream heads and their respective teams for their leadership: Nick Johnstone (data and statistics); Brian Motherway and Mel Slade (energy efficiency); Paolo Frankl, Alejandro Hernández and Mike Waldron (electricity); Laura Cozzi, Tom Howes and Sara Moarif (policy advice and modelling); Timur Gül, Paolo Frankl and Per Anders Widell (sectoral work); Simon Bennett and Jean-Baptiste Le Marois (innovation); Brian Motherway, Vida Rozite and Emi Bertoli (digitalisation); and Rebecca Gaghen and Masatoshi Sugiura (global relations).

The IEA's leadership continues to guide and support the CETP – Fatih Birol (Executive Director); Keisuke Sadamori (Director of Energy Security and Markets); Mechthild Wörsdörfer (Director of Sustainability, Technology and Outlooks); and Claire Bouteille (Chief Management Officer). Special thanks are also due to colleagues in IEA Corporate Services who have provided invaluable support to the CETP, notably, Jeremy Lagelee (Office of the Legal Counsel), Yvonne Ozoux, Deborah Barry-Doe and Ruth Fishwick (Financial Administration), Fleur Grimaud (Human Resources), as well as Donna-Jean Nicholson and Magdalena Sanocka (Communications and Digital Office).

Thanks also go to Astrid Dumond, Therese Walsh and Clara Vallois of the IEA Communications and Digital Office for their help in producing the report. Justin French-Brooks carried editorial responsibility.

The International Energy Agency is grateful for the contributions of Kathleen Gaffney to the CETP work on energy efficiency and digitalisation and for her support to other teams. She is dearly missed.

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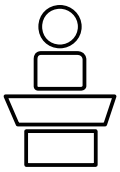
44% Proportion of global CO_2 emissions from fuel combustion emitted by CETP priority countries



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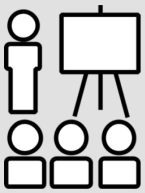

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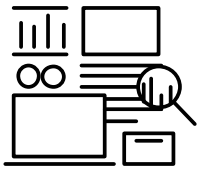
2 644 Participants trained



46 Reports produced or enhanced

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CETP progress in 2020

During its first two years of existence (2018 and 2019), the CETP created a strong foundation of engagement, relationships and partnerships with major emerging economies. This groundwork meant the programme was in a position to adapt rapidly to the disruption and opportunities brought by the Covid-19 pandemic during 2020.

In 2020 we held 30 capacity-building events across the world. Adapting to the Covid-19 crisis, our mostly online events and material helped train over 2 600 participants, ensuring the programme kept a strong expertise-sharing component at its forefront, despite travel restrictions. We also tailored our activities and analysis to the pandemic by supporting targeted appraisals, investigations and international dialogue on the Covid-19 crisis

We ensured high-level buy-in to our work through 36 discussions with government ministers and high-level officials on major energy topics, held within the framework of the CETP. We worked to provide ad hoc support through 127 technical exchanges.

The virtual nature of some of these high-level events also broadened our audience and reinforced the impact of our messages on clean energy transitions. The digital livestream of the Clean Energy Transitions Summit held in July notably attracted over 2 million viewers worldwide.

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IEA Clean Energy Transitions Summit, 9 July 2020

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How we work

The CETP harnesses the IEA's unique expertise, credibility and convening power to deepen and accelerate the implementation of clean energy transitions. The programme is designed to assist policy makers and other relevant stakeholders in their priority setting and implementation activity by combining skills: high-level strategy planning, expert-level co-operation, technical capacity strengthening and international experience sharing. The programme is designed to translate evidence and experience of energy transitions into action by advancing co-operation between countries and regions on data and analysis, policy design and implementation, capacity building, and technical and high-level engagement.

The CETP's priority countries are Brazil, the People's Republic of China (hereafter, "China"), India, Indonesia, Mexico and South Africa – economies that collectively accounted for 44% of CO_2 emissions from fuel combustion in 2019. Our additional target regions are Africa, Latin America and Southeast Asia.

The CETP achieved many on-the-ground successes in each of its seven work streams in 2020 – data and statistics, energy efficiency, electricity, policy advice and modelling, sectoral work, innovation, and digitalisation – by continuing to build upon its four key pillars: high-level engagement and collaboration, joint learning and knowledge exchange, enhancing knowledge and evidence for policy making, and supporting solutions-oriented multilateral engagement.

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Brazil

Our activities with Brazil continued to expand; key highlights of our work included:

- Working with the Ministry of Mines and Energy (MME) and the Energy Research Office (EPE) to provide continuing support on the development of regulations for the new architecture and modernisation of the power system.
- Contributing two chapters to The Atlas of Energy Efficiency – Indicators Report jointly with EPE: one highlighting the impacts of the Covid-19 crisis on energy consumption and efficiency, and another featuring an in-depth analysis of progress in Brazil and around the world on cement sector efficiency and emissions abatement.
- Engaging with Brazil to support the development of energy technology RD&D tracking.
- Continuing to expand efforts and interactions on innovation with major stakeholders throughout 2020, such as the ministries of energy and science and the Brazilian electricity regulator.

EPE/IEA 2020.

Atlas of Energy Efficiency Brazil 2020 – Indicators Report

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China

The IEA's relationship with China went from strength to strength in 2020; top highlights included:

- High-level engagement between the IEA Executive Director and Chinese officials, including Special Envoy on Climate Change Xie Zhenhua and Minister Huang Runqiu regarding extensive collaboration between the Ministry of Ecology and Environment (MEE) and the IEA on climate change co-operation.
- The 6th joint workshop with Tsinghua University to exchange expertise on efficient cooling and green buildings with a special focus on sustainable recovery and net-zero pathways.
- Supporting the National Energy Administration (NEA) in the preparation of its 14th five-year plan on energy, providing recommended targets on a rapid decarbonising pathway.
- Advising China on the design of its national ETS, power sector reform and long-term low-carbon policy packages.
- Advising grid operators and market regulators on the effective design of the country's power markets to facilitate a high renewables system.
- Mapping China's clean energy innovation landscape and recent trends, continuing in 2021 ahead of finalisation of the 14th five-year plan.
- Significant methodological work and early release of Chinese energy statistics and balances in 2020 (and 2021).

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High-level exchanges with Chinese officials

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India

Engagement with India under the CETP was strengthened in 2020 across all work streams; top examples include:

- Dr Fatih Birol's participation in an online conference with the Prime Minister of India, the Hon. Narendra Modi, and global energy leaders to discuss the outlook for the energy sector.
- Supporting the Bureau of Energy Efficiency (BEE) to identify energy efficiency stimulus measures that could be included in an economic recovery package.
- Publication of the India 2020 Energy Policy Review, providing insights on the rise of India in the global energy market and recommendations for strengthening its energy sector.
- Working with NITI Aayog, the government of India's think tank, to share expertise on national energy tariffs and prices, and provide recommendations to enhance data to inform and support policies.
- In collaboration with the Ministry of New and Renewable Energy (MNRE), influencing policy by sharing innovative regulatory and policy options to scale up rooftop PV in India.
- A state-level workshop in Gujarat to inform actions for integrating solar and wind into its electricity system; developing the Gujarat power system model and a renewable energy integration roadmap.
- Producing the third joint Clean Energy Investment Trends report with the Council on Energy, Environment and Water (CEEW) to assess the challenges to attracting capital.
- The Iron and Steel Technology Roadmap, with a particular focus on decarbonising the sector in India.
- High-level dialogue with officials, building on the ETP Special Report on Clean Energy Innovation, and generating interest in deepening co-operation.

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IEA Executive Director participates in the Indian energy meeting with PM Modi

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Indonesia

In 2020 the IEA's work programme with Indonesia became one of our most dynamic, with Indonesia increasingly looking to the IEA as a central day-to-day partner on key policy priorities – with enormous potential to continue to expand impact in 2021. Highlights included:

- Tailored guidance on how to develop effective renewables remuneration mechanisms that are at the centre of the upcoming Presidential Decree on Renewables, and which are critical to enhancing the clean energy investment environment in Indonesia.
- Detailed analysis of grid integration aspects of one of the world's largest planned floating solar projects, contributing to its ultimate approval in late-2020.
- Launching high-profile long-term assistance on power system enhancement – including institutional, regulatory, policy and techno-economic aspects – to drive renewables integration and modernisation.
- The preparation of an Indonesia country report under the auspices of the 2020 World Energy Investment publication on Attracting private investment to fund sustainable recoveries: The case of Indonesia's power sector.
- Supporting the Ministry of Energy and Mineral Resources (MEMR) in the development of regulations for electric vehicles and a land-based transport roadmap.
- Engagement with senior Indonesian officials to assist their policy making for the transition from LPG to electric cook stoves for household and small-scale use.
- Early release of Indonesian energy statistics and balances in 2020 (and 2021)

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Attracting private investment to fund sustainable recoveries: The case of Indonesia's power sector

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Africa

The year was highly successful for the IEA's engagement with Africa, including:

- Providing training and capacity building on energy statistics and modelling to officials from the energy ministries of 10 sub-Saharan African countries. Around 100 high-level participants have taken part in the first online training activities.
- Releasing the Clean Energy Transitions in North Africa report, which identified pathways and recommendations to accelerate clean energy transitions in five countries (Algeria, Egypt, Libya, Morocco and Tunisia).
- Promoting energy efficiency in the region, helping bring together initiatives from Energy Efficient Lighting and Appliances (EELA) and the United Nations Environment Programme (UNEP) to drive further development of minimum energy performance standards in sub-Saharan Africa.
- Updating annual country-by-country data on energy access and access modelling for World Energy Outlook and SDG7 reports.
- Working with governments to assess the impacts of Covid-19 on electricity and clean cooking access, and to understand emergency measures.
- Assessing the climate vulnerability and resilience of the power sector to enhance the climate resilience of African hydropower through a climate risk and impact assessment, and by introducing potential resilience measures.
- Examining options for the future design of South Africa's carbon tax for the National Treasury, its role in addressing environmental externalities in liquid fuel taxation, and how it could be used to incentivise improved emissions intensity in the electricity sector.
- Early release of South African energy statistics and balances in 2020 (and 2021)

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Clean Energy Transitions in North Africa report

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Latin America

During 2020 our engagement with the region expanded through activities such as:

- Expanding collaboration with the Latin American Energy Organization (OLADE) on data and statistics to include energy efficiency indicators and energy price data.
- Launching the online course on Energy Efficiency in Buildings, which reached students from across the region, with 646 completing the full 40-hour course.
- The global conference Energy Efficiency – An Ace up the Sleeve for Energy Transitions, co-organised with the Chilean Ministry of Energy, which drew more than 1 000 viewers.
- Work with Chile on the preparation of its flexibility strategy, which will change the country's approach to flexibility in the coming years.
- Under the 3DEN Initiative, expanded research on the policy, regulatory and investment context needed to upgrade and mobilise Latin America's grid infrastructure for the clean energy transition, engaging with OLADE and governments and stakeholders across the region, including in Brazil, Chile, and Colombia.

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IEA–OLADE Ministerial Roundtable

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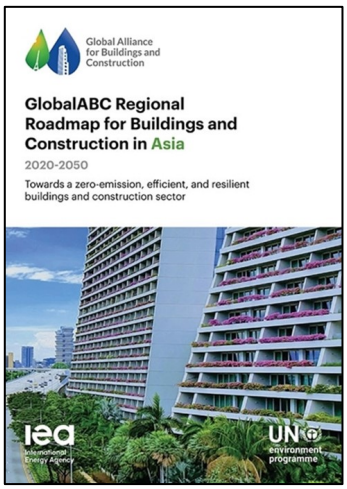
Southeast Asia

Highlights of our ever-expanding work with Southeast Asia in 2020 included:

- Strengthened relationship following ASEAN's decision to name the IEA as a strategic partner in 2019, as emphasised by the IEA Executive Director's speech to the 38th ASEAN Ministers of Energy Meeting.
- Expanded analysis of cooling in support of the ASEAN–IEA Cooling Partnership and completion of a retail market survey of air conditioners and refrigerators, using crowd-sourced data in Indonesia, Thailand and Viet Nam.
- Continued support as a main partner to the ASEAN Secretariat and various stakeholders (such as Heads of ASEAN Power Utilities/Authorities [HAPUA] and the ASEAN Energy Regulatory Network [AERN]) to facilitate progress on developing the recommendations IEA provided on minimum requirements for multilateral power trade.
- Responding to a request from 2020 ASEAN Chair Viet Nam to explore ways to enhance private-sector investment in transmission regionally. Expanding and enhancing the grid is critical to clean energy transitions in Southeast Asia.
- Assistance to the region to assess the challenges and opportunities that carbon markets present to the power sector and on integrating carbon markets into other clean energy policies in the region, particularly in Thailand.
- Technical assistance with Thailand, and its state-owned utility EGAT, on ways to enhance the contractual and technical flexibility of the power sector, an innovative approach that is critical to the decarbonisation of electricity.
- Early release of Thailand and Singapore data in 2020 (April), and even earlier in 2021 (February).



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GlobalABC Roadmap for Buildings and Construction in Asia 2020-2050

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Looking ahead

The need for the CETP – and its prospects for further impact – has never been stronger. As the IEA further strengthens its role in leading global clean energy transitions, the CETP will enhance work to reduce investment gaps in emerging and developing economies, improve the prospects for job creation through clean energy transitions, and help ensure people-centred transitions. The IEA will further build upon its trusted relationships with major emerging economies to further promote implementation of sustainable recoveries.

The programme will also expand its influence and impact by enhancing collaboration with leading international financial institutions, economic ministries and other important partners. In March 2021 the IEA hosted – jointly with the UK government – the IEA-COP26 Net Zero Summit to take stock of the growing list of commitments to reach the goals of the Paris Agreement and focus on the implementing actions necessary to begin turning the growing number of net-zero goals into reality.

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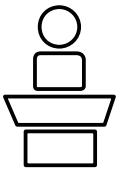
Overview of the CETP

2020 CETP highlights

44% Proportion of global CO_2 emissions from fuel combustion emitted by CETP priority countries



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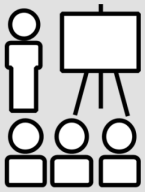

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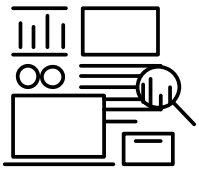

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CETP progress in 2020

During 2017-2019, its first two years of existence, the CETP created a strong foundation of engagement, relationships and partnerships with major emerging economies. This groundwork meant the programme was in a position to adapt rapidly to the disruption brought by the Covid-19 pandemic during 2020. We rapidly established new modes of working to ensure the programme stayed on track and activities could be adapted to the circumstances in each of its seven work streams. In 2020 we held 30 capacity-building events across the world. Our mostly online events and material helped train over 2 644 participants, ensuring the programme kept a strong expertise-sharing component at its forefront, despite travel restrictions.

Within the framework of the CETP, 36 discussions were also held with government ministers and high-level officials on major energy topics. In addition, we worked to provide ad hoc support through 127 technical exchanges. This regular contact was supported by our on-the-ground contractors and others; our embrace of virtual forms of communication ensured our engagement endured and continued to bridge the gap between policy makers' ambitions for sustainable energy systems and implementation.

Far from being a hindrance, the virtual nature of some of these high-level events – a number of which were publicly broadcast – broadened our audience and reinforced the impact of our messages on clean energy transitions. The digital livestream of the Clean Energy Transitions Summit held in July notably attracted over 2 million viewers worldwide.

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IEA Clean Energy Transitions Summit, 9 July 2020

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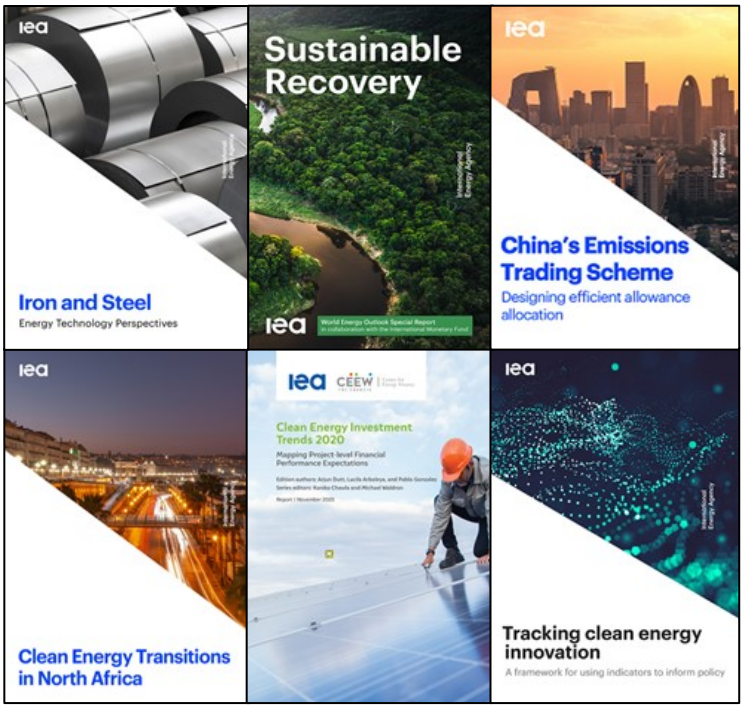
The CETP also responded to the Covid-19 crisis by adapting the substance of its 2020 activities and analysing the economic and social disruption faced by the world. We constantly reoriented the programme's activities, scope and focus so that planned and new work could reflect ongoing challenges and offer recommendations and leads for a sustainable recovery.

The CETP has supported targeted appraisals, investigations and international dialogue on the Covid-19 crisis and has contributed to enhance IEA analysis. We published or contributed to 46 reports in 2020 alone, notably the IEA Energy Efficiency Indicators 2020, which included data for Brazil for the second time, the India 2020 Energy Policy Review, analysis of potential design implications of the ETS in China, a comprehensive assessment of the state and conditions for accelerating Clean Energy Transitions in North Africa, and analysis to show relevant models for attracting private investment in transmission grids.



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Selected IEA analysis produced with priority countries and regions in 2020

How we work

The CETP harnesses the IEA's unique expertise and convening power to deepen and accelerate the implementation of clean energy transitions. The programme is designed to assist policy makers and other relevant stakeholders in their priority setting and implementation activity by combining skills: high-level strategy planning, expert-level co-operation, technical capacity strengthening and international experience sharing. The programme is designed to translate

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evidence and experience of energy transitions into action by advancing co-operation between countries and regions on data and analysis, policy design and implementation, capacity building, and technical and high-level engagement.

To achieve these goals, during 2020 the CETP continued listening to countries' needs and partnered with a wider range of stakeholders, increasingly co-ordinating its activities with other international organisations. These engagements allowed the IEA to reach out far beyond the energy policy community with entities such as:

- African Development Bank (AfDB)
- Asian Development Bank (ADB)
- Association of Southeast Asian Nations (ASEAN) Secretariat
- Economic Commission for Latin America and the Caribbean (ECLAC)
- International Renewable Energy Agency (IRENA)
- International Monetary Fund (IMF)
- Latin American Energy Organization (OLADE)
- World Bank
- bilateral development agencies.

Supporting sustainable recoveries: The IEA Sustainable Recovery Plan

The Covid-19 pandemic has delivered the biggest global economic shock in peacetime since the 1930s, with severe impacts on employment and investment across all sectors, including energy. In June, as governments were starting to deploy unprecedented fiscal action, the IEA set out a Sustainable Recovery Plan with a view to delivering a cleaner, affordable, more secure and more resilient energy system, and provide a major boost to employment and economic growth.

The plan draws on new IEA analysis of the direct and indirect jobs created by different measures and was carried out in collaboration with the IMF. It sets out the policies and targeted investments for six priority sectors to kick-start and ensure sustainable recoveries from 2021 to 2023. Overall spending is around USD 1 trillion per year, 70% of which comes from private sources, leveraged with direct financial public support and well-designed policy.

Assessed global-level outcomes would boost economic growth by an average of 1.1 percentage points a year, saving or creating 9 million jobs a year and making 2019 the definitive peak in global emissions, ensuring the world stays on track to reach long-term climate goals, including the Paris Agreement.

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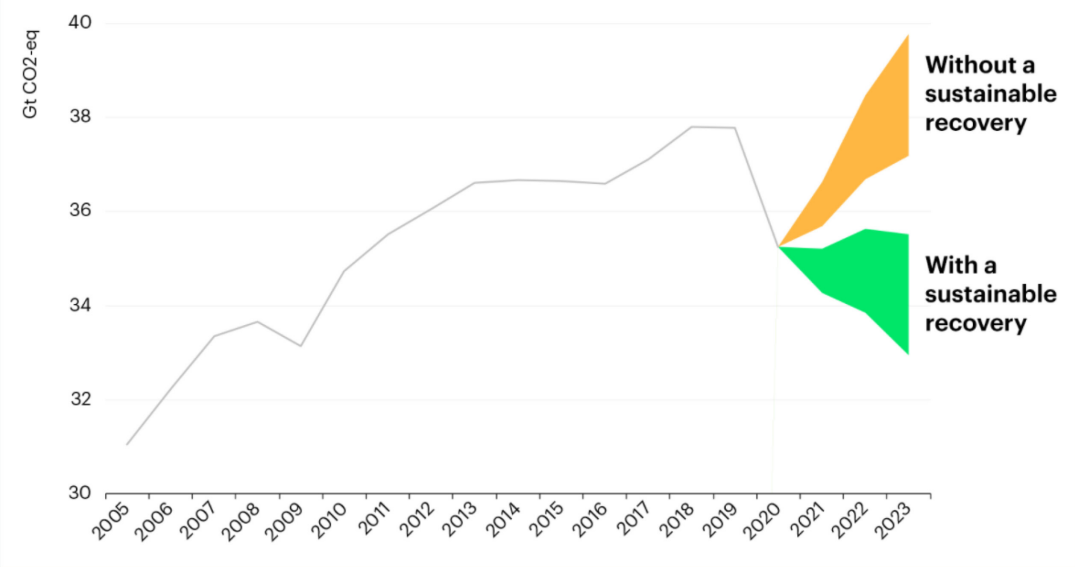
Energy-sector GHG emissions, 2005-2023



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The Sustainable Recovery Plan would reduce annual energy-related greenhouse gas emissions by nearly 4.5 billion tonnes.

The Sustainable Recovery Plan is fully integrated into the latest update of the Sustainable Development Scenario, issued in the October 2020 World Energy Outlook, and the newly designed Net Zero Emissions by 2050 case (NZE2050).

Overall, the programme has continued to build upon its four key pillars:

- encouraging high-level engagement and collaboration
- supporting joint learning and knowledge exchange
- enhancing knowledge and evidence for policy making
- supporting solutions-oriented multilateral engagement.

High-level engagement and collaboration

In 2020 the CETP capitalised on its unique partnership with major emerging economies to become a worldwide platform for common reflection and shared learning. IEA members and emerging economies explored new ways to influence the global agenda on climate change and sustainable development through their contribution to and active involvement in the programme's projects, events and analysis.

In line with CETP objectives, the IEA Secretariat continued to bring together emerging economies and meet with key decision makers from the public and private sectors. Amongst all the events, the IEA Clean Energy Transitions Summit held in June stands out. It gathered 40 ministers from around the world, representing over

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80% of the world economy, to discuss how to bring about a sustainable and resilient recovery from the Covid-19 crisis and achieve a definitive peak in global carbon emissions. This discussion also included the ministers of the six key emerging economies targeted under the CETP – Brazil, China, India, Indonesia, Mexico and South Africa – and from countries in targeted regions, such as Chile, Colombia, Morocco, Panama, Senegal and Thailand. During the year the IEA also convened other high-level events such as the Ministerial Roundtable on Economic Recovery through Investments in Clean Energy (hosted with Denmark) and the Ministerial Roundtable on Mobilising Investments for Secure and Sustainable Power Systems (with the United Kingdom).

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Ministerial Roundtable on Economic Recovery through Investments in Clean Energy

Overall, in 2020 we held 36 ministerial and high-level meetings to keep fostering political will for clean energy transitions. For example, the IEA co-organised the 2nd Global Ministerial Conference on System Integration of Renewables with Singapore; strengthened engagement with key decision makers in the African continent through the Africa Ministerial Roundtable on the Impact of Covid 19 in Africa's Energy Sector, the Second African Union Commission (AUC)–IEA Ministerial Forum and the preparation and launch of the Clean Energy Transitions in North Africa report; and organised different events in China, such as the Electric Power Sector Transformation seminar, gathering high-level counterparts from the public sector, other international entities, academia and think tanks.

Joint learning and knowledge exchange

The expertise and relationships gained through activities supported by the CETP enrich and strengthen the IEA's platform for sharing best practices and lessons from around the world, benefiting the whole IEA family. In 2020 we continued to foster technical co-operation between CETP priority countries and IEA members through the platform provided by the CETP. Examples include the series of tailored webinars

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we set up with Brazil's EPE on power market modernisation; a webinar series on grid operation and development to inform Indonesia's policy-making process; and state-level virtual training workshops in India on power system transformation and activities on energy statistics and end-use data collection.

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Power system transformation workshop in Maharashtra, India

As training is an instrumental activity within the programme, the IEA will continue developing tailored exchanges to efficiently transfer state-of-the-art knowledge and share experiences. In 2020 the IEA delivered training to more than 2 644 people through the CETP (and participants expressed a satisfaction rate of over 85% with these activities).

Knowledge and evidence for policy making and implementation

The CETP also continued to support partner countries by sharing its expertise on policy design and implementation. Throughout the year the IEA directly engaged with government authorities to provide tailored knowledge and evidence for policy making and contribute to the design of major policies.

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Selected IEA tailored analysis produced in 2020

In 2020 the CETP produced 20 tailored analyses targeting emerging economies and 26 IEA reports were enhanced using data and insights derived from the CETP's work. This activity allows the IEA not only to share its expertise, but also to develop global knowledge of transition-related issues and incorporate lessons learned from emerging countries.

Solutions-oriented multilateral engagement

The work developed during the first three years of the CETP has also supported the IEA's role as a global clean energy hub, providing analysis and policy guidance on a full range of low-carbon technologies. The stepping-up of CETP activities in 2020 enabled unprecedented levels of collaboration, as we partnered with institutions across the world – such as the AUC, OLADE, ASEAN, the United Nations Framework Convention on Climate Change (UNFCCC), UNEP and the Intergovernmental Panel on Climate Change (IPCC) – to leverage our efforts and increase our impact.

Future direction

2021 and the next few years will be critical to ensure the global energy system emerges from the current crisis in a sustainable way. The CETP will continue to focus on supporting and accelerating clean energy transitions in major emerging and developing economies, to avoid a rebound in CO_2 emissions that would place out of reach the international goals in the Paris Agreement or see the economic recovery leave a large part of the population without access to clean and resilient energy access.

The need for the CETP – and its prospects for further impact – has never been stronger. As the IEA further strengthens its role in leading global clean energy transitions, the CETP will enhance work to reduce investment gaps in emerging and developing economies, enhance the prospect for job creation through clean energy transitions, and help ensure people-centred transitions. The IEA will build

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upon its trusted relationships with key emerging economies to further promote implementation of sustainable recoveries. The programme will expand its influence and impact by enhancing collaboration with leading international financial institutions, economic ministries and other key partners.

In March 2021 the IEA hosted – jointly with the UK government – the IEA-COP26 Net Zero Summit. Following the inaugural Clean Energy Transitions Summit in 2020, this new event allowed us to take stock of the growing list of commitments to reach the goals of the Paris Agreement and focus on the implementation actions necessary to begin turning the growing number of net-zero goals into reality. The event built momentum towards COP26 and informed the preparation of the IEA's upcoming Special Report, The World's Roadmap to Net Zero by 2050.

CETP progress highlights

The following section provides a selection of highlights from our 2020 work and an outline of 2021 objectives and activities.

1. Data and statistics

- Early release of energy statistics and balances in 2020 for a number of CETP focus countries (China, India, Indonesia, South Africa), and yet again in 2021.
- Contribution to the design and release of the new Weather for Energy database and the recent Energy and Carbon Tracker data product.
- Work to develop new indicators related to the clean energy transition on many fronts, with a focus on innovative measures related to invention, corporate R&D, start-ups, early-stage financing and measures of life-cycle energy use.
- Engagement with Brazil to support development of energy technology RD&D tracking.
- Significant methodological work and early release of Chinese energy statistics and balances in 2020 (and 2021).
- Working with NITI Aayog, the government of India's think tank, to share expertise on national energy tariffs and prices, and provide recommendations to enhance data to inform and support policies.
- Engagement with new partners (UNFCCC, UNEP and IPCC) on building energy data capacity for climate reporting.
- Initial engagement with South Africa to enhance communication and co-operation on end-use data and energy efficiency indicators, in addition to building stronger basic energy statistics.
- Providing training and capacity building on energy statistics and modelling to officials from the energy ministries of 10 sub-Saharan African countries. Around 100 high-level participants have taken part in the first online training activities.
- Expanding collaboration with OLADE on data and statistics to include energy efficiency indicators and energy price data.
- Early release of data on the annual fuel mix, energy balances and CO_2 emissions from fuel combustion.

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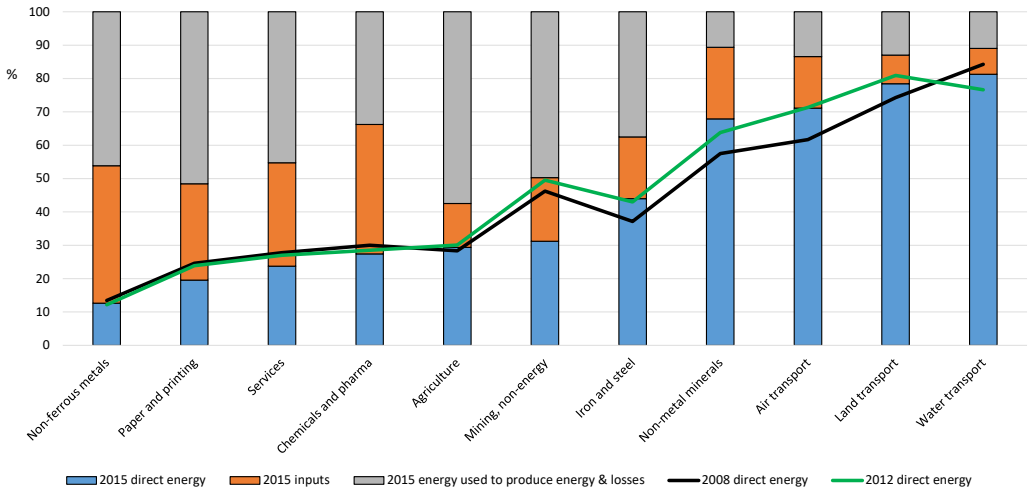
Share of direct and indirect energy in total energy consumed in production in India (preliminary results)



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Note: Preliminary estimates based on experimental work linking IEA Energy Balances data with OECD Input-Output tables.

In 2021 we will continue to work with key emerging economies to improve the comprehensiveness and quality of their basic energy statistics, as well as leverage opportunities to expand data collection beyond basic energy statistics to include, for example, prices, RD&D, end-use data and energy efficiency indicators. We will continue to develop experimental indicators related to clean energy transitions based on a variety of micro-data sources (e.g. start-up rates and early-stage financing; invention and corporate R&D; and lifecycle measurement of energy intensity based on linking energy balances with input-output tables [see figure]).

Our work will also continue on: developing and applying new methods (econometric and machine learning) to improve the timeliness of robust estimates of energy date; conceiving and holding virtual training events; overseeing the development of training materials and expanding training beyond basic energy statistics, for example to cover energy efficiency indicators and energy data for climate reporting; and identifying training and capacity-building opportunities jointly with current and new partner organisations to maximise effectiveness.

2. Energy efficiency

- In India supporting the BEE to identify energy efficiency stimulus measures that could be included in an economic recovery package.
- Contributed two chapters to The Atlas of Energy Efficiency – Indicators Report jointly with EPE in Brazil: one highlighting the impacts of the Covid-19 crisis on energy consumption and efficiency, and another featuring an in-depth analysis of progress in Brazil and around the world on cement sector efficiency and emissions abatement.
- Co-organised the 6th joint workshop with Tsinghua University to exchange expertise on efficient cooling and green buildings with a special focus on sustainable recovery and net-zero pathways.

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- In Indonesia supported MEMR in the development of regulations for electric vehicles and a land-based transport roadmap.
- Promoting energy efficiency in sub-Saharan Africa, helping bring together initiatives from EELA and UNEP to push further development of minimum energy performance standards in the region.
- Launching the online course on Energy Efficiency in Buildings, which reached students from across Latin America, with 646 completing the full 40-hour course.
- The global conference, Energy Efficiency – An Ace up the Sleeve for Energy Transitions, co-organised with the Chilean Ministry of Energy drew more than 1,000 viewers.
- Expanded analysis of cooling in support of the ASEAN–IEA Cooling Partnership and completion of a retail market survey of air conditioners and refrigerators, using crowd-sourced data in Indonesia, Thailand and Viet Nam.
- Publication of GlobalABC Roadmaps for Buildings and Construction, providing a framework for assessing priority actions across the themes of urban planning, new buildings, existing buildings, appliances and systems, operations, materials, resilience and clean energy.
- Working with the UK government to deliver a Product Efficiency Call to Action ahead of COP26 through the SEAD initiative.

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6th joint workshop with Tsinghua University

In 2021 we will continue to support the scale-up of energy efficiency activities that generate economy-wide benefits in major emerging economies, especially Brazil, China, India, Indonesia, Mexico, South Africa, Southeast Asia and Latin America. In addition, we will continue organising capacity-building and training activities, such as the Energy Efficiency in Emerging Economies Policy Training Weeks and the development of a platform to deliver a greater number of online training courses, providing more opportunities for countries to build capacity.

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We will also continue to support the reinvigoration of SEAD and the UK COP26 Product Efficiency Initiative, efforts to set and promote international benchmarks and indicators on energy use in industrial sectors, and efforts to design and implement electric mobility programmes and national roadmaps for buildings and construction.

3. Electricity

- Working with MME and EPE to provide continuing support on the development of regulations for the new architecture and modernisation of the power system in Brazil.
- Supporting China's National Energy Administration (NEA) in the preparation of its 14th five-year plan on energy, providing recommended targets to follow a rapid decarbonising pathway.
- In collaboration with MNRE, influencing policy by sharing innovative regulatory and policy options to scale up rooftop PV in India.
- A state-level workshop in Gujarat to inform actions for integrating solar and wind into its electricity system; developing the Gujarat power system model and a renewable energy integration roadmap.
- Producing the third joint Clean Energy Investment Trends report with CEEW to assess challenges to attracting capital in India.
- Launching high-profile, long-term assistance to Indonesia on power system enhancement – including institutional, regulatory, policy and techno-economic aspects – to drive renewables integration and modernisation.
- Work with Chile on the preparation of its flexibility strategy, which will change the country's approach to flexibility in the coming years.
- Continued support as a main partner to the ASEAN Secretariat and various stakeholders (such as HAPUA, AERN) to facilitate progress on developing the recommendations IEA provided on minimum requirements for multilateral power trade.
- 2nd Global Ministerial Conference on System Integration of Renewables, with the participation of close to 30 ministers and industry leaders, to explore emerging issues in the acceleration of renewables integration and power system resilience; launched the Power Systems in Transition report.

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2nd Global Ministerial Conference on System Integration of Renewables

During 2021 this work stream will focus on enhancing the capability of large emerging economies to develop and implement strategies to securely and cost-effectively decarbonise their power system – in particular through the integration of higher shares of variable renewables. We will support cost-effective policies and incentive schemes to accelerate deployment of renewable electricity sources, and will help integrate renewables in economic recovery packages by tackling challenges that increase the perceived risk of investing in renewables in emerging economies.

We will seek to help CETP countries and regions by providing advice to improve electricity market design, system operation, institutional structures and regional system integration. We will also analyse operational procedures and provide recommendations on how enhanced procedures and digitalisation can increase efficiency and security and enable higher shares of VRE. The topic of flexibility – technical, institutional and contractual – is critical in this work stream, as it is a major challenge to clean energy transitions in many emerging economies. Finally, we will also work with targeted countries and regions on policy frameworks and financial measures that reduce risk and improve financing conditions so as to attract private capital into electricity systems at scale. This supports the transition to more sustainable pathway and helps fund sustainable recoveries.

4. Policy advice and modelling

- High-level engagement between the IEA Executive Director and Chinese officials, including Special Envoy on Climate Change Xie Zhenhua and Minister Huang Runqiu regarding extensive collaboration between the MEE and IEA on climate change co-operation.
- Advising China on the design of its national ETS, power sector reform and long-term low-carbon policy packages.

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- Publication of the India 2020 Energy Policy Review, providing insights into the rise of India in the global energy market and recommendations for strengthening its energy sector.
- Engagement with senior Indonesian officials to assist their policy making for the transition from LPG to electric cook stoves for household and small-scale use.
- Examining options for the future design of South Africa's carbon tax for the National Treasury, its role in addressing environmental externalities in liquid fuel taxation, and how it could be used to incentivise improved emissions intensity in the electricity sector.
- Focus on assessing clean energy transitions in North Africa, particularly through the Clean Energy Transitions in North Africa report, and identifying pathways and recommendations to accelerate clean energy transitions in five countries (Algeria, Egypt, Libya, Morocco and Tunisia).
- Updating annual country-by-country data on energy access and access modelling for World Energy Outlook and SDG7 reports.
- Working with governments to assess the impacts of Covid-19 on electricity and clean cooking access, and to understand emergency measures.
- Assessing the climate vulnerability and resilience of the power sector to enhance the climate resilience of African hydropower through a climate risk and impact assessment, and by introducing potential resilience measures.
- Assistance to Southeast Asia to assess the challenges and opportunities that carbon markets present to the power sector and on integrating carbon markets into other clean energy policies in the region, particularly in Thailand.
- Developed the IEA Implementing Effective Emission Trading Systems report, an important source for policy makers considering the implementation of ETSs in their countries.

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Climate Impacts on African Hydropower

In 2021 we will continue working to enhance the resilience of energy systems to climate change by developing analytical and policy support targeted at decision makers in developing economies that are particularly vulnerable to climate hazards. We will also continue: contributing to the success of China's national ETS

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with technical inputs; supporting the Indian government in tackling interrelated energy, environment, climate change and development challenges through improved policy integration; and providing technical support to countries implementing carbon pricing, in all cases under challenging economic circumstances.

Throughout the year we will also help track sustainable recovery efforts across the globe to be able to support policy making; continue assessing air pollutant emissions in the energy sector in a number of major emerging economies; and work with targeted countries and regions on further analysing the interlinkages between employment and energy transitions. We will also launch new initiatives to collaborate with emerging economies and regions on policy frameworks and financial measures that reduce risk and improve financing conditions so as to attract private capital into clean energy and associated infrastructure at scale. We will continue to assess country-specific policy advice and best practice across core themes of the energy transition.

5. Sectoral work

- Launch of a new Clean Energy Ministerial (CEM) Biofuture Platform Initiative at CEM-11, co-led by Brazil, India, Canada, the Netherlands, the United Kingdom and the United States.
- The Iron and Steel Technology Roadmap with a particular focus on decarbonising the sector in India.

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Iron and Steel Technology Roadmap

Our work in 2021 will focus on supporting countries to design and implement an electric mobility programme as part of an overall shift to a sustainable low-carbon transport sector within the framework of a global programme supported by the Global Environment Facility (GEF). In 2021 we will also continue to cement the IEA's role as a global knowledge hub on clean hydrogen by strengthening collaboration with emerging countries and international funding institutions on their hydrogen plans and activities. In addition, in the bioenergy sector we will continue

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to build on the IEA's current analysis and engagement work, and seek to provide technical and policy guidance related to sustainable bioenergy in emerging economies. This will further support the IEA's role as co-ordinator of the new CEM Biofuture Platform Initiative and facilitator of the Biofuture Platform.

6. Innovation

- Engagement on the impacts of the Covid-19 pandemic by providing analysis of data and policy recommendations for innovation in sustainable recoveries.
- Further engagement with Brazil to support the development of energy technology RD&D tracking.
- Expanded efforts and interactions on innovation in Brazil with major stakeholders throughout 2020, such as the ministries of energy and science and the Brazilian electricity regulator.
- Mapping China's clean energy innovation landscape and recent trends, continuing in 2021 ahead of finalisation of the 14th five-year plan.
- High-level dialogue with Indian officials, building on the ETP Special Report on Clean Energy Innovation, and generating interest in deepening co-operation.
- Developed a framework for evaluating and communicating clean energy innovation policies, and used it in the ETP Special Report on Clean Energy Innovation and in Energy Policy Reviews of IEA member countries and partner countries.

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Tracking Clean Energy Innovation

Our work in 2021 will build on the resurgence of interest in clean energy innovation around the world to meet climate and economic goals, in particular in emerging economies. Governments are consistently promoting investment in clean energy technologies in the context of sustainable recoveries, and there is a huge opportunity to ensure that best practices are shared and implemented around the world. This includes fostering linkages between energy policy and science and technology ministries, with whom IEA is actively cultivating new relationships. IEA work is founded upon its longstanding strength in supporting countries to gather and share data to track progress of clean energy innovation, convening countries

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to share experiences, and promoting the IEA Technology Collaboration Programmes (TCPs) as a platform for international co-operation.

In addition, 2021 will see us develop several projects in response to requests from governments and related stakeholders. These include mapping the Chinese approach to energy innovation and its outlook for the 14th five-year plan, support for a data platform for the Brazilian government, gathering best practice examples of support for clean energy start-ups for India, and a handbook for TCPs and governments that wish to expand their technology collaboration with multilateral efforts. In 2021 we will continue regular publication of energy innovation indicators, including investment, alongside support for multilateral forums such as Mission Innovation in areas including data.

7. Digitalisation

- Under the 3DEN Initiative, expanded research on the policy, regulatory and investment context needed to upgrade and mobilise Latin America's grid infrastructure for the clean energy transition, engaging with OLADE and governments and stakeholders across the region, including in Brazil, Chile and Colombia.
- High-level and technical engagement with senior experts from more than 40 countries.
- Continuation of the IEA's Modernising Energy Efficiency through Digitalisation webinar series, with a focus on digital tools for an existing oil and gas field, energy-saving consumer devices and fintech to scale up finance for clean energy.

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Top factors disrupting power systems according to participants in high-level consultation

In 2021 the digitalisation work stream will continue to have two main goals: develop analysis and actionable policy guidance aimed at accelerating grid modernisation and the effective use of demand-side resources, under the 3DEN Initiative; and exploring how digitalisation can accelerate the implementation of energy efficiency and support data-driven policy making on energy efficiency.

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During 2021, the 3DEN Initiative will support Italy's G20 Presidency with a focus on how national governments can support cities to become drivers and test beds in the use of digitalisation opportunities to accelerate progress towards net-zero emissions by 2050. This will establish and maintain momentum around digitalisation, while providing an opportunity to stimulate global dialogue around the topic of smart grid implementation in cities.

We will also expand the IEA's publicly available Policies and Measures Database to include information on policies, programmes and measures related to digitalisation.

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Structure of the CETP

Governance

The CETP works across the IEA Secretariat, co-ordinating a number of interrelated projects and cross-sectoral initiatives led by different IEA divisions and units. IEA senior management and the CETP Steering Group, which includes Division Heads from across the IEA, guide the work that the CETP conducts. The Steering Group provides strategic guidance on the programme activities and advises senior management on the allocation of resources for the different work streams under the CETP.

A central co-ordination team leads CETP work and is located in the IEA Strategic Initiatives Office. It is responsible for overall quality control, strategic management, fundraising, disseminating key messages, information exchange, co-ordination and reporting. The team is supported by the Office of the Legal Counsel, the Communications and Digital Office, Human Resources and the Financial Administration. The CETP co-ordination team can be reached at IEA.CETP@iea.org. CETP activities are also supported by country desk officers located in the Office of Global Energy Relations, by contractors in Brazil, India and Indonesia, and by energy efficiency co-ordinators in Indonesia, Mexico and India.

The CETP's strategy is also informed by bilateral discussions with countries and institutions supporting it and by the Programme Funders Strategy Group. This group allows supporters to engage in strategic conversations about the CETP's development and implementation, and to ensure that IEA efforts are complementary to other bilateral and multilateral collaborations.

Work with major emerging economies

Under the CETP, the IEA engages with governments and regional organisations through deep and sustained partnerships. Our projects include analytical work, technical co-operation, training and joint learning exchanges, strategic engagement and tailored just-in-time support based on the requests of government stakeholders.

As shown in the figure below, CETP priority countries represented 44% of CO_2 emissions from fuel combustion in 2019 (developing economies' overall share was 66%). Under the IEA's Stated Policies Scenario (STEPS) – which reflects the impact of existing policy frameworks and announced policy intentions – priority countries would account for roughly 46% of global emissions by 2040. Thus, working with the CETP's priority countries is vital if we are to achieve a global clean energy transition.

It is important to note that per-capita emissions in many of these priority countries are still quite small compared to those in developed economies. In this context, it

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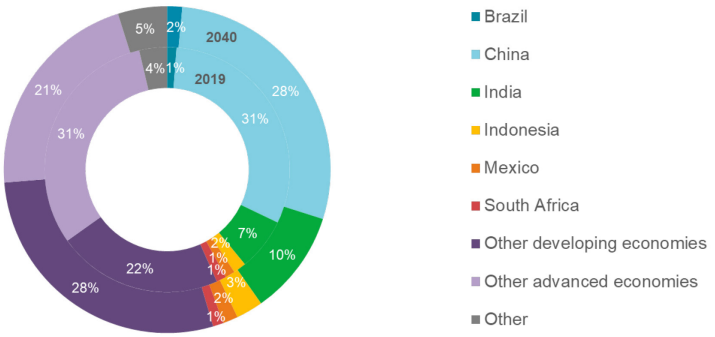
is important for the CETP also to consider overall development objectives and to ensure our activities are based on the interests expressed by the priority countries themselves.

CO_2 emissions from fuel combustion under the STEPS: 2019 versus 2040



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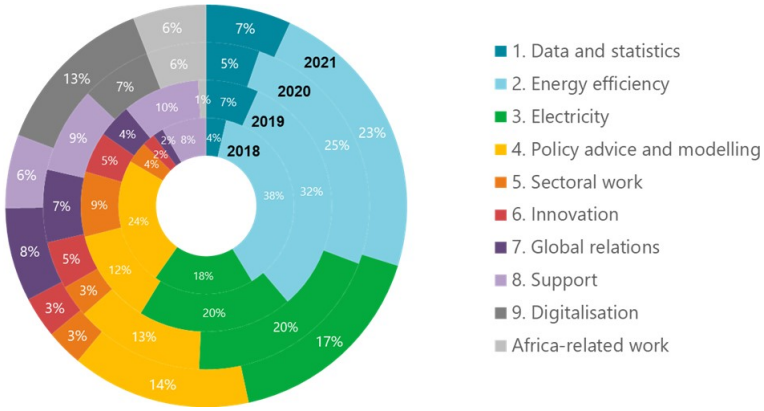
In 2020 CETP activities expanded in all work streams, with energy efficiency continuing to account for the largest share of our work, followed by electricity and policy advice, and modelling. In addition, the work under the new digitalisation work stream expanded significantly last year – and we expect it will continue this trend in 2021.

CETP activities in 2018-2021 by work stream



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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.

In addition, even though activity continued to grow in all of our six priority countries, the year saw the continued expansion of our regional work in Africa, Latin America and Southeast Asia, building on our relationships and relying on partners to increase impact.

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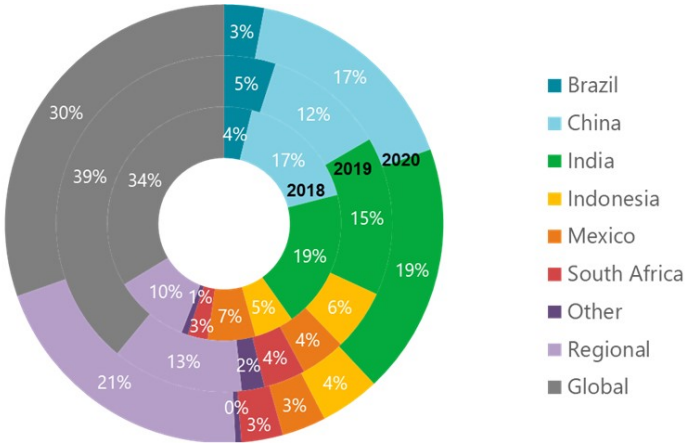
CETP activities in 2018-2020 by country/region



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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.

Additional IEA resources

Many major IEA publications have benefited from improved data, analysis and collaboration from priority countries and other emerging economies. These analytical outputs, developed through the CETP and beyond, have supported the transition to clean energy systems and include the following:

- World Energy Outlook 2020
- Energy Technology Perspectives 2020
- Tracking Clean Energy Progress
- Renewables 2020
- Energy Efficiency 2020
- Sustainable Recovery
- World Energy Investment 2020
- Global Energy Review 2020
- Clean Energy Innovation
- Power Systems in Transition
- Clean Energy Transitions in North Africa
- Tracking Clean Energy Innovation
- Implementing Effective Emissions Trading Systems
- Clean Energy Investment Trends 2020
- Iron and Steel Technology Roadmap
- India 2020
- China's Emissions Trading Scheme
- Climate Impacts on African Hydropower
- Global EV Outlook 2020
- Tracking SDG7: The Energy Progress Report, 2020

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2020 Activities in Brazil

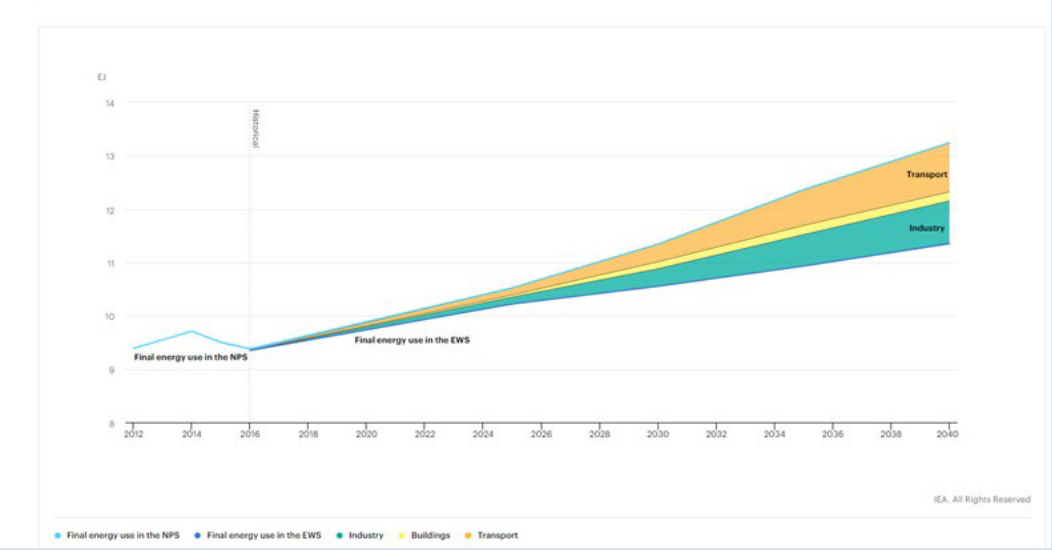
Highlights of CETP activities in Brazil during 2020

- Working with MME and EPE to provide continuing support on the development of regulations for the new architecture and modernisation of the power system.
- Contributed two chapters to The Atlas of Energy Efficiency – Indicators Report jointly with EPE: one highlighting the impacts of the Covid-19 crisis on energy consumption and efficiency, and another featuring an in-depth analysis of progress in Brazil and around the world on cement sector efficiency and emissions abatement.
- Engagement to support the development of energy technology RD&D tracking.
- Continued to expand efforts and interactions on innovation with major stakeholders throughout 2020, such as the ministries of energy and science and the Brazilian electricity regulator.

Broader Brazil–IEA context

- The IEA has been working closely with Brazil since 2006.
- Joint achievements prior to the CETP included the joint publication of the Technology Roadmap – Hydropower and the World Energy Outlook 2013. Brazil participates in five IEA TCPs.
- Brazil activated association status with the IEA in October 2017.
- The IEA and Brazil signed a two-year work programme in December 2019.

Energy savings by sector in Brazil, Efficient World Scenario vs New Policies Scenario



Source: IEA (2018), *Energy Efficiency in Brazil*, https://www.iea.org/data-and-statistics/charts/energy-savings-by-sector-in-brazil-ews-vs-nps.

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Data and statistics

The IEA continued working with Brazil (EPE and MME) to consolidate the country's end-use data collection, reporting methodologies and development of energy efficiency indicators following international good practice, with data for Brazil included in the IEA Energy Efficiency Indicators 2020 highlights for the second time.

We also continued working with our Brazilian counterparts on innovation data. After several webinars and missions to the country in 2019, in 2020 we jointly worked to finalise the outcome of the Energy Big Push project, consolidating the planned database on energy R&D data tracking. Our Brazilian counterparts shared new data on energy technology RD&D budgets by category, with the IEA providing validation and feedback (further details below).

Energy efficiency

The IEA's work on energy efficiency in Brazil in 2020 focused on deepening co-operation on industrial benchmarking and buildings, and understanding the impacts of the Covid-19 crisis on energy demand and efficiency. Our activities included:

- With EPE, developing joint analysis of the Brazilian cement sector in an international context. This expanded our co-operation on benchmarking undertaken in 2019, and was published in January 2021 as part of the Brazilian Atlas of Energy Efficiency – Indicators Report. The analysis focuses on opportunities to reduce emissions in the cement sector through energy efficiency and other technology options.
- Assessing the impacts of the Covid-19 crisis on energy consumption and efficiency in Brazil in 2020, in a special chapter of the Brazilian Atlas of Energy Efficiency – Indicators Report. The chapter highlights changes in energy consumption patterns in transport and households, and impacts on jobs and investment. It highlights the benefits of a strengthened focus on energy efficiency programmes from job creation, reduced pollution and improved health.
- Engagement with MME and experts on energy efficiency in buildings, including a presentation on the IEA TCPs that relate to buildings and how to increase engagement initiatives that best align with research and policy priorities being developed in Brazil

EPE/IEA 2020.

Atlas of Energy Efficiency Brazil 2020 – Indicators Report

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Electricity

Our engagement with MME and EPE continued with the IEA providing ad hoc support on the development of regulation linked to the new architecture of the power system. Major activities included a series of tailored webinars and the preparation of analysis with EPE. The main output of this engagement was the webinar we prepared in collaboration with EPE to inform MME officials about the different options for power market modernisation, both evaluating EPE's proposal and presenting further independent views from the IEA perspective.

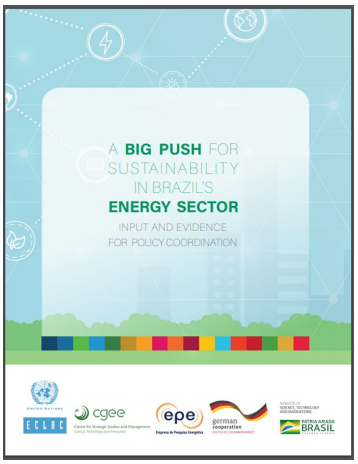
Tailored webinars included the following:

- Webinars 1 and 2: Overview of the Colombian model and the conceptual background of reliability mechanisms.
- Webinars 3 and 4: The Mexican case, capacity market and long-term auctions.
- Webinar 5: Historical evolution and the current situation of electricity market design in Brazil.
- Webinars 6 and 7: Brazilian proposals for the reliability mechanisms and capacity markets.

Different transition mechanisms were discussed, including the potential separation of the current "Garantia Fisica" scheme towards a market with separate products for energy and a peak capacity. The IEA has advocated a technology-neutral approach. As a result of this engagement, the IEA has been invited to provide targeted advice on the modernisation process, with activities continuing in 2021.

Innovation

Brazil raised the level of policy importance given to clean energy innovation in 2020. This included the establishment of an inter-ministerial strategic committee to oversee a review of policy practices. The IEA is engaged in several discussions in connection with this initiative, notably on data to track innovation spending and other metrics.



ECLAC, CGEE, EPE.

A Big Push for Sustainability in Brazil's Energy Sector

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In 2020 the IEA continued supporting Brazil's work to enhance tracking of innovation spending and outputs, and to support innovation policies, engaging with a multitude of local institutions. We played an active part in the culmination of the Energy Big Push, a collaborative project aiming to support the promotion of sustainable energy development in Brazil with a focus on innovation. This project was co-led by the Centre for Strategic Studies and Management under the Ministry of Science and Technology, and EPE under MME.

> "First, and perhaps most importantly, the Energy Big Push has created a platform for key stakeholders in Brazil to connect, engage and collaborate. By bringing together relevant ministries and institutions, common challenges may be explored collectively. Only through co-ordinated and targeted efforts can energy innovation deliver tangible outcomes for Brazil."
>
> ECLAC et al. (2020), A Big Push for Sustainability in Brazil's Energy Sector.

The IEA provided extensive analytical support, shared experience from IEA family countries, contributed to the final Energy Big Push publications and co-organised online events with local institutions. ECLAC was involved as project manager, providing an opportunity for the IEA to engage with international partner organisations in the region and align messages on clean energy transitions and the role of technology innovation. The final Energy Big Push reports present and discuss the main findings and implications for the future of clean energy innovation in Brazil, as reflected in the IEA launch event held in October 2020. This lays the foundation for further collaborative work in 2021.

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Energy Big Push launch event

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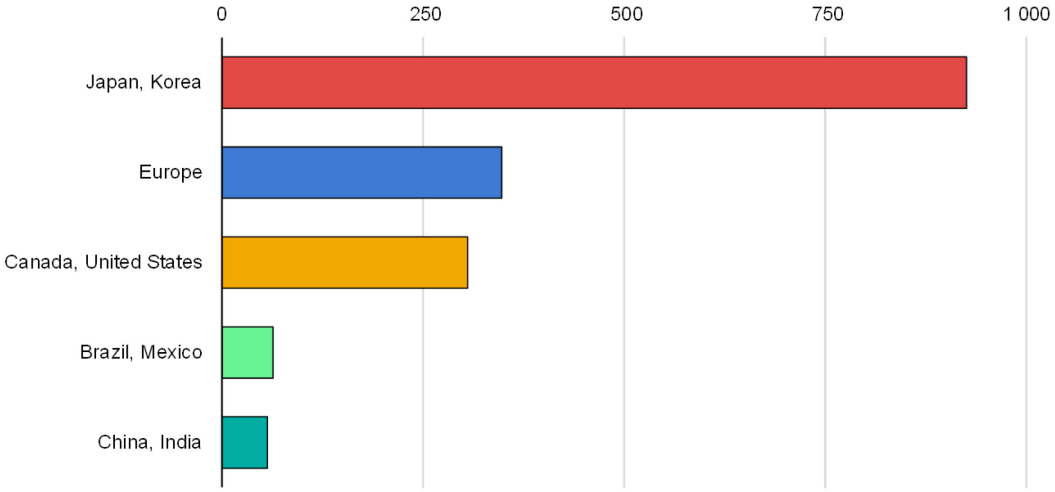
In 2020 the IEA also co-organised with MME and EPE an expert discussion on The Role of Innovation in Brazil's Clean Energy Transition. At this virtual event we presented the ETP Special Report on Clean Energy Innovation to a local audience and considered the implications for innovation priorities and challenges in the wake of Covid-19, bringing to the table officials and experts from the public and private sectors. The IEA laid the ground for providing increased support to ANEEL – Brazil's electricity regulator – as it proceeds in 2021 with the reform of its energy R&D programme and programme for modernisation and digitalisation. Building on analysis underpinning its recent report, Tracking Clean Energy Innovation, the IEA and ANEEL are now discussing how IEA can support the 2021 regulatory reform schedule to include tracking innovation progress and assessing the effectiveness of innovation policy. The IEA also provided comments to EPE's Energy Strategy for 2050, focusing on the role technology innovation could play in achieving energy and climate goals.

Estimated number of personnel for energy R&D per million inhabitants in selected countries and regions



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Source: IEA (2020), *Tracking Clean Energy Innovation,* https://www.iea.org/reports/tracking-clean-energy-innovation

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2020 Activities in China

Highlights of CETP activities in China during 2020

- High-level engagement between the IEA Executive Director and Chinese officials, including Special Envoy on Climate Change Xie Zhenhua and Minister Huang Runqiu regarding extensive collaboration between MEE and the IEA on climate change co-operation.
- The 6th joint workshop with Tsinghua University to exchange expertise on efficient cooling and green buildings with a special focus on sustainable recovery and net-zero pathways.
- Supporting the NEA in the preparation of its 14th five-year plan on energy, providing recommended targets to follow a rapid decarbonising pathway.
- Advising China on the design of its national ETS, power sector reform and long-term low-carbon policy packages.
- Advising grid operators and market regulators on the effective design of the country's power markets to facilitate a high renewables system.
- Mapping China's clean energy innovation landscape and recent trends, continuing in 2021 ahead of finalisation of the 14th five-year plan.
- Significant methodological work and early release of Chinese energy statistics and balances in 2020 (and 2021).

Broader China–IEA context

- In 2015 China became one of the first countries to activate association status with the IEA. China participates in 24 IEA TCPs.
- Following the opening of the IEA–China Liaison Office in Beijing in 2017, we have further strengthened co-operation. For example, the World Energy Outlook 2017 special report focused on China.
- China and the IEA signed a second three-year work programme at the IEA Ministerial in December 2019.

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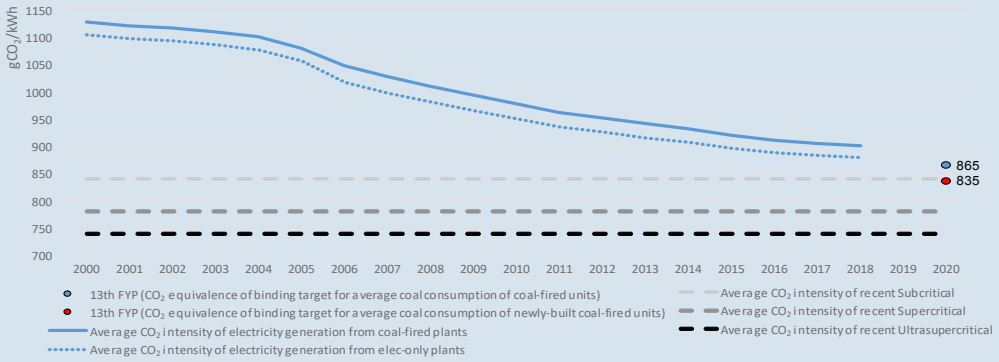
Average CO_2 intensity of power generation from coal power plants in China, 2000-2018



Source: IEA (2020), *China's Emissions Trading Scheme*, https://www.iea.org/reports/chinas-emissions-trading-scheme.

Data and statistics

For the first time there was an "early" release of Chinese energy statistics and balances in April 2020. This involved considerable methodological work to estimate flows since the official 2018 data were not yet available. This background work paved the way for an even earlier 2021 release in February, including the 2014-2017 revisions and 2018 data issued by the National Bureau of Statistics of China in December 2020.

In addition efforts were made to ensure the availability of international guidelines to the Chinese energy statistics community through the translation of the International Recommendations on Energy Statistics into Chinese, achieved in March 2020. This is part of as part of ongoing work to make resources available in Mandarin, including translating and editing videos.

Energy efficiency

In 2020 we highlighted the principal insights from the Chinese abridged version of Energy Efficiency Market Report 2019 in an IEA commentary on the role of energy efficiency in China's sustainable recovery plan. Within one week of the commentary's release on the WeChat account of the China Council for an Energy Efficient Economy it reached more than 800 views, with 82 local stakeholders such as the Chinese National Institute for Standardisation and State Grid Energy Research Institute sharing the post. The analysis from the report was covered by local online newspapers.

We also held many fruitful engagement activities with a wide range of Chinese stakeholders in 2020. Dr Wan Gang, Vice Chairman of the Chinese People's Political Consultative Conference and previous Minister of Science and Technology, joined the Global Commission for Urgent Action on Energy Efficiency

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and helped raise the profile of energy efficiency strategies as a means for new and stronger policy action by governments across the globe. New engagements with sector-specific players helped deepen sector-level energy efficiency progress in China, and included meeting the Society of Automotive Engineers of China to discuss the battery swapping system and the International Institute of Green Finance on energy efficiency financing developments.

The 6th joint workshop with Tsinghua University in September brought together around 70 global and local academics, practitioners and private players to exchange their expertise on efficient cooling and green buildings, with a special focus on sustainable recovery and net-zero pathways. For the joint webinar on economic recovery in emerging Asia, we invited the Chinese ESCO Association to illustrate the role of ESCOs in accelerating clean energy transition and a green recovery.

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6th joint workshop with Tsinghua University

In 2020 the IEA and the National Development and Reform Commission – in addition to reviewing their joint achievements under the memorandum of understanding – also agreed on the priority areas for future co-operation, which include digitalisation, energy efficiency data and indicators, the SEAD initiative and jointly developing energy efficiency policy recommendations for the upcoming 14th five-year plan in light of China's commitment to carbon neutrality by 2060. The first draft has been shared with the commission and we aim to jointly finalise the analysis and make policy recommendations in the first quarter of 2021. This work will naturally open up discussions around data as they form the basis of our analysis, thereby contributing to a better understanding of China's data and relevant methodologies. A set of IEA policy recommendations sent directly to and reviewed by the commission, the central body in charge of national five-year plans, will mark a new level of co-operation between the IEA and China. In parallel, the IEA's E4 programme – a cross-agency initiative led by the IEA Renewable Energy

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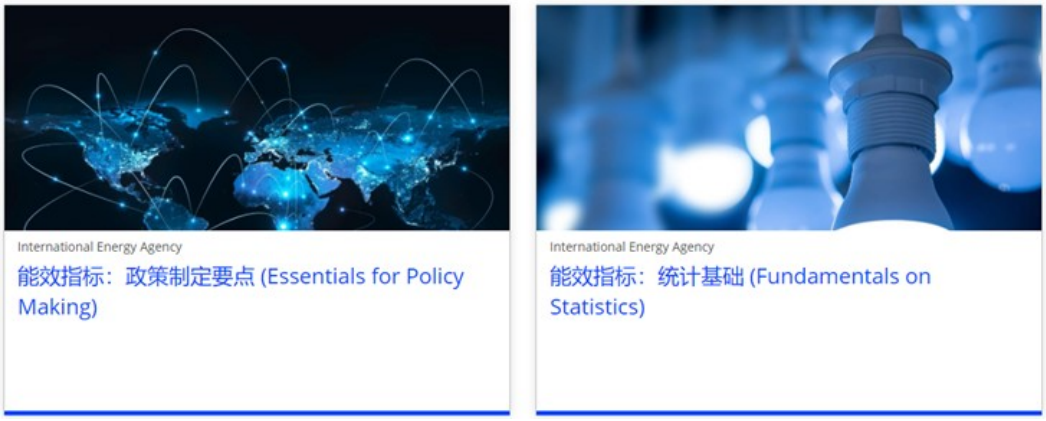
Division – contributed to clean energy policy recommendations for China's 14th five-year plan to ensure it reflects the role of energy efficiency in accelerating China's clean energy transition.

The online IEA Energy Efficiency Indicators Course was translated into Chinese at the end of 2020. The course will be officially launched in the first quarter of 2021 to increase participation among Chinese speakers.



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IEA Energy Efficiency Indicators Course in Chinese

Ongoing research includes work on a report entitled *Evolving ESCOs in China*, which sheds light on how the Chinese ESCO market became the world's largest and fastest-growing over the past two decades. It has a special focus on digitalisation using the results of the IEA and China Energy Management Company Association joint survey on 10 local ESCOs in China. The report is due to be launched in the first quarter of 2021. Another study that we are developing with the China National Institute of Standardization is entitled *Multiple Benefits of Standards and Labelling*, which looks at how reinforced standards and labelling programmes have brought lasting social, economic and environmental benefits to China. The study, planned for release in the second quarter of 2021, will align well with the IEA's SEAD activities in the lead up to COP26.

Electricity

Throughout 2020 the IEA continued to support China in the preparation of its 14th five-year plan and by providing analyses and expertise to support the country's power sector transformation. Building upon its historic engagement with the country, the IEA organised the China Electric Power Sector Transformation webinar with the China Electric Power Planning & Engineering Institute, the Royal Danish Embassy in Beijing and the Danish Energy Agency, with support from China's National Energy Administration, the French Development Agency (Agence Française de Développement) and the European Commission.

This event provided insights into China's electric power sector transition and policy options that can facilitate it, both in the near future (14th five-year) and in the medium and long term (2035-2050). Produced with input from international and

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Chinese experts, it covered topics such as: China's potential flexible resources; the critical role played by supporting policies and mechanisms to bolster the transition; and the outlook for renewable energy and other clean energy developments in China.

The issues covered in the webinar remain highly relevant to policy makers for the drafting of mechanisms that can expedite China's power sector transformation.

We are preparing the report *China 14th Five-Year Plan on Renewable Energy Development: IEA Perspective and Suggestions* as part of the IEA–China three-year work programme signed in December 2019. Renewable energy is identified as one of the major areas for collaboration between the IEA and China in this second joint programme. This research report aims to provide input for China's forthcoming 14th five-year plan on renewable energy development. It also refers to other specific areas such as the five-year plan on electric power and the five-year plan on system reform and energy efficiency.

First the report assesses the achievements and challenges of the 13th five-year plan on renewable energy. Based on this analysis, it then proposes policy pathways for the 14th five-year plan covering the period 2021-2025. For the first time, the report goes beyond the Chinese electricity sector and also provides detailed policy suggestions for the heat and transport sectors. The report was delivered to the NEA in February 2021.

Our policy suggestions in this report take into account the goals previously set by Chinese authorities and other boundary conditions relevant for the country. For electricity, the report suggests shifting the policy focus from installed capacity to electricity generation, and proposes an ambitious and mandatory renewables portfolio standard with tradable green certificates. This scheme would support China's goal of expanding competitive electricity markets and would promote further power exchange between provinces to support the system integration of wind and solar PV.

Finally, the IEA also launched new work with Imperial College Centre for Climate Finance & Investment to produce an analysis of climate finance as a form of institutional investment and the financial performance of listed equity investments in renewables in India and China.

Policy advice and modelling

> "Given the dominance of coal power in China's power sector and in its overall CO_2 emissions, how the country's fleet of coal-fired power plants is managed will be essential for China to meet its climate goals and other sustainable energy goals."
>
> IEA (2020), *China's Emissions Trading Scheme*

The IEA continued to support China on the design of its national ETS, on power sector reform and on long-term low-carbon policy packages. Our work on this topic

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particularly focused on supporting the success of China's national ETS – an important element in driving China's longer-term energy transition – by providing technical contributions on topics such as design implications and the scheme's interactions with other major energy and climate policies.

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High-level exchanges with Chinese officials

Our efforts to support these objectives included analysis particularly requested by China's officials, such as:

- Designing an efficient allocation of allowances, which considers the implications of proposed trial benchmark options for China's coal-fired power sector. This in-depth analysis also assesses how the options would affect allowance allocation to different types of plant, and considers the critical elements that would determine whether generation units experience a deficit or a surplus of allowances. The report also looks at how these impacts would be distributed across provinces and companies, and provides practical suggestions on how the ETS design could evolve to play a more central role in driving China's energy transition.
- Analysis of the role of the ETS in decarbonising China's power sector, jointly prepared with Tsinghua University's Institute of Energy, Environment and Economy (3E). This report aims to improve understanding of the role of China's national ETS and opportunities for it to support power system transformation and reduce CO_2 emissions. The analysis relies on an in-depth modelling exercise for the power sector at the national and provincial levels from 2020 to 2035. It is intended to assist in designing a benchmark trajectory over time that would see CO_2 emissions from power generation peak before 2030, and could position the ETS as a main driver of China's power system transformation. The analysis' key findings and recommendations were presented and discussed with MEE in late 2020.

This work was requested and endorsed by high-level Chinese officials from MEE, who expanded their request to the IEA to providing further technical assistance on China's ETS and strengthening our collaboration with their local experts from

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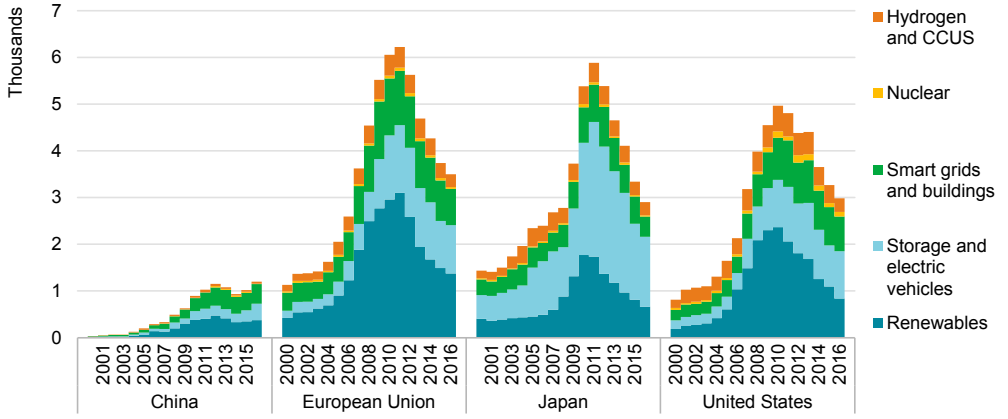
Tsinghua University. The analyses involved consultations and exchanges with other local institutions such as China's National Center for Climate Change Strategy and International Cooperation, China Electricity Council, and with Chinese experts at the IEA. They were also co-ordinated and discussed with major international co-operation stakeholders such as Energy Foundation-China, EDF-China, EU-China ETS, GIZ, ADB and the International Carbon Action Partnership (ICAP).

Innovation

Innovation is at the forefront of energy policy making in China, particularly as it seeks to meet the technological challenge of achieving carbon neutrality by 2060. Chinese policy makers are keen to have IEA support in fully understanding this challenge. At the same time, knowledge outside China of how innovation works in the country is limited as it undergoes major changes.

In 2020 the IEA continued working with China on clean energy innovation, notably building on relationships developed through secondments to the IEA from China's Ministry of Science and Technology (MOST) and NEA. In 2020 we began analytical work to map China's clean energy innovation landscape and examine recent trends, with an agreement with MOST to publish findings in 2021 and organise a joint workshop on the topic with key Chinese experts and decision makers ahead of the finalisation of the 14th five-year plan. Further research into the evolving role of sub-national actors and state-owned enterprises in Chinese energy innovation, for example in the area of hydrogen, is ongoing. It will help us to better integrate Chinese energy technology developments into IEA modelling and policy recommendations in 2021.

Issuance of patents for low-carbon energy technologies in selected countries/regions



Notes: Patent counts refer to the number of granted international patent families that include at least two geographical offices. Counts are allocated to countries based on the country of the inventor. CCUS = carbon capture utilisation and storage; China = China (People's Republic of).

Source: IEA (2020), *ETP 2020, Special Report on Clean Energy Innovation*, https://www.iea.org/reports/clean-energy-innovation

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We co-organised a seminar entitled “Accelerating Clean Energy Innovation Towards a Net-Zero Future” to launch the ETP Special Report on Clean Energy Innovation for a Chinese audience. The event gathered high-level participants from MOST (Administrative Centre for China's Agenda 21), Energy Foundation China, Chinese Renewable Energy Industries Association, Chinese Wind Energy Association and Chinese Academy of Science, amongst others. We also worked on the translation of that report to help it to reach more Chinese readers.

These relationships will be further strengthened in 2021, with a new secondee from MOST starting at the IEA in the second quarter to help the IEA improve innovation data and understanding of China’s international energy research partnerships.

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2020 Activities in India

Highlights of CETP activities in India during 2020

- Dr Fatih Birol's participation in an online conference with the Prime Minister of India, the Hon. Narendra Modi, and global energy leaders to discuss the outlook for the energy sector.
- Publication of the India 2020 Energy Policy Review, providing insights into the rise of India in the global energy market and recommendations for strengthening its energy sector.
- Working with NITI Aayog, the government of India's think tank, to share expertise on national energy tariffs and prices and provide recommendations to enhance data to inform and support policies.
- Supporting the BEE to identify energy efficiency stimulus measures that could be included in an economic recovery package.
- In collaboration with MNRE, influencing policy by sharing innovative regulatory and policy options to scale up rooftop PV in India.
- A state-level workshop in Gujarat to inform actions for integrating solar and wind into its electricity system; developing the Gujarat power system model and a renewable energy integration roadmap.
- Producing the third joint Clean Energy Investment Trends report with CEEW to assess challenges to attracting capital.
- The Iron and Steel Technology Roadmap with a particular focus on decarbonising the sector in India.
- High-level dialogue with officials, building on the ETP Special Report on Clean Energy Innovation, and generating interest in deepening co-operation.

Broader India–IEA context

- The IEA and India have been co-operating since as early as 1998, with the signing of the Declaration of Co-operation covering issues related to energy security and statistics.
- The strong relationship resulted in a special report on India in the World Energy Outlook 2015, and the Energy Efficiency Outlook for India: Sizing up the Opportunity in 2016, while the World Energy Outlook 2018 included in-depth analysis of the Indian electricity system. In early 2021 the IEA also published the India Energy Outlook 2021.
- India joined the IEA as an association country in March 2017 and participates in 11 IEA TCPs.
- The IEA–India joint work programme from 2018 to 2020 identified a number of priority areas, including energy security and energy efficiency. We have also signed memorandums of understanding with the Ministry of Petroleum and Natural Gas, the Ministry of Science and Technology, the International Solar Alliance (headquartered in New Delhi), and The Energy Research Institute (TERI). The IEA

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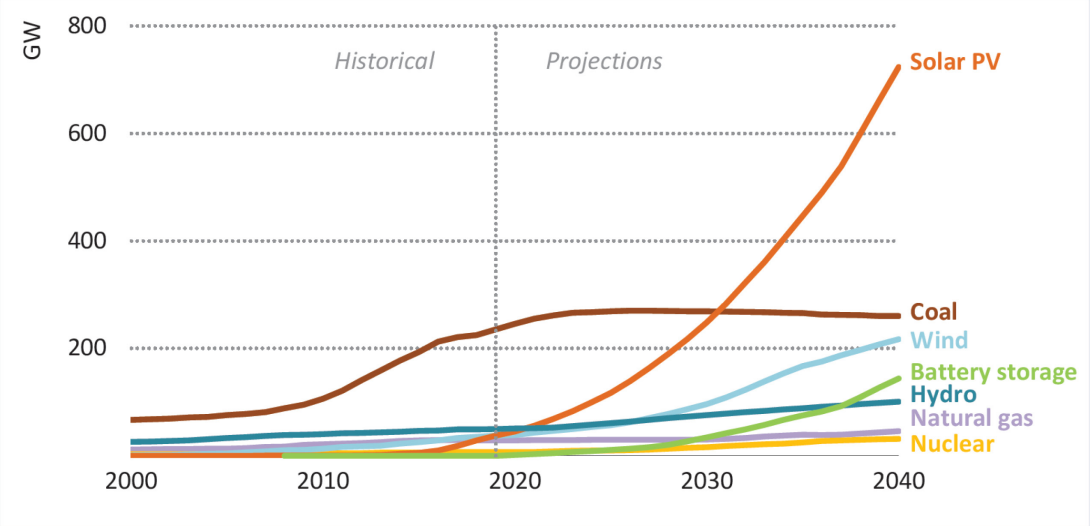
has formal working relationships across the various energy-related ministries and NITI Aayog (the government's official think tank), as well as a number of other important partners such as CEEW.

Power capacity in India by source in the Stated Policies Scenario



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Source: IEA (2020), *World Energy Outlook*.

Data and statistics

Our work on this topic focused on helping improve the comprehensiveness and quality of India's "core" energy statistics, supporting the collection of data on core energy statistics and providing training and capacity building. Our activities during 2020 included:

- Preliminary analysis of available data and methodologies for prices and taxes relating to electricity, oil products and natural gas, in co-operation with and at the request of NITI Aayog. This included clear recommendations for establishing comprehensive data collection in these areas, possibly harmonised with international standards, to correctly inform and support policies.
- Following up on the December 2018 training activities, developing a state-level virtual training course on energy statistics and end-use data collection, consisting of one high-level meeting and five webinars. This initiative is being piloted with Maharashtra State (in collaboration with Prayas Energy Group and Maharashtra Energy Development Agency) before expanding to a larger grouping of states later on.
- Work to improve the quality of data on solid biofuels and waste, launching new efforts with TERI to assess available data sources in India that could be used to improve the coverage and quality of data.
- Working with a junior consultancy to automate the scraping of real time (daily) electricity data to publish regular analysis of the impact of the Covid-19 pandemic

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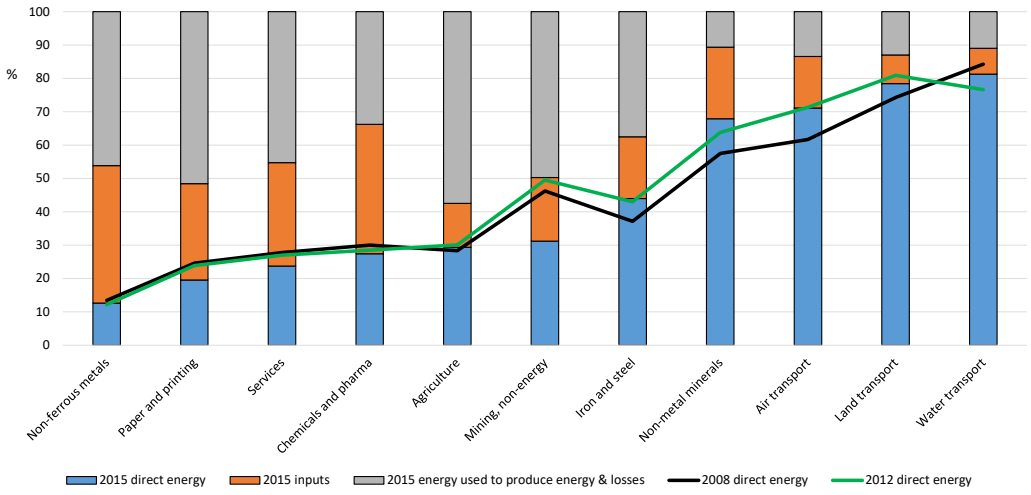
on India's electricity sector; and the scraping of monthly coal, oil, gas and electricity data, with a view to generating a calendar-year energy balance for India.

Share of direct and indirect energy in total energy consumed in production, 2015 (preliminary results)



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Note: Preliminary estimates based on experimental work linking IEA Energy Balances data with OECD Input-Output tables.

Energy efficiency

Our work on energy efficiency in India focused on industry, residential buildings and transport, and on how energy efficiency could support a green economic recovery across these sectors.

As part of the work on buildings, the IEA started developing the Roadmap for Mainstreaming Energy Efficiency in Residential Buildings in collaboration with the buildings team at the BEE. The roadmap builds on the methodology and framework set out in the GlobalABC Regional Roadmaps, but is focused on new residential buildings, and on facilitating the widespread adoption and roll-out of residential building energy codes across states and municipalities. The roadmap outlines the vision, strategy, recommended actions and indicators for the design and construction of new residential buildings; the carbon embodied in materials, systems and operations; and urban planning and clean energy. In 2020 the team held six individual stakeholder consultations with relevant organisations working in the sector and one kick-off webinar on 18 September with several speakers from state agencies and municipalities. We shared a draft of the roadmap with the BEE in December 2020 for their comments ahead of wider circulation and feedback. We are also planning another series of thematic consultation events in 2021.

With regard to efforts related to economic recovery, in response to the recession brought on by the Covid-19 pandemic, the BEE requested IEA support in identifying possible energy efficiency measures that could help stimulate a green and sustainable economic recovery. Building on the IEA's Sustainable Recovery

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Report, and articles on the potential for energy efficiency measures to support a clean economic recovery, the IEA developed a 46-page paper outlining the opportunities for energy efficiency measures and the possible short- and long-term benefits. It also outlines recommendations on how to use India's existing policies and programmes to deliver these measures. Stakeholder consultations were held in January 2021, following which the BEE will produce a joint IEA–BEE final report. The BEE will use this report to recommend measures to the Ministry of Power to support a clean recovery.

In addition, with the support of TERI, the IEA is working on a policy package to promote energy efficiency in medium-sized textile manufacturers. In 2020 the IEA developed a concept note and scope of work in collaboration with the BEE. The project deliverables are due in mid-2021.

The IEA has also been working with the BEE to define a project concept and methodology for the development of sectoral benchmarks for industrial sectors under the Perform, Achieve, Trade (PAT) Scheme. Our activities included co-ordinating high-level technical exchanges with the BEE to discuss the opportunities for and implications of using the industrial energy certificates trading platform in PAT for a carbon trading platform. This will be explored further in 2021.

With regard to transport, working with the IEA, TERI undertook an electric bus case study for Kolkata, which was covered in the Global Electric Vehicle Outlook and considered lessons learnt in Kolkata and the multiple benefits of implementation. The IEA is also examining the impacts of Covid-19 on urban transport and considering current and planned actions on urban transport infrastructure in emerging economies through a series of webinars. The India webinar, which took place in January 2021, looked at the regional perspective and provided detailed insights into action in Hyderabad and Pune, examining how social distancing and modal shift is resulting in walking and cycling infrastructure and opportunities for electric charging infrastructure.

Finally, the IEA has continued to support the BEE's contribution to global dialogue on energy efficiency by showcasing successful Indian policies and providing platforms for collaboration, such as the 3% Club and the Energy Efficiency Hub. We have also continued supporting the BEE in their leadership role in the SEAD Initiative and COP26 campaigns. The IEA has continued the webinar series on ASEAN, China and India, including Energy Efficiency in the Time of Covid-19: Supporting the Economic Recovery in Emerging Asia.

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Energy Efficiency in the Time of Covid-19 webinar

Electricity

Our activity in 2020 under this work stream continued to expand, particularly at the subnational level. Throughout the year, the IEA brought together national and state-level governments, the private sector and other relevant institutions to share our expertise on the barriers to renewable energy integration and financing. The commentary India Needs a Range of Options to Unlock the Full Flexibility of its Power System summarises many of the insights shared in 2020.

As part of our subnational work, in February 2020 the IEA organised a first state-level workshop in Maharashtra in collaboration with NITI Aayog and Prayas to share ideas and identify challenges and opportunities related to renewables integration on a single platform. The workshop also aimed to help plan the grid integration of higher shares of wind and solar in Maharashtra, while prioritising and deploying flexibility to ensure cost-effective system planning and operation in an evolving energy mix.

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State-level workshop in Maharashtra

A second virtual state-level workshop took place in October in Gujarat, organised in partnership with NITI Aayog and the Centre for Energy Regulation. The workshop informed the government of Gujarat's actions for integrating solar and wind into its electricity system, as these electricity sources will redefine how the state's power system is organised, planned and operated. The event also provided a unique platform for local and international experts to share ideas and identify recommendations for successful power system planning, operation and flexibility.

The IEA and Centre for Energy Regulation also started to develop the Gujarat power system model in co-ordination with the Gujarat State Load Despatch Centre (SLDC) in July 2019. Following the data collection and model-building phase, the preliminary results were presented during the Gujarat workshop in October 2020. This was the first time the Gujarat government could assess the impact of their new 2030 renewable energy targets. We developed a range of power sector scenarios for Gujarat using the outcomes of the workshop and the following consultation calls, plus the numerous inputs, feedback and suggestions from local stakeholders including the state electricity provider GUVNL, the Gujarat Energy Transmission Corporation, the SLDC, the Gujarat Energy Research and Management Institute, the Lawrence Berkeley National Laboratory and the Indian Energy Exchange.

The scenarios illustrate the impact of different flexibility resources on the Gujarat power system in 2030: demand response (agricultural demand), coal and gas power plant flexibility, different storage resources (pumped hydro and batteries) and a scenario with some solar capacity replaced by wind, to give a more even balance between wind and solar. The analysis and the resulting policy roadmap

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will be published in 2021 and launched with Indian government stakeholders. We included some results in the India Energy Outlook 2021.

As a result of these engagements, and in order to continue supporting India's renewable energy agenda, the IEA is also producing a renewable energy integration roadmap for three India states – Maharashtra, Gujarat and Karnataka. This detailed policy roadmap will show how these states can accelerate the uptake of variable renewable energy and take concrete actions to increase solar and wind deployment. It will take into account the principal challenges (such as frequency and voltage issues, forecasting and visibility of solar and wind, curtailment, system strength) and the full repertoire of technical and policy solutions (such as pumped hydro vs battery storage, demand response, tariff design, inertia additions) for each state. The roadmap builds on analytical studies done by the IEA and other partners, as well as in-depth stakeholder engagement.

In addition to our extensive collaboration with institutions such as NITI-Aayog, the IEA's engagement has prompted active collaboration and knowledge sharing with many different local, national and international actors in the Indian context. They include TERI, state governments, local think tanks such as Prayas, the Centre for Energy Regulation and CSTEP, industry groups such as the India Smart Grid Forum and India Energy Exchange, and international organisations such as GIZ, the National Renewable Energy Laboratory and the Lawrence Berkeley National Laboratory.

The IEA also continued collaborating with CEEW to produce a third joint Clean Energy Investment Trends report, which examines the financing trends and availability of capital in the renewable energy sector. It looks at the main sensitivities affecting returns and the challenges of attracting capital, while offering an update on renewable energy debt financing and market trends, and analysis of the appeal of utility-scale solar PV and onshore wind energy in India.

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Clean Energy Investment Trends 2020

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Our collaboration with CEEW also included important work on distributed solar PV. The rooftop solar PV sector plays a crucial role in achieving India's ambitious renewable energy targets by 2022 and beyond. However, the progress of small residential and commercial applications has been slow compared to utility-scale solar PV and onshore wind. Policy, regulatory and administrative challenges at both central and state level hamper a faster expansion of rooftop installations. In order to discuss and address some of these challenges, the IEA in co-operation with CEEW and the MNRE organised an online workshop entitled Unlocking the Economic Potential of Rooftop Solar in India on 12 October 2020. The workshop brought together Indian central and state-level policy makers, the business community, regulators and distribution companies, with international experts from Australia, Brazil, Germany and the United States.

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Unlocking the Economic Potential of Rooftop Solar in India workshop

Based on this successful workshop and on positive feedback from the ministry, the IEA and CEEW are planning to publish a joint report in March 2021. The report will highlight six challenges to achieving faster expansion of rooftop solar and offer detailed policy options, business solutions and administrative modifications. They include:

- Enhancing economic incentives for distribution companies to support rooftop solar deployment.
- Improving access to financing for consumers interested in rooftop solar.
- Optimising net- and gross-metering rules regarding system integration and remuneration.
- Streamlining disbursement of direct subsidies and the overall investment process for small rooftop solar.
- Expanding promotion of rooftop solar among residential and SME consumers and boosting their confidence.

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These proposals could accelerate deployment in the next one to two years and do not require structural changes to central or state regulatory frameworks. They are expected to bring benefits for both distribution companies and rooftop solar owners. In the longer term, reaping the benefits of greater distributed energy resources requires a new approach to system operation, electricity market design and energy policy. This includes harmonisation of rooftop solar support rules across the country, facilitating open-access power procurement that includes small rooftop solar installations, using building codes to stimulate demand for rooftop projects and reducing cross-subsidies in electricity tariffs while protecting vulnerable consumers.

Finally, the IEA also launched new work with Imperial College Centre for Climate Finance & Investment to produce an analysis of climate finance as a form of institutional investment and the financial performance of listed equity investments in renewables in India and China.

Policy advice and modelling

In January 2020 the IEA and the Indian government launched the India 2020 Energy Policy Review – the result of an extensive process of engagement and discussion, made possible by support from the highest levels of the Indian government. Dr Fatih Birol presented the key findings in New Delhi in the presence of several cabinet-level ministers, energy secretaries, ambassadors, think tanks and the media.

The review provides insights into the rise of India in the global energy market and a comprehensive analysis of the country's energy sector. We make recommendations for strengthening energy policies in numerous areas, including: advancing energy market reforms, notably in power and gas markets; strengthening energy security; integrating higher shares of variable renewables; addressing air and water quality; and reducing vulnerability to the impacts of climate change.

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IEA executive director participates in the Indian energy meeting with PM Modi

Our work in 2020 also continued to help the government of India address interrelated energy, environment, climate change and development challenges through improved policy integration and alignment. In March 2020 the IEA produced an issues paper on "Opportunities for energy sector air quality and climate change policy synergies in India'" for the Ministry of Environment, Forest and Climate Change to present an approach to and the benefits of integrated policy assessment. The issues paper was subsequently discussed with partners within the government and the Indian research community. They welcomed the proposed policy scope of quantitative analysis outlined in the issues paper and highlighted the relevance and timeliness of the work.

Based on the issues paper, we prepared an analytical report "Air quality and climate policy integration in India – Achieving synergies and co-benefits". The report assesses policy integration issues in four areas that impact both air pollution and climate change: captive power plants, road transport electrification, access to modern cooking fuels, and industrial energy savings within the PAT scheme. The analysis led to co-operation with the air pollution modelling team at TERI for the first time, providing enhanced modelling on air quality. Significant parts of the analysis fed into the IEA's India Energy Outlook, and the report formed the basis of extensive expert consultations; a final version will be published in April 2021.

Findings from all these efforts and analysis can also be found in the commentary Sustainable Development and Energy Policy in India's Covid-19 Recovery, prepared for a broader Indian audience to help share the analysis in a timely manner. We have also disseminated the findings through several engagements and discussions with the ministry and the BEE – particularly to assist their efforts to extend PAT scheme into a carbon trading scheme – and through a virtual stakeholder workshop to discuss our work and exchange information with the government and think tanks.

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In early 2020 the IEA also announced that it would produce a special World Energy Outlook focused on India. The analysis – which will be finalised in 2021 – will support India with modelling and insights on integrated policy approaches to clean energy transitions and ways to mitigate energy-related impacts of the Covid-19 crisis. Developed in collaboration with Indian ministries, think tanks (TERI, CEEW) and local experts, this special report will present scene-setting analysis incorporating the response to the current crisis, as well as analysis of topics such as the energy-water nexus, clean energy transformation in power and end-use sectors, and clean energy investment and finance in the country.

Finally, we provided input and comments to NITI Aayog for the energy chapter of the Vision 2035 strategy document for India, covering outlooks, energy efficiency and the role of technology innovation.

Sectoral work

> "The projected growth in India's steel production is a challenge as much as it is an opportunity for the country. It is a challenge because the overriding importance of steel for India's economic growth means that production capacity has to be available and sufficient to meet growing demand. It is an opportunity in that actions taken by government and industry over the coming years can put India's steel sector at the forefront of technological development."
>
> IEA (2020), *Iron and Steel Technology Roadmap*

Our activity under this work stream focused on the development of an Iron and Steel Technology Roadmap (part of ETP), which analyses sustainable pathways for the iron and steel sector, with a particular focus on India, and provides a roadmap of stakeholder actions to implement such a transition.

The analysis, launched in October 2020, explores technologies and strategies necessary for the iron and steel sector to pursue a sustainable pathway; analyses critical technologies and processes that would enable substantial CO_2 emission reductions in the sector; assesses the potential for resource efficiency; and concludes with an outline of priority actions, policies and milestones to accelerate progress towards zero emissions from the iron and steel sector. The roadmap's focus on India provides guidance for policy makers, steel producers and investors on the critical opportunities and challenges for the Indian steel sector, and a roadmap to set India on a sustainable pathway.

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Launch of the IEA Energy Technology Perspectivies 2020 report in India

The IEA also held an Indian launch of ETP 2020 in November 2020. Dr Fatih Birol introduced the event and a keynote address was provided by Mr Prakash Javadekar, Honourable Minister of Environment, Forest and Climate Change (and Minister of Heavy Industries and Public Enterprises). The launch was followed by a high-level panel discussion, which highlighted the importance of linking supply and demand, and connecting technology development with market deployment in the endeavour of accelerating clean energy innovation.

Innovation

India's promotion of domestic clean energy innovation received a boost in 2020: the government launched a process to develop a new Science and Technology Innovation Policy with energy and climate as core pillars, launched a National Hydrogen Energy Mission and increased the level of ambition under the framework of Mission Innovation. The IEA continued its extensive activity to support these different work streams in India, starting with the publication of the India 2020 Energy Policy Review, which includes a first-of-its-kind peer review of India's energy technology innovation policies.

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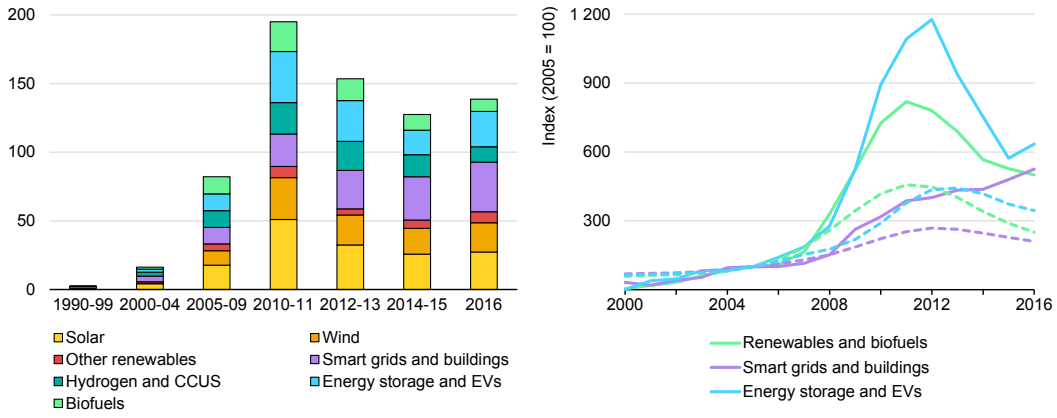
Number of Indian patents granted in selected low-carbon energy technologies (left) and benchmark against global trends (right)



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Notes: Patents granted in a selection of CCMTs related to low-carbon energy technologies (e.g. renewables, hydrogen, batteries and EVs, and efficiency), filed in two or more geographical offices. Geographical distribution by inventor country of residence. Right-hand graph: index (2005 = 100) of three-year moving average; dotted lines for global trends; solid lines for India.

Source: IEA (2020), *Tracking Clean Energy Innovation*, https://www.iea.org/reports/tracking-clean-energy-innovation

A highlight of our work was the high-level discussion Accelerating Clean Energy Innovation: Global Needs and Opportunities for India, co-organised with partners at the Ministry of Science and Technology to launch the ETP Special Report on Clean Energy Innovation for an Indian audience. The online event, which focused on the role of innovation for clean energy transitions in the wake of Covid-19, included the IEA Executive Director, the Principal Scientific Adviser to the government of India, the Secretary of India's Department of Biotechnology and Indian experts from the public and private sectors and academia. This enabled the IEA to strengthen relationships with local institutions and lay the ground for further collaboration in 2021, such as the Mission Innovation-backed Clean Energy International Innovation Centre, the Indian Institute of Technology Delhi, TERI, Tata Power and Social Alpha.

New projects were launched in 2020 that will continue during 2021:

- Input to the India Energy Outlook on future energy technology opportunities and strategies for India.
- Guidance to the Department of Biotechnology on the next phase of Mission Innovation, with a focus on bioenergy, pressing technology innovation gaps and international collaboration.
- Collaborative work with Ministry of Science and Technology partners on best practice for accelerating clean energy start-ups, to be published in 2021, and on global experiences with clean energy innovation policies (with external partners, including the Indian Institute of Technology Delhi).
- Partnership with India's Clean Energy International Incubation Centre on its 2021 "Techtonic" challenge for clean energy start-ups.

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Online event on accelerating clean energy innovation

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2020 Activities in Indonesia

Highlights of CETP activities in Indonesia during 2020

- Tailored guidance on how to develop effective renewables remuneration mechanisms that are at the centre of the upcoming Presidential Decree on Renewables, and which are critical to enhancing the clean energy investment environment in Indonesia.
- Detailed analysis of grid integration aspects of one of the world's largest planned floating solar projects, which contributed to its ultimate approval in late 2020.
- Launching high-profile, long-term assistance on power system enhancement – including institutional, regulatory, policy and techno-economic aspects – to drive renewables integration and modernisation.
- The preparation of an Indonesia country report under the auspices of the 2020 World Energy Investment publication on Attracting Private Investment to Fund Sustainable Recoveries: The Case of Indonesia's Power Sector.
- Supporting MEMR in the development of regulations for electric vehicles and a land-based transport roadmap.
- Engagement with senior Indonesian officials to assist their policy making for the transition from LPG to electric cook stoves for household and small-scale use.
- Early release of Indonesian energy statistics and balances in 2020 (and 2021)

Broader Indonesia–IEA context

- Indonesia was one of the first three countries to activate association status with the IEA in 2015, after completing two in-depth reviews of Indonesia's energy policies, in 2008 and 2015.
- Indonesia and the IEA signed an ambitious two-year joint work programme in December 2019, following several previously successful programmes.
- The IEA's work and collaboration went from strength to strength in 2020, with the agency increasingly uniquely placed among international actors to provide advice on key policy priorities across a range of areas, and especially on power systems.
- Rapidly scaling up work with Indonesia is a key priority of the Secretariat, in order to take advantage of this powerful momentum.

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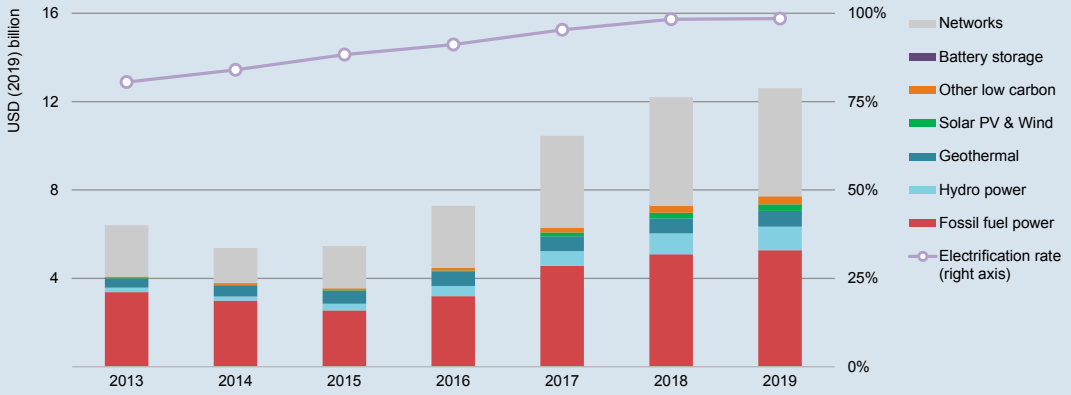
Power investment trends in Indonesia, 2013-2019



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Notes: PV = photovoltaic. Investment is measured as the ongoing capital spending in capacity. The scope and methodology for tracking energy investments is available here.

Source: IEA (2020), *Attracting Private Investment to Fund Sustainable Recoveries: The Case of Indonesia's Power Sector*, https://www.iea.org/reports/attracting-private-investment-to-fund-sustainable-recoveries-the-case-of-indonesias-power-sector.

Data and statistics

Building upon two CETP-funded missions in 2019, the IEA has solidified close relations with the energy statistics community in Indonesia. This has resulted in considerable progress in improving the timeliness and quality of Indonesian energy data and the inclusion of Indonesia in the February 2020 release of energy statistics and balances, a very significant achievement that was replicated in February 2021.

Energy efficiency

Our work on energy efficiency in 2020 focused on policy reform and improving data collection methods and reporting.

On industrial energy efficiency the IEA has been working with MEMR to review and redesign its industry energy management reporting system and to develop a website with best practice information for industry on energy efficiency. The IEA and MEMR have engaged industry and other government departments throughout the redesign process. This has helped the ministry build relationships with industry and, in turn, the new system will both reduce the sector's reporting burden and provide the ministry with better quality data.

The IEA released two online training courses: Energy Efficiency Indicators: Fundamentals on Statistics; and Essentials for Policy Making. In late 2020 the

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courses were translated into Bahasa Indonesia. They will be formally launched in Indonesia in 2021, followed by a series of workshops on benchmarking for Indonesia.

We were also invited by MEMR to support the development of a new ministerial regulation on public electric vehicle charging stations. The initial focus of our support has been on providing international experience on battery swapping for two-wheelers. An important outcome was a technical note highlighting international experience in the context of policy development, covering policies, standards, business models, distribution, pricing and manufacture. The technical note was underpinned by a mixture of desk-based analysis and discussions with organisations working in this area, including operators and standards boards. Complementing this, we are facilitating discussions between these parties and MEMR. We presented the technical note and outcomes to MEMR in November 2020 – the discussion highlighted next steps which we will use to inform activities in 2021.

The IEA is also providing support to the Directorate General of New and Renewable Energy and Energy Conservation on the development of a land-based transport roadmap. The roadmap looks at future energy-saving policy scenarios and details the role of different transport energy efficiency measures in achieving these scenarios. Measures include improvements in vehicle efficiency through electrification and fuel economy standards, as well as travel efficiency through a shift to more sustainable modes. Timescales for the roadmap are 2025, 2030 and 2050, with Indonesia's National Energy Planning targets informing actions for 2025. Discussions with the directorate general took place throughout 2020, with a draft version of the data analysis and mitigation options for the roadmap presented in December. The outcomes will inform the development of the final roadmap, which is due to be released in early 2021.

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Energy Efficiency in the Time of Covid-19: Action on transport urban infrastructure and impacts to support social and economic recovery in Indonesia webinar

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Finally, the IEA is examining the impacts of Covid-19 on urban transport and considering current and planned actions on urban transport infrastructure in emerging economies through a series of webinars. The Indonesia webinar looked at the regional perspective and then provided detailed insights into action in Jakarta, examining how social distancing and modal shift is resulting in new walking and cycling infrastructure. The discussion also looked at steps to ensure successful implementation, including engagement with stakeholders and opportunities for data collection. We will use the outcomes of the webinar series to publish a commentary examining best practice from an emerging economy perspective.

Electricity

The IEA's work with Indonesia on the power sector has experienced enormous growth in 2020. Following the signing of the IEA–Indonesia Joint Work Programme at the IEA Ministerial in December 2019, MEMR requested that the IEA support the implementation of a forthcoming decree on renewable energy. Working closely with MEMR counterparts and officials from local utilities, the IEA developed a comprehensive multi-year workplan to meet this request.

The first part of this project was completed in the latter half of 2020 and was a system integration analysis of a brand new, 145 MW Cirata floating solar facility in West Java. This project is slated to be one of the largest solar facilities in the country, and one of the largest floating solar facilities in the world. The IEA performed a detailed assessment of the project's impact on the Java-Bali system and what integration tools would be most efficient for the entire system. This created comfort for the government in moving ahead with the milestone project, and in turn built trust in the IEA's ability to respond to pressing concerns of the government.

The second part of this work is ongoing and consists of a detailed analysis of the Java-Bali power grid, as part of efforts to prepare for the planned integration of larger shares of variable renewable electricity. This is expected to contribute directly to MEMR's ability to evaluate how to enhance the power system in Java-Bali to enable clean energy transitions and integrate higher shares of renewables. It will also investigate policies relevant for all of Indonesia on strengthening transmission, increasing and maintaining reliability when integrating renewable energy, and enhancing system operations to facilitate integration. The IEA is working closely with PLN, the state utility and its regional subsidiaries, as well as with MEMR to exchange data and modelling, and developing meaningful policy recommendations.

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Attracting private investment to fund sustainable recoveries: The case of Indonesia's power sector

The final part of this project will be an assessment and analysis of the impacts of the presidential decree on renewable electricity in Indonesia.

Additional work under this workplan includes tailored capacity-building events on issues related to the efficient management of the grid, and knowledge and evidence for policy makers to support the country's transition to clean energy and its recovery from the ongoing crisis.

We also prepared the IEA report Attracting private investment to fund sustainable recoveries: The case of Indonesia's power sector, a country-specific analysis falling within World Energy Investment 2020. This report assesses the country's shift to economic recovery and a more sustainable power system; explores the implications for decision-making; tracks investment and financing trends in the power sector; characterises the availability of public and private funds; and identifies the main issues that affect investment decisions and essential factors to take into account in policy making.

> "An enhanced investment framework for renewables and reforms that attract higher levels of private capital would help support sustainable economic recovery in Indonesia"
>
> IEA (2020), Attracting private investment to fund sustainable recoveries: The case of Indonesia's power sector

The IEA also undertook a range of additional activities at the request of Indonesian counterparts to support the country's transition, including ad hoc assessments in support of Indonesia's clean energy goals, such as presenting a case study on industrial tariff setting in Viet Nam with key findings for Indonesia's case; and tailored analysis of remuneration mechanisms for renewables and enabling investment frameworks. A 2021 suite of webinars on smart grids, interconnection and reliability, and other power-sector focused actions are also planned.

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Policy advice and modelling

With the objective of contributing to Indonesia's proposal to transition from LPG to electric cook stoves for household and small-scale use, the IEA prepared an ad hoc analysis of international best practices and cost-benefit outcomes of cook stove electrification initiatives. Our analytical output considered experiences on transitions from LPG to electric stoves in a diverse set of countries (e.g. Ecuador, Senegal and Morocco) and was followed by direct engagement with Indonesian senior officials to assist their policy-making process.

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2020 Activities in Mexico

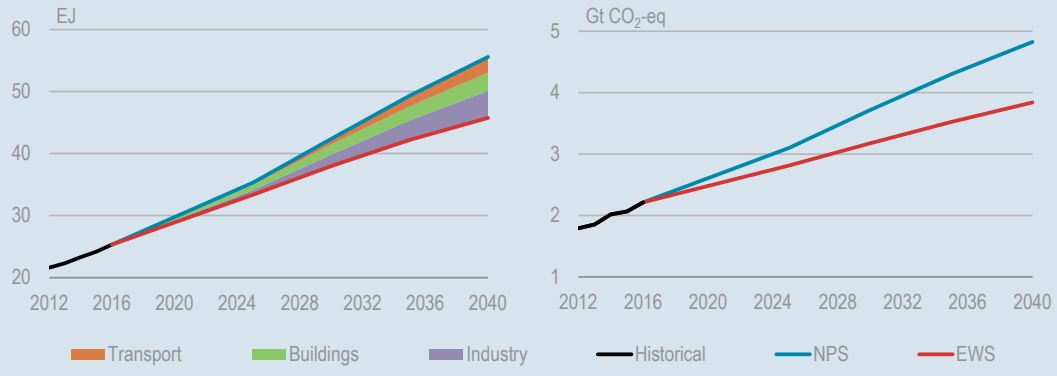
Highlights of CETP activities in Mexico during 2020

- Mexico participated in a number of headline events in 2020, contributing to international dialogue and highlighting Mexican experience and best practices on energy efficiency and clean energy transitions.

Broader Mexico–IEA context

- Mexico officially became the 30th IEA member country on 17 February 2018, and the first member in Latin America.
- As with all member countries, the IEA Secretariat is working with Mexico to provide technical support on data collection systems. Mexico participates in nine IEA TCPs.
- Since taking office on 1 December 2018, the administration of President Andrés Manuel Lopez Obrador has been developing its new Sectoral Programme for Energy as well as a new Energy Transitions Strategy. The IEA and the Ministry of Energy (SENER) are exploring bilateral activities under these initiatives.
- In the meantime, engagement with Mexico consisted of continued dialogue on energy data and statistics as part of IEA data collection, the participation of Mexican delegates in IEA online events and webinars, and the strong participation of Mexican stakeholders in regional webinars and conferences.

Total final energy use and emissions in the New Policies Scenario and Efficient World Scenario for Mexico, 2012-40



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Source: IEA (2018), EE Market Report for Mexico.

Energy efficiency

In 2020 SENER and the National Commission for the Efficient Use of Energy (CONUEE) actively participated in several events, advancing dialogue on clean

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energy transitions and energy efficiency, and benefitting from opportunities to share Mexico City's experiences of energy efficiency.

Activities developed throughout the year include:

- The participation of SENER and CONUEE in several events, such as the E4 Roundtable and Energy Efficiency Working Party. CONUEE shared insights from Mexico at the webinar on Energy Efficiency in the Time of Covid-19: Highlights from the Energy Efficiency 2020 Report held on 9 December 2020.
- Mexico City shared its experiences alongside the cities of Bogotá and Buenos Aires in a webinar on Energy Efficiency in the Time of Covid-19: Action on transport urban infrastructure and impacts to support social and economic recovery in Latin America, held on 4 November 2020.
- Mexico City further participated in the IEA's 5th Annual Global Conference on Energy Efficiency, providing insights on how it is advancing energy efficiency in all sectors and across the city.

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2020 Activities in South Africa

Highlights of CETP activities in South Africa during 2020

Examining options for the future design of South Africa's carbon tax for the National Treasury, its role in addressing environmental externalities in liquid fuel taxation, and how it could be used to incentivise improved emissions intensity in the electricity sector.

Initial engagement with South Africa to enhance communication and co-operation on end-use data and energy efficiency indicators.

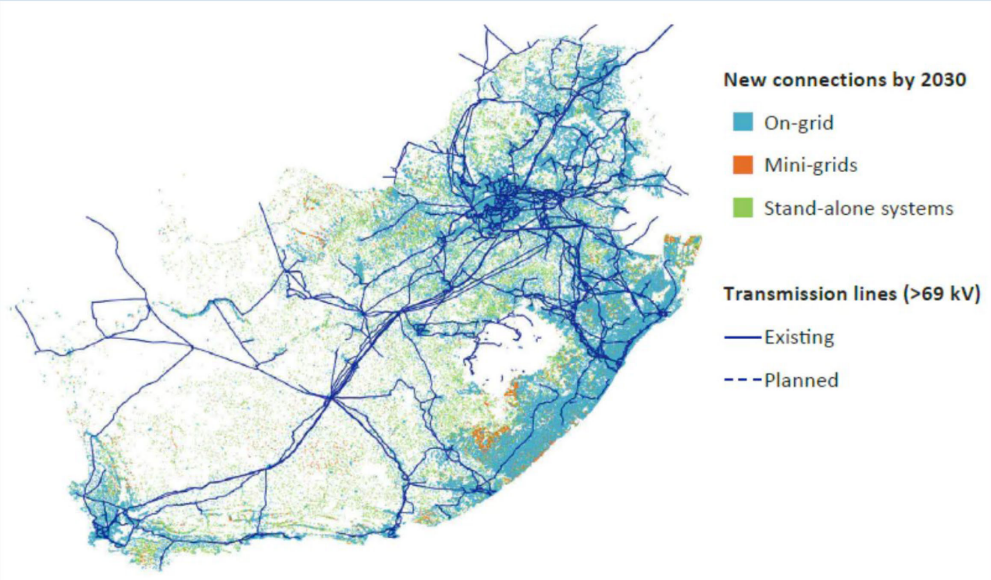
Early release of South African energy statistics and balances in 2020 (and 2021).

Extension of work on indicators for energy-intensive sectors across G20 countries to less energy-intensive sectors such as the automotive industry, which is of strategic importance to the government of South Africa.

Broader South Africa–IEA context

- Co-operation between the IEA and South Africa builds on a nearly decade-long relationship shaped by collaboration on previous joint work programmes.
- South Africa joined the IEA family as its most recent association country in October 2018.
- South Africa participates in eight IEA TCPs.
- The IEA and South Africa signed a three-year work programme in November 2018.

Map of South African electricity access solutions by type in the Africa Case



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Source: ***South Africa Energy Outlook: Analysis from Africa Energy Outlook 2019,*** **https://www.iea.org/articles/south-africa-energy-outlook.**

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Data and statistics

With the objective of improving the comprehensiveness and quality of basic energy statistics, the IEA embarked on initial engagement with South Africa, which will continue during 2021. Our expectations are that improved communication and closer co-operation should lead to greater collaboration on end-use data and energy efficiency indicators, in addition to stronger basic energy statistics.

There has been considerable progress in improving the timeliness of South African energy data. This resulted in the inclusion of South Africa in the April 2020 release of energy statistics and balances, a very significant achievement that paved the way for an even earlier release in 2021, in February.

Energy efficiency

In 2020 we continued to extend our work on indicators for energy-intensive sectors across G20 countries to less energy-intensive sectors such as the automotive industry, of strategic importance to the government of South Africa because of its role in economic development and job creation.

2020 focused on improving energy data reporting and indicators, in particular for industry. The IEA supported cross-agency collaboration and brought together stakeholders from across sectors in a series of workshops to help harmonise data requirements. Current activities are now focused on providing South Africa with support to set up a digital data collection process that will allow government to track energy efficiency progress in industry and set more detailed indicators. This will be done through best practice sharing from work completed by the IEA in other key emerging economies (such as Indonesia) and facilitating discussion with IEA member countries.

Policy advice and modelling

As sustainable energy transitions require the refinement of a complex mixture of policies to achieve multiple national objectives, in 2020 we supported South Africa by evaluating the interaction and impact of critical climate change and low-carbon energy policy drivers.

Highlights of our engagement were the delivery of two ad hoc analyses for the South African Treasury related to implementation of the carbon tax. The first analysis focused on implications of using benchmarks in the power sector to determine tax-free allowances under the carbon tax, to incentivise improved emissions intensity. The second examined environmental aspects of fuel tax reform, including the potential role of the carbon tax within the fuel tax system, as part of the South African Treasury's work on Covid-19 recovery and stimulus measures. Both pieces of analysis responded to specific policy challenges, and were developed through very regular technical consultation sessions with the Treasury. Delivered in 2020, the reports also formed the basis for further intra-government and expert consultations, and revised versions of the reports are set to be published in 2021.

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2020 Activities in Africa

Highlights of CETP activities in Africa during 2020

- Providing training and capacity building on energy statistics and modelling to officials from the energy ministries of 10 sub-Saharan African countries. Around 100 high-level participants have taken part in the first online training activities.
- Releasing the Clean Energy Transitions in North Africa report, which identified pathways and recommendations to accelerate clean energy transitions in five countries (Algeria, Egypt, Libya, Morocco and Tunisia).
- Promoting energy efficiency in the region, helping bring together initiatives from EELA and UNEP to push further development of minimum energy performance standards in sub-Saharan Africa.
- Assessing the climate vulnerability and resilience of the power sector to enhance the climate resilience of African hydropower through a climate risk and impact assessment, and by introducing potential resilience measures.
- Updating the annual country-by-country data on energy access and access modelling for World Energy Outlook and SDG7 reports.
- Working with governments to assess the impacts of Covid-19 on electricity and clean cooking access, and to understand emergency measures.

Data and statistics

Our efforts in 2020 focused on contributing data and expertise to the first CETP Africa report on the clean energy transition in North Africa, released in September 2020, as well as on providing continued support for the upcoming reports on the clean energy transitions in the sub-regions of the Sahel (due in 2021) and the Horn of Africa (due in 2022). In particular, we focused on identifying data gaps in the countries of the abovementioned regions, as well as proposing and implementing solutions (resource allocation for the coming years) to fill the data gaps to feed into the reports on time.

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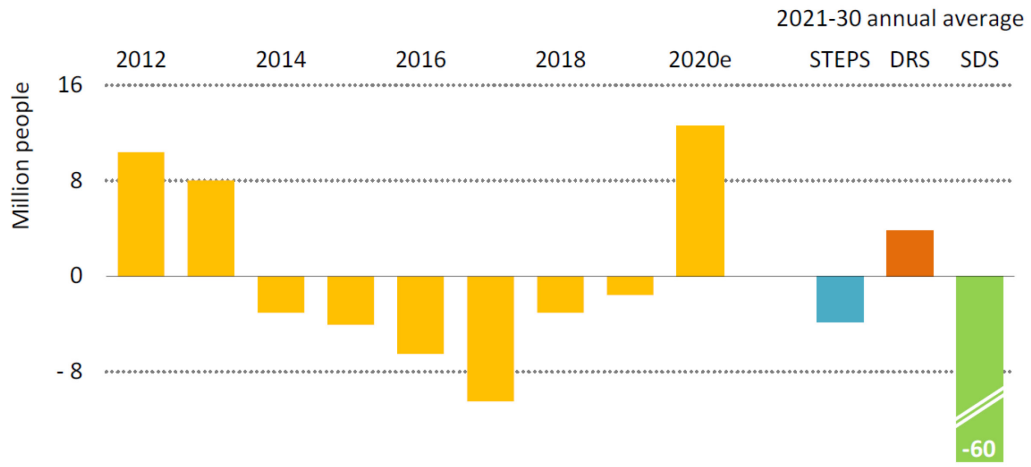
Annual changes in population without access to electricity in sub-Saharan Africa by scenario



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Notes: Values for 2020 are estimates.
Source: IEA (2020), *World Energy Outlook 2020*.

Under an EU-funded capacity-building programme, the IEA's Energy Data Centre also supported the organisation and launch of online training events in Senegal and Ethiopia in spring 2020, followed by Benin in November/December 2020. Experts from other sub-Saharan countries were also invited to these online events with the aim of maximising outreach, impact and exchange. CETP funding allowed additional resources to be allocated to the training events, maximising the teaching material quality and coverage, including the translation into French of the International Recommendations for Energy Statistics, achieved in September 2020.

The IEA also continued its work on enhancing the availability of data on energy prices in Africa, and we will be working during 2021 to improve the time granularity and quality of the data, in collaboration with stakeholders in focus countries.

Energy efficiency

Our longstanding engagement with South Africa has enabled the IEA to create new partnerships with sub-Saharan Africa countries on clean energy transitions. The role the IEA can play in the post-Covid-19 period is significant, as governments strive to achieve economic development in a resource-constrained climate. Following the Energy Efficiency Training Week in Pretoria in 2019, which brought together 150 policy makers from 33 countries in sub-Saharan Africa, the IEA has been strengthening relationships with the major regional organisations involved in promoting clean energy transitions in Africa, such as ECREEE, SACREEE, EACREEE, AfDB and EELA.

We now have a strong position in the promotion of energy efficiency in the region, helping bring together initiatives from EELA and UNEP to push further development of minimum energy performance standards in sub-Saharan Africa.

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The IEA has also been providing the North African region with analysis and support for their clean energy transition activity. We published a report on Clean Energy Transitions in North Africa in September 2020, including the energy efficiency dimension.

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Clean Energy Transitions in North Africa report

Addressing the impacts that more rapid urbanisation is expected to have across the continent over the next decade (and beyond), the IEA also developed an Africa Regional Roadmap for Buildings and Construction. This sets out targets and timelines towards achieving zero-emission, efficient and resilient buildings and construction between 2020 and 2050. The roadmap covers eight themes, including urban planning, new buildings, existing buildings, building operations, appliances and systems, materials, resilience and clean energy. For each of these themes, the roadmap identifies priority actions for policy and technology. We developed this roadmap in collaboration with the GlobalABC and UNEP.

Electricity

Our activity under this work stream included producing the Secure, Sustainable and Affordable Power Systems in Emerging Economies report. This analysis clarifies the role that thermal plants play in the power systems of emerging economies (particularly in Southeast Asia and Africa) in different IEA scenarios, including the Stated Policies Scenario and Sustainable Development Scenario of the 2019 World Energy Outlook.

Policy advice and modelling

Our policy work with Africa continued growing in 2020. We focused particularly on supporting African countries with their energy strategies and practices for clean energy transitions by sharing expertise to enhance data, inform decision making and guide policy implementation. The overall aims of our work are to support sustainable and accelerated development, achieve SDG7, promote

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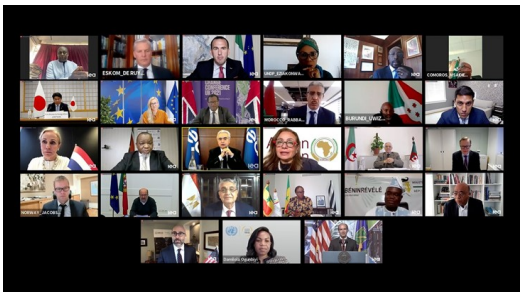
increased energy security and affordability, and accelerate the development of clean energy systems across Africa.

> "With its young and dynamic population, Africa has an increasingly important role in the world's energy future. The region has long been a key part of the IEA's work, but I am delighted that our engagement with African governments, institutions and energy companies continues to grow stronger."

Dr Fatih Birol, African Ministerial Roundtable highlights energy's vital role in response to the Covid-19 crisis

Our engagement with Africa included several technical and high-level meetings, such as the Africa Ministerial Roundtable on the Impact of Covid 19 in Africa's Energy Sector held in June and the Second AUC–IEA Ministerial Forum: Securing Africa's Energy Future in the Wake of Covid-19 held in November.



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Africa ministerial events

In 2020 the IEA focused on assessing clean energy transitions in North Africa, particularly through the Clean Energy Transitions in North Africa report, launched in September at the Clean Energy Transitions in North Africa Conference with the participation of energy leaders and other stakeholders from the region. The report identifies pathways and recommendations to accelerate clean energy transitions in five countries (Algeria, Egypt, Libya, Morocco and Tunisia).

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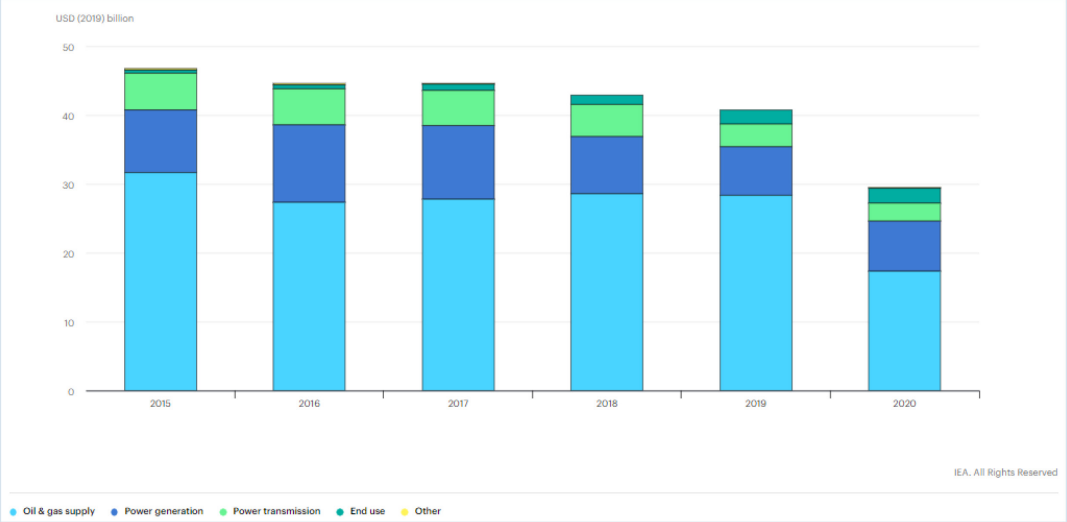
Clean Energy Transitions in North Africa report

Launched at the Clean Energy Transitions in North Africa Conference in September – organised by the IEA with the support of the Ministry of Energy, Mines and Environment of Morocco – the report aims to take stock of the region's current energy trends and illustrate policy-relevant best practices that can help advance the decarbonisation of the region's energy systems. The report highlights policy recommendations and opportunities to enable policy makers to build future energy systems based on the deployment of clean, affordable and efficient energy sources and technologies.

The analysis shows how the present Covid-19 crisis provides an opportunity for North African countries to re-evaluate energy strategies and accelerate their clean energy transitions. Countries can take advantage of the momentum from the crisis to build up a resilient, secure and clean energy sector that will help deliver a transformative economic recovery in a post-Covid-19 world. By accelerating transitions, the region can fully tap its energy sector potential to deliver a sustainable low-carbon economic recovery that creates much-needed new jobs and promotes long-term inclusive growth and socio-economic development.

Energy sector investment in North Africa, 2015-2020



Source: IEA (2020), *World Energy Investment 2020*.

The report's major findings include the following:

- North African countries have already achieved near-universal access to electricity and clean cooking (SDG7.1); ensuring that the poorest continue to be able to pay and do not lose access to essential energy services will be a critical objective in the months and years to come.
- The goal of scaling up renewable energy (SDG7.2) is set to be the driving force of North Africa's clean energy transitions; there is scope to accelerate deployment by increasing the level of ambition and developing policies that help address certain challenges, such as improved access to affordable financing, effective auction design, improved regulatory frameworks and implementing cost-reflective energy tariffs.

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- Progress on SDG7.3, improving energy efficiency, has been stagnant; policy packages combining incentives, information and regulation can maximise the benefits from energy efficiency across North African countries. This especially relates to a range of more easily achievable opportunities in the industrial, buildings and transport sectors.
- North Africa is one of the most vulnerable regions to climate change; governments can develop policies, regulations, incentive mechanisms and guidelines to integrate climate resilience considerations into central planning and encourage private investment in building resilience.

During 2020 the IEA also worked on assessing the climate vulnerability and resilience of the power sector (specifically hydropower) in the region. The analysis explores the climate resilience of African hydropower through a climate risk and impact assessment, and introduces potential resilience measures. It qualitatively assesses the climate risks to African hydropower plants in 13 African countries and examines potential climate impacts quantitatively, comparing two climate scenarios. Based on the assessment, it identifies measures to enhance climate resilience and provides policy recommendations.

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Climate Impacts on African Hydropower

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2020 Activities in Latin America

Highlights of CETP activities in Latin America during 2020

- Expanding collaboration with OLADE on data and statistics to include energy efficiency indicators and energy price data.
- Launching the online course on Energy Efficiency in Buildings, which reached students from across the region, with 646 completing the full 40-hour course.
- The global conference, Energy Efficiency – An Ace up the Sleeve for Energy Transitions, co-organised with the Chilean Ministry of Energy drew more than 1 000 viewers.
- Work with Chile on the preparation of its flexibility strategy, which will change the country's approach to flexibility in the coming years.
- Under the 3DEN Initiative, expanded research on the policy, regulatory and investment context needed to upgrade and mobilise Latin America's grid infrastructure for the clean energy transition, engaging with OLADE and governments and stakeholders across the region, including in Brazil, Chile and Colombia.

In 2020 the IEA continued its expanding activity with Latin America, working with regional institutions to leverage their local capabilities and increase impact. In addition to the issues highlighted below, during the year we hosted the IEA–OLADE Ministerial Roundtable. During this high-level exchange, ministers and officials from Latin American countries accounting for close to 70% of the region's energy demand examined how to put energy at the heart of their post-Covid economic recovery, while moving towards more sustainable and resilient energy systems in a way that creates opportunity for all.

> "This vital dialogue highlighted Latin America's many strengths – both in terms of its pioneering achievements on renewables, its rich energy resources and its diverse and dynamic population. I'm confident that the region has the potential to build a bright energy future."
>
> Dr Fatih Birol, Latin American Ministers and energy leaders stress need for sustainable and inclusive recovery from the Covid-19 crisis

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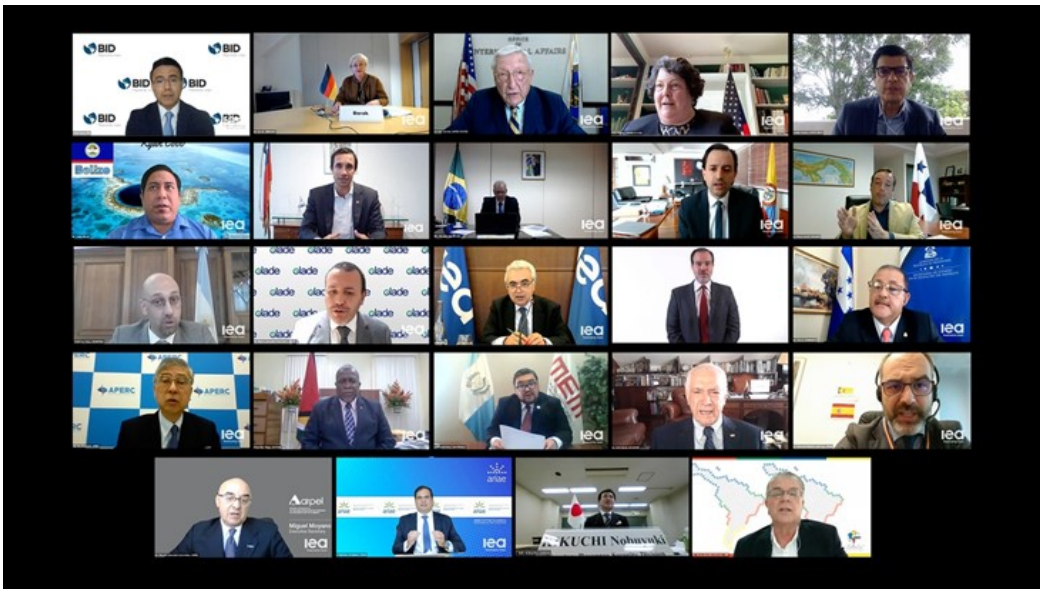

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IEA–OLADE Ministerial Roundtable

Data and statistics

The IEA has continued collaborating with OLADE on data and statistics, and agreed to expand their co-operation, potentially to include energy efficiency indicators and energy price data. IEA participation in technical exchanges also allowed discussion with different countries, including Colombia and Costa Rica, on new data needs. IEA staff have also contributed to OLADE webinars, including remarks from the IEA Chief Statistician.

Energy efficiency

In 2020 the IEA strengthened collaboration on energy efficiency with Chile and the Central American Integration System (SICA) region. We organised a series of webinars dedicated to stimulating dialogue on the Covid-19 crisis and energy efficiency. Specific activities in 2020 included the following:

- The IEA, in partnership with the Chilean Ministry of Energy, organised a regional energy efficiency event on 1 October 2020, Energy Efficiency – An Ace up the Sleeve for Energy Transitions. The event attracted more than 1 000 viewers, and featured government representatives and private-sector stakeholders from Chile, other Latin American countries and around the world. The event provided the opportunity to highlight the benefits of energy efficiency, to stimulate a discussion around the now-adopted energy efficiency law in Chile (at the time in draft form), and to explain how energy efficiency can be a pillar of energy transitions and economic growth.
- The IEA launched the Spanish version of its online course, developed with the Development Bank of Latin America (CAF), on Energy Efficiency in Buildings. So far 646 people have completed the 40-hour course, and another 873 have completed at least one of the four course modules.

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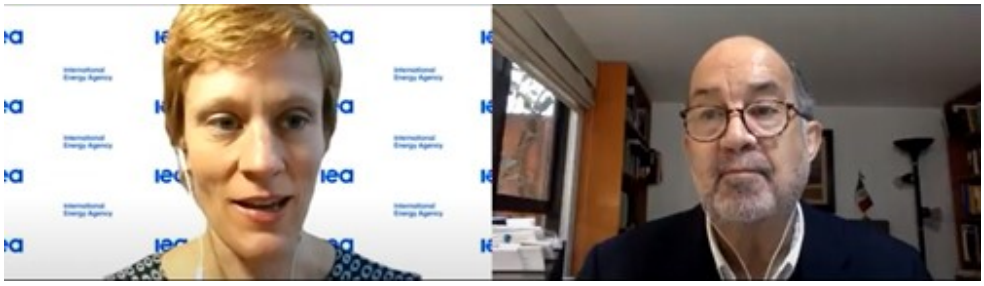
Homepage of the IEA–CAF Energy Efficiency in Buildings online course

- The IEA engaged in discussions with SICA on opportunities to support development of energy efficiency appliance standards in the region, as well as opportunities for capacity building and co-operation on efficiency and on data and statistics. At the end of 2020 we completed discussions around a memorandum of understanding to formalise a working relationship (the agreement was signed in February 2021).
- The IEA organised a series of webinars under the heading Energy Efficiency in the Time of Covid-19 to share with Latin America our own analysis of sustainable recovery and to learn about strategies underway in the region. The series delivered four webinars between July and December 2020, focusing on energy efficiency as a vehicle for sustainable relief and recovery, recommendations for urgent action on energy efficiency, action on urban transport infrastructure, and highlights from Energy Efficiency 2020.



Energy Efficiency in the Time of Covid-19: Highlights from Energy Efficiency 2020 webinar

Electricity

Our work with Latin America involved sharing IEA's expertise on power sector flexibility and energy security. Through our participation in different events and engagements, the IEA was able, for example, to contribute towards the preparation of Chile's flexibility strategy.

This an example of the IEA's suggestions being considered and included in the definitive proposal that will change Chile's approach to flexibility in the coming

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years. As a result, the IEA has been invited to provide input to the long-term implementation plan for the Energy Ministry's 2050 net-zero strategy, by joining the consultation roundtable series on smart grids.

Digitalisation

During 2020 the IEA – under 3DEN Initiative – expanded research on the policy, regulatory and investment context needed to mobilise grid infrastructure for the clean energy transition in Latin America. Work under this work stream with the region included the following:

- The IEA co-organised and moderated a Digitalisation Panel at OLADE Energy Week on 16 November 2020, which featured a dynamic discussion on the status of digitalisation in Latin America, lessons learned and the impacts of the Covid-19 crisis. The panel included regional and international perspectives on opportunities and challenges to digitalisation. The video reached more than 1 600 viewers.
- Presenting key findings of our analysis of smart grids and digitalisation to Colombian stakeholders, including research undertaken in Brazil, Chile and Colombia.

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2020 Activities in Southeast Asia

Highlights of CETP activities in Southeast Asia during 2020

- Strengthened relationship following ASEAN's decision to name the IEA as a strategic partner in 2019, as emphasised by the IEA Executive Director's speech to the 38th ASEAN Ministers of Energy Meeting.
- Expanded analysis of cooling in support of the ASEAN–IEA Cooling Partnership and completion of a retail market survey of air conditioners and refrigerators, using crowd-sourced data in Indonesia, Thailand and Viet Nam.
- Continued support as a main partner to the ASEAN Secretariat and various stakeholders (such as HAPUA, AERN) to facilitate progress on developing the IEA recommendations on minimum requirements for multilateral power trade.
- Responding to a request from 2020 ASEAN Chair Viet Nam to explore ways to enhance private-sector investment in transmission, regionally. Expanding and enhancing the grid is critical to clean energy transitions in Southeast Asia.
- Assistance to the region to assess the challenges and opportunities that carbon markets present to the power sector and on integrating carbon markets into other clean energy policies in the region, particularly in Thailand.
- Technical assistance to Thailand, and its state-owned utility EGAT, on ways to enhance contractual and technical flexibility of the power sector, an innovative approach that is critical to the decarbonisation of electricity.
- Early release of Thailand and Singapore data in 2020 (April), and even earlier in 2021 (February).

During 2020 the strong relationship between ASEAN and the IEA continued to be strengthened. The IEA has worked closely with ASEAN on energy policy since 2011 when the two organisations signed a memorandum of understanding. This close collaboration on energy policy was reflected in ASEAN's decision to name the IEA as a strategic partner in 2019. Our connection with ASEAN and Southeast Asia as a whole is evident in the activities highlighted below, as well as in the IEA Executive Director's speech to the 38th ASEAN Ministers of Energy Meeting. During this event, the IEA shared the latest insights on the impact of the Covid-19 pandemic on global energy markets and how the major economic shock has significantly affected the global energy landscape.

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"We will continue to help build the region's capacity to take on emerging challenges through our world-class analysis, data and policy advice. We look forward to supporting Southeast Asian countries as their role on the global energy stage expands and they map out their paths to a cleaner and more resilient energy future."

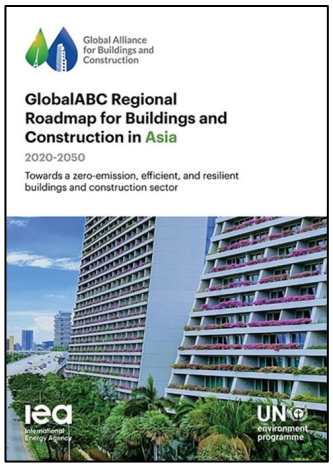
Dr Fatih Birol, Executive Director highlights importance of sustainable recovery at ASEAN Ministerial meeting

Data and statistics

There has been considerable progress in improving the timeliness of South East Asia energy data in 2020. This resulted in the inclusion of Singapore and Thailand in the April 2020 release of energy statistics and balances, a very significant achievement that paved the way for an even earlier release in 2021, in February. The IEA Energy Data Centre reached out to Enterprise Singapore in late 2020 to reinforce our longstanding data-sharing co-operation.

Energy efficiency

The IEA has been working closely with ASEAN member states, the ASEAN Centre for Energy and the ASEAN Secretariat on activities under the ASEAN–IEA Joint Programme of Work. In 2020 we continued to expand our analysis of cooling in support of the ASEAN–IEA Cooling Partnership formed under Thailand's 2019 ASEAN Presidency. The partnership recently completed a retail market survey of air conditioners and refrigerators using crowd-sourced data in Indonesia, Thailand and Viet Nam, and has used web-scrapping software to collect information on sales of these products in Indonesia. We are currently presenting these results to the countries and are building on the analysis through the development of an ASEAN Sustainable Cooling Roadmap, which is an IEA project supported under the ASEAN Plan of Action for Energy Cooperation Phase II.



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GlobalABC Roadmap for Buildings and Construction in Asia 2020-2050

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In 2020 the IEA also finalised the GlobalABC Regional Roadmap for Buildings and Construction in Asia. The roadmap sets out targets and timelines towards achieving zero-emission, efficient and resilient buildings and construction between 2020 and 2050. It covers eight themes: urban planning, new buildings, existing buildings, building operations, appliances and systems, materials, resilience, and clean energy. Priority actions relating to policy and technology are identified for each of the eight themes, as well as other enabling activities, including capacity building and finance. We will build on this work through the development of ASEAN-specific roadmaps for the buildings and construction sector in 2021. These will be completed in partnership with the ASEAN Secretariat and ASEAN Centre for Energy.

In 2020 the IEA and Singapore's Energy Market Authority continued their partnership to provide annual training events under the Singapore–IEA Regional Training Hub. The 2020 event was held online and focused on Sustainable Energy Policies for Smart Cities. More than 250 policy makers, urban planners and academics from 27 countries attended the event. The IEA and Energy Market Authority will be holding another training event together in 2021.

Electricity

The IEA continued its support for ASEAN's integration agenda as a main partner to the ASEAN Secretariat and various stakeholders (such as HAPUA, AERN). We facilitated progress in developing the recommendations we made on minimum requirements for multilateral power trade. Throughout the year, we continued our focus on helping these organisations build capacity for their regional network of regulators, a vital task to facilitate the establishment of multilateral power trade. Other activities included the preparation of tailored outputs and sharing of expertise at different technical and high-level events, such as:

- Supporting the development of capabilities in the ASEAN regulatory network via workshops and discussion papers on the minimum requirements to establish multilateral power trade (identified in the study on multilateral power trade in ASEAN published in 2019).
- Providing expert input, as a member of the technical review group, to the ASEAN Interconnection Masterplan Study (AIMS) Phase III. This was conducted by the ASEAN Centre for Energy to enhance connectivity and market integration in ASEAN to allow for high utilisation of renewable energy. In 2020 the IEA participated in a series of meetings to provide technical input, review the study and improve the quality of AIMS III preliminary results. Our input built upon the ASEAN renewables integration analysis that the IEA completed in 2019.

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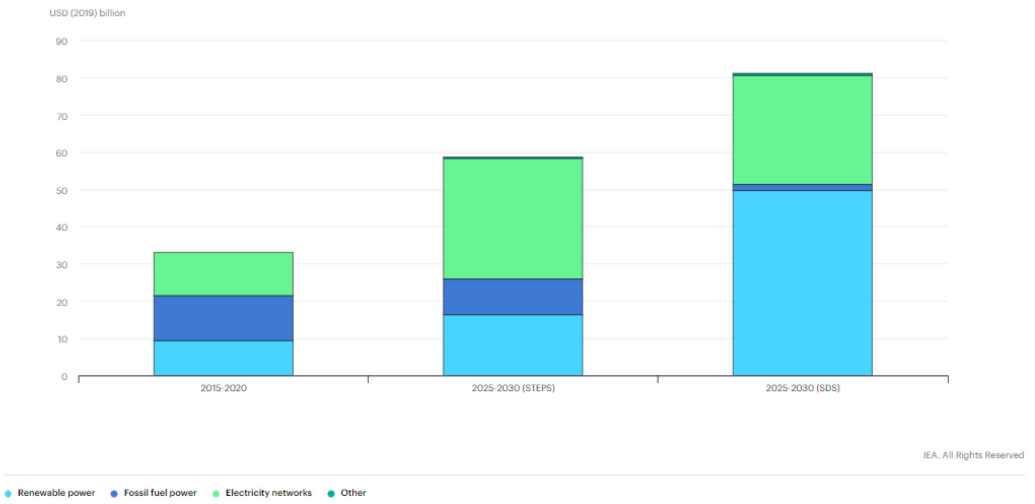
Current power sector investment in Southeast Asia compared with annual average investment in the States Policies Scenario and Sustainable Development Scenario, 2015-2030



Notes: STEPS = Stated Policies Scenario; SDS = Sustainable Development Scenario. Projected investment is expressed as the annual average over the 2025-2030 period. Other power includes investment in battery storage and nuclear power.

Sources: IEA (2020), *World Energy Outlook 2020*.

At the request of the ASEAN chair (Viet Nam), we also crafted analysis to show relevant models for attracting private investment in transmission grids. And during 2020 we also produced the Secure, Sustainable and Affordable Power Systems in Emerging Economies report, which clarifies the role that thermal plants play in the power systems of emerging economies (particularly in Southeast Asia and Africa) in different IEA scenarios, including the Stated Policies Scenario and Sustainable Development Scenario of the 2019 World Energy Outlook.

In addition, the IEA also worked with Thailand to share its expertise on the integration of renewable energy. During 2020 we continued collaborating with the Electricity Generating Authority of Thailand by sharing expertise on clean energy transitions and energy security to support Thailand's integration of renewables and achievement of renewable energy targets. These efforts have resulted in the IEA working on the development of the Thailand in-depth flexibility study, which analyses the options for enhancing power system flexibility in the country and covers technical and contractual flexibility aspects. The study builds on the renewable energy grid integration assessment that the IEA conducted for Thailand in 2018.

Our activity under this work stream also continued to support Thailand's carbon pricing project, which analyses carbon pricing for the power sector, co-ordinated under the policy advice and modelling work stream mentioned below. This work benefited from the local collaboration of the Thailand Greenhouse Gas Management Organisation (TGO) and input from several units within the IEA, and is based on the power system model developed for the Thailand flexibility study mentioned above. Our work with Thailand has also benefitted from the direct inclusion of Thai experts working within the IEA.

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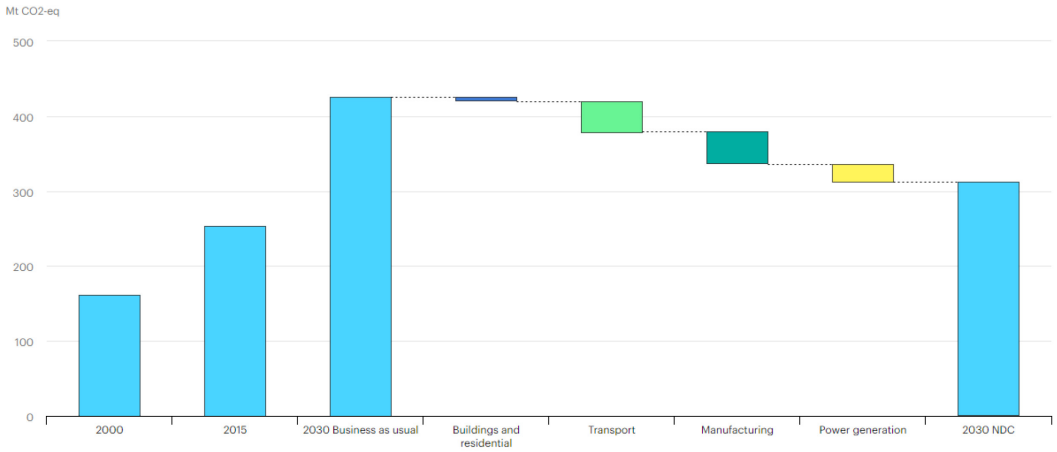
Policy advice and modelling

In 2020 the IEA worked to assist the Southeast Asia region assess the challenges and opportunities that carbon markets present to the power sector and the integration of carbon markets with other clean energy policies in the region. Our work started with Thailand, presenting crucial lessons from international experience that can be applied locally.

Thailand's energy-sector nationally determined contribution roadmap, 2000-2030



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Source: Thailand Ministry of Natural Resources and Environment (2018).

During 2020 we produced two analyses to inform Thailand's policy makers, including the report Putting a price on carbon – An efficient way for Thailand to meet its bold emission target and an ad hoc assessment for TGO on the potential effects of carbon pricing on the Thai power sector to 2030. Through these efforts, we worked together to support the government in overcoming key hurdles to the development of carbon markets.

Our work relied on regular consultation meetings with TGO and other actors from the Ministry of Energy, and with local experts working at the IEA.

To enhance IEA outreach and policy advice in the Asia-Pacific region on carbon pricing, the IEA – in collaboration with ICAP and the Konrad-Adenauer-Stiftung's Regional Programme Energy Security and Climate Change – held two closed virtual workshops in July and December, and a public high-level event in December. We shared findings from the CETP's work with China and Thailand on carbon pricing and power market reform.

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2020 Global activities

Highlights of global CETP activities in 2020

- Early release of data on the annual fuel mix, energy balances and CO_2 emissions from fuel combustion.
- Publication of GlobalABC Roadmaps for Buildings and Construction providing a framework for assessing priority actions across the themes of urban planning, new buildings, existing buildings, appliances and systems, operations, materials, resilience and clean energy.
- Working with the UK government to deliver a Product Efficiency Call to Action ahead of COP26 through the SEAD initiative.
- Held the 2nd Global Ministerial Conference on System Integration of Renewables with participation by close to 30 ministers and industry leaders to explore emerging issues in the acceleration of renewables integration and power system resilience. Launched the Power Systems in Transition report.
- Developed the IEA Implementing Effective Emission Trading Systems report, an important source for policy makers considering the implementation of ETS in their countries.
- Launched a new CEM Biofuture Platform Initiative at CEM-11, co-led by Brazil, India, Canada, the Netherlands, the United Kingdom and the United States.
- Developed a framework for evaluating and communicating clean energy innovation policies, and used it in the ETP Special Report on Clean Energy Innovation and in energy policy reviews of IEA member countries and partner countries.
- Expanded research on the policy, regulatory and investment context needed to maximise digitalisation opportunities in power systems to accelerate clean energy transitions.

Data and statistics

Developing and refining data infrastructure

Given the relevance of CETP focus countries to the global energy system, the IEA has worked hard to improve the comprehensiveness and quality of major emerging economies' "core" energy statistics and to maximise opportunities to expand data collection to topics beyond basic energy statistics (to variables such as prices, RD&D budgets, detailed end-use data to build energy efficiency indicators). Our activities in 2020 included:

- Adding new countries to several statistical IEA products, both through direct engagement and research on data sources. They include the energy efficiency database, emergency data collection and the Joint Organisations Data Initiative,

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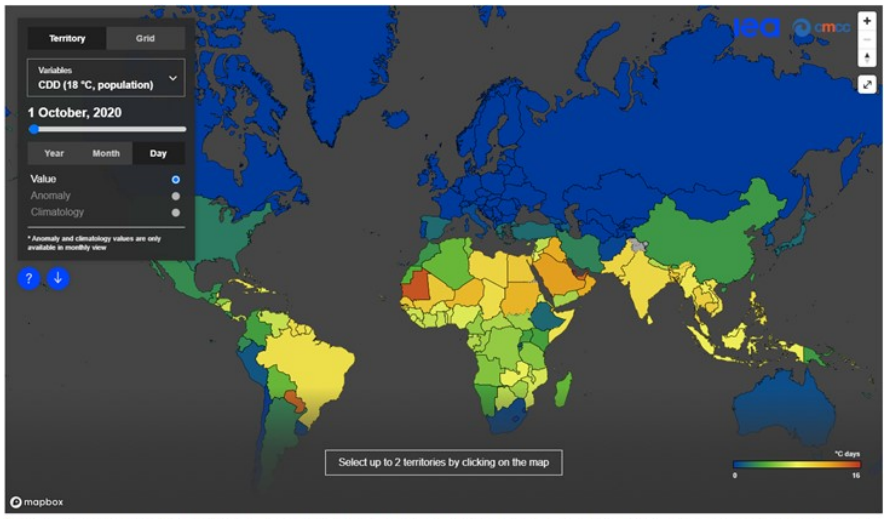
monthly electricity and World Energy Prices products, and annual energy statistics and balances.

- A new project to collect early data on countries' electricity fuel mix, which allowed for the inclusion of a number of new countries in World Statistics and Balances.
- Expanding the CO_2 emissions database coverage by over 60 countries, with estimations based on secondary energy data sources, to enhance IEA coverage of carbon data.
- Early release of World Energy Balances, World Energy Statistics and CO_2 emissions from fuel combustion databases; anticipated release of the global CO_2 emissions database; anticipated mid-year release of the efficiency indicators database.
- Enhanced the existing database on energy prices with 85 new products/sectors and by adding new datasets on taxation and price regulation.
- Inclusion of estimations of emissions by end use in the efficiency indicators database.
- Further design of a new interactive statistical output with visualisation of global data, by country, mainly to track the progress of decarbonisation in the energy and electricity mix.
- Design of a new database on weather-related information for energy analysis.
- Delivery of energy data analysis to the UNFCCC for the GHG inventory review process of 24 countries.
- Delivery of targeted emissions and balances data to the IPCC (including indirect emissions at sub-sectoral level; dedicated regional aggregation; and expanded geographical coverage based on secondary sources).
- Launching a new project to improve the quality of the solid biofuels data, working with partner organisations such as the Food and Agriculture Organization.
- Recruiting outside expertise to develop data web scraping of external annual data to feed into our core work.
- Developing real-time data scraping of electricity data to feed into IEA's analyses, in particular the first ever Electricity Market Report.



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Weather for Energy Tracker

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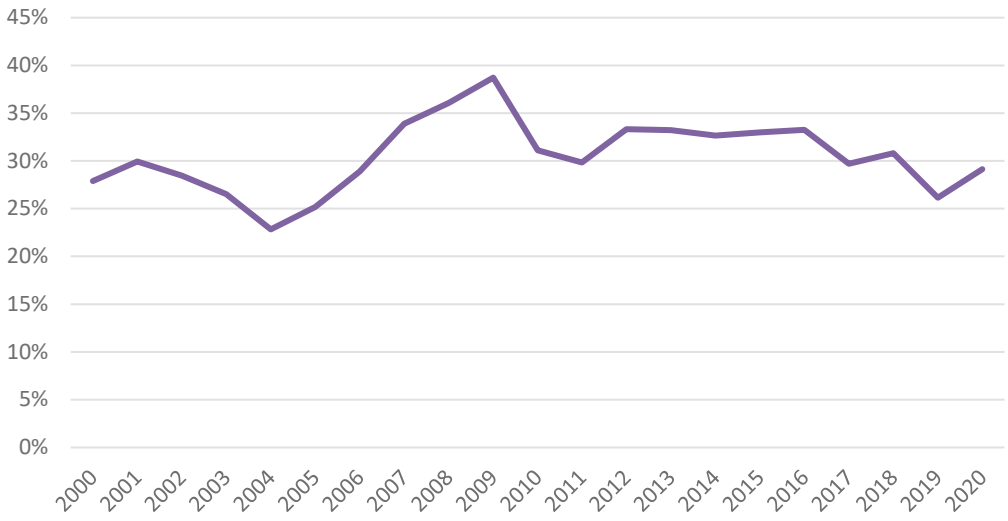
Experimental work on key indicators and their timeliness

In 2020 the IEA launched a new project focused on developing a set of new indicators at a granular level that can assess the extent to which countries are transitioning towards "cleaner" energy systems. Adapting to the changing 2020 circumstances, this activity mostly focused on assessing whether the Covid-19 crisis had led to a permanent structural break in the nature of energy systems, or rather a phenomenon with temporary impacts followed by a convergence to pre-Covid "business-as-usual" trajectories.

Preliminary data on share of "clean" energy start-ups in total energy start-ups



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Note: Preliminary estimates based on experimental work linking IEA Energy Balances data with OECD Input-Output tables.

As part of this initiative, we sought to complement our work on official statistics and develop experimental indicators of progress on the clean energy transition based on a variety of micro-data sources. We developed an initial subset of indicators over the course of 2020. Our work also sought to develop and apply new methods to improve the timeliness of providing robust estimates of specific energy outcomes. During 2020 our achievements included:

- Developing new, technology-specific measures of corporate R&D.
- Linking the IEA Energy Balances data with OECD databases.
- Developing new indicators related to start-up rates for "clean" energy firms at the level of country, year and field.
- Developing new technology-specific indicators of invention at a highly disaggregated technological level by country, year and technology.

We also concluded preliminary work on the development of:

- Technology-specific measures of corporate R&D.
- Early-stage financing at the level of country, year and field.

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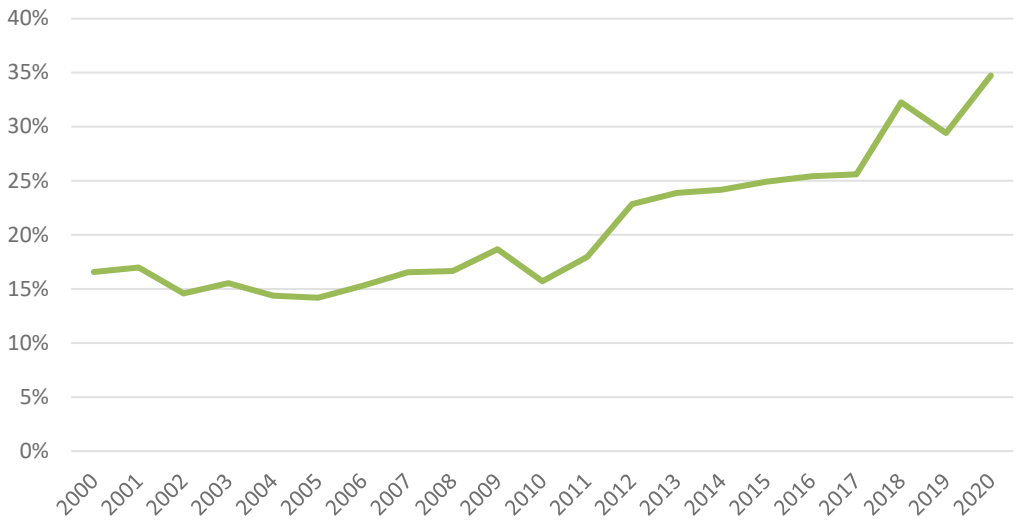
- Sectoral “lifecycle measures” of energy intensity using energy balances data and inter-country input-output tables (63 countries and 19 sectors).
- New indicators of the digitalisation of “clean” energy invention and entrepreneurship.

We launched preliminary work with researchers at the Harvard Business School on the development of a new measures of “grid quality” across regions, within countries and over time.

Preliminary data on share of digital energy start-ups in total energy start-ups



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Note: Preliminary estimates based on experimental work linking IEA Energy Balances data with OECD Input-Output tables.

In some cases, the data have significant lags for various external reasons, and we completed preliminary work to “nowcast” using econometric techniques and machine-learning methods.

Training and capacity building

Training and capacity building in all their forms remained an essential element of the CETP, particularly given the increased need for robust and timely energy data and statistics in light of the ongoing public health crisis. In 2020 the IEA organised a large number of training events. We especially encouraged and supported the participation of statisticians from partner countries in IEA energy training courses.

We continued developing the relevant training materials and expanding the areas of training beyond core energy statistics. We also identified training opportunities jointly with relevant existing or new partner organisations to maximise effectiveness. Our activities in 2020 included:

- Shifting the Paris-based flagship training event to an online setting. A great deal of preparatory work was undertaken to ensure a successful adaptation of the

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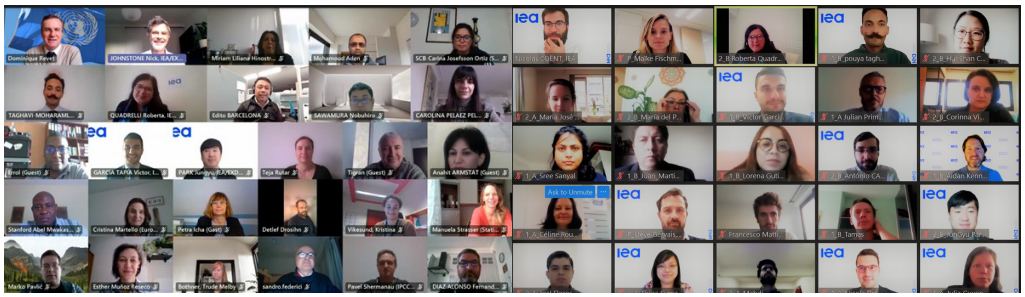
content and training methods to online conditions. The October training included 82 participants from 34 countries, including 4 participants from Brazil, 5 from India and 4 from Mexico.

- A joint UNFCCC (and UNEP) virtual workshop to improve energy data for GHG inventories under the UNFCCC transparency framework.
- Support for training activities on energy statistics and modelling in African countries, piloting with Senegal and Ethiopia and then testing further in Benin, to be expanded in 2021 to another seven focus countries and beyond.



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Energy statistics workshops

Energy efficiency

Capacity building, targeted analysis and technical exchange formed the foundation of engagement on energy efficiency with emerging economies in 2020. The Covid-19 pandemic changed the way that we conducted outreach and activities, which shifted to a virtual format. In response to the crisis, the energy efficiency programme turned its attention to understanding and communicating the role of energy efficiency in sustainable recovery, so as to support emerging economies grappling with the need to address growing economic and social challenges.

The IEA's Sustainable Recovery report provided a vision of how policy makers could align recovery measures with sustainable energy transitions, growing jobs and addressing social issues while pursuing environmental objectives. The report emphasises the role of energy efficiency as an engine of job creation across sectors and particularly in the buildings sector. With even greater jobs potential per dollar invested in emerging economies, this analysis played a central role in our engagement with emerging economies throughout the year.

The Recommendations for Urgent Action on Energy Efficiency developed by the Global Commission for Urgent Action on Energy Efficiency, with close analytical support from the IEA, offer further detail of how to align action on energy efficiency with social and economic priorities arising from – and exacerbated by – the Covid-19 crisis. The report provides a vision and a range of options and examples of how countries can accelerate action on energy efficiency, leveraging existing energy efficiency programmes to serve recovery objectives. It incorporates leading examples from around the world, many of which come from policies and programmes in emerging economies.

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Sustainable, inclusive and equitable recovery was the central theme of the Clean Energy Transitions Summit, held on 9 July 2020. The event featured strong participation from leaders of emerging economies, who shared their perspectives and vision for clean energy transitions and the link to sustainable recovery, with energy efficiency playing a central role.

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5th Annual Global Conference on Energy Efficiency

Similarly, the 5th Annual Global Conference on Energy Efficiency addressed the role of energy efficiency in sustainable economic recovery to create jobs and support development; the need to engage all levels of society to accelerate progress; and the importance of global collaboration and sharing global best practice. The event was held virtually for the first time. While this limited opportunities for personal engagement, it expanded the availability of the event to a global audience, attracting a record number of participants.

As further elaborated below, the IEA continued to advance capacity building across core programme areas – industry, transport, buildings and cities – responding to requests for support in priority areas.

Training

In 2020, due to the Covid-19 pandemic, it was not possible to organise in-person energy efficiency training and capacity-building events. Instead, the IEA ramped up its online capabilities, adjusting plans so as to create online events and resources. Online training evolved from the specific training modules developed for the Energy Efficiency Policy in Emerging Economies Training Week, which has become a flagship event of the IEA E4 Programme. Highlights included the following:

- Together with the Energy Market Authority of Singapore, the IEA delivered the Singapore–IEA Regional Training Programme on Sustainable Energy Policies for Smart Cities. The course was based on the cities' training module of the Energy Efficiency in Emerging Economies' Training Week, and adjusted in content and format to enable an interactive virtual dialogue and learning experience.

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- We launched the Spanish version of the online course on Energy Efficiency in Buildings, developed with CAF. The course is based on the buildings module of the Energy Efficiency in Emerging Economies' Training Week, adapted to include examples from Latin America and to incorporate a special section on space cooling. The course was first launched in English in 2019 and in Spanish in 2020, while translation into Portuguese began in 2020, the launch expected in 2021.
- We completed the translation of the IEA's online courses on energy efficiency indicators into Chinese. To reach a wider audience of policy makers, in 2018 the IEA launched these two self-paced online courses in English (Energy Efficiency Indicators: Fundamentals on Statistics; and Essentials for Policy Making). With the translation into Chinese, the courses are now available in five languages (Bahasa Indonesia, Chinese, English, Portuguese and Spanish), with plans to expand outreach in 2021. As with the Buildings and Singapore Cities courses, the energy efficiency indicators course is closely linked to the indicators module of the Energy Efficiency in Emerging Economies' Training Week.
- We conducted a survey of the IEA's Energy Efficiency in Emerging Economies' Training Weeks to evaluate how they have served alumni since they participated and how they can be improved. We had responses from 239 alumni in over 69 countries; more than half work in the government sector, with the private sector, academia, international organisations and NGOs also represented. The vast majority (77%) concluded that the training weeks had led them to change their behaviour in some way. Examples include: enhanced stakeholder engagement; improved data collection processes; conceiving a regional minimum energy performance standards programme; and developing energy conservation building codes. The survey also collected feedback on the content and quality of the training weeks and ideas on how to improve them in the future.

Industry

Activities to advance progress on energy efficiency in industrial sectors included:

- Benchmarking analysis of energy-intensive sectors – iron and steel, cement, aluminium, pulp and paper, petrochemicals – which are also job intensive and represent 75% of overall energy efficiency savings potential. Our work will now extend to less energy-intensive sectors.
- Development of an industry policy package, a combination of regulatory, incentive and information measures, that can be developed quickly to unlock energy efficiency potential.
- Multiple webinars across regions (with countries such as India and South Africa) to promote the impact of energy efficiency in economic recovery plans, with a focus on industry.

Transport

Our transport work in 2020 covered three key themes: urban infrastructure (walking and cycling infrastructure and electric vehicle charging); electric vehicles; and development of land-based transport roadmaps.

We held a series of webinars in 2020 and early 2021 that looked at urban infrastructure activity in emerging economies (Latin America, Indonesia and India)

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in response to Covid-19 and the need for social distancing and job creation, as well as alignment with longer-term plans. Panellists identified measures at the national and regional level, in addition to in-depth city case studies. The series also covered a number of lessons learned and best practice examples, including on gender inclusion and stakeholder engagement. All these outcomes will inform analysis to be completed in early 2021.

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Global EV Outlook 2020

Tailored work on electric vehicles also included topics such as:

- Battery swapping: in-depth analysis for the Indonesian government on the potential for battery swapping for electric two-wheelers.
- Electric buses: a case study for Kolkata, India, undertaken by TERI, which was covered in the Global Electric Vehicle Outlook.
- Integration of electric vehicles in areas of extreme climate, which examined energy production and vehicle use aspects in hot climates as part of a webinar series that will be continued in 2021.

The IEA is providing support to the Indonesian Directorate General of New and Renewable Energy and Energy Conservation on the development of a land-based transport roadmap. The roadmap looks at future energy-saving policy scenarios and details the role of different transport energy efficiency measures in achieving these scenarios. Outcomes will inform the development of roadmaps for the ASEAN region more broadly in 2021.

Buildings

The series of four GlobalABC Roadmaps for Buildings and Construction were finalised and launched in 2020, including a Global Roadmap and regional roadmaps for Latin America, Asia and Africa. These roadmaps were developed in collaboration with UNEP, the World Resources Institute and the WorldGBC, as

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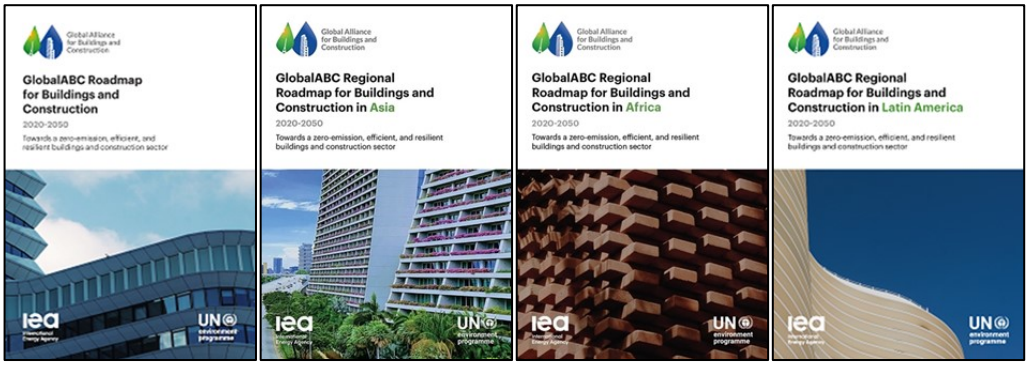
well as GlobalABC members and over 700 stakeholders. They provide a framework for assessing priority actions across the themes of urban planning, new buildings, existing buildings, appliances and systems, operations, materials, resilience and clean energy. They include key actions, targets and timelines for policy, technology, finance and capacity building to attain zero-emission, efficient and resilient buildings.



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GlobalABC Roadmaps for Buildings and Construction

Each roadmap was launched at relevant industry events, including the International Congress for Sustainable Cities hosted by the Costa Rica Green Building Council in July, the Singapore International Energy Week and the Africa Webinar Series of the Africa Regional Green Building Council network in October.

The regional roadmaps have already inspired the development of sub-regional and national roadmaps among diverse partners, including roadmaps for Cambodia and Viet Nam by the United Nations Development Programme and the Programme for Energy Efficiency in Buildings respectively, Colombia and Turkey by the World Resources Institute, and ASEAN and India by the IEA.

Cities

Our work on the nexus of energy efficiency and cities has been gaining attention in recent years. Building on the body of knowledge developed in the IEA's Energy Efficiency Training Weeks' module on cities, in September 2020 the IEA in collaboration with the Energy Market Authority of Singapore delivered the Singapore–IEA Regional Training Programme on Sustainable Energy Policies for Smart Cities. The training programme brought together policy makers, urban planners and academia to explore the multiple facets of enabling energy efficiency in Southeast Asian cities through efficient and smart technologies, policies and planning tools that meet the local conditions and urban energy challenges. The training comprised three main modules: spatial planning and transport; municipal services; and distributed energy resources.

The event inaugurated a new format due to the challenging context of the Covid-19 crisis, with a new model of online training using a dedicated facilitator and a range of interactive tools to mimic as closely as possible a face-to-face environment. The event was very successful, gathering 250 participants from over

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27 countries, making it E4's largest training event to date. It demonstrated sustained engagement among participants throughout the week, culminating in the final feedback session where each of the groups presented a draft policy strategy to improve energy efficiency in a core aspect of urban planning, transport or municipal services.

The cross-cutting theme of urban planning was also an important focus of the three GlobalABC regional roadmaps mentioned above. They explored the role of urban development approaches in supporting low-carbon and sustainable energy consumption in new developments. In addition, they highlighted regional differences in trends and challenges in the linkages between energy efficiency and resilience at the city level and how they connect with low-carbon buildings.

Finally, as part of our work on this topic, we have developed relationships with important urban sustainability networks, such as the Carbon Neutral Cities Alliance, the Global Covenant of Mayors for Energy and Climate, the European Bank for Reconstruction and Development Green Cities Programme and C40. These networks have welcomed the IEA enthusiastically into partnership as we bring important insights on the clean energy transition. We co-hosted several webinars with these networks, notably to share key findings and recommendations from the WEO Sustainable Recovery report to help inform local policy makers' recovery plans. These relationships will help disseminate IEA policy messages on clean energy transitions and refine the relevant messages for cities through the extensive networks of these multiplier organisations.

The SEAD Initiative

Established in 2009, the Super-efficient Equipment and Appliance Deployment (SEAD) Initiative is a voluntary collaboration among governments under the CEM. It works to promote the manufacture, purchase and use of energy-efficient appliances, lighting and equipment worldwide. SEAD fosters co-operation among its participating governments to strengthen energy efficiency standards, labelling and related programmes that can spur the deployment and the development of super-efficient appliances and equipment. In late 2019 the IEA took over the role of SEAD Operating Agent and is working to strengthen SEAD.

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SEAD members and partners

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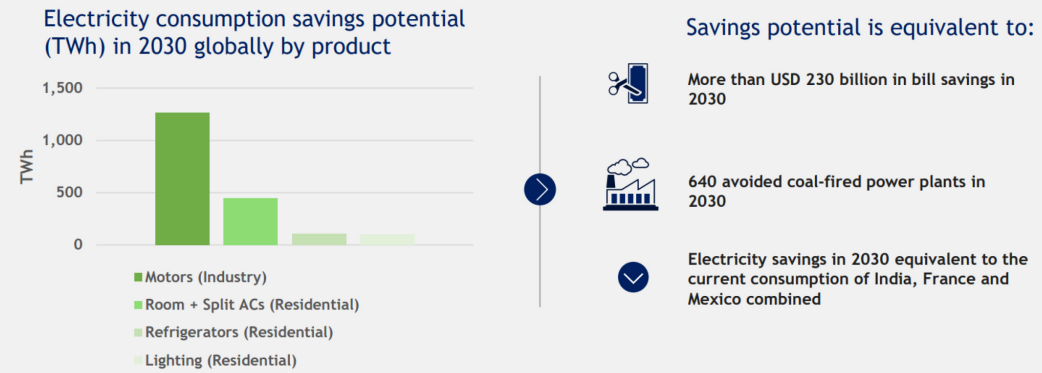
The IEA, through the SEAD Initiative, is working with the UK government to deliver a Product Efficiency Call to Action ahead of COP26. The Call to Action is an initiative calling on governments to raise their ambition on the product efficiency of air conditioners, refrigerators, lighting and industrial motors sold globally. In November 2020 the IEA organised a number of workshops in India, Southeast Asia, and sub-Saharan Africa to promote SEAD and raise ambition.

Electricity consumption savings potential globally by product, 2030



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Assumptions: Motors savings potentials are based on differences between the Stated Policies Scenario (STEPS) and the Sustainable Development Scenario (SDS), savings for the other products are based on a separate model with aligned scenarios. Consumer bill savings are based on current electricity prices in countries where savings accrue. The average coal-fired power plant is assumed to generate 3 TWh per year.

Source: IEA-Provisional estimates subject to change.

In December the IEA organised a SEAD webinar on Maximising the Impact of Appliance Efficiency Policy with Digital Tools. The webinar built on the IEA's work on innovative data collection using web scraping and crowd sourcing methods in Southeast Asia and South Africa, and supports the IEA's broader work programme on digitalisation and energy efficiency.

Electricity

System integration of renewables

One of our major activities in 2020 was the 2nd Global Ministerial Conference on System Integration of Renewables, hosted with Singapore and focusing on "Investment, Integration and Resilience: A Secure, Clean Energy Future". Organised with Singapore, it included the participation of close to 30 ministers and industry leaders, including six ministers from ASEAN countries. In addition to providing a platform for ministers, CEOs and thought leaders to explore emerging issues in the acceleration of renewables integration and power system resilience, the event also featured the launch of the Power Systems in Transition report. Surveying the ongoing multiple transformations in the electricity sector, the report addresses three core aspects of electricity security: energy transitions with more variable renewables, cyber risks, and climate impacts. It includes global case studies, including experience from Brazil, ASEAN, India and China.

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2nd Global Ministerial Conference on System Integration of Renewables

Power System Flexibility Campaign

With support from the CETP, the IEA continued throughout 2020 to co-ordinate the work of the Power System Flexibility Campaign (PSF) under the CEM. The CEM–PSF Power System Flexibility workshop in February was among the activities that the IEA developed, to share experiences across the CEM–PSF network on power system transformation, with a focus on demand flexibility, progress in market design and sector coupling opportunities. Also as part of the work under the PSF, the IEA co-organised with Agora Energiewende (in the framework of the Berlin Energy Transition Dialogue webinars) the CEM–PSF Next Steps for Energy Systems Integration workshop. It addressed present IEA analysis, expert case studies on electric vehicle integration and the potential for hydrogen integration into power systems. In April the IEA also organised a knowledge exchange webinar on electric vehicle and power system integration, based on the technical aspects of ongoing projects and policy priorities for scaling up electric vehicle deployment.

The IEA also supported the CEM PSF–International Smart Grid Action Network pre-event to the 11th CEM webinar: A Holistic Approach to Low-Emission Energy Systems through Sector Integration. Held in September, this event brought together ongoing and upcoming CEM work from various perspectives, looking at power system integration enabled by digitalisation and new technologies for power system flexibility – such as electric mobility and distributed storage. The discussions focused on key policy support, including market design, multi-stakeholder co-ordination and cross-sectoral approaches. The impact of the PSF and the partnerships established through its work have enabled IEA to increase its reach and participation in external forums. A follow-up three-year initiative is currently in planning to build on the work on renewables integration, from power system flexibility to broader energy systems integration. The proposed initiative is due to be discussed at the next CEM preparatory meeting.

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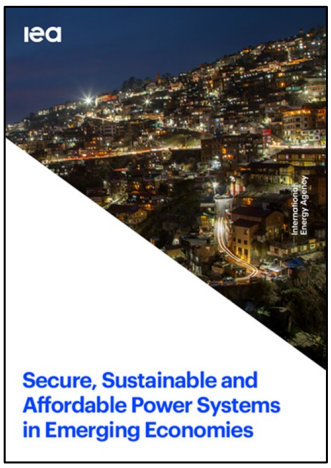

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Secure, Sustainable and Affordable Power Systems in Emerging Economies

Throughout 2020 the IEA developed or supported many other knowledge-sharing events, including:

- The Electricity Security workshop in January 2020, which helped capture input from various stakeholders and to identify common as well as diverging views considered in the Secure, Sustainable and Affordable Power Systems in Emerging Economies report.
- A technical workshop in February on Market Design For Demand-Side Flexibility, organised by the IEA, the Swedish Energy Markets Inspectorate and the Swedish Smartgrid Forum.
- Participation in the Wind Integration workshop to both present the Secure, Sustainable and Affordable Power Systems in Emerging Economies report and showcase recent integration work in Asia.

Clean energy investment and financing

As regards the investment and finance component of this work stream, the IEA started new efforts to prepare a special focus on two topics: the role of institutional investors in energy investment; and sustainable finance and energy investment as part of the World Energy Investment 2020 report. The topics assess how financial markets play an amplification role in energy investment on both the downside and the upside, providing insights relevant to clean energy transitions around the globe.

Furthermore, as part of the work under this component, the IEA also continued supporting the co-ordination of the CEM Investment and Finance initiative. As part of this initiative, we presented the World Energy Investment 2020 report and analysis from the Sustainable Recovery report during the CEM-11 side event Mobilising Investors to Finance Clean Energy Transitions – How Can Private Capital Boost a Sustainable Recovery?

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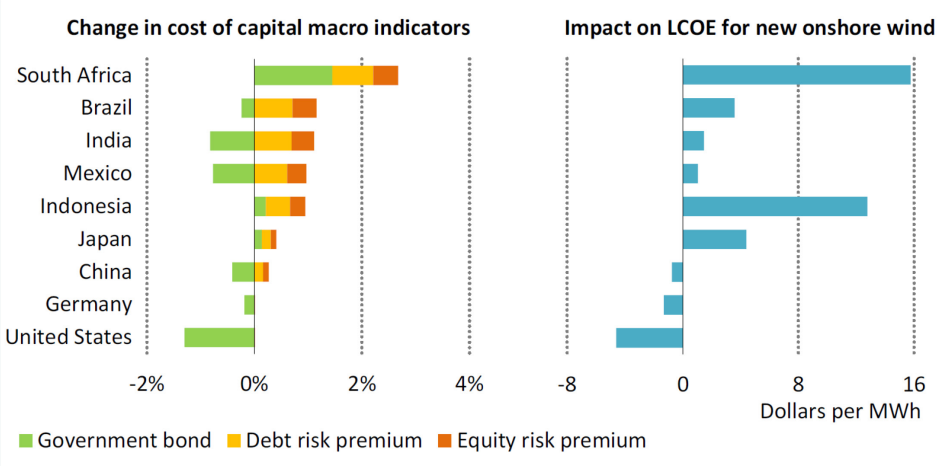
Changes in cost of capital macro indicators for selected countries, 2019-2020, and their indicative impact on the levelised cost of new onshore wind



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Source: IEA (2020), *World Energy Outlook 2020*.

Policy advice and modelling

Climate impacts on transitions

As part of global efforts under this topic, in 2020 the IEA worked on establishing energy-sector climate resilience indicators to systematically integrate climate aspects into the development and assessment of energy policies. This work will help enhance the resilience of energy systems to climate change by developing analytical and policy support outputs targeted at decision makers in emerging economies that are particularly vulnerable to climate hazards. Our outputs on this topic are being disseminated to key stakeholders through events such as the UNFCCC Race to Zero Dialogues and will continue in 2021.

Emissions trading systems

Informed by our work with China, the IEA also developed guidance for policy makers considering the implementation of an ETS in their countries. The IEA Implementing Effective Emission Trading Systems report examines international experience in the design and implementation of emission trading systems around the world. Furthermore, it identifies the principal energy-related challenges drawn from real-world experiences, exploring lessons and answering questions for jurisdictions interested in developing a new ETS, and opening the door to deeper examination of technical issues. The report focuses on four issues that different existing trading systems have had to address, and the design choices made in doing so: the system's role and function, interaction with wider energy transition strategies, application to different power market structures, and application to industrial sectors. Drawing on examples from national and subnational jurisdictions around the world, it provides a succinct summary of lessons and guiding questions for policy makers for each of the four issues.

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Implementing Effective Emissions Trading Systems: Lessons from international experiences

Global Energy Review

As part of our work to increase understanding of the Covid-19 pandemic and to provide knowledge and evidence for decision makers, the IEA developed outputs such as the Global Energy Review. This analysis provided an almost real-time view of the pandemic's extraordinary impact across all major fuels. Based on the analysis of more than 100 days of real data, the review included estimates of how energy consumption and CO_2 emission trends were likely to evolve over the rest of 2020.

Energy interactions with air pollution and water

In 2020 the IEA continued to work on enhancing its capabilities to assess – for the different scenarios described in World Energy Outlook – the extent of air pollutant emissions from the energy sector in a number of targeted emerging economies, the implications for local air quality and the associated impact on human health. The work supported the:

- Quantification of emissions trajectories of local pollutants and their impacts (based on World Energy Outlook scenarios).
- Provision of air quality indicators and assessment of health impacts based on emissions trajectories of local pollutants.
- Preparation of text, tables and figures included in World Energy Outlook 2020.

Sectoral work

Sustainable bioenergy

Building on the IEA's extensive expertise and engagement on bioenergy, we continued to provide technical and policy guidance relating to sustainable bioenergy in emerging economies, with a specific focus on advanced biofuels.

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This project supported the IEA's roles as co-ordinator of the new CEM Biofuture Platform Initiative and as facilitator of the Biofuture Platform, a 21-country initiative chaired by Brazil, aiming to accelerate the transition towards a sustainable bioeconomy. Despite the Covid-19 crisis, our activities in 2020 led to a number of important achievements, including:

- Launch of a new CEM Biofuture Platform Initiative at CEM-11, co-led by Brazil, India, Canada, the Netherlands, the United Kingdom and the United States. The launch event was attended by high-level representatives, including Minister Bento Albuquerque (Brazil) and the IEA's Executive Director, Dr Fatih Birol. In addition to senior government representatives from co-lead countries and Indonesia, senior managers from major industry groups also participated. They included the Executive Chairman of Praj Industries (India) and the President and CEO of Neste Corporation (Finland). Following the event, we issued a press release that triggered wide media coverage.
- Organising Biofuture Platform web meetings for all members in June and December 2020, with the participation of government officials from 15 countries, the IEA and other intergovernmental organisations. During these meetings, the IEA presented its analysis of bioenergy and facilitated strategic discussions with policy makers and industry leaders about Covid-19 impacts and related challenges and opportunities. These meetings also provided the opportunity to receive member countries' approval of the 2020-2021 workplan and to reinforce their commitment to it.
- Adoption of Five Biofuture Platform Principles for Post-Covid Bioeconomy Recovery and Acceleration, following a formal consultation process among Biofuture members and partner organisations. We issued a press release, generating strong media attention. The application of the principles was discussed during a webinar with representatives from Brazil, Canada, India and France – and from the Finland-based company Neste, who shared their experiences in the design and implementation of policies and strategies aligned with these principles.
- Enhanced co-operation with the private sector, including through a dedicated IEA Renewable Industry Advisory Board event, and establishing a network of around 30 reference companies. To further promote private-sector engagement, we developed a proposal to establish a CEM Biofuture Campaign after extensive consultation with member countries and industry leaders.
- Developing a policy blueprint for transport biofuels, including preliminary methodology and conceptual framework. The blueprint was applied to three pilot countries, Brazil, the Netherlands and the United States, providing interesting insights into the relevance of the tool and the effectiveness of bioenergy policies in these countries. In light of this work, we organised a forum to discuss the strengths and weaknesses of policies such as California's Low Carbon Fuel Standard, Canada's Clean Fuel Standard, Brazil's RenovaBio, and Europe's Renewable Energy Directive II. The forum was preceded by a high-level opening ceremony, with contributions from Ministers Ernesto Araújo and Bento Albuquerque (Brazil), and the IEA's Executive Director, among others.

Global E-Mobility Programme

During 2020 the IEA continued preparing a GEF-funded proposal with UNEP aiming to support countries design and implement electric mobility programmes

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as part of an overall shift to a sustainable, low-carbon transport sectors. The programme was approved by the GEF Council in June 2019 and final project documentation was submitted in 2020; it is expected that the programme will be launched in early 2021. The IEA will work closely with key stakeholders (EVI members and partners, TCPs, mobility model networks) and the other implementing agencies to ensure that the tools developed offer great value to the participating countries. In total, the programme will comprise a global project (led by the IEA and UNEP) and 27 country projects. Anticipated outputs for 2021 include:

- Knowledge products for electric vehicle policy implementation.
- Online tools such as life-cycle costs and total ownership cost.

Energy and gender

The objective of this work was to build knowledge and data in CETP focus countries on challenges relating to gender and energy, with a focus on employment and energy access. The CETP increased its internal capacity by supporting a Clean Energy, Education and Empowerment Programme fellow to work on further developing the IEA's current database with gender-disaggregated data, which include among other things information on female and male participation in decision making in government, industry and academia.

CCUS Model Regulatory Framework

Building on the update of the carbon capture, use and storage (CCUS) legal and regulatory database (publication forthcoming), the IEA is drafting a new CCS Model Regulatory Framework to provide policy makers and legislators, especially in CETP focus countries, with a regulatory "toolkit" to facilitate CCUS activities. This work is supervised by the CCUS Unit with the support of the Office of the Legal Counsel and students from the Sciences Po Law School Clinic.

Innovation

Our innovation work in 2020 continued to focus on three objectives: enhancing the tracking of innovation spending and outputs; supporting innovation policies through reviews and best practice exchanges; and promoting international collaboration and participation in energy innovation partnerships.

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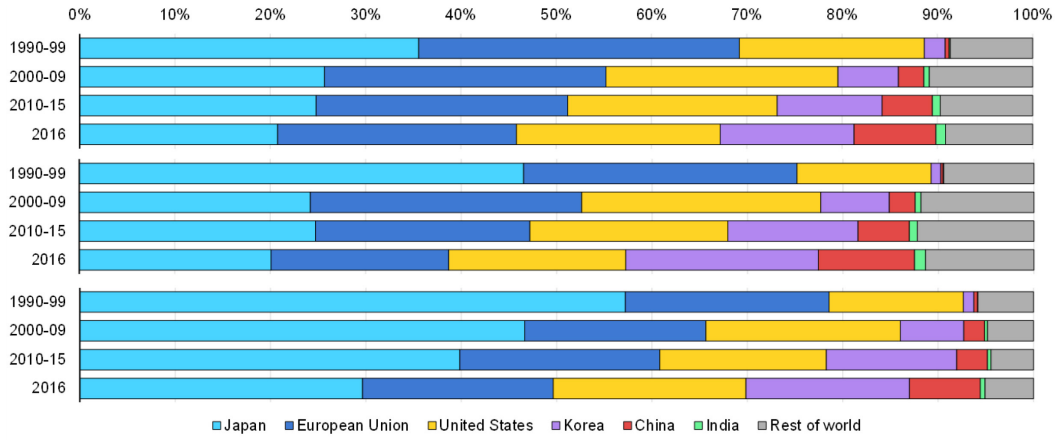
Share of selected countries or regions in global international patenting for all low-carbon energy technologies (top), in solar technologies (middle), and in battery and EV technologies (bottom) over time



Source: IEA (2020), *Tracking Clean Energy Innovation*, https://www.iea.org/reports/tracking-clean-energy-innovation

Given the global need to develop more, better and cheaper technologies to achieve clean energy transitions, we redoubled our efforts to understand and track progress of clean energy innovation in 2020. For example, the IEA produced a Tracking Clean Energy Innovation Framework, which provides public and private decision makers with a more comprehensive approach to energy innovation policy and a set of metrics to track progress. Strategies for tracking progress and embedding innovation policy within energy policy are long-term commitments, and data collection can be challenging. Yet this work shows that tracking progress is an important element of policy good practice, through which all countries might find quick-win opportunities to improve. For emerging economies aiming to enhance their innovation policies, innovation system mapping and experience sharing can help drive progress, as illustrated by the Energy Big Push project with Brazil.

During 2020 the IEA also produced analyses to measure the impact of the Covid-19 pandemic on global clean energy innovation efforts, such as in flagship ETP Special Report on Clean Energy Innovation and Clean Energy Innovation in the Covid-19 Crisis: Investing Today to Ensure a Sustainable Tomorrow. Current budgets for clean energy R&D are not in line with the announced ambitious international climate and sustainable development goals. The IEA has set five core innovation principles for policy makers designing Covid-19 recovery packages: (a) prioritise, track and adjust; (b) raise public R&D and market-led private innovation; (c) address all links in the value chain; (d) build enabling infrastructure; and (e) work globally for regional success.

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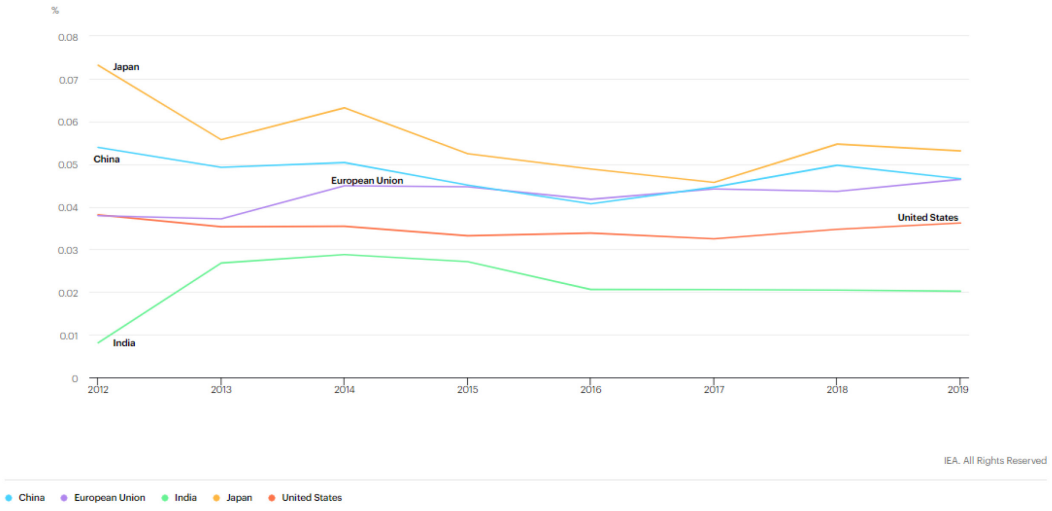
> "Given the shared benefits associated with the development of new clean energy technologies, R&D in this area is more often conducted internationally, with positive implications for the quality of innovation and knowledge diffusion. Evidence indicates that this is particularly valuable for emerging economies. Significantly, multilateral institutional initiatives can facilitate this process, including the IEA Technology Collaboration Programme."
>
> IEA (2020), Clean Energy Innovation in the Covid-19 Crisis: Investing Today to Ensure a Sustainable Tomorrow

In addition, the IEA continued collaborating and engaging with its major partners to continue supporting the global energy innovation agenda. Among others, the IEA is providing sustained support to the Mission Innovation (MI) Secretariat and country teams, particularly in the lead up to the MI-5 Ministerial and as countries discuss the launch of MI 2.0 and specific missions. The IEA has also been exchanging knowledge with the European Commission, such as on ways to track the progress of clean energy innovation efforts and focus on outputs and outcomes. Collaboration with academics around the world has also enabled the IEA to gather frontier knowledge related to good energy innovation policy practice, as well as tracking clean energy R&D spending.

Public energy R&D as a share of GDP in selected countries, 2012-2019



Notes: EU includes the budget of the European Commission, plus EU member countries as of December 2019 that are also members of the IEA, as well as Norway.

Sources: IEA calculations based on IEA Energy technology RD&D budget, 2020, https://www.iea.org/reports/energy-technology-rdd-budgets-2020; and Gross domestic expenditure on R&D by sector of performance and socio-economic objective (SEO)", OECD.Stat (database), https://stats.oecd.org

Digitalisation

Work under the 3DEN Initiative saw a significant increase in profile and a wide range of scoping activities in 2020, including a webinar in March to officially launch

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the work stream. Over 600 participants from 40 countries took part in the launch event and the importance of this new work was highlighted at IEA high-level events, including the Global Conference on Energy Efficiency, the Africa Ministerial Roundtable and the Clean Energy Transitions Summit, and in external events, such as the Climate Ambition Summit, EU Sustainable Energy Week and the Climate Week NYC.

The 3DEN initiative is engaging with a wide range of organisations, national governments and relevant agencies, energy utilities, international organisations, research bodies and consultancies, bringing together diverse stakeholders to foster dialogue, share experiences, leverage existing work and knowledge, and identify gaps where the IEA could add value.

High-level expert consultation on digitalisation, energy efficiency and smart grids

On 11 March 2020 the IEA held a high-level expert consultation on digitalisation, energy efficiency and smart grids to launch the digitalisation work. Our objective was to share real-world experiences in smarter low-carbon electricity systems, and discuss best practices in policy, business models and technology deployment for smart grids to unlock the cost-effective potential of system-wide energy efficiency. Initially planned to take place in person in Paris, the event was held online due to the imposition of Covid-19 pandemic travel restrictions. Two sessions were organised to allow wider participation and global outreach, with 600 people participating from 40 countries. More than 380 organisations were represented, including ministries, regulators, industry, financial institutions and academia.

The online event gave global experts and stakeholders the opportunity to share their real-world experiences of low-carbon electricity systems, starting with the Italian case, followed by international perspectives and case studies from Thailand, Malaysia and India. The afternoon session was kicked off by presentations from the United States and Canada, followed by case studies from the UK Energy Systems Catapult and Enel. The event achieved extensive international interest and a willingness to contribute to the 3DEN initiative, while the discussions confirmed the importance and timeliness of the topic.

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Top factors disrupting power systems today according to participants

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The 3DEN initiative has already contributed to the IEA's analytical work on smart grids and power system modernisation, as laid out in the World Energy Outlook Special Report on Sustainable Recovery, featuring new analysis of grid-related measures that could boost employment and deliver long-term sustainability and resilience advantages. Among other topics, the report highlights how stimulus measures promoting efficient networks can improve the integration of variable renewables and enable demand-side response. It includes a set of recommendations to policy makers for stimulating grid investment, such as raising borrowing limits, providing tax credits, expanding employee caps, streamlining permitting processes, and expanding training and skill conversion programmes.

The initiative also allowed us to further expand our analysis of electricity grids, reflected in the World Energy Outlook 2020. The report estimates that to expand and digitalise grids, a critical step in supporting power system transition, investment levels must increase. Over the next decade, grid investment must average more than USD 400 billion per year, 50% higher than in 2019.

Under the energy efficiency and digitalisation work streams, the IEA's Modernising Energy Efficiency through Digitalisation webinar series continued in 2020, with three further webinars:

- Benefits of digital tools on an existing oil and gas field (17 March 2020), where Eni introduced its integrated approach to the digitalisation of an oil and gas plant with the objective of improving energy efficiency, reducing emissions, improving safety and optimising production.
- Smart, energy-saving consumer devices (2 June 2020), which examined the topic and provided guidance for policies to encourage "smartness" within consumer devices.
- Opportunities for fintech to scale-up finance for clean energy (11 June 2020), which looked at the potential role of fintech to scale up the availability and reduce the cost of clean energy finance in emerging economies, with a case study presented from Indonesia.

In addition to the above, this work stream supported the organisation of the SEAD Webinar on 3 December 2020: Maximising the Impact of Appliance Efficiency Policy with Digital Tools.

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Abbreviations

AERN	ASEAN Energy Regulatory Network
ADB	Asian Development Bank
AFD	Agence Française de Développement
AfDB	African Development Bank
ASEAN	Association of Southeast Asian Nations
AUC	African Union Commission
BEE	Bureau of Energy Efficiency
CCUS	carbon capture, use and storage
CEM	Clean Energy Ministerial
CEEW	Council on Energy, Environment and Water
CETP	Clean Energy Transitions Programme
CONUEE	National Commission for the Efficient Use of Energy
COP26	26th Conference of the Parties
CO_2	carbon dioxide
DISCOM	distribution company
DRS	Delayed Recovery Scenario
ECLAC	Economic Commission for Latin America and the Caribbean
EACREEE	East African Centre for Renewable Energy and Energy Efficiency
ECREEE	ECOWAS Centre for Renewable Energy and Energy Efficiency
EELA	Energy Efficient Lighting and Appliances
EPE	Brazilian Energy Research Office
ESCO	energy service company
ETP	Energy Technology Perspectives
ETS	emissions trading system
FAO	Food and Agriculture Organization
FYP	five-year plan
GEF	Global Environment Facility
GHG	greenhouse gas
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GlobalABC	Global Alliance for Buildings and Construction
HAPUA	Heads of ASEAN Power Utilities/Authorities
ICAP	International Carbon Action Partnership
IEA	International Energy Agency
IMF	International Monetary Fund
IPCC	Intergovernmental Panel on Climate Change
IRENA	International Renewable Energy Agency
LPG	liquefied petroleum gas
MEE	Ministry of Ecology and Environment
MEMR	Ministry of Energy and Mineral Resources
MME	Ministry of Mines and Energy
MNRE	Ministry of New and Renewable Energy
MOST	Ministry of Science and Technology
NEA	National Energy Administration
NZE2050	Net Zero Emissions by 2050
OLADE	Latin American Energy Organization
PAT	Perform, Achieve, Trade
PSF	Power System Flexibility Campaign
PV	photovoltaic
RD&D	research, development and deployment
SACREEE	Southern African Development Community's Centre for Renewable Energy and Energy Efficiency
SDG	Sustainable Development Goal
SDS	Sustainable Development Scenario
SEAD	Super-efficient Equipment and Appliance Deployment
SENER	Ministry of Energy
SICA	Central American Integration System

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SLDC	State Load Despatch Centre
STEPS	Stated Policies Scenario
TCP	Technology Collaboration Programme
TGO	Thailand Greenhouse Gas Management Organisation
TERI	The Energy Research Institute
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change

Units of measure

GW	gigawatt
EJ	exajoule
g CO_2/kW	gramme of carbon dioxide per kilowatt
GJ	gigajoule
Gt CO_2-eq	gigatonne of carbon dioxide equivalent
GW	gigawatt
kt	kilotonne
MW	megawatt
Mt CO_2-eq	million tonnes of carbon dioxide equivalent
TWh	terawatt hour

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