



Clean Energy Transitions Programme

Annual Report 2022

International
Energy Agency



INTERNATIONAL ENERGY AGENCY

The IEA examines the full spectrum of energy issues including oil, gas and coal supply and demand, renewable energy technologies, electricity markets, energy efficiency, access to energy, demand side management and much more. Through its work, the IEA advocates policies that will enhance the reliability, affordability and sustainability of energy in its 31 member countries, 11 association countries and beyond.

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

IEA member countries:

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

The European Commission also participates in the work of the IEA

IEA association countries:

Argentina
Brazil
China
Egypt
India
Indonesia
Morocco
Singapore
South Africa
Thailand
Ukraine

Abstract

In the five years since its launch, the Clean Energy Transitions Programme (CETP) has become the largest and most important programme at the International Energy Agency (IEA). It has been the main vehicle through which the IEA has established, deepened and strengthened partnerships with major non-member countries – those countries that are at the forefront of the clean energy transition. The programme has also played a crucial role in enabling the IEA to strengthen its global leadership role in clean energy transitions at a pace and scale that would otherwise not have been possible, with great benefit to the programme's focus countries and IEA member countries alike.

This CETP Annual Report 2022 provides an overview of the programme's major achievements in the last year. During this time, the CETP has driven forward an ambitious and impactful agenda, even as the world has contended with multiple overlapping crises. As just some examples, the CETP delivered the [Energy Sector Roadmap to Net Zero Emissions in Indonesia](#), which ministers strongly welcomed at the G20, and has played a key role in shaping Indonesia's landmark Just Energy Transition Partnership (JETP). Similarly, the IEA has been able to take its engagement to a whole new level with various African countries, such as with its first-ever report on the [Clean Energy Transitions in the Greater Horn of Africa](#), and provided policy advice that was directly accepted into China's latest five-year plan. More broadly, it has also supported strategically important work on critical minerals, energy employment and clean energy investment. Overall, the CETP's combination of data, insight, advice and capacity building is making a strong positive contribution to advancing clean energy transitions around the world – with a focus on emerging and developing economies.

Finally, the CETP Annual Report 2022 also provides an overview of the programme's objectives, governance and strategic framework, as well as new developments related to the Joint Commitment of the Funders adopted at the IEA Ministerial Meeting in March 2022.

Table of contents

CETP in 2022 – a landmark year	5
Overview of the CETP in 2022.....	13
Introduction to the CETP.....	13
Joint Commitment	14
Strategic Framework.....	14
CETP delivery and governance	16
Pillar I – Accelerating national transitions	18
India.....	18
Indonesia.....	28
Southeast Asia	37
China	47
Brazil	57
Latin America	61
Africa	68
South Africa.....	79
Middle East and North Africa	81
Pillar II – Multilateral co-ordination	85
Biofuture Platform	85
G20.....	88
Regulatory Energy Transition Accelerator (RETA).....	91
UN-related collaboration	93
Pillar III – Enabling global energy dialogue.....	97
Data and statistics.....	98
Critical minerals.....	108
Digitalisation	111
Energy employment and skills	117
People-centred clean energy transitions	118
Energy efficiency training.....	120
Energy technology and innovation.....	121
Phasing out coal emissions	125
Implementing policies for clean energy transitions.....	127
Private and public sector investment.....	127
Reducing methane emissions.....	130
Secure power systems transformation	130
CETP contribution to IEA flagship analysis	133
Funding.....	135
Dissemination.....	139
Acknowledgements, contributors and credits.....	141
Abbreviations.....	143

CETP in 2022 – a landmark year

In the five years since its launch, the Clean Energy Transitions Programme (CETP) has become the largest and most important programme at the International Energy Agency (IEA), enabling the delivery of world-class analysis and policy advice to accelerate clean energy transitions in emerging and developing economies worldwide. The CETP works across three pillars, the first being the largest, on national transitions, with a priority focus on Brazil, the People's Republic of China (hereafter, "China"), India, Indonesia and South Africa, plus regional work across Latin America, the Middle East and North Africa, sub-Saharan Africa and Southeast Asia. The second pillar contains the CETP's work on strengthening multilateral coordination, through the IEA's participation in initiatives such as the Biofuture Platform, the Regulatory Energy Transition Accelerator, the G20, and UN-related collaborations. The final pillar showcases the IEA's work at a global level to enable and accelerate clean energy transitions. This includes work on critical mineral supply chains and policies, digitalisation of power systems, analysis of energy employment and skills, technology and innovation, private and public sector energy investment, and others.

Over the past year the CETP has driven forward an ambitious and impactful agenda, even as the world has contended with multiple overlapping crises. The programme has had over 140 high-level meetings with policy makers, almost 300 workshops and technical exchanges with over 14 000 participants, produced or enhanced over 120 data products, models, tailored policy briefs and reports, and delivered training to over 800 policy professionals. Overall, in 2022 the CETP's combination of data, insight, advice and capacity building has made a seismic contribution to advancing clean energy transitions around the world. It has unleashed the IEA's world-leading expertise and provided a proven model to accelerate clean energy transitions through a strong combination of insight, implementation and impact.

In **Indonesia**, together with the Ministry of Energy and Mineral Resources (MEMR), the CETP delivered [An Energy Sector Roadmap to Net Zero Emissions](#), which ministers strongly welcomed at the G20, and has played a key role in shaping Indonesia's landmark USD 20 billion Just Energy Transition Partnership. The JETP will significantly accelerate Indonesia's transition toward a cleaner energy future, reducing cumulative greenhouse gas emissions by more than 300 megatons through 2030 and a reduction of well above 2 gigatons through 2060 from Indonesia's current trajectory. To move this to action, the IEA has worked to strengthen policies, including consultations on Indonesia's fuel economy standards to improve vehicle efficiency, as well as participation in the review of Indonesia's

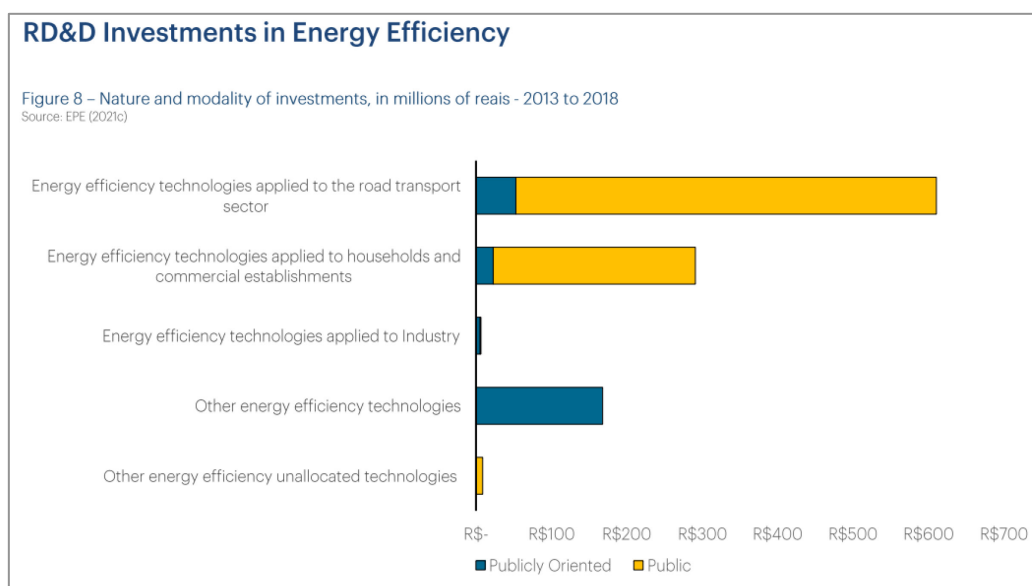
Presidential Decree on renewable energy. Further, the IEA has supported direct implementation of energy projects, for example through detailed analysis and techno-economic modelling of the Java-Bali and Sumatra power systems.



IEA. All right reserved.

Dr Fatih Birol and H.E. Minister Tasrif launching An Energy Sector Roadmap to Net Zero Emissions in Indonesia at the G20 Ministerial Meeting in Bali

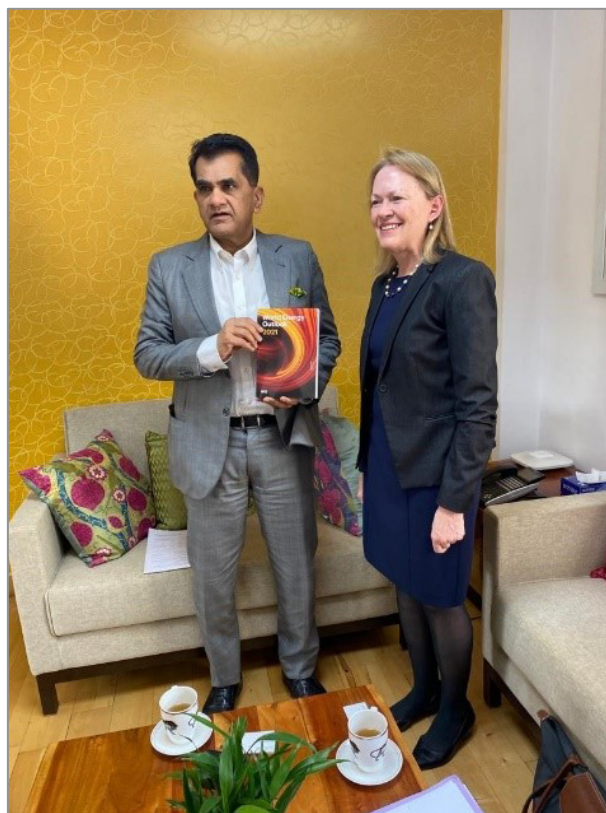
In **Brazil**, the CETP has been instrumental in reshaping and emphasising the need for clean energy research, culminating in the revision of a federal law on R&D spending obligations. Thanks to the close collaboration on innovation data, Brazil became the first non-IEA member to submit RD&D spending data to the IEA. In partnership with the Energy Research Office (EPE), an official think tank of the Brazilian government, the programme delivered energy efficiency benchmarking of key sectors and recommendations on how to further improve energy efficiency and decarbonisation pathways. This included the launching of the [Atlas of Energy Efficiency in Brazil 2021](#), with a special chapter on freight transport, and release of [Pulp and Paper Industry in Brazil and in the World](#) – two sectors that are critical for Brazil's decarbonisation efforts and have shown massive potential for both monetary and carbon savings.



Atlas of Energy Efficiency in Brazil, 2021, Indicators Report

In **China**, the IEA has reinforced its trusted advisor status, by holding closed-door sessions with government partners on power sector reforms, resulting in remarkable policy impact; the IEA recommendations were reflected in China's *Five-Year Plan for Renewable Energy Development*. This plan aims to deliver an extra 1.09 trillion Kwh of renewable energy generation in China by 2025. In addition, references to the IEA were included in five national policy documents on energy and climate, calling for relevant ministries and companies to strengthen cooperation. The programme has enabled China's Ministry of Ecology and Environment to improve the world's largest emissions trading system, including via publication of [Enhancing China's ETS for Carbon Neutrality: Focus on Power Sector](#).

Together with the **Indian** government, the CETP has delivered analysis and policy advice on energy efficiency in the building sector in cooperation with the Bureau of Energy Efficiency (BEE) of the Ministry of Power. Further, the CETP has delivered policy advice on solar PV, decentralised solar programmes and bioenergy in liaison with India's government and major think tanks. These exchanges fed directly into the [Solar PV Global Supply Chains](#) report published in July 2022 and presented at the first high-level forum on solar PV manufacturing. Finally, the IEA supported preparations ahead of India's first-ever G20 presidency and Clean Energy Ministerial to be held in 2023, including the energy track, finance track and disaster risk reduction track.



IEA. All right reserved.

Mary Warlick, Deputy Executive Director of the IEA and Amitabh Kant, G20 Sherpa, and ex NITI Aayog CEO

Across **Africa**, thanks to the CETP, the IEA has been able to take its engagement, insights and advice to a whole new level with various African countries, including the publication of the [Africa Energy Outlook 2022](#) in partnership with Africa Union Commission and United Nations Economic Council for Africa. The report presented the first ever Sustainable Africa Scenario, exploring a cost-effective pathway to reach universal electricity and clean cooking access and fulfil all African climate pledges in full and on time. This scenario supported African negotiations at COP27, including the new [Africa Just and Affordable Energy Transition Initiative](#) championed by the Egyptian COP presidency. Further, the IEA has published its first-ever report on [Clean Energy Transitions in the Greater Horn of Africa](#) – taking findings to a more granular level with priority actions for countries.

The programme also leveraged the IEA's effective working relationship with hydrocarbon producer economies in the **Middle East and North Africa** to support them in the process of decarbonising their energy systems. This included working with Egypt, Algeria and Oman in their transitions towards the decarbonisation of oil and gas sectors, with a special focus on methane abatement. The IEA also scaled up efforts with Egypt over 2022, including around their Presidency of the Conference of the Parties (COP). Finally, the IEA has enjoyed a close collaboration with Oman on green hydrogen and energy modelling to support clean energy policies.

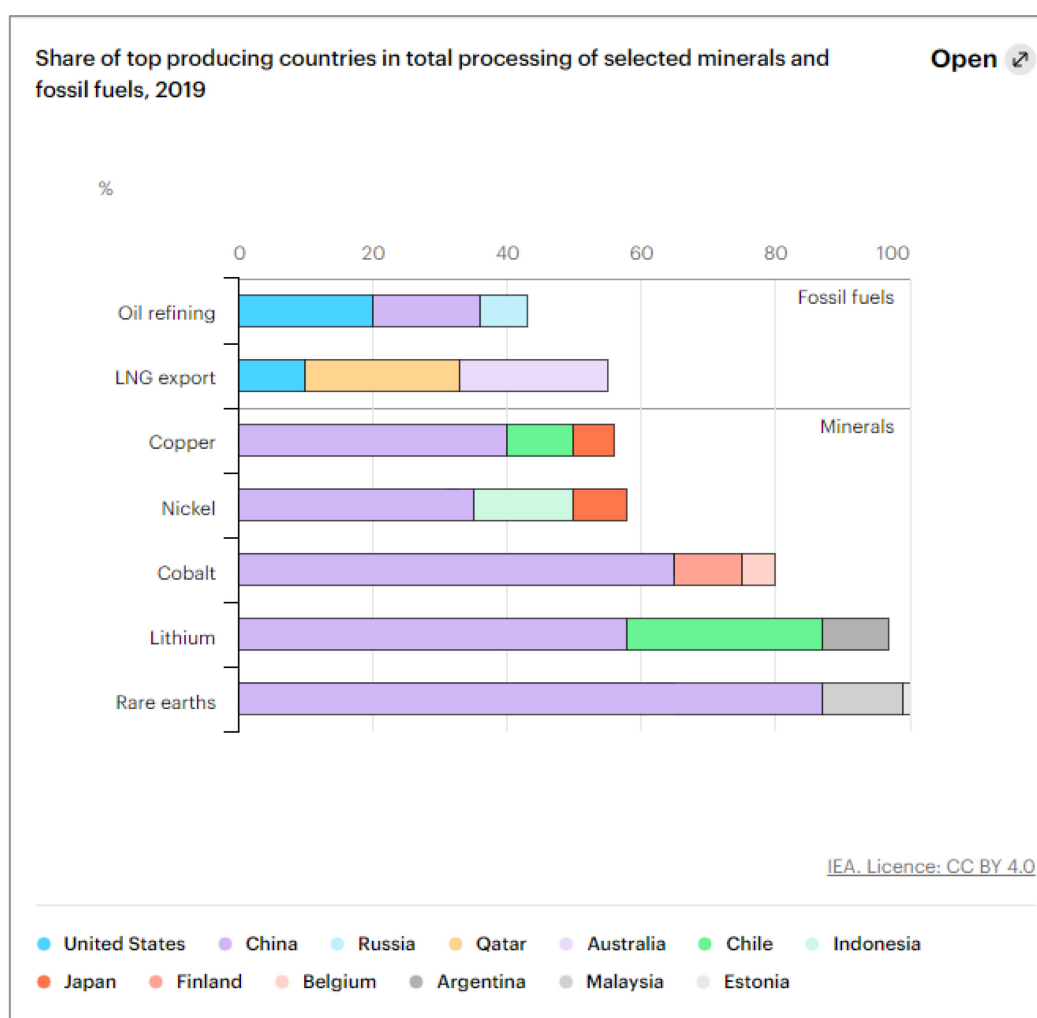
Within **Latin America**, the IEA played a prominent role in the Energy Week held by the Latin American Energy Organisation (OLADE) in Panama, with the IEA's contribution to Panama's energy transition being recognised with an official award granted by the government. The Central American Integration Organisation adopted a regional appliance standard for air conditioners, a process informed by the IEA's previous participation in the Technical Working Group on Energy Efficiency. The IEA [Critical Minerals Policy Tracker](#) highlighted prominent policies and regulations already in place in eight Latin American countries – Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Mexico and Peru – to enhance security of supply, incentivise new resource development and ensure sustainable and responsible production.

In **Southeast Asia**, the IEA has worked with countries across the region, for example with Thailand in the process of designing and implementation of its Climate Change Act. Further, the IEA has supported Cambodia as chair of ASEAN and with the ASEAN Secretariat. Some successes with ASEAN have included the [Roadmap for Energy-Efficient Buildings and Construction](#) and the [Roadmap towards Sustainable and Energy-Efficient Space Cooling](#) to support the development of energy efficiency policies in the region.

The CETP provided support for IEA participation in various **multilateral initiatives** of critical importance to the coordination of energy transitions goals, such as the **Biofuture Platform**. The IEA continued supporting the initiative as facilitator, co-ordinator of the relevant Clean Energy Ministerial (CEM) Biofuture Initiative and co-manager of the Clean Energy Ministerial Biofuture Campaign. The work of the Biofuture Platform generated increased interest in bioenergy and industry involvement in the sector. With the **Group of 20 (G20)**, the IEA provided support to Indonesia's 2022 presidency with analytical recommendations on net zero pathways, clean energy technologies and investment, and global energy markets and security. The IEA has also worked closely with India to prepare for the country's G20 presidency in 2023. The **Regulatory Energy Transition Accelerator (RETA)**, a partnership with IRENA, the World Bank and the UK energy regulator, the IEA, as the Administrator, has spear-headed the signing up of more than 30 regulators from across the globe by the end of 2022, discussed and agreed an impactful work programme, and undertaken a series of foundational activities that has set RETA up for success in 2023. Work in 2023 will include understanding how regulators mandates can be improved to include energy transitions, the unique role of energy regulation in small island development states, and, together with the Rocky Mountain Institute (RMI), the launching of a knowledge hub. At **COP**, the IEA's work was greatly appreciated and recognised throughout COP27 in Egypt. Notably, the IEA [World Energy Outlook 2022](#) was referenced in the COP27 final decision, the Sharm el-Sheikh Implementation Plan. The IEA also continued its longstanding role as a co-custodian of data for the **United Nations energy-related SDGs**. The latest projections were able to fully capture the effects of the setback on reaching

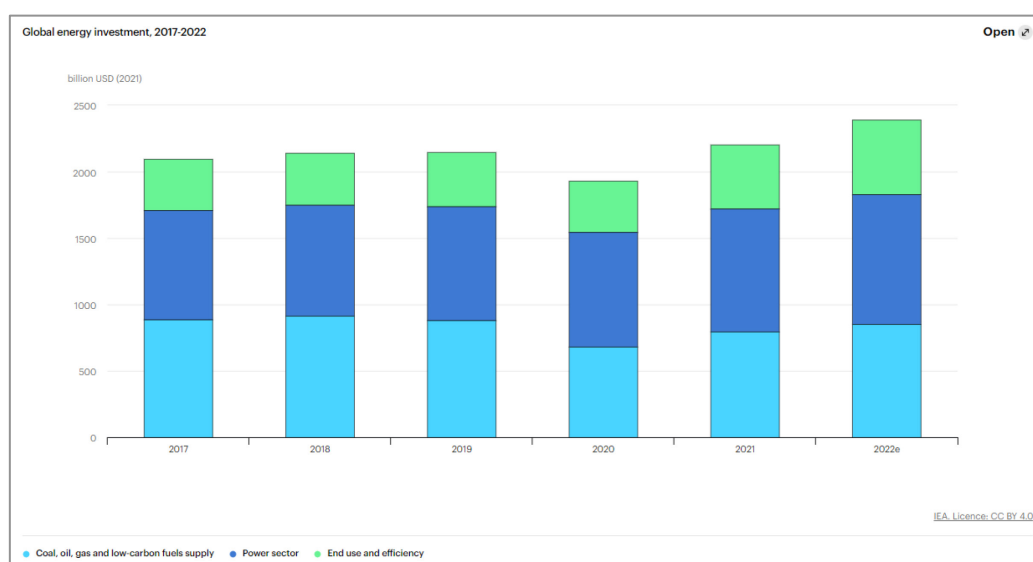
universal access caused by the Covid-19 pandemic, mostly concentrated in sub-Saharan Africa. Recent analysis has reflected the affordability impacts of the global energy crisis.

Finally, the CETP has continued to shape the **global dialogue** on energy transitions with a series of high-level events, timely and impactful analytical products and datasets, and hard-hitting reports. For instance, the IEA has become a global voice on **critical minerals** with modelling and in-depth analysis of supply chains and the release of the [Critical Minerals Policy Tracker](#). This tool helps governments explore new critical mineral policies, and analysis of the importance of environmental and social governance in supply chains. This report shone a spotlight on the current market concentration in China, and though this has historically brought huge gains in cost reductions for renewable energy, this has now created a global risk to supply chains and energy security due to the market dominance of one country.



Critical Minerals Policy Tracker 2022, IEA, 2022

Further, the CETP has expanded the IEA's work on **People-Centred Clean Energy Transitions** delivering the first [IEA Clean Energy Labour Council](#), which brought together representatives of national trade unions with strong representation from CETP focus countries. Within the workstream of **Energy Employment and Skills**, publication of the first ever [World Energy Employment](#) report, which provided a first-of-its kind estimate of how many workers are employed in the global energy sector, accompanied by projections of future labour demand by sector and region under different scenarios. The CETP has also advanced the work of **Private and Public Clean Energy Investment**, to raise awareness of the risk of shortfalls in clean energy investment in emerging and developing economies and offer solutions that unlock capital through enhanced market and regulatory design. This included the release of [World Energy Investment 2022](#) and the launching of the Cost of Capital Observatory which highlights the huge differences in the cost of capital for renewable energy investments between emerging and developing countries and high-income countries. This is in no part due to the risks associated with the policy landscape – the IEA, spear-headed under the CETP, will tackle these challenges by providing clear-headed policy advice to de-risk clean energy investments and accelerate access to finance and deployment of renewable energy. In addition, the [IEA Government Energy Spending Tracker](#) continued its tracking of newly announced government policies including financial support for clean energy, which was updated twice in 2022 – in line with a request made in the [G20](#) leaders communique.



World Energy Investment 2022, IEA, 2022

The CETP has also led important improvements to non-member country **Data** and experimental work on key indicators and the timeliness of data, and the creation of a user-friendly data portal for facilitated access to indicators with important

implications for clean energy transitions. Further, the CETP delivered a major project on **Digitalisation** of power systems, which furthered strengthened the analysis and dissemination of findings on the importance of digital technologies for energy decarbonisation, clean energy transitions and net zero. Finally, support for multilateral **Innovation** partnerships and the work on energy innovation policies and data has been scaled up under the CETP, including publication of [Tracking Clean Energy Innovation in the Business Sector: An Overview](#) and [How Governments Support Clean Energy Start-ups: Insights from selected approaches around the world](#), as well as a [new data exploration tool](#) on public RD&D in energy.

In 2022, CETP funders recognised that in the first five years of its existence the programme has managed to achieve impact far above its scale. They also recognised its untapped upside potential and came together to provide a new impetus to scale up CETP work. The Joint Commitment agreed upon at the IEA Ministerial in March 2022 is to “...work together to make available a collective annual fund of around EUR 20 million and, in response to the decade of action, we affirm our intention to further strengthen financial support through to 2030”. This will maximise the programme’s strategic alignment and will scale up its support for the focus countries. On the back of this Joint Commitment, the IEA has delivered the CETP Strategic Framework – setting out the strategic direction for the programme for the coming two years, plus the 2023 workplan. Achieving full buy-in from both the partner countries where the CETP is implemented, as well as the CETP funders.

Overview of the CETP in 2022

Introduction to the CETP

The objective of the CETP is to help accelerate progress towards the goal of realising global net zero emissions from energy through a secure and people-centred clean energy transition, particularly in major emerging and developing economies.

The CETP was launched at the 2017 IEA Ministerial to provide independent, cutting-edge support to the governments of six major emerging economies – Brazil, China, India, Indonesia, Mexico and South Africa – and other governments through its collaboration with regional organisations in Africa, Latin America and Southeast Asia.

These countries and regions were selected because of their significant potential to reduce their greenhouse gas (GHG) emissions and the IEA's strong institutional links with the respective governments and regional organisations. The work the CETP does with individual countries and regional organisations stems from their demands and is shaped by iterative consultations between their representatives, IEA experts and other relevant stakeholders.

In just five years the CETP has grown to become the largest, and arguably most important, programme for the IEA. It has played a crucial role in enabling the IEA to strengthen its global leadership role in clean energy transitions at a pace and scale that would otherwise not have been possible. As a result, we have been able to accelerate transitions around the globe through a mix of insight, implementation and impact.

Over this past year the CETP's work has delivered large-scale impact for our members and partners across the globe. Taking one recent example, we launched the [Energy Sector Roadmap to Net Zero Emissions in Indonesia](#), which ministers strongly welcomed at the G20, and which has played a major role in shaping Indonesia's landmark Just Energy Transition Partnership. Similarly, with the CETP the IEA has taken its programme of engagement, insights and advice to a whole new level, working with many countries across Africa, Asia, Latin America and beyond.

The CETP has also been a critical instrument for the modernisation of the IEA. It is transforming the relationship between the agency and many of the world's emerging economies, particularly those with rapidly growing energy demand. The programme has strengthened the IEA's capacity to achieve real-world impact with

key partners by drawing on the vast scope of the agency's expertise and its ability to combine data and evidence-driven analysis with strategic policy and regulatory advice.

Joint Commitment

In March 2022 the IEA received a major funding boost from member countries to enable it to significantly scale up its work supporting the transition to clean energy in emerging economies. The funding increase for the CETP was announced at a special event on the sidelines of the 2022 IEA Ministerial Meeting in Paris, where ministers from IEA member countries and beyond met to discuss how to accelerate clean energy transitions and strengthen energy security.

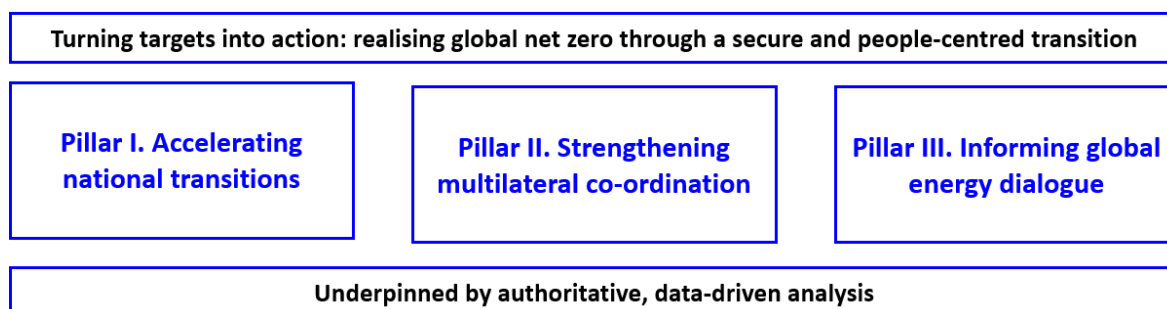
The new CETP funding stream of EUR 20 million a year is from the voluntary contributions of 15 IEA member countries and the European Union, who confirmed their financial support till 2030 in a new Joint Commitment. The increased funding will expand the IEA's development of more tailored and practical national net zero roadmaps for emerging economies.

The CETP has been funded by Australia, Belgium, Canada, Denmark, France, Germany, Ireland, Italy, Japan, the Netherlands, Spain, Sweden, Switzerland, the United Kingdom, the United States and the European Commission. Among those, Belgium, Ireland, Spain and the United States all provided contributions to the programme for the first time as part of the new Joint Commitment.

Strategic Framework

With the 2022 Joint Commitment, CETP funders agreed a revised structure on which to base the CETP's work: the Strategic Framework. This new approach structures the programme's work around three pillars and the corresponding countries, regions and workstreams.

CETP Strategic Framework



IEA. CC BY 4.0.

Pillar I, **Accelerating national transitions.** The IEA's top priority under the CETP is to support emerging and developing economies to develop and implement timely strategies or roadmaps for achieving national clean energy transition goals in line with the Paris Agreement objectives and SDGs. Work on Pillar I is largely organised around eight workstreams, which the IEA views as critical for driving a systems-wide transition. Supporting national implementation remains at the core of the programme, including enhanced support for the development of national and regional net zero roadmaps.

Pillar II, **Strengthening multilateral co-ordination.** Work on Pillar II is ordered around IEA-led activities under the CETP and CETP-supported IEA engagement in key partnerships and fora. The IEA is making significant inputs to major international collaboration mechanisms such as the Group of 7 (G7), the Group of 20 (G20), the Clean Energy Ministerial (CEM), the Regulators Energy Transitions Accelerator (RETA), Mission Innovation (MI), and the IEA's own Technology Collaboration Programmes (TCPs).

Pillar III, **Informing global energy dialogue.** The IEA's authoritative energy data and modelling capabilities, as well as its extensive policy experience and holistic approach, make it a trusted voice to inform global energy dialogue and key decision makers in the private sector, multilateral banks and international development agencies. Pillar III is organised around major cross-cutting themes, which help generate the political conditions for greater action.



IEA. All right reserved.

*CETP funders' meeting at the IEA Ministerial Meeting,
24 March 2022*

CETP delivery and governance

A central CETP Core Team, housed in the IEA Secretariat's Strategic Initiatives Office, is responsible for the strategic management of the programme, engagement with donors, the dissemination of key messages and information exchange. The CETP Core Team also co-ordinates work planning, monitoring and reporting. CETP activities are delivered by around 160 colleagues within the IEA Secretariat in Paris, supported by country desk officers in the IEA's Office of Global Energy Relations (GER) and in-country energy specialists engaged as contractors in CETP priority countries.

CETP governance consists of four elements: the Funders' Strategic Co-ordination Group, the Cross-Agency CETP Steering Committee, interaction with the broader IEA membership, and co-ordination at country and regional levels.

The Funders' Strategic Co-ordination Group is the main co-ordination body for the CETP. The group allows funders to engage in strategic conversations about the CETP's strategic priorities, and to advise on the programme's workplan development and implementation. This includes ensuring that its work complements other bilateral and multilateral initiatives. All CETP Joint Commitment signatories are invited to nominate a representative to the group, which meets quarterly. It is chaired on a rotational calendar year basis by participating donor country representatives. The group can invite additional country delegates to participate in meetings as observers, for example representatives of prospective donor countries.

The Cross-Agency CETP Steering Committee, which includes IEA senior management and division heads from across the IEA Secretariat, is convened periodically to exchange information on activities under the CETP. Under the guidance of the IEA Executive Director, it advises on resource allocations to the different workstreams under the CETP. Country desk officers in the GER contribute to ensure streamlined and coherent country and regional strategies. This includes, in some cases, co-ordination with in-country energy specialists.

Interaction with the broader IEA membership

As not all IEA members are CETP funders, the IEA Secretariat reports on the CETP to, and seeks guidance from, the broader IEA membership via the Governing Board, the Standing Group on Global Dialogue and the other committees and standing groups of the agency. This is to showcase achievements and identify potential collaborations and new funders while ensuring that programme planning and budget allocation remain aligned with the IEA ministerial mandates and the IEA Programme of Work and Budget.

Co-ordination at country and regional levels

With a more systematic approach to meetings for and with CETP donors taking place in CETP priority countries, the next phase of the CETP includes strengthened co-ordination at country and regional levels between the CETP and the activities of other partners, including relevant national and regional actors in the country of activity and international organisations.

With national and regional partners, the IEA already seeks collaboration with the relevant government ministries and policy makers responsible for the energy sector and relevant research institutes. The IEA will seek to co-ordinate with the in-country activities of a range of international partners.

With in-country partners, CETP activities will be delivered in co-ordination with the relevant bilateral co-operation programmes of IEA members in the priority countries and regions, including with funders' embassies. In particular, CETP funders are encouraged to share with the IEA Secretariat information about existing and prospective co-operation initiatives on clean energy in the CETP priority countries and regions to maximise the impact of, and establish synergies between, our respective efforts.

Pillar I – Accelerating national transitions

India

Highlights

- Work on energy efficiency in the building sector in co-operation with the Bureau of Energy Efficiency (BEE) of the Ministry of Power and production of internal policy guidance *Roadmap for Mainstreaming Energy Efficiency in Residential Buildings*.
- Support for implementation of energy efficiency measures in industry in co-operation with The Energy Resources Institute (TERI) for the use of BEE, including a policy package to promote energy efficiency in small and medium-sized textile manufacturers.
- Policy advice on solar PV, decentralised solar programmes and bioenergy in liaison with India's government and major think tanks. These exchanges fed directly into the [Solar PV Global Supply Chains](#) report published in July 2022 and presented at the first high-level forum on solar PV manufacturing.
- Biofuels and bioenergy policy guidance provided to the Ministry of Petroleum and Natural Gas and the Ministry of New and Renewable Energy, as well as input to TERI's analysis of biogas-based power generation and thermal application programmes.
- Exchanges with India's Ministry of Science and Technology on how to enhance its work on tracking national energy innovation spending and further develop its incubation support for clean energy technology start-ups from India and overseas.
- Scaling up of the people-centred transitions work in India including workshops with Indian and international counterparts, building strong links with Indian institutions and government stakeholders working on the issue.
- A series of knowledge-sharing events on energy innovation policy organised in close co-operation with the Indian Institute for Technology Delhi.
- The IEA joined the steering committee of India's new Climate and Energy Modelling forum and contributing to the process of scenario development for India's achievement of net zero emissions.
- Support for the preparations ahead of India's first-ever G20 presidency and Clean Energy Ministerial to be held in 2023, including the energy track, finance track and disaster risk reduction track.

India's challenge is "to industrialise but not carbonise", as the Government of India (GoI) puts it, and the path that India takes has the potential to provide a model of green economic development for other emerging and developing countries. At COP26, Prime Minister Modi announced ambitious targets for India's energy transition, notably for 50% of electricity generation to come from non-fossil sources by 2030 and to achieve net zero emissions by 2070. The IEA has therefore focused its work on key areas to support India's energy transition priorities. Of immediate importance are the IEA's support for India's first-ever presidency of the G20 in 2023, along with its joint hosting of the CEM/MI Ministerial.



IEA. All right reserved.

IEA Executive Director with Prime Minister Modi at the G7 Summit

The IEA has been working with a range of GoI ministries and entities to develop G20 workstreams, notably:

- Energy track – working with the Ministry of Power, Ministry of New and Renewable Energy, Ministry of Petroleum and Natural Gas, Ministry of Mines and NITI Aayog on issues including energy security and clean energy supply chains; “fuels for the future” (green hydrogen, ammonia, biofuels and e-mobility); energy efficiency and industrial decarbonisation; low-cost financing for energy transitions; just energy transitions; and critical clean energy technology gaps, e.g. energy storage.
- Finance track – contributing IEA analytical input to inform both the Sustainable Finance Working Group on clean energy investment and the Framework Working Group on the macroeconomic impact of energy insecurity, climate change and transition pathways.
- Disaster risk reduction track – development of ideas for work on the climate resilience of the energy sector.

In addition, the IEA has provided support for India's new Climate and Energy Modelling Forum by joining the steering committee and contributing to the development of scenarios for India's achievement of net zero emissions. More generally, the IEA has provided policy advice and joined exchanges between technical experts on a number of topics as they relate to India, including renewable energy, transport, energy efficiency, people-centred transitions, carbon capture, utilisation and storage (CCUS), alternative fuels and the role of natural gas in energy transitions, as outlined in more detail below.



IEA. All right reserved.

*IEA Deputy Executive Director Mary Warlick and Amitabh Kant,
G20 Sherpa, and ex NITI Aayog CEO*

We have engaged in a number of outreach activities to strengthen the IEA's relationship with India, including the following events organised in partnership with Indian stakeholders:

- A workshop on CCUS with the Ministry of Petroleum and Natural Gas and the Indian Institute of Technology Bombay in September 2022.
- Events on people-centred clean energy transitions at The Energy and Resources Institute (TERI) World Sustainable Development Summit in February 2022 and the Global Clean Energy Action Forum in September 2022.

Our work to present and disseminate IEA analysis in India included:

- The [Solar PV Supply Chains](#) report presented at an EU-organised conference in Delhi in September, and a closed-door roundtable with Indian industry also in September.
- The [Global Hydrogen Review](#) presented at a conference organised by the Ministry of New and Renewable Energy and the Confederation of Indian Industry in Delhi in October.

IEA visits to India allowed us to participate in multilateral forums convened by India, such as:

- The CEM meeting in April.
- The International Coalition for Disaster Resilient Infrastructure meeting in May.
- The International Solar Alliance Assembly in October.

We have built relations with key GoI and industry stakeholders to further our significant collaboration and the IEA-India relationship (Strategic Partnership), particularly by presenting IEA analysis in person.



IEA. All right reserved.

IEA Executive Director Dr. Fatih Birol with Honourable Minister of Petroleum and Natural Gas, Mr. Hardeep Singh Puri, on the 24th of May while in Davos for the World Economic Forum

Energy efficiency in India

2022 activities on energy efficiency focused on finalising the internal report *India Roadmap for Mainstreaming Energy Efficiency in Residential Buildings*, enabling exchanges at the national level on fuel economy standards, and developing a cross-agency report on the climate and air pollution benefits of a clean road sector transition in India.

Buildings

The *India Roadmap for Mainstreaming Energy Efficiency in Residential Buildings* was developed in partnership with the Bureau of Energy Efficiency (BEE) at the Ministry of Power, involving numerous Indian and international building and construction experts through a series of stakeholder consultations, reviews and online workshops.

According to the BEE report [Impact Assessment of Energy Efficiency Measures 2021](#), residential buildings already accounted for 24% of India's final electricity consumption and around 300 Mt of related CO₂ emissions in fiscal year 2018-19. Floor space is set to more than double over the next 20 years, with over 70% of construction expected in urban areas, which could drive a fivefold increase in residential electricity demand. According to the [IEA Stated Policies Scenario](#), electricity demand from buildings could account for about 50% of India's total generated electricity by 2040, if no further improvements are made to the energy efficiency of the country's building stock.

The roadmap focuses on the adoption of the [Eco-Niwas Samhita](#) (ENS) building code along with other voluntary green building standards. The ENS is a non-mandatory national residential building energy conservation code. The roadmap provides key recommendations for seven action areas, including new and existing buildings, building materials, systems and operations, sustainable energy, urban planning and resilience. The ENS has been further strengthened by the Energy Conservation (Amendment) Bill that was passed on 12 December 2022, which extends the application of the code to office and residential buildings with a connected load of 100 kW or above, and expands the notion of [green buildings](#) to include energy efficiency and renewable energy sources.

Industry

Following the completion of an internal report on energy efficiency potential and proposals for a policy package to promote energy efficiency in small and medium-sized textile manufacturers, the IEA held several follow-up meetings with BEE to discuss priority measures for implementation. The result is a package that comprises a number of actionable measures, including scaling up the use of energy efficient motors through aggregation, e.g. through an energy service

company (ESCO) approach, the development of technology lists, and allowing aggregators to acquire access to the Perform, Achieve and Trade (PAT) scheme. Based on the analysis conducted and the proposed policy package, the IEA team and TERI developed a proposal for the development and operationalisation of an innovative ESCO model to promote premium efficiency motors among textile producers in the Surat textile cluster of Gujarat. The concept note is currently with BEE for consideration.

Vehicle fuel economy

The IEA has continued to enable the exchange of national experiences of the design of fuel economy standards and their implementation between the Government of Indonesia and BEE. A national high-level workshop on the design of fuel economy standards and data collection was held in March, followed by a high-level workshop on case studies in May, including a presentation by BEE on the Indian fuel efficiency standards for heavy-duty and other vehicles.

We have also conducted an analysis of India's road transport energy consumption and related GHG emissions, presented different scenarios for future development and discussed policy options to contribute to India's commitment to achieve carbon neutrality by 2070. Besides a desk review and analysis, the IEA team conducted a series of public and private-sector stakeholder interviews between May and August, and held regular co-ordination calls with NITI Aayog.

Carbon market

In June the IEA organised a high-level workshop on carbon market development with BEE, showcasing international examples of carbon markets and emissions trading schemes, and discussing possible design options for the Indian carbon market. Further activities and exchanges on the national carbon market design are envisaged for 2023, based on the national carbon market framework in India. The Energy Conservation (Amendment) Bill, passed by the Indian parliament on 12 December, mandates the use of non-fossil energy sources, stipulates penalties for non-compliance with fuel consumption norms and promotes the development of a domestic carbon market to support the decarbonisation of the Indian economy and the achievement of the SDGs.

Indicators

The IEA had several exchanges with BEE on the development of end-use and energy efficiency indicator roadmaps, including for India and other countries in the Emerging Economies Programme. BEE showed interest in the IEA's support for establishing an energy data management unit, and the continuation of previous multilateral collaboration on energy efficiency data and indicators in 2023.

ESCOs

On several occasions BEE consulted with the IEA on international experiences and successful business models for strengthening national ESCO markets. Based on the recommendations of the 2022 budget presentation, an ESCO webinar showcasing international business models was designed for the GoI, but later postponed. The Alliance for an Energy Efficient Economy (AEEE), which also serves as the national ESCO association of India, was invited to present the Indian market experience at a special event at the 7th Global Conference on Energy Efficiency. The Energy Savings Insurance model was subsequently included in the possible areas for action in the OECD Clean Energy Finance and Investment Roadmap for India. The IEA contributed their experience and several case studies to the development of this roadmap and participated in two workshops on enhancing energy efficiency in micro, small and medium-sized enterprises.

Dialogue

The IEA strengthened its engagement with Indian national stakeholders by delivering keynote speeches at important national events, including the 2022 Forum on Energy Efficiency and Decarbonisation (February) and the conference on Augmenting Nature by Green Affordable New Habitat (September), which featured around 75 speakers from over 15 countries and international organisations.

The IEA has also continued to support India's contribution to global dialogue on energy efficiency by showcasing successful business models and policies, and providing platforms for exchange and collaboration, such as the 3% Club and the Energy Efficiency Hub. The IEA continued to support BEE in their co-leadership of the Super-efficient Equipment Appliance Deployment (SEAD) initiative and COP26 campaigns, including the COP26 Product Efficiency Call to Action.

Renewable energy in India

In 2022 the IEA's work on renewable energy policies in India mainly focused on solar PV supply chains, distributed solar PV and bioenergy. We carried out our activities in liaison with GoI ministries (Ministry of Natural Resources and Energy and Ministry of Petroleum and Natural Gas), think tanks (TERI, Council on Energy, Environment and Water [CEEW]), industry and other stakeholders.

Solar PV

The policy focus on and discussion of solar PV supply chains increased strongly in India in 2022, as solar was included in the Production Linked Incentive Scheme that had been launched in 2021. The IEA carried out extensive analysis of PV

supply chains in India, which informed and were part of the special report on [Solar PV Global Supply Chains](#) published in July.



IEA. All right reserved.

*IEA Executive Director with the India Solar Alliance Director
General Dr. Ajay Mathur at COP27*

Building on this work, we completed a number of exchanges and communication and dissemination activities with India, notably:

- Presentation of the IEA's work on solar PV supply chains at the first high-level Forum on Solar PV Manufacturing, with the participation of Kadri Simson (European Commissioner for Energy), Raj Kumar Singh (Minister of Power), Bhagwath Khuba (Minister of State for Chemicals and Fertilizer, New and Renewable Energy) and Indu Shekhar Chaturvedi (Secretary, Ministry of New and Renewable Energy).
- Organisation of a joint IEA–CEEW workshop focusing on polysilicon and wafer manufacturing, presenting and discussing international experience and best practices.
- Meetings with multiple stakeholders, including the Ministry of Natural Resources and Energy and Ministry of Petroleum and Natural Gas, the EU delegation to India, the Center for Study of Science, Technology and Policy (CSTEP), CEEW and multiple private companies planning to invest in PV manufacturing in India.
- CEEW expert participation in the IEA public webinar on the [Solar PV Global Supply Chain](#) report, providing India's perspective.

Furthermore, the IEA, in co-operation with TERI, advised and provided analysis and data on off-grid and decentralised solar programmes to the Ministry of Natural Resources and Energy.

Bioenergy

On bioenergy, the IEA advised:

- The Ministry of Petroleum and Natural Gas on the IEA's approach to forecasting bioenergy, data sources, global coverage and market forecasts.
- The Ministry of New and Renewable Energy's Joint Secretary Sh. Jagdale on biogas, including on potential topics for a biogas workshop with India.
- TERI's analysis in collaboration with Ministry of New and Renewable Energy on data collection and information on biogas-based power generation and thermal application programmes.

Critical minerals in India

The IEA worked with the Ministry of Mines and Indian think tanks to develop an approach paper for the G20 Energy Transitions Working Group on how to address the vulnerability of the critical minerals supply chain through international collaboration. The IEA contributed data and analysis on critical minerals supply and demand, including the growth in demand for key clean energy technologies and the industry's investment costs, in order to inform recommendations for how the G20 can manage supply–demand pressures as part of a global clean energy transition.

Transport and air pollution in India

Building on the IEA's 2021 report [Air Quality and Climate Policy Integration in India](#), the IEA prepared an in-depth report exploring future CO₂ and air pollutant emissions from road transport in the country. Road transport presently accounts for 12% of India's energy-related CO₂ emissions and is a key contributor to urban air pollution. As India seeks to meet the increasing demand for private mobility and the transport of goods, energy use and CO₂ emissions from road transport could double by 2050, making it a key sector for India's clean energy transition. The report provides detailed projections of future CO₂ and air pollutant emissions under current policies, identifies technologies with the greatest additional mitigation potential, and provides policy options to bring these technologies into the vehicle fleet.

The report was requested by India's public think tank NITI Aayog. To inform the analysis, the IEA organised a series of bilateral technical meetings between May and August with experts from GoI, think tanks and industry. The topics covered progress in and the prospects for electrification, fuel efficiency improvements and the role of alternative fuels (e.g. biofuels and hydrogen) in different vehicle segments, and the opportunities for and challenges of tackling urban air pollution from road transport, as well as the role of taxation and finance in accelerating the transition towards cleaner road transport.

The final report, shared with NITI Aayog in November, received highly positive feedback from both NITI Aayog and the experts consulted during the process. The report is expected to be launched jointly with NITI Aayog in Q1 2023.

Innovation in India

The IEA organised a series of knowledge-sharing events on energy innovation policy in close co-operation with the Indian Institute for Technology Delhi (IIT Delhi) School of Public Policy as the organising partner of preparatory meetings. The events resulted in enhanced dialogue among participants from various developing countries. For example, they connected India's Ministry of Finance and the Office of the Chief Scientific Advisor of India with other emerging market and developing economies to explore opportunities to co-operate on supporting clean energy start-ups with innovative technologies in these specific market contexts. IEA activities also supported India's Ministry of Science and Technology to enhance its work on tracking national energy innovation spending and further develop its incubation support for clean energy technology start-ups from India and overseas.

Indonesia

Highlights

- We produced [An Energy Sector Roadmap to Net Zero Emissions in Indonesia](#) in close collaboration with Indonesia's Ministry of Mineral Resources and Energy (MEMR). The report directly underpinned Indonesia's Just Energy Transition Partnership (JETP), a landmark agreement launched at the G20 Leaders' Summit in Bali in September 2022.
- The [Joint IEA-MEMR Statement](#) by H.E. Mr Arifin Tasrif, Minister of Energy and Mineral Resources, Indonesia and Dr Fatih Birol, Executive Director of the IEA, released to accompany the Indonesia Net Zero Roadmap, demonstrated that Indonesia has a viable path to reaching its target of net zero emissions by 2060, bringing major benefits to its citizens in the process, such as more secure and affordable energy supplies.
- We delivered the second edition of the [Security of Clean Energy Transitions](#) at the direct invitation of the Indonesia's MEMR to support the G20 discussions on energy transitions.
- The comprehensive work programme between the IEA and MEMR allowed for direct input into policy development, including consultations on Indonesia's fuel economy standards with the objective of improving vehicle efficiency, as well as participation in the review of Indonesia's Presidential Decree on renewable energy.
- We have also supported direct implementation of energy projects, for example through detailed analysis and techno-economic modelling of the Java-Bali and Sumatra power systems.

An IEA family member since 2015, Indonesia continues to be a major IEA association country, and our relationship with the Southeast Asian nation proved once again to be strong and fruitful in 2022.

Indonesia is not only one of the most populous countries in the world, fourth behind China, India and the United States, but the country is also expected to become the world's fourth biggest economy by 2050. With this in mind, Indonesia's energy trajectory has significant implications for global energy markets and achieving collective climate goals.

During 2022 the IEA and Indonesia's Ministry of Energy and Mineral Resources (MEMR) continued to strengthen their co-operation, with the IEA assisting and supporting the country in creating the necessary policies and frameworks to

achieve net zero emissions by 2050. More specifically, at Indonesia's request and in collaboration with MEMR, the IEA produced [An Energy Sector Roadmap to Net Zero Emissions in Indonesia](#). This guides the country in its energy transition over the coming decades, notably in areas such as the coal phase-down, scaling up clean energy investments, and critical minerals. The roadmap underpinned the landmark USD 20 billion agreement, the Just Energy Transition Programme (JETP), between Indonesia and international partners, signed in November at the G20 Leaders' Summit in Bali.



The IEA also supported Indonesia in its G20 presidency, providing guidance and focus group discussions on emissions trading system (ETS) design, analytical studies and events on power system enhancement and renewables integration, and work on energy efficiency through roadmaps and policy reform. We are currently working closely with Indonesian institutions as well as donors and international partners on the implementation of the JETP.

Indonesia's Net Zero Roadmap

Thanks to the support of the CETP, the IEA was able to develop and publish [An Energy Sector Roadmap to Net Zero Emissions in Indonesia](#). Indonesia is a critical country in the fight against climate change as the world's largest coal exporter,

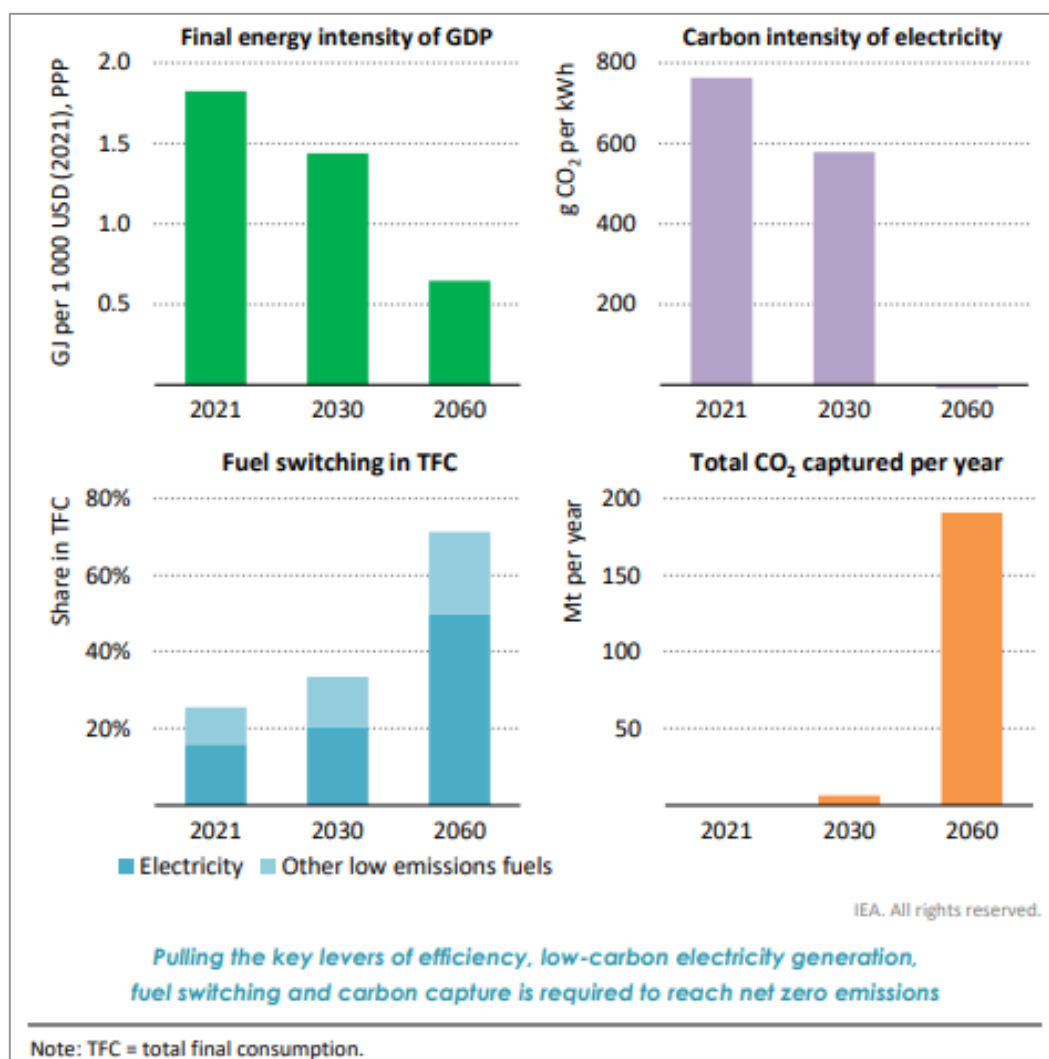
fourth most populated country and seventh largest economy. Without further policy action, Indonesia's energy sector emissions are set to grow to about annually 1 Gt by 2050, as much as it currently emits from land-use change.



IEA. All right reserved.

*Dr Fatih Birol and H.E. Minister Tasrif launching
An Energy Sector Roadmap to Net Zero Emissions in Indonesia
at the G20 Ministerial Meeting in Bali*

The report was developed in close collaboration with MEMR. The IEA and MEMR held six in-depth technical workshops between January and April 2022 to inform the modelling and analysis in the report. This assisted in building up a high degree of mutual trust and confidence. As a testament to this, the published report was prefaced by a [joint statement](#) signed by the Minister of Energy and Mineral Resources, Mr Arifin Tasrif, and the IEA Executive Director, Dr Fatih Birol, setting out key near-term policy priorities for Indonesia's net zero transition. Mr Tasrif recognised that the IEA's roadmap to net zero emissions in Indonesia "reflects the IEA's status as the global authority and was conducted hand-in-hand with my ministry," adding that it "sets out a clear and achievable path forward, based on energy efficiency, renewables and electrification." "This demonstrates that a transition to net zero in Indonesia can be just, affordable and rich with opportunities," he added.

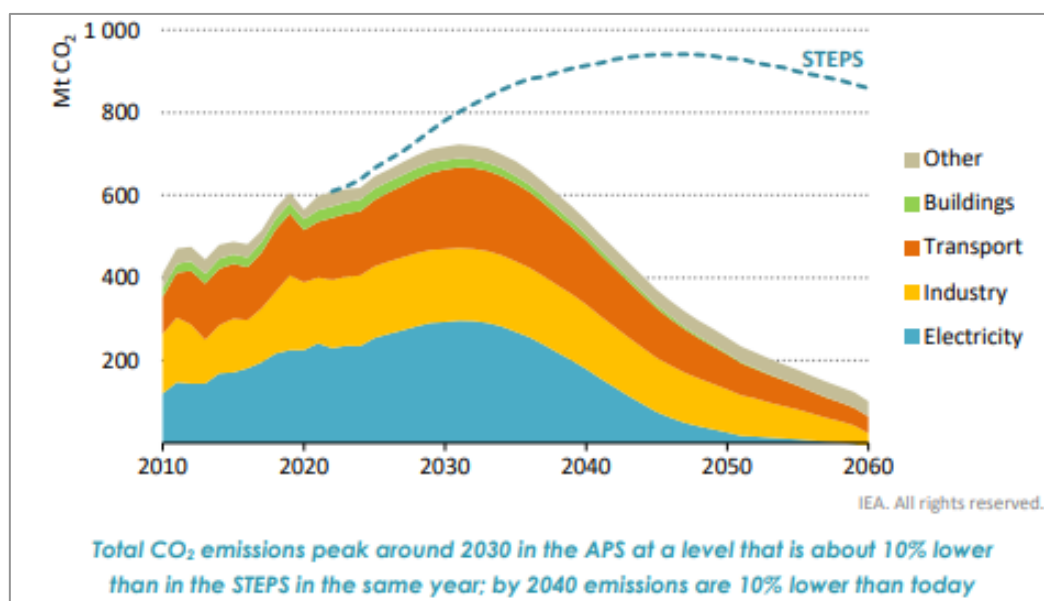


Four key pillars of the energy transition to net zero emissions in Indonesia, 2021-2060
An Energy Sector Roadmap to Net Zero Emissions in Indonesia, IEA, 2022

During the report's development and after its publication, the IEA also conducted a number of briefings for members of the International Partners Group (IPG),¹ who at the time were negotiating the JETP. The IEA also held briefings for members of the Indonesian JETP team in the Coordinating Ministry for Maritime and Investment Affairs. Thanks to this engagement, the IEA's net zero report became a key input into the JETP negotiation. The IEA directly facilitated agreement on an ambitious JETP outcome, as the key targets from the JETP were directly lifted from the IEA's net zero roadmap (notably the commitment for electricity sector emissions to peak at 290 Mt and to achieve a share of renewables in electricity generation of 34% by 2030).

¹ The IPG comprises the governments of Japan, the United States, Canada, Denmark, Germany, France, Norway, Italy and the United Kingdom, and the European Union.

In fact, several major aspects of the roadmap informed key targets in the Indonesia JETP, including IEA analysis showing that Indonesia could achieve a peak in its electricity sector emissions by 2030 to put them on a path to reaching net zero by around 2050. Other important elements included: the urgency of the early scaling up of renewable power, such as solar, wind, hydro, geothermal and bioenergy; the critical importance of international support for financing such a pathway; and ensuring the energy supplies needed for Indonesia to take advantage of the economic opportunities of the transition in areas such as critical minerals and clean energy technologies.



Total energy CO₂ emissions by sector in the Indonesia in the Announced Pledges Scenario, 2010-2060
An Energy Sector Roadmap to Net Zero Emissions in Indonesia,
IEA, 2022

Carbon pricing in Indonesia

Indonesia is working towards the development and implementation of a domestic ETS for the power and industrial sectors as one of the policy mechanisms to help meet the targets in its nationally determined contribution (NDC) and foster low-carbon sustainable development. The IEA and its counterparts in the OECD Clean Energy Finance and Investment Mobilisation Programme and MEMR hosted a series of focus group discussions to support this goal, allowing relevant international experience to be shared with Indonesian counterparts.

These focus group discussions, held between February and May, allowed in-depth analysis of a variety of elements critical to the development of an effective ETS, each relevant to the Indonesian context. Each event attracted a large number of participants and generated lively discussion. The proceedings were documented and published in a summary paper that serves to guide the Indonesian government in its deliberations on the design of the ETS. Indonesian officials were

also invited to participate in a joint [IEA-International Carbon Action Partnership-Konrad-Adenauer-Stiftung in-person event](#) at the Asia Pacific Climate Summit 2022 in Singapore in December, where carbon pricing in the region was discussed.

Subsequently the IEA hosted a further focus group discussion for the purpose of examining the treatment of smaller generators under carbon pricing regimes elsewhere, with a view to informing the ongoing design and implementation discussion in Indonesia. During this event, country experts shared their experience of pricing the emissions of smaller generators. Once more, a large number of participants joined the event, the outcome of which has informed the next phase of this work programme.

Analytical output included a short guidance note based on the outcome of the dialogue sessions, presented to MEMR for the purpose of informing the next stage of the ETS design process.

Energy efficiency in Indonesia

The IEA's work on energy efficiency in Indonesia focused on roadmaps, policy reform and reporting.

Industry

The IEA continued its work with the Indonesian government on indicators and benchmarking for the industrial sector. For a more in-depth understanding of a specific sub-sector, in May we held a workshop on energy efficiency in Indonesia's pulp and paper sector. The event gathered 94 participants and included presentations from South Africa's National Energy Development Institute and Brazil's Energy Research Office on their management of data collection and indicators for industry, in particular the pulp and paper sector.

Transport

At the request of the Indonesian government, the IEA supported the country's development of fuel economy standards, which are identified as playing a key role in improving vehicle efficiency to help achieve its net zero goals.

We undertook a scoping study to look at the current status of data and other requirements for implementing fuel economy standards. Two workshops underpinned the study, with each workshop involving over 70 Indonesian stakeholders from across government (including MEMR and the Ministry of Transport) and the private sector. An integral part of the second workshop was an exchange with India drawing on its experience of implementing fuel economy standards.

Our scoping study report provided a summary of relevant data, identified gaps and provided detailed suggestions for the next steps to meet data needs relating to the

implementation of standards in the longer term. The outcomes of the report have informed the Indonesian government's work with data providers to address these gaps, as well as providing key insights into the metrics to be captured in Indonesia's new transport energy data reporting system (POME).

We are currently in discussions with the Indonesian government on the next steps for our support as it relates to the implementation of fuel economy standards.

In related work, at the request of the Indonesian government the IEA provided support for the development of POME, the country's new energy reporting system for the transport sector. This is the first time that the transport sector has been required to report its energy use. We provided detailed guidance on the data reporting templates that underpin the energy reporting system. This included guidance on the metrics to use as well as the categories to be covered. These suggestions have been adopted in the templates.

As only limited transport data reporting is currently required, the upgrading of the reporting system will assist the Indonesian government in its collection, analysis and use of data for the development of transport energy efficiency indicators and other policies.

Buildings and appliances

The [ASEAN roadmaps on efficient buildings](#) and [cooling](#), published in April, formed the basis of the IEA's meeting with Indonesia's Directorate of Energy Conservation and the Ministry of Public Works to discuss future areas of collaboration and potential implementation activities. We prepared a summary paper outlining potential implementation areas for Indonesia and shared it with participants for their feedback. To support this work programme, we also drafted an article describing how digital data collection can assist in the development of energy efficiency policies for air conditioners in Indonesia.

In December, at the request of MEMR and to support its policy decision making, the IEA provided Indonesia with a report on international best practices for energy efficiency benchmarking in buildings.

Cross-sectoral

The IEA continued to support Indonesia's contribution to the global dialogue on energy efficiency by providing platforms for collaboration and policy exchange, in particular through Indonesia's 2022 G20 presidency. We also presented on the energy efficiency panel of the Indonesia Sustainable Energy Week, outlining global energy efficiency developments and key considerations for energy efficiency for Indonesia. This support will continue in 2023 as Indonesia takes over as Chair of ASEAN and champions regional co-ordination efforts on energy efficiency.

Following up on the analysis used for the Indonesia Net Zero Roadmap and to support the country in meeting its ambitious climate goals, the IEA's energy efficiency team put together a policy review that provides in-depth analysis of Indonesia's existing policy framework and lays out key areas where international and IEA support could help bridge current policy gaps. We provided MEMR with the policy review in December, detailing how policy gaps across different sectors can be filled through a policy package approach that includes regulation, information and incentives. The recommendations from that policy review were well received and form the basis of the 2023 work plan.

Renewables integration in Indonesia

The IEA continued its analytical studies and events focusing on the enhancement of Indonesia's power system and renewables integration, in liaison with MEMR, the state electricity company (Perusahaan Listrik Negara [PLN]) and other national institutions. Our work included a [case study](#) on the Cirata 145 MW floating solar PV plant, the largest hybrid hydro-PV plant in Southeast Asia at the time, describing how to maximise the benefits of the project, highlighting options for its secure integration into the Java-Bali grid and giving recommendations in view of the further expansion of variable renewable electricity.

Next, we undertook a detailed analysis of the Java-Bali and Sumatra power systems in the context of Indonesia's 2025 renewable energy targets. This task entailed detailed techno-economic modelling to assess system requirements and flexibility options. We presented the results to Indonesian stakeholders in April and the key outcomes of the report were discussed in a workshop in June. The final version of the [report](#) was published in August.



The IEA also reviewed Indonesia's new Presidential Decree on renewable energy, providing insights and feedback in an online meeting with government representatives.

A clear demonstration of the impact of our engagement with Indonesia came from representatives of the MEMR in September 2022, at a workshop closing the Clean Energy Transitions in Emerging Economies project, delivered as part of the CETP. They described how trust with the IEA had been built over time since the Cirata floating solar project collaboration, which started in 2020, and allowed for an increasingly successful policy dialogue. They further described how IEA's work on attracting private investment in transmission systems and wheeling mechanisms provided input for a renewable energy law in Indonesia, issued at the end of 2022. They underlined that this work paved the way for the Indonesia Net Zero Roadmap, supported by the CETP.

They also explained that the energy transition in Indonesia, in addition to hydropower, will need to rely on solar energy to reach the 2060 net zero target. In this specific respect, this presentation demonstrated the impact of relevant IEA work done to assess the impact of higher shares of renewable energy on the power system, and to identify technical, regulatory and policy actions to ensure the cost-effectiveness and reliability of the clean energy transition.

Southeast Asia

Highlights

- Launch of the [Southeast Asia Energy Outlook 2022](#)
- Support for Thailand in the process of designing and implementation of its Climate Change Act
- Support for Cambodia in its chairmanship of the ASEAN presidency
- Delivery of the [Roadmap for Energy-Efficient Buildings and Construction](#) and the [Roadmap towards Sustainable and Energy-Efficient Space Cooling](#) to support the development of energy efficiency policies in the ASEAN region
- A series of regional workshops to catalyse national and regional progress on minimum energy performance standards for the ASEAN Low Carbon Energy Programme
- Official review of the ASEAN Interconnection Masterplan Study III Phase 3, which established the main direction in which the region's interconnections will be developed, with great potential for increasing the integration of renewables
- Training on efficient grid-interactive buildings – the 6th Annual Training Event under the Singapore-IEA Regional Training Hub

The IEA continued to build on its strong and important relationship with Southeast Asian countries. As net energy importers, ASEAN energy markets faced multifaceted challenges in 2022: global supply constraints and affordability issues caused by the Russian Federation (hereafter, “Russia”)’s invasion of Ukraine, a difficult economic recovery after the Covid-19 pandemic, and a pressing need to ensure secure and just energy transitions. Under the chairmanship of Cambodia, ASEAN made considerable efforts towards energy security and energy transitions for its members, strengthened their energy co-operation and further invested in the development of interconnections in the region.

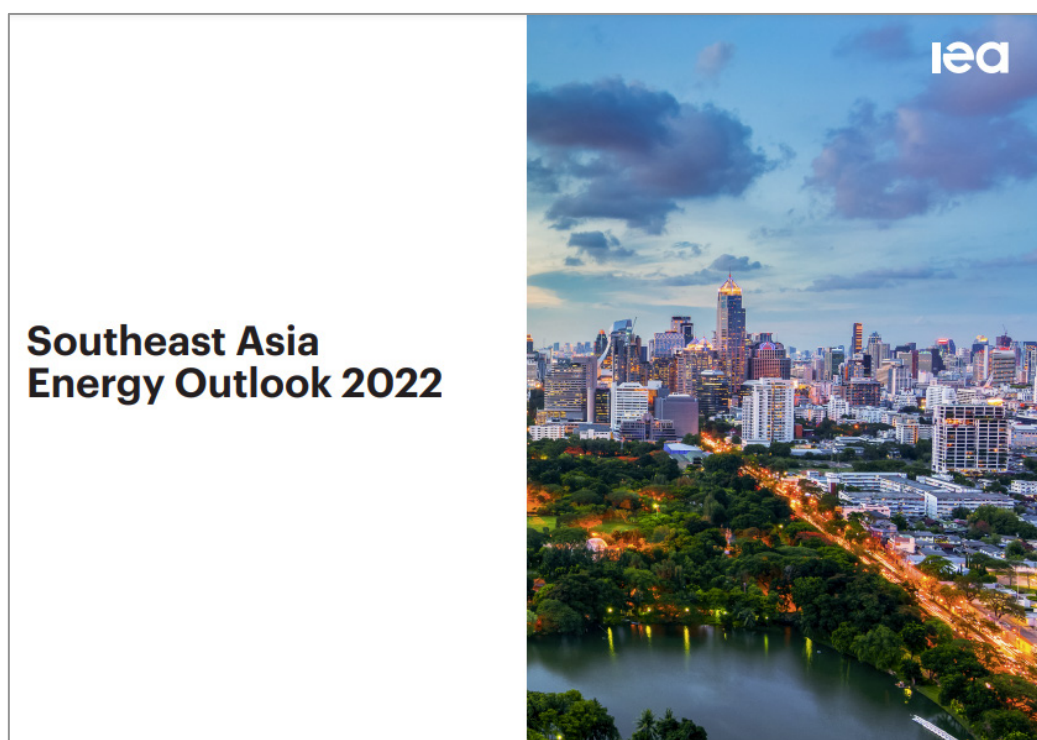
Southeast Asian countries are set to play an even greater role in global energy transitions in the coming decades, as their markets and populations continue to grow rapidly and they continue to supply critical minerals and manufacture clean energy products. Given the importance of the region, the IEA has supported Cambodia in its chairmanship, as well as ASEAN work on energy policy through:

- Reports such as the [Southeast Asia Energy Outlook 2022](#).
- Studies on policy integration, interconnections and energy efficiency for buildings and transport, among others.

- Capacity development and workshops.
- Singapore and Thailand remained key partner countries and we look forward to supporting Indonesia in its chairmanship during 2023.

Southeast Asia Energy Outlook 2022

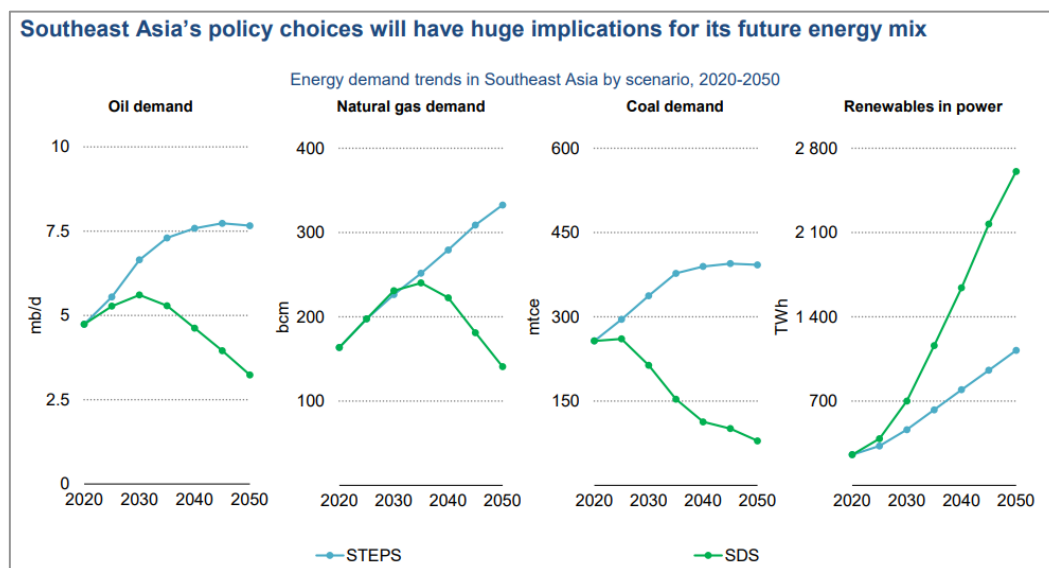
The [Southeast Asia Energy Outlook 2022](#) is the fifth edition of this World Energy Outlook Special Report. Building on its important partnership with Southeast Asia, the IEA has published these studies on a regular basis since 2013. The studies offer insightful prospects for the ten member countries of the ASEAN countries. Since the last edition of this report, the energy prospects for Southeast Asia have been affected by the Covid-19 pandemic, new energy and climate policy commitments and, most recently, high and volatile prices exacerbated by Russia's invasion of Ukraine. Covid-19 led to a major economic shock for countries in Southeast Asia and the economic recovery now risks being slowed by higher energy prices. In the run up to the UN Climate Change Conference (COP26) in November 2021, several governments in Southeast Asia announced ambitious targets for reaching neutrality and curbing reliance on coal-fired power.



Against this backdrop of new uncertainties and ambitions, this report explored possible trajectories for Southeast Asia's energy sector, differentiated primarily by the policies pursued by governments across the region. It relies on the scenarios included in the latest edition of the *World Energy Outlook* and analyses four key areas in depth: investment for the clean energy transition, power sector

decarbonisation focusing on system flexibility, low-carbon fuels, and the supply and demand of critical minerals.

The report stressed that total energy investment would need to reach USD 190 billion a year by 2030 to meet the region's climate goals, up from around USD 70 billion a year between 2016 and 2020. While international development finance is essential, the report says ASEAN members could reduce financing costs and attract private investors by signalling their clear commitment to deploy low-carbon energy and by improving regulatory and financing frameworks.



Southeast Asia Energy Outlook 2022, IEA, 2022

According to the report, Southeast Asia is set to play a major role in global energy transitions as a key supplier of critical minerals and manufacturer of clean energy products. Indonesia and the Philippines are the two largest nickel producers in the world; Indonesia and Myanmar are the second and third largest tin producers; Myanmar accounts for 13% of global rare earth production; and Southeast Asia provides 6% of the world's bauxite. Meanwhile, Malaysia and Viet Nam are the world's second and third largest manufacturers of solar PV modules, while Thailand is the 11th largest car manufacturer in the world and could become a key manufacturing hub for electric vehicles. Investment in mineral exploration has declined in recent years, and the region's share of the global mineral exploration budget has halved since 2012. This trend needs to reverse if Southeast Asia is to realise its potential in this growing sector.

Climate policy in Thailand

The IEA built on work completed in previous years to support Thai policy makers in the design and implementation of climate policies, mindful of the fact that Thailand is currently in the process of adopting its Climate Change Act. Work in 2022 expanded on the analysis conducted over the past two years on carbon pricing and policy integration for the clean energy transition in Thailand, as well as related activities in the Southeast Asia region.

The project leveraged IEA expertise and experience of working on international climate policies not just in Southeast Asia, but also with the OECD membership and among other CETP countries. With this in mind, two analytical reports were prepared:

- A report on the role of tradable certificate schemes in clean energy transitions, which examines best practice elsewhere with a view to its applications in the Thai context.
- A report on measures that have been, or will be, adopted domestically in Thailand to support the clean energy transition.

The reports were produced in co-operation with Chiang Mai University and the Thailand Greenhouse Gas Management Organization (TGO). The reports were reviewed by Thai partners and underwent external peer review with a view to publication in the first quarter of 2023. This work will be used to support the development of policies, most notably in the Thai industrial sector with a possible emphasis on CCUS.

Other outputs included:

- Policy integration studies for TGO, namely the finalisation of two papers on climate and energy policy integration, the first drawing out key lessons from international experience with tradable certificates, and the second a case study on how these lessons could apply in Thailand. Both papers will be published in the second quarter of 2023.
- Technical exchange with Thai stakeholders, in collaboration with TGO, to communicate the findings of the analysis through a workshop and launch event.

ASEAN renewables integration support

CETP funding was used to advance work on the regional integration of the Southeast Asian power system. This was carried out in co-operation with ASEAN and different organisations under it, focusing on building upon previous work on multilateral power trading.

The first output was a review of the ASEAN Interconnection Masterplan Study (AIMS) III Phase 3, where the IEA reviewed the framework and terms of reference for the study. AIMS is led by the ASEAN Centre for Energy (ACE) and establishes the main direction in which the region's interconnections are to be developed, with great potential for increasing the integration of renewables.

The second output focused on supporting the Cambodian ASEAN chairmanship on the topic of developing the capacity of the ASEAN Energy Regulatory Network (AERN). Through a series of three workshops, the IEA shared with AERN members experiences of multilateral power trading across the world through peer-to-peer learning. Each workshop was led by the IEA and delivered by one or more experts from three different regional networks: Central America (26 April), Europe (25 May) and Southern Africa (13 July). The workshops allowed for the private exchange of experiences between these regulators, as well as the establishment of further relations between regional regulators and ASEAN. Each workshop was attended by more than 25 participants, representing the 10 member states of ASEAN. These capacity development events strengthened the knowledge and ability of AERN members to understand the role of the institutions needed to further develop multilateral power trading in Southeast Asia. A final workshop is set to take place in early 2023 as a wrap-up session and a link to further work in the region under the CETP.

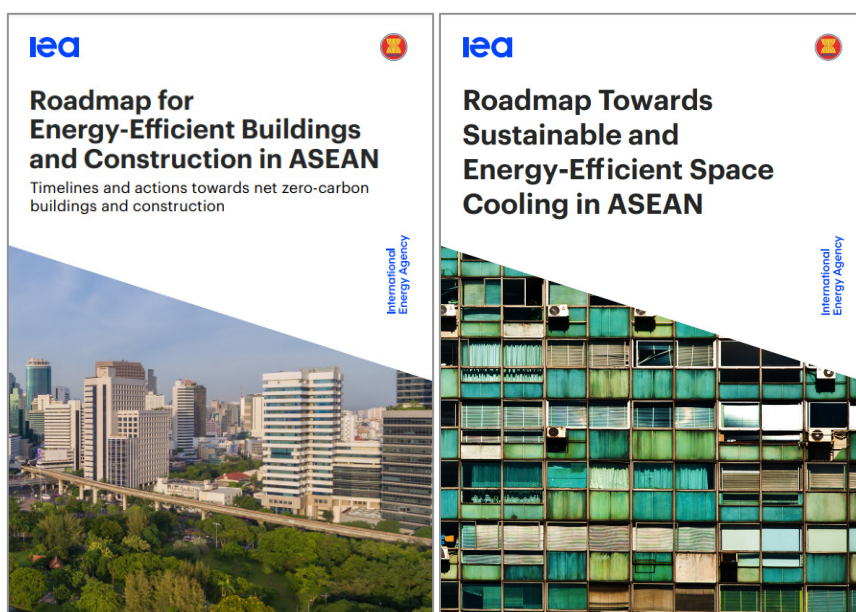
Energy efficiency in Southeast Asia

Energy efficiency in buildings and appliances was a major focus for the ASEAN work plan for the year.

Buildings

The IEA delivered a pair of ASEAN roadmaps in collaboration with ASEAN member states through the Energy Efficiency and Conservation Sub Sector Network, the ASEAN Secretariat and ACE.

The project aimed to help address increasing energy demand and emissions and to improve collaboration between stakeholders in the region. The two roadmaps, the [Roadmap for Energy-Efficient Buildings and Construction](#) and the [Roadmap towards Sustainable and Energy-Efficient Space Cooling](#), were published in April 2022, alongside a launch event co-ordinated by the IEA and ACE, which included presentations by energy efficiency experts from across the ASEAN region.



In October the IEA delivered a presentation on ASEAN roadmaps at a webinar organised by the World Resources Institute (WRI) to discuss decarbonisation solutions for cities. This presentation looked at how Southeast Asian cities can harness building decarbonisation measures to confront the climate emergency.

In partnership with the Carbon Trust and the International Copper Alliance, the IEA contributed to a series of international workshops to catalyse national and regional progress on minimum energy performance standards (MEPS) for the ASEAN Low Carbon Energy Programme.

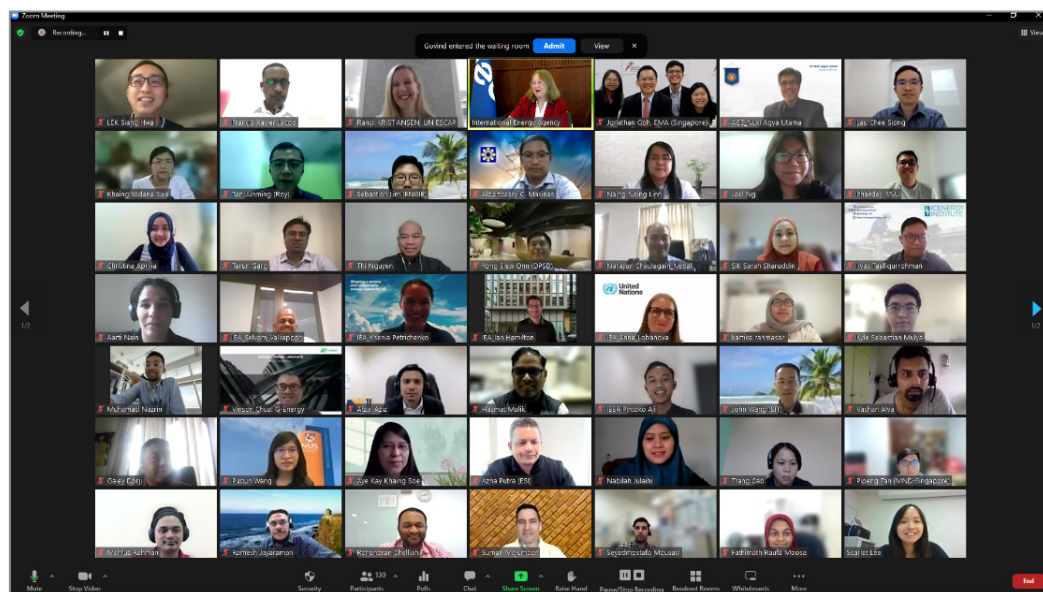
In August the IEA presented at a further webinar organised by the WRI to discuss cooling solutions for building decarbonisation. We presented on cooling policy packages and the multiple benefits of improving the energy efficiency of space cooling that were outlined in the ASEAN space cooling roadmap.

The roadmaps project and the follow-up activities to disseminate and present the roadmaps have helped ASEAN to achieve part of its action plan for energy for 2021-2025, which seeks to develop and implement regional and national policy roadmaps for MEPS and to conduct information sharing on energy efficiency in buildings.

Building upon the recommendations of the ASEAN roadmaps and outcomes of the stakeholder consultations with the representatives of ASEAN member states, the synergies between energy efficiency in buildings and digitalisation were identified as a key area of interest for policy makers.

In this regard, the concept of efficient grid-interactive buildings was identified as a priority for further analytical and policy work in ASEAN. This was the main topic of the [sixth annual training event under the Singapore-IEA Regional Training Hub](#),

which was co-organised by the IEA and Singapore’s Energy Market Authority in July as part of their continued partnership.



IEA. All right reserved.

Screenshot of the first session of the sixth annual training event under the Singapore-IEA Regional Training Hub, 5 July 2022

Over 150 participants from 20 countries attended the training. Around one-third of the participants were from national governments, with around half of these participants being senior officials. Participants expressed high levels of satisfaction with the training – 98% of those who responded to the post-training evaluation survey expressed their satisfaction with an overall score of 80% or higher.

More than 40 experts from the IEA and other institutions supported the training with their expertise through a series of presentations, interactive breakout sessions and assignments. It allowed for the identification of a number of international best practices, case studies and benefits that efficient grid-interactive buildings can offer.

Based on the insights gathered during the training and in collaboration with ACE, we designed a policy-oriented analytical study to inform policy makers of the various opportunities for and barriers to interactivity between efficient buildings and the grid, based on international best practice tailored to the ASEAN context.

We collected data and information for the analysis from secondary sources through desktop research, as well as through a series of interviews with in-country experts on buildings and the electricity sector (at least one expert on each of the topics in each ASEAN country). In total, we interviewed 14 experts for this study.

The draft report is expected to be completed in April 2023 and the preliminary results to be shared with ASEAN stakeholders during a workshop in May. The feedback from this workshop will be incorporated into the final version of the report, which will aim to inform policy makers on how buildings-to-grid interactivity could be incorporated into the policy and project development processes.

In June the IEA co-hosted with the Asian Development Bank a detailed workshop at the Asia Clean Energy Forum, entitled “Energy efficiency for a secure and net zero emissions energy system”. The workshop looked at the role of innovative technologies for improving the energy efficiency of buildings and case studies on different business models.

Appliances

IEA work on appliance efficiency in Southeast Asia focused on market data. We collected market information on the price and efficiency of air conditioners, refrigerators and fans using crowd sourcing techniques with the support of PREMISE. Countries where this information was collected comprised: Indonesia, the Philippines, Thailand, Viet Nam and Malaysia. These data support the understanding of the distribution of new efficient products sold (i.e. tracking the average and best technology over time) as well as the market price versus its efficiency curve. This analysis is being used to influence policy decisions in various countries. To date, the data have been used in the [Energy Efficiency 2022](#) market report, Latin America and sub-Saharan training weeks, and communications with governments participating in SEAD (e.g. Latin America Pathway, ASEAN).

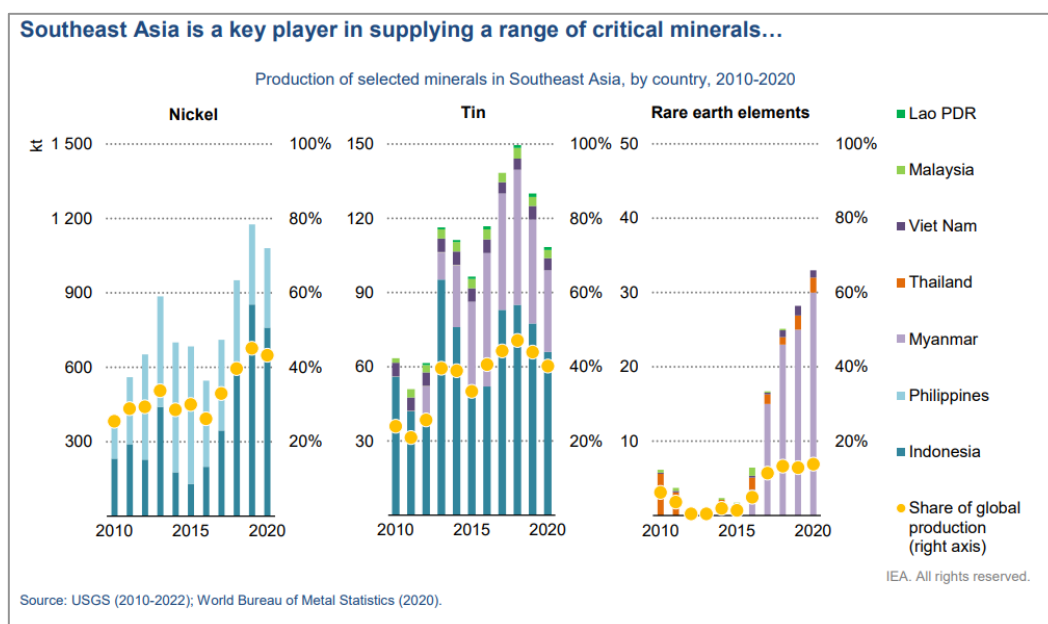
In April the IEA participated in the annual spring Energy Efficiency and Conservation Sub Sector Network meetings and side event on efficiency in the transport sector.

Cross-sectoral

Building on a growing work programme in Southeast Asia, this year the IEA [Energy Efficiency 2022](#) report included a special chapter on the ASEAN region. This chapter of the technical report presented analysis of ASEAN energy use trends, sectoral considerations for energy efficiency, and ways to raise energy efficiency ambition in the region. At the report’s launch event and working party meeting, the IEA presented the special chapter and slides on ASEAN to showcase this regional focus.

Critical minerals in Southeast Asia

Our analysis of the major challenges and tasks facing Southeast Asia in the sustainable development of its resources centred on a dedicated section on critical minerals in the [Southeast Asia Energy Outlook 2022](#).



Southeast Asia Energy Outlook 2022, IEA, 2022

In addition, we organised a series of bilateral discussions with key Asian governments (e.g. India, the Philippines and Indonesia) and other important stakeholders (e.g. the ASEAN Secretariat and Centre for Energy, the UN Economic and Social Commission for Asia-Pacific, the Institute of Energy Economics Japan, and the Korean Energy Economics Institute) to promote knowledge exchange and provide support for policy development. The IEA also participated in region-specific workshops and events to present analysis on the topic.

The [Critical Mineral Policy Tracker](#), launched in November, highlighted prominent policies and regulations already in place in Southeast Asian countries (such as Indonesia and the Philippines) that enhance the security of supply, incentivise new resource development and ensure sustainable and responsible production.

Clean electricity transition in Thailand

Engagement with policy makers in Thailand on the topic of electricity markets began with the analytical IEA report [Thailand Power System Flexibility Study](#), which was published in 2021 and received high-level recognition at the beginning of 2022. In bilateral discussions, the Thai Ministry of Energy and the Electricity Generating Authority of Thailand (EGAT) have cited our analysis of technical and contractual flexibility as an extremely valuable analysis that supports the shaping of the National Energy Plan.

The close co-operation between the IEA and Thai policy makers continued after the conclusion of the study, with the IEA directly supporting policy development in

the country. A joint study programme between the IEA, EGAT and the Thai Ministry of Energy was drafted for 2022-2023, outlining the IEA's support for Thailand's clean electricity transition. In 2022 this included regular exchanges with EGAT and the Ministry of Energy of Thailand, and the provision of articles, reports and recommendations. For example, in the summer we provided a set of recommendations, building on the findings of the flexibility study, as input to the Thai power development plan negotiations. A closed-door meeting was held between the Ministry of Energy, EGAT and the IEA to present the main recommendations and answer questions from Thai stakeholders. The second output of this workstream was a [technical report on the role of hybrid PV technologies](#) in Thailand's power system decarbonisation, published in November.



China

Highlights

- Direct closed-door collaboration on power sector reforms, resulting in remarkable policy impact: IEA recommendations were reflected in China's *Five-Year Plan for Renewable Energy Development*. In addition, references to the IEA were included in five national policy documents on energy and climate, calling for relevant ministries and companies to strengthen co-operation.
- Support for China's Ministry of Ecology and Environment to improve the world's largest emissions trading system, including direct exchanges, publication of [Enhancing China's ETS for Carbon Neutrality: Focus on Power Sector](#) and a closed-door workshop organised in May at the ministry's request to develop further implementation guidance.
- The [8th IEA-Tsinghua Annual Workshop](#) on the near-term policy, technology and financing options for decarbonising space heating.
- Inclusion in the IEA [Energy Efficiency Market Report 2022](#) of an additional China-specific chapter on evolving energy service companies. The IEA has also released an abridged Chinese version of the report.
- Release of [Tracking Clean Energy Innovation – Focus on China](#), an analysis following up on the successful [Energy Sector Roadmap to Carbon Neutrality in China](#). The innovation workstream also included a successful workshop on [Clean Energy Innovation in China: The Road Ahead](#), organised in September with the EU-China Energy Cooperation Platform.

The IEA enjoyed remarkable successes and policy impact in China during the year. Notable examples are the inclusion of IEA policy recommendations in China's *14th Five-Year Plan for Renewable Energy Development (2021-2025)*, and references to the IEA in five national policy documents on energy and climate, calling for relevant ministries and companies to strengthen co-operation. Added to that, numerous high-level exchanges – including at the 2022 IEA Ministerial and COP27 – highlighted the IEA's importance as a knowledge partner and multilateral platform for IEA member engagement with China.

2022 was a challenging year for China, marred by reduced economic growth and energy supply issues linked to extreme weather conditions. As a result of the war in Ukraine and global energy market upheaval, China continued to prioritise energy security, specifically domestic coal mining and thermal power generation to alleviate demand pressure on its grids. At the same time, China continued to lay the policy foundation for its 2060 carbon neutrality goal and introduced

ambitious clean energy targets. Despite these challenges and stringent Covid-19 lockdowns that impeded travel to and from China, the IEA managed to maintain constructive technical exchanges with Chinese counterparts. Chinese ministries and state-owned enterprises reached out to the IEA on numerous occasions for insights on energy market developments. With the relaxation of Covid-19 restrictions at the end of 2022, partners expressed strong interest in resuming in-person engagements in 2023.



IEA. All right reserved.

Dr. Fatih Birol with Minister Xie Zhenhua, Special Envoy for Climate Change, Ministry of Ecology and Environment of the People's Republic of China, at COP27

Energy efficiency in China

The IEA continued its close co-operation on energy efficiency with China's National Development and Reform Commission (NDRC) in accordance with the joint memorandum of understanding signed in October 2018.

In a [bilateral meeting in January 2023 between IEA and the NDRC Department of Resource Conservation and Environmental Protection](#), both sides outlined their commitment to continued co-operation on joint research, policy dialogue, experience sharing and capacity building on energy efficiency. This included exploring opportunities for joint analysis on the role of energy efficiency in implementation of China's policy framework to achieve carbon neutrality and for

carbon emissions to peak at the sector level, and furthering co-operation on energy efficiency indicators and training.

Building on the 2021 report [An Energy Sector Roadmap to Carbon Neutrality in China](#), the IEA engaged with national and sector-specific players to deepen understanding of the role of energy efficiency in delivering peak-carbon and carbon neutrality targets. In particular, this focused on the buildings and heating sectors, but also explored closer engagement on efficient appliances and industry.

COP27

In November the IEA supported a COP27 China Pavilion Event on the forthcoming *China Energy Transformation Outlook 2023*, organised by NDRC Energy Research Institute (ERI). Our participation in an expert panel discussion provided the opportunity to engage with experts, including those from the NDRC, NDRC ERI and the Chinese Academy of Sciences to understand the analysis and priorities in the report and highlight the importance of energy efficiency to China's energy transition. Following this opportunity, we have been in discussion with NDRC ERI on how to provide input to future versions of the outlook.



IEA. All right reserved.

*Event on the China Energy Transformation Outlook 2023 at
COP27 China Pavilion, November 2022*

8th IEA-Tsinghua Annual Joint Workshop

In October the IEA organised a successful 8th IEA-Tsinghua Annual Workshop on the near-term policy, technology and financing options for decarbonising space heating. The online public workshop attracted over 200 participants, with expert

speakers from the IEA, the NDRC, Tsinghua University, Chinese National Institute of Standardisation, the Danish Energy Agency, the Japan Building Research Institute and the German Energy Agency.

During the workshop NDRC Energy Conservation Division Director, Kun Qin, highlighted the important role of the workshop as a platform for sharing key policies and technologies available to reduce buildings sector emissions.



IEA. All right reserved.

8th IEA-Tsinghua Annual Joint Workshop, October 2022

This workshop and the direct support provided by partners also allowed the IEA to collect up-to-date information on trends and developments in the Chinese heat pump market, which provided valuable inputs for the forthcoming reports, [The Future of Heat Pumps](#) and [Energy Technology Perspectives 2023](#).

Energy Efficiency Market Report

In March the IEA produced an [abridged Chinese version](#) of its [Energy Efficiency Market Report 2021](#) in an article in *Chinese Investment Magazine*, entitled “[Investing in efficiency: key for carbon neutrality and economy](#)”. The article was posted on the official Wechat account and shared with experts from stakeholders including Tsinghua University and the Chinese National Institute of Standardisation.



In November support from China's Energy Management Conservation Association helped the IEA to draft a section for [Energy Efficiency Market Report 2022](#) entitled "China continues to drive global growth in ESCO market". Additional analysis was drawn from a prior August 2021 report entitled [Evolving Energy Service Companies in China](#).

Electricity security

The IEA continued to engage with China to support its power sector reforms, with a focus on the national guidance to establish a unified national electricity market system (Document No. 118), released by the NDRC and National Energy Administration (NEA) in January 2022. The IEA hosted two webinars that fed into ongoing work on power markets in China. A report is planned for publication in 2023. As a result of this engagement, the IEA was invited to deliver keynote speeches on the topic at several events hosted by Chinese entities and international partners. This should support a consistent programme of work for the next two to three years with the NEA and other Chinese institutions.

September saw the third webinar on China's power sector transformation, co-hosted by the IEA, the China Electric Power Planning & Engineering Institute, the

Danish embassy in Beijing, the Danish Energy Agency and GIZ, with support from the European Commission. The focus was on markets, articulated around the following high-level questions: What are the key components of electricity security throughout the transition, amid the growing uncertainties on international markets? How is flexibility ensured in a system with a high share of variable renewables, like wind and solar power? How will power markets enable a secure, clean energy transition? What are the options for implementing a unified system of power markets? How is carbon pricing supporting a secure, clean energy transition?

In December we co-organised a closed-door workshop with Chinese experts on the role of spot markets in China's unified power market framework. Discussions centred on the target market design models proposed by the IEA and other possible options, the transitional steps from today's status quo towards the possible target models, and the role of various stakeholders and the impacts of the markets on them.

Renewable energy policy

The IEA continued to co-operate with China on renewable energy policies throughout 2022. This close dialogue with the Chinese administration built upon our successful co-operation during 2021 and resulted in a virtual IEA-NEA closed-door workshop on renewable energy policy in January 2023.

This co-operation is well established and reflected in the Chinese policy making process. Previously, the NEA has acknowledged the IEA's contribution to renewable energy policy development in China in a letter from the Director General of the New and Renewable Energy Department, Mr Li Chuangjun. He stated that, "The policy recommendations put forward by the [IEA] study not only draw on the advanced experience and practices of relevant countries, but also are tailored to the context of China's renewable energy sector, therefore providing reference significance for further enriching and improving the coming *14th Five-Year Plan on Renewable Energy Development*". The first joint workshop organised by the IEA and NEA at the end of 2021, on renewable electricity support policies and development, the application of renewable energy in the transport sector, and renewable energy for heating in China, prepared the ground for both continued dialogue and policy results in 2022.

When the *14th Five-Year Plan for Renewable Energy Development* was published in June 2022, the IEA was humbled to see various recommendations provided by our study and during the workshop reflected in the law. The most notable recommendation taken on board in the *14th Five-Year Plan* is that for the first time China did not publish technology-specific capacity targets, but instead proposed absolute renewable electricity generation and share targets – with comparable shares to those proposed by the IEA, in particular for solar and wind.

The second main area was to introduce targets for non-electricity sectors. For the first time, China proposed an overarching goal for the heating sector to replace 60 Mt of standard coal consumption with renewable energy sources including biomass, geothermal and solar thermal. In our report we stated: “China should consider a package of strategic policies to accelerate renewable heat deployment in buildings and industry in line with the China’s net zero target by 2060”. The IEA report had suggested 58 Mt of coal equivalent growth of renewable heat in the period 2019-2025 would be required to achieve China’s long-term climate goals. The actual plan published by China included a heat-specific target close to the IEA analytical output.

The third most notable area related to recommendations to move from a subsidy-driven to a more market-oriented power system, including through the implementation of renewable portfolio standards with a green certificate system and a floor price. The *14th Five-Year Plan for Renewable Energy Development* foresees the following policy goals by 2025:

- Accelerate large-scale renewables deployment
- Increase the share of renewables in overall energy demand growth, not only in electricity
- Shift from subsidy-oriented to market-oriented renewable deployment with a fixed price for the purchase of renewable electricity
- Promote a stable and secure electricity system

The other main areas of renewable energy policy in which the plan takes account of the IEA’s policy recommendations to some degree include:

- Actively promote distributed solar PV and wind
- Introduce renewable portfolio standards, green certificates and carbon markets
- Increase interministerial and regional co-ordination
- Achieve cost reductions for renewable electricity technologies
- Upgrade renewable energy equipment
- Increase the focus on bioenergy and its sustainability
- Expand renewable heat

The close dialogue with Chinese partners continues. In the latest workshop held in January 2023, the NEA confirmed its interest and willingness to continue discussions on some of these areas in more detail in 2023. The focus will be on market-oriented incentives for renewable power and on bioenergy.

Carbon pricing in China

The CETP enabled the IEA to provide ongoing support for China's Ministry of Ecology and Environment (MEE) to improve the world's largest ETS. This support – and that of others – resulted in MEE publishing a [significantly more ambitious draft allowance allocation plan](#) for the compliance period 2021 and 2022.

Publication of [Enhancing China's ETS for Carbon Neutrality: Focus on Power Sector](#) with Tsinghua University took place in May, advising China on enhanced ETS design options that could, together with existing renewable energy policies, align its electricity sector with its carbon neutrality target. The report launch event attracted about 2 300 viewers and was presented at several subsequent events including at a COP27 China Pavilion side-event. The report was widely read by the MEE and helped it to communicate plans to expand the ETS to industry and consider the introduction of auctioning emissions allowances. It was also covered by media outlets including [S&P Global](#) and [Carbon Brief](#). Interest in the project and report findings has led to invitations to present at various internal and external events, including at the IEA's third webinar on China's Power Sector Transformation, and a Forum on Integrated Energy Systems with a High Proportion of Renewable Energy, organised by China's State Grid Economic and Technological Research Institute, which attracted 300 000 viewers.

Key findings and recommendations from the report were earlier discussed directly with MEE policy makers in February; they welcomed the findings and requested further inputs from the IEA for policy implementation. Following the publication of the report, the MEE and affiliated researchers started communicating more actively – despite a serious economic downturn in China – on plans to expand the ETS to industry and introducing auctioning before 2025. In addition, it helped the MEE publish a [significantly more ambitious draft allowance allocation plan](#) for the compliance period 2021 and 2022. At the meeting with the IEA's Deputy Executive Director during COP27, Director General Li Gao emphasised the strong importance the MEE attaches to continued collaboration with the IEA and welcomed further IEA input on ETS.



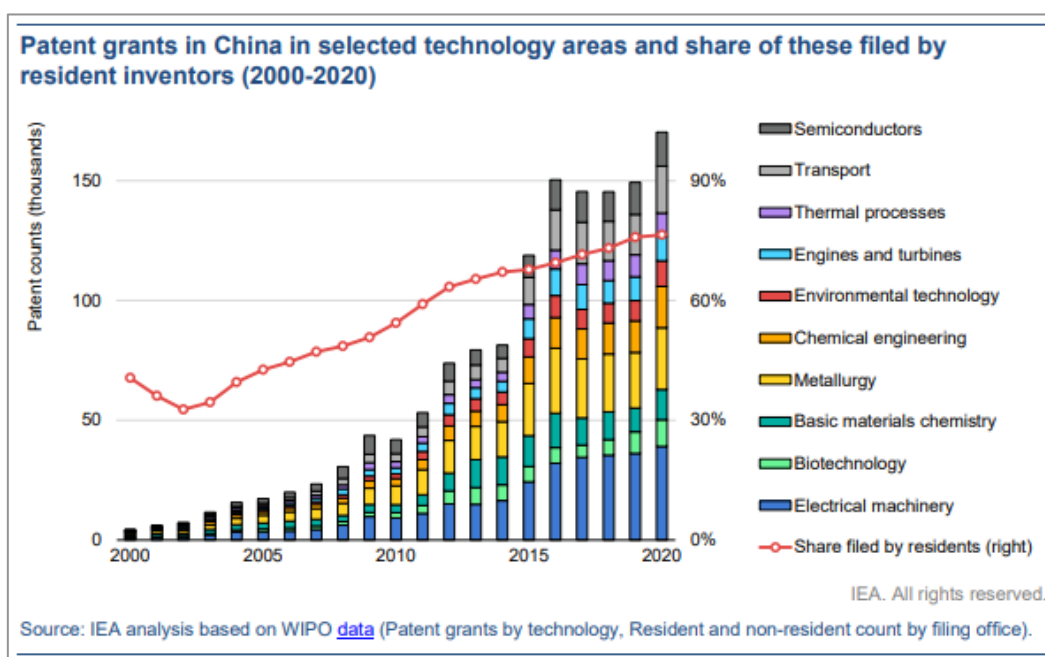
Following a request from the MEE on experiences of allowance auctioning in other ETSs worldwide, the IEA used its convening power to organise together with Tsinghua University a closed-door workshop in May 2022. The workshop allowed the sharing of international experiences on introducing allowance auctioning in an ETS. The workshop was opened by the MEE and benefited from the participation of China's National Center for Climate Change Strategy and International Cooperation, Shanghai Energy and Environment Exchange, China's national ETS Registry, policy makers from the European Union, Korea, New Zealand and Massachusetts, and selected Chinese and international experts. It also served as input to the report *Enhancing China's ETS for Carbon Neutrality: Introducing Auctioning – Lessons from International Experience*. This report provides detailed knowledge and recommendations for Chinese policy makers on the design and implementation of auctioning as well as the use of auction revenues. The report was finalised in 2022, with a consultation meeting with the MEE and publication planned in Q1 2023.

Overall, the project is continuing to contribute to greater availability of evidence and options for strengthening China's national ETS, enabling the MEE to publish and implement more ambitious ETS regulations. The project also facilitated the participation of high-level Chinese researchers and business executives at the [22nd IEA-IETA-EPRI GHG Emissions Trading Workshop](#). The project's outputs have also attracted interest from other international organisations including the European Commission, World Bank and IMF, who referenced the IEA's China ETS publications in exchanges with and recommendations to China. The IMF is, for example, planning to draw on the IEA's China ETS publications in its upcoming [2022 Article IV Consultation](#) with China.

Innovation policies in China

Building on the 2021 report [An Energy Sector Roadmap to Carbon Neutrality in China](#), which proposes a path for China to achieve its peak-carbon and neutrality goals, the IEA released a complementary analysis in March 2022 focusing on China's clean energy innovation landscape. [Tracking Clean Energy Innovation – Focus on China](#) maps the institutional and policy landscape for clean energy innovation in China and shows trends for selected metrics to track and explain progress on technology development. Both reports benefited from the inputs and reviews of Chinese experts, academics and government officials.

The innovation report finds that in the last 20 years China has strengthened its position on the global stage as an energy innovator, as illustrated by the stories of solar power and, more recently, electric mobility. This is the result of several decades of increasing policy focus on technology innovation, which underpin China's ambitions to become a producer of knowledge and foster innovation-driven socio-economic development.



Tracking Clean Energy Innovation – Focus on China, IEA, 2022

In September 2022 the IEA co-organised a seminar entitled [Clean Energy Innovation in China: The Road Ahead](#) with the EU-China Energy Cooperation Platform to present the main findings of the report and discuss with Chinese and European experts from government, academia and business the policy and technology priorities and opportunities in the 14th Five-Year Plan period (2021-2025). The event was well received and attracted attention from policy makers from across China and Europe.

Brazil

Highlights

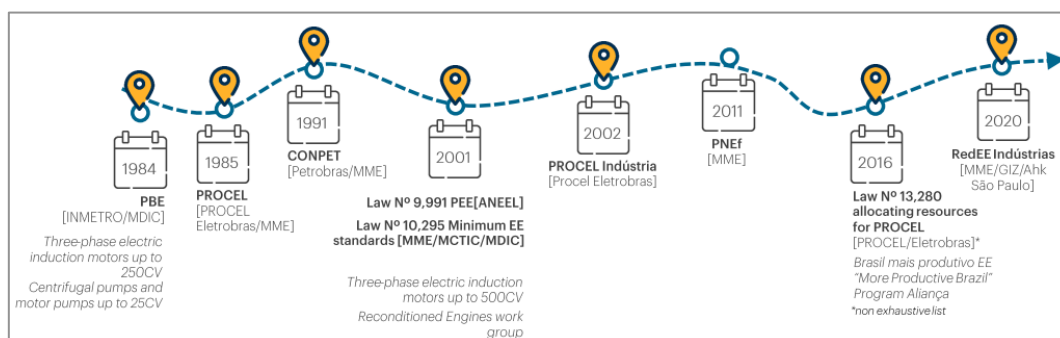
- Work on technology innovation that was instrumental in reshaping and emphasising clean energy research in Brazil. It has also informed the revision of a federal law on R&D spending obligations. Brazilian partners confirmed that this work has spearheaded institutional change and created a more robust framework for long-term clean energy innovation spending.
- Close collaboration on the energy efficiency benchmarking of key sectors and recommendations on how to further improve energy efficiency and decarbonisation pathways with the Energy Research Office (EPE), an official think tank of the Brazilian government.
- Release in early 2022 of the [Atlas of Energy Efficiency in Brazil 2021](#), which included a special chapter on freight transport, and release of [Pulp and Paper Industry in Brazil and in the World](#) – both publications developed jointly with the EPE and the relevant sectors with high potential for decarbonisation.

Energy efficiency in Brazil

The IEA continued its fruitful collaboration with the Energy Research Office (EPE) to develop international benchmarking analysis of Brazil's key sectors and recommendations on how to further improve energy efficiency and decarbonisation pathways. The [Atlas of Energy Efficiency in Brazil 2021](#), published in early 2022, included a special chapter on freight transport, which builds on a [dedicated analysis of the sector](#) developed a few months earlier. The IEA also published a joint report with EPE, [Pulp and Paper Industry in Brazil and in the World](#), looking at the main attributes and recommendations for the sector based on Brazilian and international experience. Brazil is the second largest pulp producer in the world after the United States, accounting for more than 11% of global production, and is one of the world's top exporters. In 2020 pulp and paper production accounted for 16% of final industrial energy consumption in the country, well above the 5.3% share that the industry consumes at a global level. This makes it a crucial sector for Brazil's efforts to use energy more efficiently and reduce emissions.

Both reports represent an important ongoing collaboration to identify opportunities to advance efficiency in key sectors in Brazil, involving ongoing dialogue with EPE, the Ministry of Mines and Energy and industry associations.

The IEA worked with the Ministry of Mines and Energy and the National Energy Conservation Programme (Procel) to finalise a template to track the benefits of energy efficiency programmes in buildings, including job creation, water, energy and financial savings, and improved health and well-being. The template will strengthen programme evaluation to provide data on the benefits of energy efficiency in priority areas.



Source: EPE. Images ; Icons made with Freepik.

Main highlights of energy efficiency policies related to the industrial sector.

Atlas of Energy Efficiency Brazil 2021, Indicators report

With the support of the CETP, the IEA deepened its engagement with the Brazilian power regulator ANEEL on the topic of digitalisation and the link with distribution network operations and demand-side management. The dialogue has been timely, given the tremendous growth of PV on the Brazilian power system, the hydrological crisis in late 2021 and early 2022, and the need to consider how to strengthen the visibility and responsiveness of distributed resources. These will continue to be frontline issues, with strategies being developed in 2023 and beyond.

Innovation policies in Brazil

The highlights of our innovation work included the delivery to the Brazilian government of a requested report on tracking clean energy innovation in the business sector, and a series of meetings that created new connections among clean energy innovation policy experts in emerging economies. These two activities culminated in discussion sessions on innovation policy and tracking in emerging and developing economies at the Global Clean Energy Action Forum in Pittsburgh in September 2022. Presentations from Brazil, India and Morocco and on Nigeria placed the topic on the agenda for MI and CEM delegates for the first time.

The IEA's work across these topics in Brazil was rewarded by high-level engagement and had a notable impact on strategic direction among IEA member countries: the IEA Committee on Energy Research and Technology (CERT)

2022-2027 revision of the *IEA Medium-Term Strategy for Energy Research and Technology* undertakes to “continue to engage with key emerging market and developing economies, providing a joint platform for knowledge exchange and collaboration as well as for collecting and sharing information on their RD&D priorities and spending in those countries...” and to “continue the implementation of the revised TCP Action Plan, and its five action areas [including] engagement with emerging economies and the private sector”.

The work on technology innovation has received high-level appreciation in Brazil and was instrumental to a variety of important developments in the country. In particular, the work under the CETP that supported the development of Brazil's INOVA-e platform received recognition from partners in the Brazil's Energy Research Office. At a workshop organised in September in Brussels to review and close a three-year project “Clean Energy Transitions in Emerging Economies” delivered as part of the CETP, Energy Research Office representative described how co-operation with the IEA led to the formation of a network of government stakeholders in Brazil that support clean energy innovation policy and budgets to an unprecedented degree. He also commented on how the results of the project are used for priority setting, using the platform INOVA-e as an example which, among other data, shows the amount of investment in RD&D in Brazil across the years as a percentage of GDP. Based on this information, the government of Brazil decided to drive those funds towards clean energy investment. Additionally, thanks to co-operation on the INOVA-e platform, Brazil became the first non-IEA member to submit R&D spending data to the IEA.

Electricity in Brazil

Since Brazil activated its association status in 2017, and in response to a request from the Brazilian Deputy Minister of Mines and Energy, the IEA has provided broad policy support to new regulatory developments in the Brazilian power sector. In 2022, at the request of the Ministry of Mines and Energy, the IEA organised a series of closed-door technical exchanges on electricity tariff reform, which aims to ensure a closer linkage between tariff adjustments and the actual purchase of wholesale electricity, thereby improving the conditions for incorporating variable renewable energy into the system. The IEA responded to an information request from a director at the Ministry of Mines and Energy to understand how other countries across Asia, Latin America and North America are use regulated tariff design to protect customers from volatility while limiting the financial exposure of regulated utilities. We collected and presented experiences from countries that have increased the frequency of updates to the regulated cost components of their tariffs and used tolerance bands for price increases. The findings from this comparative analysis are being used to complete the ministry's regulatory impact assessment.

The CETP activities also informed the ongoing revision of Federal Law 9.991/2000 on R&D spending obligations of the electricity regulator ANEEL in Brazil. The IEA and ANEEL co-operated on the topic of metrics for impact evaluation. ANEEL has drafted the update and is expected to publish the four-year Strategic Innovation Plan in 2023.

Latin America

Highlights

- The IEA played a prominent role in the Energy Week held by the Latin American Energy Organisation (OLADE) in Panama. Our contribution to Panama's energy transitions was recognised with an official award granted by the government.
- The Ministry of Energy of Chile invited the IEA to provide inputs to its recently created working group on energy poverty. The group is responsible for formulating a medium-term plan to tackle issues of energy quality and affordability and access to clean energy services, as well as energy subsidy reform.
- The IEA [Critical Minerals Policy Tracker](#) highlighted prominent policies and regulations already in place in eight Latin American countries – Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Mexico and Peru – to enhance security of supply, incentivise new resource development and ensure sustainable and responsible production.
- The Central American Integration Organisation adopted a regional appliance standard for air conditioners, a process informed by the IEA's previous participation in the Technical Working Group on Energy Efficiency.
- A highly successful Latin America Energy Efficiency Policy Training Week saw about 1 700 people participate in the launch event and 139 people from 23 countries complete the 20-hour training.

RD&D data in Latin America

On 5 September, in collaboration with the UN Economic Commission for Latin America and the Caribbean, the Brazilian Ministry of Foreign Affairs, the EPE, the Center for Strategic Studies and Management and the Chilean Ministry of Energy, the IEA organised a webinar on enhancing public RD&D data collection with a focus of Latin American countries' experiences. As well the organisers, speakers included representatives from the European Commission and MI. The webinar increased regional engagement on the collection of public RD&D data and allowed the exchange of experiences on the status and processes of mapping innovation in clean energy.

Critical minerals in Latin America

As part of our regional work on critical minerals, the IEA finalised a preliminary analysis of selected Latin American countries' production of critical minerals for the energy transition (e.g. lithium, nickel, graphite and copper) and identified the sector's opportunities and barriers. This analysis, together with a series of bilateral engagements with the governments of Argentina, Brazil, Chile and Colombia, fed into the commentary *Latin America's Opportunity in Critical Minerals for the Clean Energy Transition* (forthcoming). The commentary summarises the key environmental, social and governance (ESG) issues around critical mineral production in Latin America and the challenges of developing critical mineral resources in a sustainable way that brings benefits to all its people while supporting global clean energy transitions.

The first release of the [Critical Minerals Policy Tracker](#) in November 2022 highlighted prominent policies and regulations already in place in eight Latin American countries (Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Mexico and Peru) to enhance security of supply, incentivise new resource development and ensure sustainable and responsible production.

In November the IEA organised a high-level round table on the margins of the 2022 EU–Latin America Convention on Raw Materials, in Santiago de Chile, hosted by the European Commission. The convention brought together participants from governments, geological agencies, industry and researchers in the European Union and Latin America under the overarching theme “Mineral Raw Materials for the Clean Energy Transition”. Over 150 people joined in person and a similar number attended virtually. Chile's Mining Minister, Marcela Hernando Pérez, opened the event.

On the first day the IEA hosted a roundtable focused on “Mobilising Investment in Sustainable Critical Mineral Value Chains”. The session was moderated by one of our senior energy analysts, with virtual opening remarks from IEA's Chief Energy Economist, Tim Gould. The panellists were Lilia Mascarenhas (Secretary of Geology, Ministry of Mines and Energy, Brazil), Pamela Morales (Undersecretary for Mining Development, Ministry of Economy, Argentina) and Ariel Yopez (Infrastructure and Energy Sector Manager, Inter-American Development Bank). The panellists highlighted the importance of the session's theme – mobilising investment – and stressed the need to build the mid- and downstream value chain beyond mining, having a stable regulatory framework to attract investment and strengthening institutional capacity, among others. An IEA representative also participated in a session on “Analysis of critical raw materials for the energy transition” and presented the IEA's latest analysis on critical minerals, including

key findings from a dedicated chapter in [World Energy Investment 2022](#) and the [Critical Minerals Policy Tracker](#). The session was also joined by panellists from EC JRC, BRGM (France) and DERA (Germany).

Energy efficiency in Latin America

A highlight of the IEA's activities in Latin America in 2022 was the successful realisation of the [Latin America Energy Efficiency Policy Training week](#) in virtual format. The training week was organised in partnership with the Secretariat of Energy of Panama, Development Bank of Latin America (CAF), and World Bank Energy Sector Management Assistance Programme (ESMAP). The week kicked off with a [high-level launch event](#) that featured leading voices in the region, including government officials, private-sector actors and youth leaders. About 1 700 people connected to the launch event and 139 people completed the 20-hour training, which covered three parallel course streams: buildings, appliances, and indicators and evaluation. Participants came from 23 countries, with nearly half representing national and subnational governments in the region.

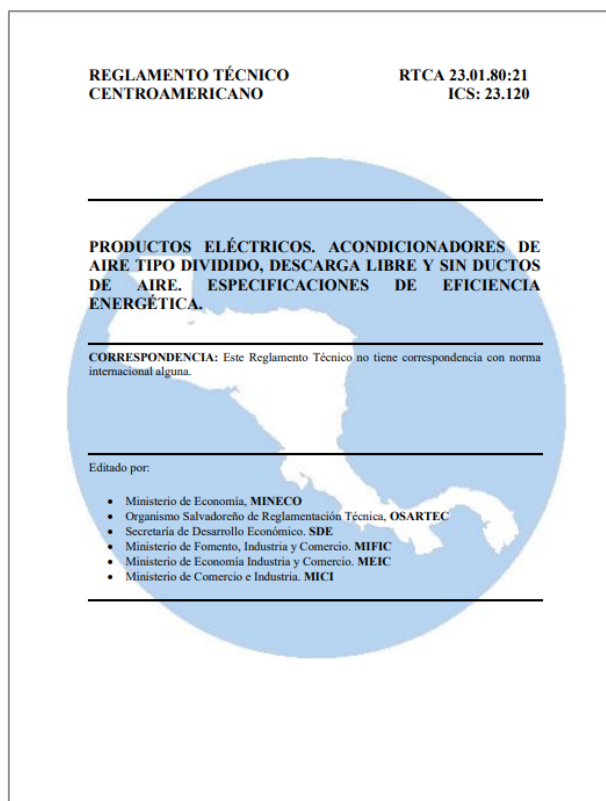
The training week served to provide capacity building, policy exchange and the advancement of ideas to strengthen energy efficiency across key sectors in the region. The quality of the participants and engagement was supported by strong co-operation with regional partners and stakeholders. The courses benefited from lectures and group work led by regional experts, further strengthening learning and advancing relationships.

The IEA continued its webinar series in the region with two webinars co-organised with the Secretary of Energy of Mexico (SENER) and National Commission for the Efficient Use of Energy (CONUEE). The IEA presented highlights from the [World Energy Outlook](#) and [Energy Efficiency Market Report](#). Together, 741 people in the region attended the webinars.

The IEA joined forces with the Swiss Agency for Development and Cooperation (SDC) to advance policy dialogue and planning in the region on energy efficiency in buildings. The IEA participated in a two-day in-person workshop to support the [development of net zero building roadmaps](#) for academia, local government and the private sector in Ecuador. The IEA drew on its experience of developing and supporting implementation strategies for the *Mexican Roadmap for Buildings and Construction*. The IEA further recorded a lecture for an [international online course on Net Zero Buildings](#) in November 2022, and is co-operating with the SDC, Colombia Green Building Council and the University of the Andes in organising a two-day in-person regional training course on the topic in 2023.

The IEA continued its co-operation with SICA, the Central American Integration Organisation, which is developing regional appliance standards. This included a presentation on energy efficiency in water pumping systems to support

discussions on the benefits and opportunities to develop regulations in this area. It is worth noting that SICA adopted a regional [energy efficiency standard](#) for air conditioners in 2022, a process that the IEA helped inform through its co-operation with the Technical Working Group on Energy Efficiency in 2021.



On 30 May, as part of the Digital Demand Driven Electricity Networks (3DEN) initiative delivered under the CETP, the IEA organised a webinar on [Distributed Renewable Energy and the Digital Transformation of Energy Systems – Challenges and Opportunities for Latin America](#). The webinar was structured around two panels: the first, focusing on the private sector, presented international experiences with using digital solutions to optimise distributed generation; and the second focused on regulators from Latin America, who discussed practical challenges and opportunities. Regulators from Argentina, Brazil, Chile and Colombia participated in the panel discussion sharing their experiences. The webinar also helped strengthen awareness of the importance of digital technologies aimed at supporting the visibility and controllability of distributed energy resources for the massive roll out of distributed solar PV. The webinar was attended by over 100 participants and received excellent feedback from participating regulators. As a result of the event, the Argentinian Association of Regulators (ADERE) is considering joining RETA.

Stakeholder engagement, knowledge sharing and dissemination in Latin America

Over the course of the year, the IEA organised a series of in-person, virtual and hybrid events to disseminate the results of the work that has been made possible by CETP funding. These events helped inform governments and stakeholders in the energy ecosystem across the region of the latest trends, technological innovations and market developments in the global energy sector. Moreover, the IEA organised four co-ordination meetings in Mexico City, Brasilia, Buenos Aires and Santiago with representatives from the embassies and co-operation agencies of CETP donor countries. These meetings allowed us to create synergies and avoid duplication between IEA work and energy co-operation activities that CETP donor countries are deploying locally.

Hydrogen

Building upon the success of the [Hydrogen in Latin America](#) report launched in 2021, in 2022 the IEA continued to engage with energy ministries across the region to support the design and implementation of their national hydrogen strategies. Over the course of the year, the IEA organised hybrid technical sessions with the governments of Argentina, Brazil and Chile to disseminate the main findings of the [Global Hydrogen Review 2022](#) and discuss the policy-making challenges that countries are facing locally. These sessions enhanced government officers' knowledge of the latest hydrogen developments, including the state of play of pilot projects, variations in demand and production, trade agreements and the cost of electrolyzers.

In Argentina, director- and senior-level representatives from three different authorities joined the session: the Development Secretariat, the Energy Secretariat and the Ministry of Economy. The Argentinian government stated that IEA data on global hydrogen trends helped inform their hydrogen strategy making and invited the IEA to present its analysis before the Interministerial Roundtable on Hydrogen in 2023.

In Brazil the IEA contributed to a hybrid training event convened by the Federal Public Administration School (ENAP), which mobilised 160 government officials from both federal and state governments. The presentation fed into a wider capacity-building programme for Brazilian public servants aimed at enhancing their knowledge of and technical capacity for low-carbon hydrogen.

The session in Chile was hosted by the Chilean Economic Development Agency (CORFO) and was combined with a presentation by the IEA on how governments can support clean energy start-ups. CORFO is the leading institution promoting entrepreneurship, innovation and competitiveness in Chile. It has also been at the forefront of boosting clean energy innovation in the region, supporting energy

start-ups through its flagship incubator “Start-up Chile” and an open call to fund green hydrogen projects. CORFO welcomed the IEA’s presentations and expressed its interest in IEA support and input during the open calls for energy innovators, due in 2023.

Methane

Thanks to the CETP’s continued support of the IEA’s work on methane, we organised a virtual dissemination event for the Spanish version of the report [Driving Down Methane Leaks from the Oil and Gas Industry: A Regulatory Roadmap and Toolkit](#) for a Latin America audience, a leading region for oil and gas production. The IEA estimates that across Central and South America around 45% of oil and gas production emissions can be abated at no net cost, substantially reducing the environmental impact of this sector’s emissions.



The webinar attracted over 50 participants and gathered experts from Colombia, Mexico, Argentina and the United States, who explored how policy and regulation can drive emissions reduction in the region and how voluntary actions by the industry can complement these efforts.

OLADE

The IEA also played a prominent role in the Energy Week held by the Latin American Energy Organization (OLADE), which took place as a hybrid event in Panama during 12-16 December. The OLADE Energy Week positions itself as one of the major sectoral conferences in the region. For the 2022 event it convened on-site government ministers and high-level government representatives from 21 OLADE member countries and over 2 173 civil servants (both virtually and in person).

Four IEA officers participated in events on low-carbon hydrogen, energy efficiency, long-term energy outlooks and critical minerals for the energy transition, sharing key findings from the IEA's analytical work enabled by the CETP. The IEA's Deputy Executive Director took part in the 52nd OLADE Ministerial Meeting opening, where she had the opportunity to provide input on energy security, just energy transitions and the growing engagement of the IEA in Latin America. In front of the gathering of Latin American ministers, Panama handed over an award to the IEA in recognition of its contribution to the country's energy transition.

People-centred energy transitions

Given the expertise that the IEA has developed in recent years on people-centred energy transitions, an emerging stream of work largely supported by CETP funding, the Ministry of Energy of Chile invited the IEA to provide inputs to its recently created working group on energy poverty. This has been tasked with formulating a medium-term plan to tackle issues of energy quality and affordability and access to clean energy services, as well as energy subsidy reform. In the second half of 2022 the IEA participated in two sessions of the working group, which gathers director-level representatives from three different ministries (Ministries of Energy, Finance, and Social Development and Family) and the Mining and Energy Commission of the Senate. The IEA presented its findings on energy poverty indicators and energy poverty measurement, and mobilised experts from Colombia and Mexico to share experiences on energy subsidy reform and enhancing energy subsidy targeting. The government of Chile has expressed its appreciation for the IEA's contributions to their policy making on energy poverty and requested that this collaboration continue in 2023.

Africa

Highlights

- Publication of the [Africa Energy Outlook 2022](#), which presented the first ever Sustainable Africa Scenario, exploring cost-effective pathway to reach universal electricity and clean cooking access and fulfil all African climate pledges in full and on time.
- Release of the [Clean Energy Transitions in the Greater Horn of Africa](#) at a joint event in Uganda with the Ugandan Ministry of Energy and Mineral Development. The report was based on the most comprehensive data collection for the region to date and the development of specific regional scenarios, with strong emphasis on collaboration amongst experts and policy makers in the region.
- Continued support for the development of policies for clean transitions in energy producer economies in Africa, with a special focus on natural gas, as well as carbon capture, utilisation and storage policies in Senegal, Nigeria and South Africa.
- Direct input into energy efficiency incentive measures developed in South Africa by the Department of Mineral Resources and Energy. This is part of our ongoing policy support, first to develop the national energy efficiency strategy, then to carry it out, and now to review it.
- Highly successful regional training on energy efficiency policy packages for sub-Saharan Africa, with the participation of nearly 300 policy makers from the region.

Despite being home to almost one-fifth of the global population, sub-Saharan Africa is the least studied region with regard to its energy systems. The IEA has a long history of working with the region, having started two decades ago the annual collection of country-by-country data on electricity access. Ever since, Africa has been integral to the IEA's work: in our analysis, such as the annual *World Energy Outlook* and *World Energy Investment Report*; in our engagements and capacity-building programmes; and through the IEA's increasing role in convening global energy leaders to achieve clean energy transitions and universal access simultaneously.



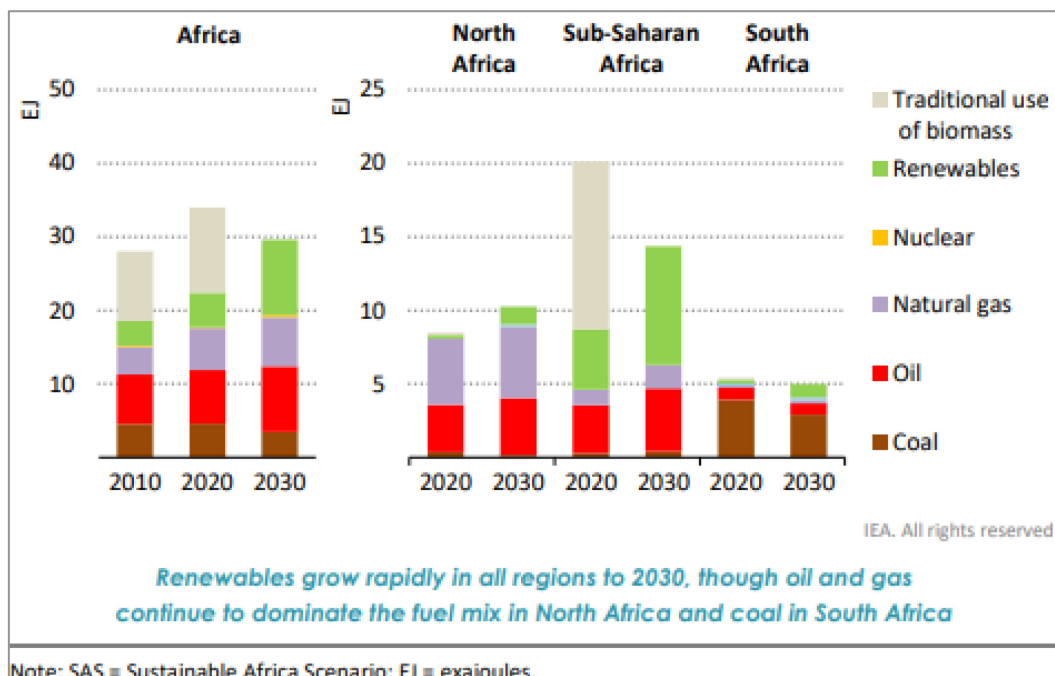
Africa Energy Outlook 2022

The IEA issued a new flagship WEO Special Report on Africa, which explores a Sustainable Africa Scenario, which meets all African climate and access targets on time and in full, while reflecting the new context of the global energy sector related to the global energy crisis and an accelerated transition to clean energy. This new report was developed to support African countries identify options and financial strategies for reaching their own goals, focusing on actions needed during the coming decade, while balancing the increasing economic strains they face due to the crisis

The [Africa Energy Outlook 2022](#) was produced in co-operation with the African Union Commission, the UN Economic Commission for Africa, and more than 20 African experts from 15 different countries. The outlook provided an important analytical grounding for African countries in the lead up to the African COP27 hosted in Egypt, and its analysis featured in a number of African initiatives launched at the COP, including the Egypt-led initiative, the [Africa Just and Affordable Energy Transition Initiative](#).

The IEA report is already figuring heavily in investment and portfolio decisions at development agencies, multilateral development banks, project developers and commercial banks, notably informing investments in the power sector, especially for reaching universal access, and for natural gas, where the report helped draw brighter lines around the use of natural gas for domestic development in Africa in

light of global ambitions to reach net zero. This work has prompted a number of additional requests from governments for deeper collaboration on regional or country-specific roadmaps to help support the design of national energy strategies and support Just Energy Transition Partnerships on the continent.



*Energy investment in Africa, 2014-2021,
Africa Energy Outlook 2022, IEA, 2022*

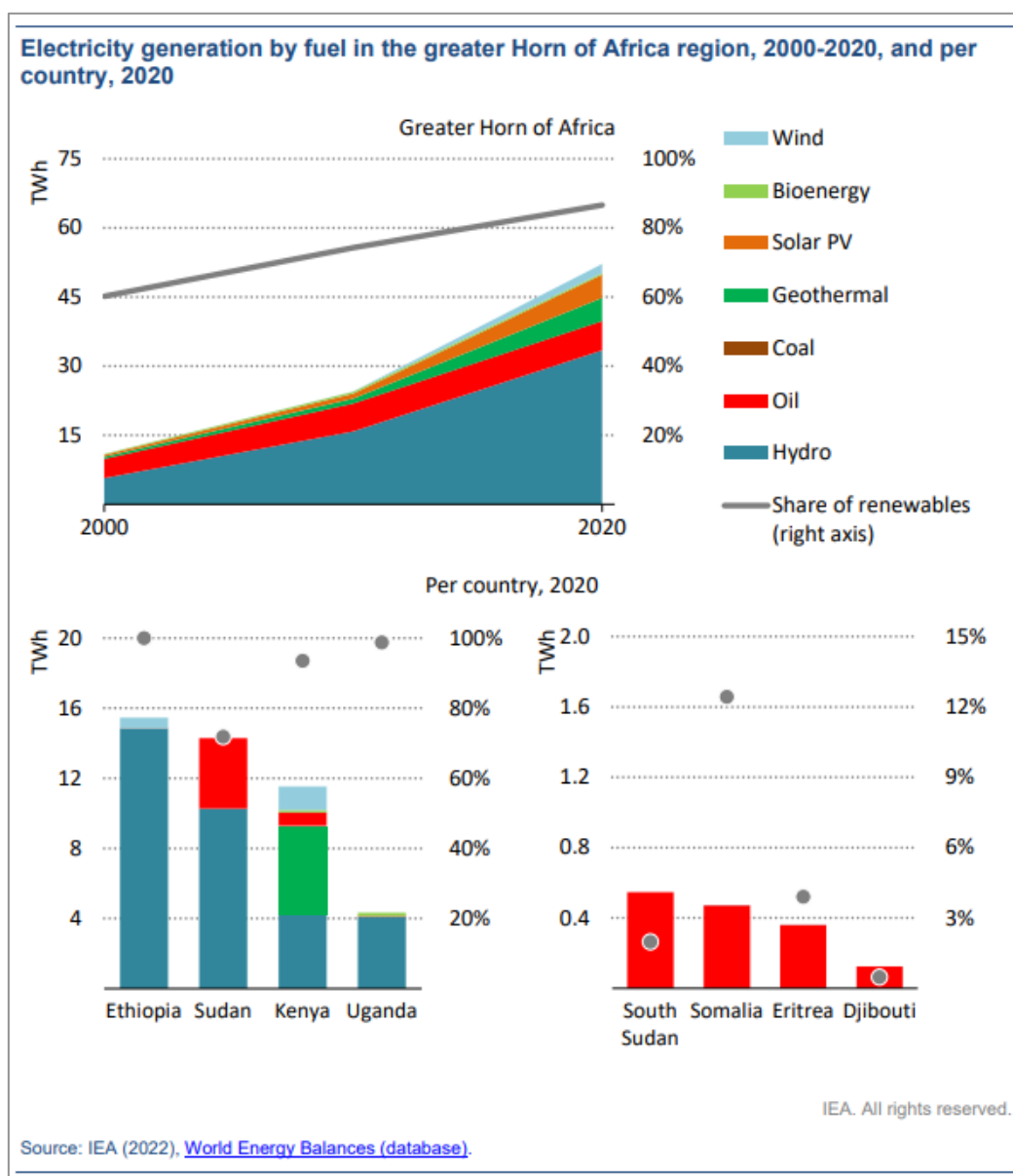
The report also highlighted a number of key innovation opportunities, notably hydrogen, where Africa's production costs by 2030 would be competitive with other major producers on a delivered-cost basis should it be sent to Northern Europe. Africa is already a major producer and exporter of the critical minerals needed in the clean energy transitions, with the opportunity to double the size of the revenues from critical minerals by 2030. The report highlights practical policy approaches to realising a doubling of energy investment, which were discussed at a high-level working group on 20 June. At this meeting senior representatives from NORAD, Power Africa, the African Development Bank (AfDB), ABSA, the government of Senegal, the IFC, AFD, BII and others discussed best practices to better leverage concessional finance to attract rising levels of clean energy investment in Africa. This workshop directly led to the commissioning of a new report in 2023, further exploring current clean energy financing norms in Africa and case studies highlighting major innovations in this area that could be scaled.

Clean Energy Transitions in the Greater Horn of Africa

A major IEA analytical project to understand how the countries of the Greater Horn of Africa could transition their energy systems to be cleaner and more equitable resulted in the report [Clean Energy Transitions in the Greater Horn of Africa](#). Published in October, its key findings were translated into local languages (Swahili, Amharic, Arabic and French) to maximise its impact.

The overall objective of the project is to support energy policies, to foster regional energy collaboration and to help accelerate energy transitions in the Greater Horn of Africa. With support from the eight focus countries (Djibouti, Eritrea, Ethiopia, Kenya, Somalia, South Sudan, Sudan and Uganda), the IEA conducted research to document recent trends, highlighting good practices and identifying possible trajectories for future energy systems in the region.

The project relied on an extensive effort to obtain the latest statistics from the eight focus countries, as some of them did not have publicly available, comprehensive and detailed energy balances. Experts from the IEA Energy Data Centre collaborated with statisticians from all the countries to collect, treat and release robust data sets providing a clear view of where these countries stand in terms of energy production, transformation, demand by sub-sector and trade. Building on this detailed view of recent trends in the region and on analysis of the planned policies that will shape upcoming energy system evolutions, IEA teams developed two scenarios with projections to 2030, leveraging the IEA's unique modelling expertise. The Africa Case Scenario highlights that the region can pursue a path where access is reached in full – both for electricity and clean cooking – by the end of the decade as per the SDG7.1 target, with an energy mix more modern and efficient than today, fuelling an economy twice as large as today.



Extract from the [Clean Energy Transitions in the Greater Horn of Africa](#)

This project put a strong emphasis on collaboration among experts and policy makers in the region, with bilateral exchanges between each country and the IEA Secretariat, also with a number of collective meetings fostering dialogue. Early in 2022 initial regional dialogue focused on a virtual workshop involving participants from each country to share thoughts on different policies and practices.

In May a second workshop was organised to strengthen regional dialogue. Around 20 experts from the region gathered during two days in Nairobi, Kenya, to discuss their national policies and provide guidance for the IEA team to focus their analytical efforts on the most impactful areas. The experts very much welcomed this opportunity to take part in the dialogue and to meet their peers, including policy

makers from all focus countries and representatives from the regional economic organisation, the Intergovernmental Authority on Development (IGAD).

In October the final report was launched at a [major event](#) supported by the Ugandan Ministry of Energy and Mineral Development, in the presence of more than 20 experts from the region who shared their insights at two roundtables. Following a high-level opening with ministers from Uganda and the Netherlands, participants had the opportunity for further dialogue on their success stories and challenges in clean energy policies, exploring more specifically efforts towards greater access to electricity, clean cooking, renewables and energy efficiency. A dedicated roundtable also discussed how to mobilise investment for clean energy transitions in the region, identifying successful financial strategies, instruments and tools, as well as effective efforts to reinforce regional collaboration.

Tracking SDG7 Progress Report

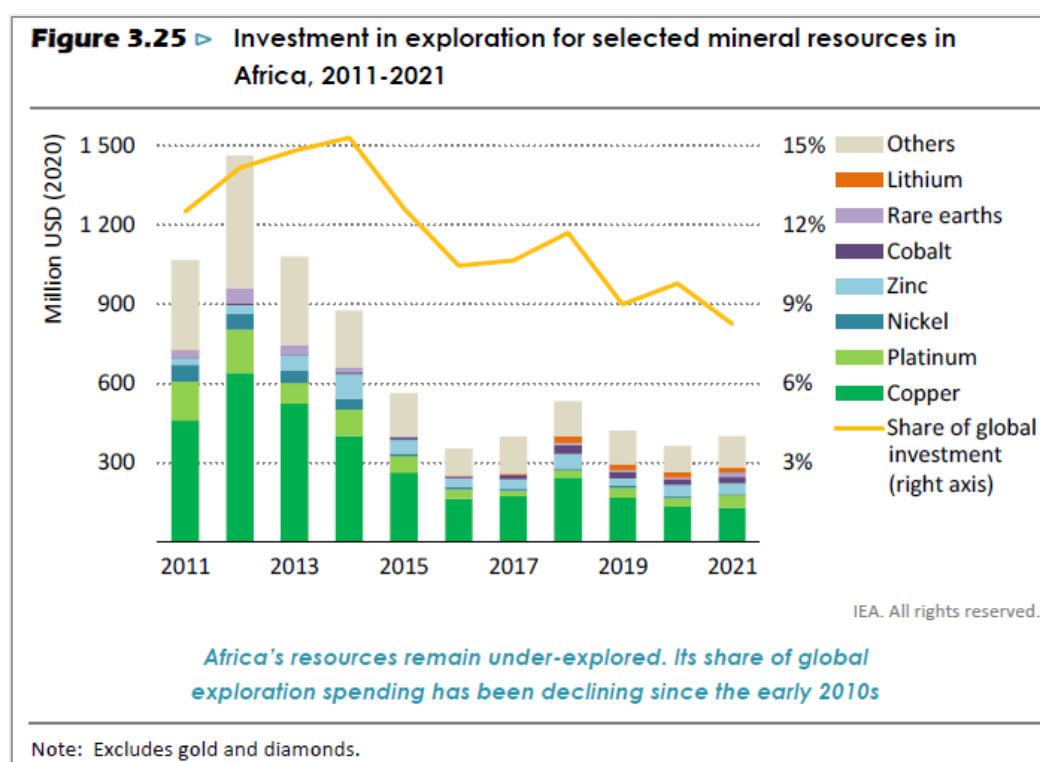
The IEA continues its long-standing role as a co-custodian of tracking progress on the UN's energy-related SDGs, where we contribute not only the official statistics on energy efficiency and renewables, but also projections for access to electricity and clean cooking to 2030. Our latest projections were able to fully capture the impacts of the setbacks on reaching universal access due to the Covid-19 pandemic, and our recent analysis reflects the affordability impacts of the global energy crisis. The IEA released [a commentary](#) highlighting the expected setback relying on the most recent data collected by the IEA on the status of electrification efforts globally. The setbacks documented were overwhelmingly concentrated in sub-Saharan Africa, and this work informed much of the IEA's engagement with countries on strengthening access institutions to reverse these setbacks. This analysis remains a central gauge for global policy makers to understand what additional efforts are needed to deliver on the UN's SDG agenda, and an important metric for mission-based organisations and multilateral development banks. The IEA also provides its reporting of official SDG7 metrics on its website, freely accessible with the most up-to-date findings.

Critical minerals in Africa

Africa holds huge amounts of mineral resources, many of which are critical to various clean energy technologies. For some mineral resources, such as cobalt, platinum-group metals and manganese, the region is already a major supplier to the global market. South Africa dominates global supplies of platinum-group metals and is also a leading producer of chromium and manganese. The Democratic Republic of the Congo (DRC) accounts for about 70% of global cobalt production. The continent also holds a sizeable share of the production of other mineral resources such as bauxite, graphite and copper. The [Africa Energy Outlook 2022](#) includes a dedicated section on critical minerals, providing the latest

assessment of production and related investments, and also exploring future opportunities. Future revenues from battery metals and other transition minerals could exceed revenues from fossil fuels by 2050, inviting African countries to create the adequate frameworks and enabling environment to fully unlock their potential. These analyses, presented at COP27, attracted particular attention from African stakeholders.

In addition, the IEA has developed the [Critical Minerals Policy Tracker](#), which currently covers two African countries – the DRC and South Africa – listing their existing regulatory frameworks and policies in place. The tracker also covers other regions of the world, enabling the benchmarking of policy tools.



IEA. CC BY 4.0.

Extract from [Africa Energy Outlook 2022](#)

Hydrogen in Africa

Clean hydrogen could offer major innovation opportunities for several African countries, as by 2030 hydrogen production costs could be competitive with other major producers on a delivered-cost basis with Northern Europe as the destination.

To explore this topic further, the IEA invested in building strong engagement with four selected countries in Africa – Senegal, Mauritania, Namibia and Kenya – with which it has developed close relationships and ensured fruitful collaboration. This planned work will include country-specific analysis, with separate reports on

Namibia and Mauritania as well as their respective launch events and dissemination. Events with Kenya and Senegal will enable to present IEA analyses to the respective governments.

Technology-specific analysis was included in the [Africa Energy Outlook 2022](#) and in the [Global Hydrogen Review 2022](#), notably analysis of the project pipeline in countries such as Namibia and Mauritania.

Dissemination of key IEA analysis on hydrogen took place at the following regional conferences:

- July 2022: Webinar conference organised by Angola (in Portuguese), where the IEA presented key hydrogen-related findings from the [Africa Energy Outlook 2022](#) to an African audience, including the Angolan government.
- September 2022: Webinar conference organised by the European Union in partnership with the African Union (the Africa-EU Partnership Forum), where the IEA discussed opportunities and challenges around hydrogen in selected African countries.
- September 2022: Webinar conference organised by the Africa Green Hydrogen Alliance, where the IEA discussed the potential for hydrogen production in certain African countries, the opportunities and global challenges.
- October 2022: Webinar conference organised by AFRICARTA, where the IEA presented key findings of the [Africa Energy Outlook 2022](#) with regard to hydrogen.
- October 2022: Africa Energy Week, one of the most important energy conferences in Africa, where the IEA participated in a roundtable discussing key topics on hydrogen.

Energy transitions in African producer economies

Producer economies have specific perspectives on clean energy transitions, given the role of their existing or rising fossil fuel industries. To address their unique challenges and enable a comprehensive discussion of the role of fuels such as gas and technologies such as CCUS in the broader context of energy transitions, the IEA has been collaborating with Nigeria – a historical and major oil and gas producer assessing CCUS opportunities, with Senegal – a major gas producer to-be, and with South Africa – where CCUS technologies and oil and gas production are under development.

The IEA continued to provide support to the governments of Senegal, Nigeria and South Africa and exchange with counterparts on topics related to global and regional natural gas markets and market reforms to support the development of competitive domestic natural gas markets, as a means of accelerating energy access and transition away from liquid fuels for electricity generation and industry.

We organised two webinar workshops in March with the Office of the Vice President of Nigeria on the commercial and regulatory aspects of developing Nigeria's domestic gas market across the upstream, midstream and downstream value chains, sharing international experience and fostering dialogue among key industry and government stakeholders in the country.

We held a joint meeting in June with the Petroleum Agency of South Africa as part of its steering committee on the social and economic analysis of the development of domestic natural gas resources.

In October we organised a technical workshop for the Ministry of Petroleum and Energy of Senegal with technical experts to address specific aspects related to the regulation of natural gas transport and the setting up of an independent gas transport operator. We also shared several global gas market updates with counterparts from the ministry.

The IEA has been leading several activities and stimulating dialogue on CCUS at a global level. In sub-Saharan Africa, collaboration has focused on Nigeria and to a lesser extent South Africa.

Nigeria has identified CCUS as an important tool to support the country in achieving its NDC target to reduce its greenhouse gas emissions compared to business as usual by at least 20% by 2030 and by up to 47% (conditional on international support), as well as accelerate its energy transition. With Nigeria's Office of the Vice President (OVP) and the World Bank, IEA experts released a paper under the framework of GHGT on 16 October: the IEA/IFC/OVP/WB paper entitled *An Integrated Collaborative Approach: CCUS Development Activities in Nigeria*. This collaborative approach also translated into panel discussions with Nigeria's OVP and international partners, including an Indonesian representative, who shared their perspectives on CCUS and industrial decarbonisation in emerging-market and developing economies (EMDEs). The IEA experts also contributed to several workshop on CCUS in Nigeria, in June and then in November, presenting the IEA's latest findings on the topic and sharing our views on the Nigerian context, including the role of CCUS in industrial decarbonisation.

Energy efficiency training in Africa

The IEA and AfDB held their first joint training course on energy efficiency in November, underlining the central role that energy efficiency can play in addressing the global energy crisis and the [multiple benefits](#) it can bring to developing economies, including in sub-Saharan Africa.

Regional Training on Energy Efficiency Policy Packages for Sub-Saharan Africa was held online from 21 to 25 November, gathering nearly 300 regional policy makers and energy professionals. It presented a detailed introduction to energy

efficiency policy packages, followed by sector-based sessions focused on appliances, buildings, industry and transport. In line with [SDG7](#), the training aimed to support the development and implementation of policies that can lower energy costs and carbon emissions while supporting economic growth.

The section on energy efficiency policy was based on the [IEA's policy package approach](#) and highlighted best practices both from around the world and within the sub-Saharan Africa region, building on the successful launch of the [IEA Africa Energy Outlook 2022](#) and the [IEA Initiative To Promote Clean Energy Transitions in Africa](#) through enhanced regional collaboration.

Throughout the five-day course, expert speakers shared international and regional experiences, with insights from South Africa, Kenya, Ghana, Nigeria, India, Australia, Mauritius, the Economic Community of West Africa States (ECOWAS), the European Union, the United Nations Industrial Development Organization (UNIDO), UNEP, the AfDB and the IEA. Online polls were used throughout the week to engage with participants.

The principal insights that were shared include the following:

- Policies that have been in place the longest are the most successful.
- On appliance efficiency, delegates saw how EU ecodesign policies have been evolving and built upon to reach today's achievements.
- In buildings, delegates saw how building codes and the energy performance certificate database have allowed Australia to achieve higher levels of energy efficiency.
- The industry, PAT scheme has enabled India to expand the number of Designated Consumers from less than 500 to more than 1 100 today.
- In transport, countries with regulations or incentives on energy-efficient purchases saw the energy efficiency level of their vehicle fleet improve 60% faster than countries that do not. Sri Lanka was highlighted as a high performer, the highest in the world in terms of EV ratio.

The event, which forms part of the IEA [Energy Efficiency in Emerging Economies Programme](#) and was carried out with funding from the IEA [Clean Energy Transitions Programme](#), aimed to help build a community of practice so that effective energy efficiency policies can play a central role in clean energy transitions, making them more affordable and accessible to all.

The IEA has also over the last year initiated contact with countries in the region with the aim of involving them in various ongoing multilateral activities related to hydrogen, such as the CEM Hydrogen Initiative (CEM H2I).

In addition to particular projects, one of the overall objectives of our engagement with Africa was to increase the participation and presence of African countries in all CETP activities. Systematic effort was made to include African partners in all knowledge-sharing initiatives, with a special focus on innovation. As a result, government representatives and experts from Ethiopia, Kenya, Morocco, Nigeria and South Africa actively participated in workshops on innovation policy and in preparatory and informational meetings. Also, thanks to CETP support, Morocco and Nigeria representatives joined the [public side event at the Global Clean Energy Action Forum](#) organised by the US Department of Energy in Pittsburgh on 23 September. These exchanges brought direct support to the clean energy innovation community in African countries and encouraged the direct exchange of experience between developing countries on the topic. Finally, it helped inform IEA analysis produced under this activity, with perspectives from African experts.

South Africa

South Africa has been an IEA association country since 2018, with institutional relations translating into analytical coverage of the country in all IEA publications, and into active collaboration on major issues such as energy efficiency. Building on these existing bases, in late 2022 the South Africa Department of Mineral Resources and Energy requested IEA support for the Integrated Resource Plan, a document aiming to anticipate future power generation capacity additions.

Energy efficiency in South Africa

The IEA continued work on industry indicators in 2022. Following two workshops in 2021, another was organised in 2022 on pulp and paper. South Africa also joined discussions with Brazil and Indonesia on indicators, sharing best practices.

We provided comments on energy efficiency incentive measures being developed in South Africa by the Department of Mineral Resources and Energy. This is part of the ongoing support we have been providing over the years, first to develop the NEED (National Energy Efficiency Strategy), then to carry it out, and now to review it.

We also supported the participation of South Africa in key energy efficiency events, including a global conference, the sub-Saharan Africa Training Week, the SEAD initiative and many others, ensuring different perspectives are expressed.

The IEA has also been supporting South Africa in its efforts to pursue a just energy transition, reviewing roadmaps, engaging with key stakeholders and providing inputs as required.

South Africa policy alignment for clean and sustainable energy transitions

CETP funding allowed for the continuation of the IEA's analytical work on environmental taxation and carbon pricing in the power and transport sector. To support the design of the second phase of South Africa's carbon tax, we developed a confidential policy paper for the South African National Treasury in April, analysing the effect of different tax design options on the power sector. The paper used and updated analysis undertaken in 2020 and 2021 under the CETP, taking into account the rise in global energy prices and new announcements on carbon pricing in the Budget 2022. The paper helped inform domestic policy discussions on carbon pricing, supporting the development the Draft Taxation Laws Amendment Bill of July 2022, which proposes an ambitious carbon price trajectory to 2030.

The CETP also supported the revision and finalisation of a report analysing the potential role of the carbon tax within the transport fuel tax system, and supported international exchange on carbon pricing. This included the engagement of South African experts in the IEA-OECD focus group discussion on the development of effective GHG ETSs and the organisation of a side-event at COP27 in the South African Pavilion on carbon pricing in the power sector.

Renewables

Our work on renewables in South Africa mainly focused on solar PV and hydropower. It included analysis of distributed PV uptake, with a specific focus on:

- Changes in policy for embedded generation.
- Changes in policy to allow for net metering (residential scale).
- Eskom's concerns around load shedding and rate increases.

The analysis set the groundwork for an ongoing assessment and forecast of the distributed PV market in South Africa, including identification of the potential business models for each segment and potential uptake. The results of this analysis were included in the forecast for South Africa in the [Renewables 2022](#) market report.

Other activities focused on the assessment of projections for hydropower capacity additions. More specifically, we carried out a review of enabling policies for hydropower development and an assessment of the current project pipeline for South Africa. This guided the analysis of hydropower development and the sector's outlook, which informed and was included in the [Africa Energy Outlook 2022](#).

Middle East and North Africa

Highlights

- Support for energy-producing countries, including Egypt, Algeria and Oman, in their transitions towards the decarbonisation of oil and gas sectors, with a special focus on methane abatement.
- An increasingly important work programme with Egypt – the country joined the IEA Family as an association country at the IEA 2022 Ministerial Meeting in March.
- Support to Egypt's Conference of the Parties (COP) presidency, including direct involvement in developing the agenda around the first Decarbonisation Day and the Energy Day.
- Work on improving climate resilience in Egypt, Morocco and Oman in close co-operation with national stakeholders.
- Close collaboration with Oman on green hydrogen and energy modelling to support clean energy policies.

The Middle East and North Africa (MENA) region has remained a priority for the IEA because of its traditional role in providing energy security, and also because these countries are increasingly confronted by the need to decarbonise their energy systems. A global hub for oil, gas and hydrocarbon products, the region has also attracted increasing interest from IEA member countries as they sought to diversify supply sources for hydrocarbons before and following Russia's invasion of Ukraine.

Beyond their importance for global energy security, several MENA producers have embarked on large-scale economic diversification programmes to reduce their economies' reliance on hydrocarbon exports. Given the centrality of the energy sector as a share of GDP and government revenues, the energy sector is undergoing an unprecedented transformation as global energy systems need to rapidly react to a changing paradigm shift.

The IEA has been accompanying MENA producers on the two pillars of their energy transitions with support from the CETP. The first is on decarbonising the oil and gas sectors, with a methane abatement workshop held with Iraq's Ministry of Oil and early discussions with Algeria and Egypt on similar efforts. The IEA has also invested significant resources in supporting MENA countries (producers and non-producers) with their clean energy transition efforts – the second pillar. Most

notably, the IEA and Oman have been working closely together on three key studies:

- The development of a macroeconomic model to analyse the impact of clean energy policies on key macroeconomic indicators.
- A green hydrogen supply chain analysis to assess the costs and benefits of developing a green hydrogen industry in Oman.
- A study to understand the implications of the development of a green hydrogen industry for renewable energy demand in the country.

The outputs are expected to be released in March 2023 and the IEA plans to leverage them to showcase Oman as a key producer economy in transition, in the region and globally. This set of studies represents a unique effort that is expected to have a notable impact in the run up to COP28, which is expected to concentrate on the opportunities and challenges faced by producers as they transition to low-carbon economies.

The IEA engaged with Egypt as a significant gas producer in the Eastern Mediterranean region. This led to the country joining the IEA family as an association country at the 2022 IEA Ministerial in March. The Secretariat has since developed a Joint Work Programme with Egypt, which is currently awaiting signature from both parties. The IEA has continuously co-operated with Japan's Embassy in Cairo, notably during the IEA Executive Director's visit to Egypt in February, when he delivered a keynote speech at the Egypt Petroleum Show (EGYPS) in the presence of the Egyptian President and several members of his cabinet.

At the multilateral level, the Japan MOFA VC supported engagements to assist the Egyptian COP27 Presidency. The IEA provided strategic direction that included developing the agenda around the first Decarbonisation Day as well as the Energy Day. Providing COP27 support enabled the IEA to engage with a wide range of stakeholders; it co-organised 23 events and participated in 78 others as speakers, always highlighting the need to pursue the dual objective of global energy security and sustainable development.

Another key engagement for the IEA has been the role it played in the establishment of the MENA Europe Future Energy Dialogue (MEFED), a platform led by Germany's GIZ and whose objective is to promote energy co-operation between Europe and the MENA region on topics such as hydrogen, renewable energy and interconnections. The first conference was held in Jordan in June with the participation of the IEA Deputy Executive Director, with the IEA acting as a member of the platform's steering committee.

As a side event to this first MEFED conference, the IEA organised a panel discussion entitled “The Road to COP27 and 28: The Role of the MENA Region in Global Decarbonisation”, gathering minister-level participants from Germany, Iraq and Jordan, moderated by the IEA.

Lastly, the IEA started engaging with the recently created EastMed Gas Forum, which gathers gas importers and exporters from the region. Members include Republic of Cyprus², Egypt, France, Greece, Israel, Italy, Jordan and Palestine, with the United States as observers. A memorandum of understanding is under preparation to support technical co-operation in gas sector decarbonisation and market analysis.

More recently, the IEA organised its first mission to Algeria, where it engaged with the Ministry of Energy and Mines, Sonatrach and the regulator on energy sector decarbonisation and scaling up renewables. The outcome of this mission has been Algeria’s expression of interest in benefiting from IEA technical assistance on methane abatement in its natural gas sector. In addition, the energy regulator initiated steps to join the IEA-supported Regulatory Energy Transitions Accelerator (RETA).

Hydrogen in Oman

With the support of a secondee from the government of Oman, the IEA organised a webinar with Oman LNG on 23 May to explore the opportunities and challenges associated with creating demand for low-emission hydrogen in Oman. Besides high-level speakers from Oman, the event also included speakers from international organisations and finance institutions, such as the World Bank. It was attended by a large number of Omani decision makers and experts, and we received highly positive feedback from delegates.

We are preparing a report on how large-scale development of renewable hydrogen could help Oman to establish new revenue streams and decarbonise domestic energy use. This work has been benefiting from the input and collaboration of Dr Abdullah Al-Abri (Omani secondee to the IEA). Preliminary data collection and background research started in the final quarter of 2021, and work on the report began officially in summer 2022.

² The information in this document with reference to “Cyprus” relates to the southern part of the Island. There is no single authority representing both Turkish and Greek Cypriot people on the Island. Türkiye recognises the Turkish Republic of Northern Cyprus (TRNC). Until a lasting and equitable solution is found within the context of the United Nations, Türkiye shall preserve its position concerning the “Cyprus issue”.

The Republic of Cyprus is recognised by all members of the United Nations with the exception of Türkiye. The information in this document relates to the area under the effective control of the Government of the Republic of Cyprus.

We gave a presentation of our early findings at the Oman Green Hydrogen Summit, held in Muscat on 5-7 December. It was very well received, attracting attention from local officials and other stakeholders and raising interest in Oman's hydrogen plans.

We also completed a techno-economic analysis of Oman's energy sector and especially of the country's potential for renewable energy and renewable hydrogen and hydrogen-derived fuels by 2030. The prospects for follow-up work to complement and expand on our analysis are under discussion.

Renewable energy deployment and policies in Egypt

The IEA conducted a detailed assessment of the long-term renewable energy market and policy framework of Egypt. More specifically, we identified policy changes and market evolution between 2021 and 2022, and assessed the status and progress of each renewable energy project under development. This allowed us to forecast renewable power investment and deployment up to 2027 and to identify key challenges to scaling up renewable electricity. The results of the analysis were included and presented in the [Renewables 2022](#) market report.

For the first time, the IEA assessed Egypt's renewable hydrogen ambitions. We researched the status of each hydrogen project to estimate the amount of renewable capacity needed to develop renewable hydrogen in the coming five years. This was part of a larger piece of research in which we benchmarked Egypt's progress in reaching its renewable hydrogen ambitions against other countries in the MENA region.

The IEA also conducted preparatory work related to a clean energy finance and investment policy review to be carried out with OECD ENV.

Finally, the IEA provided Egypt with support on hydropower at COP27. We worked with the Tajikistan government and the International Hydropower Association to organise a side event on the role of hydropower in achieving climate resilience. The IEA made two presentations: one scene-setting on the increasing role of hydropower towards net zero, and a second on resilience in hydropower and climate change: adaptation and mitigation.

Pillar II – Multilateral co-ordination

Highlights

- We continued supporting the Biofuture Platform as facilitator, co-ordinator of the relevant Clean Energy Ministerial (CEM) Biofuture Initiative and co-manager of the Clean Energy Ministerial Biofuture Campaign. The work of the Biofuture Platform generated increased interest in bioenergy and industry involvement in the sector.
- We provided support to Indonesia's 2022 presidency of the G20 with analytical recommendations on net zero pathways, clean energy technologies and investment, and global energy markets and security. We also worked closely with India to prepare for the country's G20 presidency in 2023.
- The IEA's work was greatly recognised throughout COP27 in Egypt. Notably, the IEA [World Energy Outlook 2022](#) was referenced in the COP27 final decision, the Sharm el-Sheikh Implementation Plan.
- The IEA continued its longstanding role as a co-custodian of data for the UN's energy-related SDGs. The latest projections were able to fully capture the effects of the setback on reaching universal access caused by the Covid-19 pandemic, mostly concentrated in sub-Saharan Africa. Recent analysis reflects the affordability impacts of the global energy crisis.
- The IEA continued to co-ordinate the Regulatory Energy Transition Accelerator (RETA) network, focusing on internal consolidation and outreach. We had broadened the participant base to more than 30 regulators by the end of 2022.

Biofuture Platform

The IEA successfully continued its support for the Biofuture Platform in its role as platform facilitator, co-ordinator of the related CEM Biofuture Initiative and co-manager of the CEM Biofuture Campaign. These activities triggered a number of important outcomes and impacts.

Over the course of 2022, the Biofuture Platform played a crucial role in raising the profile of bioenergy and the broader bioeconomy among key stakeholders and within relevant global processes and initiatives, contributing to shaping their agendas. Notably, the Biofuture Platform enabled ministerial and CEO-level dialogue and engagement on bioenergy and the bioeconomy at major

international events, bringing them into the mainstream and putting them on clean energy and net zero agendas at relevant, high-level forums.

In particular, at the CEM and MI Ministerial conference during the Global Clean Energy Action Forum 2022 (Pittsburgh, 21-23 September), the Biofuture Platform organised six events, which received a great deal of attention, raising awareness of the importance and the benefits of bioenergy and the bioeconomy among the CEM community. These events included:

- A CEO-Ministerial Roundtable on Bioenergy and Biofuels, which was attended by ministers or heads of delegation from six countries and by senior executives from 14 major companies, and during which a high-level biofuture statement was launched.
- A high-level event on sustainable aviation fuel, during which the Secretary of the US Department of Energy, Jennifer Granholm, launched the SAF Grand Challenge Roadmap.

Other key events organised by the Biofuture Platform in 2022 included a webinar at the G20 in Indonesia in June, entitled Biofuels for the Green Economy.

An important achievement in 2022 was sustained and further strengthened industry engagement, with significant growth in the membership of the Biofuture Campaign. This now brings together over 40 leading companies engaged in the production and use of bio-based fuels, chemicals and materials. Under the campaign, governments and industry are working together to accelerate deployment of bio- and waste-based products and showcase how they can benefit society.

With the aim of promoting an evidence-based understanding of sustainable biomass production and use, the Biofuture Platform launched a new workstream on biomass quantification and sustainability governance. The desired outcomes of this workstream are to:

- Ensure appropriate roles for sustainable biomass to help achieve goals for net zero, climate-smart energy and sustainable development.
- Reduce sustainability risks for biomass production and use.
- Increase recognition of biomass as a foundation for more inclusive, circular economies.

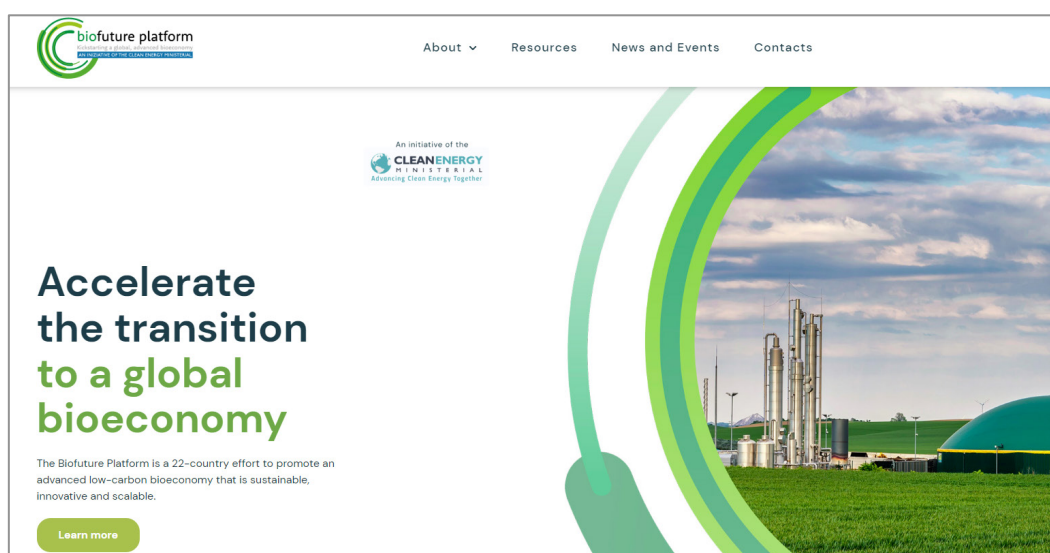
In order to provide guidance and feedback on workstream activities, a technical advisory group was convened, bringing together active and influential leaders in the bioenergy industry, bioenergy research sector, policy makers and academics with a documented record of engagement. The group brings a diversity of perspectives and expertise to the development of evidence to address

uncertainties about the contribution of biomass to sustainable development and climate change mitigation. This should reduce risk for investors, bio-project developers, policy makers and other stakeholders. As part of these efforts to promote convergence on biomass sustainability, a series of conversations were initiated with selected influential organisations traditionally sceptical towards bioenergy, such as the WRI.

Work continued on the policy blueprint, with the publication of the methodology and three country profiles (Brazil, the Netherlands and the United States), which provide useful insights into the design, implementation and effectiveness of biofuel policies in these countries, highlighting relevant lessons learned.

Co-operation with relevant initiatives was strengthened. The Biofuture Platform and the IEA Bioenergy TCP signed a memorandum of understanding under which they agreed to co-operate to help accelerate sustainable bioenergy and bioeconomy developments. Collaboration continued with the UN Food and Agriculture Organization and the Global Bioenergy Partnership, and co-operation was initiated with the recently established Integrated Biorefineries Mission (under MI).

With a view to enhancing the effectiveness and impact of its communications, the Biofuture Platform launched a new interactive website and boosted its social media presence and activities. In addition, various awareness-raising materials were developed and disseminated.



Biofuture Platform home page, biofutureplatform.org

Building upon the outcomes of the successful 2022 activities described above, an ambitious action plan for 2023 was developed and approved by the All-Member Group. The plan aims to further raise the profile of the bioeconomy and bioenergy, continuing to bring them into the mainstream of high-level processes and

discussions related to net zero and the clean energy transition. The action plan comprises five workstreams, which will be implemented in close synergy with the members of the Biofuture Platform Initiative and Campaign and in co-operation with the partner organisations mentioned above. These workstreams are:

- CEM/G20 events.
- Biomass quantification and sustainability.
- Policy best practices.
- Advancing biochemicals and biomaterials.
- De-risking project finance.

G20

Indonesia G20 Energy and Climate Programme

The government of Indonesia, which held the presidency of the G20 in 2022, invited the IEA to help shape G20 discussions on accelerating energy transitions by providing analysis and recommendations on net zero pathways, clean energy technologies and investment, and global energy markets and security.

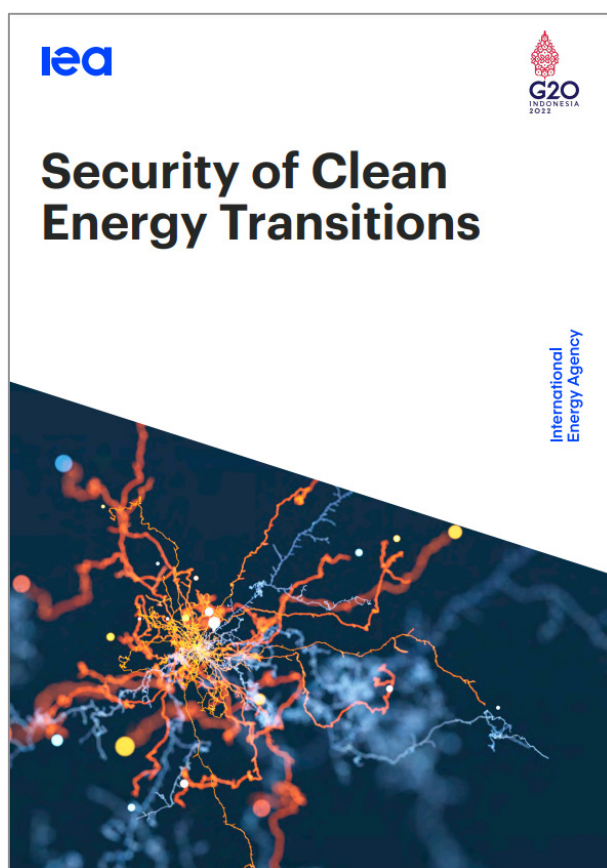
In this role as a strategic partner to the government of Indonesia, the IEA also supported MEMR on a series of G20 side events covering people-centred clean energy transitions, CCUS, security of energy transitions, biofuels, energy efficiency, and clean energy investment and finance, jointly with other international organisations. More information is in the summary report, [Summary of G20 2022 Energy Transitions Working Group Side Events](#).

The IEA played a critical role in the first ever G20 Energy Transitions Ministerial Meeting, held in Bali on 2 September. IEA Executive Director, Fatih Birol, participated in the meeting, discussing the global energy outlook and energy security, and unveiling new analysis of Indonesia's net zero pathways. These contributions were requested by the Indonesian G20 presidency and are reflected in the [G20 Chair's Summary Energy Transitions Ministers Meeting 2022](#) report.



To coincide with Indonesia's G20 presidency, the IEA developed a comprehensive report, [An Energy Sector Roadmap to Net Zero Emissions in Indonesia](#), which charts a path for the country's energy transition over the coming decades. The roadmap sets out a viable pathway for Indonesia to reach net zero by 2060, with analysis that spans key areas such as energy security and affordability, phasing down coal use, people-centred transitions, investment and financing needs, and critical minerals. The report also examines a high-ambition pathway in which Indonesia reaches net zero by 2050.

The project was requested by the government of Indonesia and was conducted in close collaboration with MEMR, demonstrating the [strong co-operation](#) between the IEA and Indonesia on energy transitions. IEA Executive Director, Fatih Birol, and Indonesia's Minister of Energy and Mineral Resources, Arifin Tasrif, also signed a [Joint High-Level Statement](#) that sets out a shared vision of Indonesia's path to net zero, drawing on the roadmap's findings.



Indonesia's government also asked the IEA to provide insights to update the G20 energy collaboration principles, adopted at the [G20 Energy and Climate Ministerial in Naples in 2021](#) (known as the Naples Principles). The resulting report, [Security of Clean Energy Transitions](#), examines the evolving nature of energy security in the context of clean energy transitions in general and on the pathway to net zero emissions in particular. In the light of the 2022 global energy crisis, it highlights emerging energy security concerns and provides key recommendations and advice to strengthen emergency response and boost international collaboration, notably among the G20. The IEA presented options for the G20 to adopt swift and collective responses to the global energy crisis at discussions in the run up to the G20 Summit in Bali.

Building on the Security of Clean Energy Transitions report, the IEA prepared policy recommendations for the G20 collective response to the global energy crisis as inputs to the G20 Leaders' Summit. Supported by the CETP, this IEA advice on the global energy crisis delivered through workshops and work streams across the G7 and the G20 on mitigating global energy price increases. In addition, the IEA's work for the G20 on energy transitions in Asia became a pillar for the formulation of the G7 work programme for Japan G7 in 2023, notably with regard to the Ministry of Economy, Trade and Industry of Japan's initiative on Asia Net Zero Emissions Community.

Under the G20 finance track, the IEA supported discussions on the role of people-centred transitions on the pathway to net zero. Building on its work with the Global Commission on People-Centred Transitions, the IEA laid out recommendations at the [Policy Levers Forum](#) on 13 June in Bali, ahead of the third G20 Sustainable Finance Working Group. The IEA provided the G20 with policy insights and advice on how to boost just transitions and green investment, and the role of finance on the pathway towards net zero emissions.

Regulatory Energy Transition Accelerator (RETA)

In November 2021 the IEA, along with the UK government, the International Renewable Energy Agency and the World Bank, launched the RETA initiative to accelerate and improve the regulatory capacity necessary to decarbonise energy systems. The IEA provides the co-ordinating function of RETA and delivers analytical work to support the initiative, both of which the CETP has supported.

In 2022 RETA entered its second year after its introduction at COP26. In the first half of 2022 RETA focused on internal consolidation and outreach, broadening its participant base from an original 20 endorsing regulators at COP26 to more than 30 by the end of 2022. In May RETA held its first steering committee meeting, which enabled it to start defining the initial set of flagship projects as well as building partnerships with a number of regional and international regulatory associations, such as the International Confederation of Energy Regulators (ICER), the Energy Regulators Regional Association (ERRA), the African Forum for Utility Regulators (AFUR) and Canada's Energy and Utility Regulators. This secured its rapid visibility while ensuring its role as a nimble platform that provides added value without competing with existing regulatory networks.

During 2022 RETA developed a needs assessment survey to understand the priorities of participating regulators and consolidate the workplan of the five main flagship projects on small island developing states, decarbonisation, interconnectors, real-time data and the accelerator's knowledge hub.

Externally, RETA organised a series of high-level discussions at the CEM and COP27 and contributed to training sessions and workshops with its various partner regulatory networks. The expertise within the RETA network has been deployed to assist information requests from Brazil and Japan, an approach that will be strengthened through the implementation of the knowledge hub in the coming year.

The first RETA Public event, [Accelerating the Energy Transition Through International Collaboration](#), was a conversation between Audrey Zibelman and energy regulators. This virtual conversation brought together Audrey Zibelman, Vice President of Tapestry (X's Electric Grid Moonshot) and Jonathan Brearley, CEO of Ofgem, as well as heads of energy regulators worldwide to discuss the regulatory gaps that need to be addressed for the energy transition. It was followed by a panel discussion gathering several energy regulation experts and practitioners from around the world.



IEA. All right reserved.

Accelerating the energy transition through international collaboration – a conversation between Audrey Zibelman and energy regulators, 21 June 2022

IEA partnered with the International Confederation of Energy Regulators to provide a dissemination workshop on the International Renewable Energy Agency's [Reorganising Power Systems for the Transition](#) report at a 21 July workshop.

RETA gave a presentation at the Renewable Energy Investment Conference organised by the Energy Regulators Regional Association and the Council of European Energy Regulators, and hosted by RETA Steering Committee member, the Georgian National Energy and Water Supply Regulatory Commission on 26-28 October. Facilitating investment in renewables is key for regulators to fulfil their goal of flexible, renewable-based systems. The conference was a major step forward in deepening regulators' knowledge, and learning from each other's experiences.

In the Eastern Caribbean, peer-to-peer exchange between energy regulators took place on 2 November at an interactive session organised by the Global Green

Growth Institute and the Organisation of Eastern Caribbean States, entitled “Regulatory Guidelines on Interconnection of Customer-Owned Renewable Energy Facilities to the Grid”. This knowledge exchange will help form a basis for RETA’s flagship project on small island developing states.

As part of the standing collaboration between RETA and ICER, whereby RETA provides expert speakers, the IEA presented its [Energy Efficiency 2022](#) report to ICER Virtual Working Groups in July and November.

UN-related collaboration

Climate resilience in MENA and COP27

The IEA’s work was greatly appreciated and recognised throughout COP27 in Egypt. Notably, the IEA [World Energy Outlook 2022](#) was referenced in the COP27 final decision, the Sharm el-Sheikh Implementation Plan. We supported Egypt’s COP27 presidency, contributing to the planning of the COP27 presidency agenda on energy and decarbonisation.

In total the IEA organised and co-organised 23 events, participated in 78 events as speakers and had more than 50 bilateral meetings and interviews, reflecting the high profile of the IEA’s role. Our presence and visibility at COP27 was remarkable not only in terms of quantity, but also quality. We were asked to contribute across a significantly expanded range of issues, covering diverse cross-cutting topics such as financing, just transitions, adaptation and resilience in addition to our outstanding presence on more traditional energy topics, engaging more partners from non-member countries including the MENA region.

Additional IEA activities at COP27 included the following:

- The IEA’s Executive Director participated in the Climate Implementation Summit (7-8 November), including a high-level roundtable entitled “Investing in the Future Energy: Green Hydrogen”, organised by the presidency.
- We provided scenario analysis and data for the establishment of the Africa Just and Affordable Energy Transition initiative and participated in weekly stakeholder meetings for this initiative. Our Deputy Executive Director spoke at the opening ceremony of the Energy Day (15 November) where the initiative was launched by the COP27 presidency.
- We supported other presidency events by providing technical input to the Energy and Decarbonisation Day programmes via regular meetings. At the request of the presidency, IEA experts moderated two high-level events on the Energy Day addressing the delivery of clean energy at a time of global crisis and the role of electrical interconnections.

- The IEA will continue its support for the United Arab Emirates' COP28 presidency. IEA experts had a series of meetings with the COP28 team to discuss our potential input to the presidency's agenda on energy.
- The IEA made its first official submission to the official UNFCCC [Global Stocktake of the Paris Agreement](#) in April 2022 as an admitted observer, and will continue to provide an official input to the first Global Stocktake.
- The IEA supported the first MENA Climate Week 2022, organised by the UNFCCC on 28-31 March. We co-organised two sessions on just energy transitions in collaboration with other major international organisations, which showed how energy transition technologies can contribute to decarbonisation and socio-economic development in the MENA region and how partnerships could accelerate it.

The IEA committed to building and enhancing the climate resilience of energy systems in the MENA region. We identified three countries, Egypt, Morocco and Oman, as first-batch countries, where building resilience against climate impacts in the energy sector is an urgent issue. We are set to release country analyses in the coming months, including assessment of climate hazards for the energy sector based on historical data and climate projections, stocktaking of existing policy measures, and making recommendations. This work started in Egypt, where the IEA organised a kick-off taskforce meeting on 10 August, inviting focal points from relevant ministries. The intermediate version of the country analysis was circulated among the taskforce members for review and received feedback in August, and the final version of the analysis is due to be released by the end of March 2023. In Morocco the IEA held two bilateral meetings with the Ministry of Energy, Mines and Environment to discuss the study. A draft version is due to be shared with partners by the end of March 2023. In Oman the IEA held a kick-off meeting with national counterparts and shared a preliminary draft. A final draft of the study is set to be shared by the end of March 2023.

The GEF-funded Global E-Mobility Programme

The GEF-funded Global E-Mobility Programme was launched at COP26 with the aim of supporting the shift to electric mobility in low- and middle-income countries. The IEA leads two of the global thematic working groups (Light-Duty Vehicles and Charging Infrastructure/Grid Integration/Batteries), providing knowledge products and developing a network for advocacy, technology and policy advice. The IEA is also responsible for setting up a framework to track progress on the deployment of EVs in the participating governments, building on the work of the CEM Electric Vehicles Initiative, which the IEA co-ordinates.

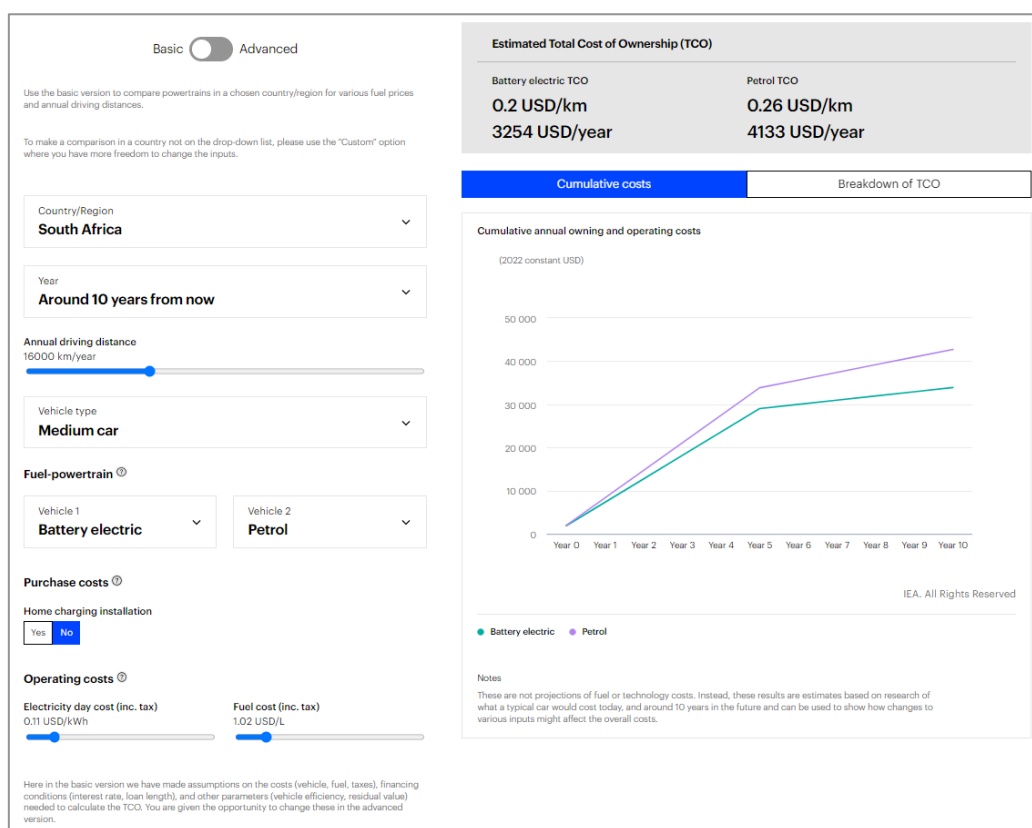
The IEA works closely with the E-Mobility Programme and its regional platforms led by the following organisations: UN Environment (Africa), AfD (Asia), EBRD

(Eastern Europe and the Middle East) and Centro de Movilidad Sostenible Mario Molina Chile (Latin America and the Caribbean). The output of the programme included:

- Launch of an IEA policy brief on public charging infrastructure, released in April,
- Launch of the IEA interactive tool for measuring the total cost of ownership for various types of vehicles, launched in December,
- Launch of the IEA policy manual on grid integration, launched in December.

In addition to this, the IEA organised a number of preparatory and launch webinars for the programme's participants. The IEA has also as part of its role to track progress included

Participating countries in the annual data collection exercise for the Global EV Outlook.



Extract from the Electric Vehicles: Total Cost of Ownership Tool, www.iea.org/data-and-statistics/data-tools/electric-vehicles-total-cost-of-ownership-tool

Co-operation on data

As energy data are key to climate reporting, we have strengthened our already strong relationship with the UNFCCC on data and transparency by sharing

targeted data from across topics for their NDC tracking activities. We are also collaborating on GHG review data preparation and training UNFCCC colleagues to use our data for smoother operations. And finally, we are starting discussions on a new workstream to develop country capacity on energy data for climate reporting. The IEA's objective to improve the quality of global energy statistics aligns with the UNFCCC priority to improve global energy data in view of the Paris Agreement reporting requirements.

To build capacity, we developed a joint concept note to support countries as they work towards meeting the Enhanced Transparency Framework of the UNFCCC. We contributed to two national-level workshops assessing national data (Ghana and Benin) and agreed to jointly organise country-level capacity-building workshops in 2023 in selected countries. For those workshops, the IEA will deliver targeted training material on how to improve energy data to fill GHG inventories according to the IPCC Guidelines – material targeting communities working on energy and climate data, which typically sit in different institutions. The collaboration with UNFCCC will help improve communication and data sharing between national energy and environment ministries, with the ultimate result of improving data quality.

Other successful collaborations with UN bodies included:

- Collaboration with United Nations Statistics Division (UNSD) on the revision process for the product classification, SIEC.
- Organisation and chairing a session at the [2022 UNECE Expert Forum of producers and users of climate statistics](#), which led to requests from countries for guidance on using microdata and administrative sources to develop energy and climate indicators (a webinar is be planned for Q1 2023).
- Provision to UNSD of [SDG data](#) (the IEA is custodian of SDG 7.2, 7.3 and 9.4).
- Collaboration with UNIDO on SDG9 data and other indicators and with UNSD on SDG7 data.
- Communication with the International Atomic Energy Agency (IAEA) on capacity-building activities.

Pillar III – Enabling global energy dialogue

Highlights

- Important improvements to non-member country data and experimental work on key indicators and the timeliness of data, and the creation of a user-friendly data portal for facilitated access to indicators with important implications for clean energy transitions.
- Advancing the timely work on critical minerals with modelling and in-depth analysis of supply chains and the release of the [Critical Minerals Policy Tracker](#), a tool to help governments explore new critical mineral policies, and analysis of the importance of environmental and social governance in critical mineral supply chains.
- Our convening of the first [IEA Clean Energy Labour Council](#), which brought together representatives of national trade unions with strong representation from CETP focus countries.
- Publication of the first ever [World Energy Employment](#) report, which provided a first-of-its kind estimate of how many workers are employed in the global energy sector, accompanied by projections of future labour demand by sector and region under different scenarios.
- A major project on digitalisation of power systems, which furthered strengthened the analysis and dissemination of findings on the importance of digital technologies for energy decarbonisation, clean energy transitions and net zero.
- Advancing the work on financing clean energy transitions to raise awareness of the risk of shortfalls in clean energy investment in emerging and developing economies and offer solutions that unlock capital through enhanced market and regulatory design. This included the release of [World Energy Investment 2022](#) in June as well as other analytical studies and analytical efforts, notably the [Government Energy Spending Tracker](#).
- Support for multilateral innovation partnerships and the work on energy innovation policies and data, including publication of [Tracking Clean Energy Innovation in the Business Sector: An Overview](#) and [How Governments Support Clean Energy Start-ups: Insights from selected approaches around the world](#), as well as [new data exploration tool](#) on public RD&D in energy.

Data and statistics

Non-member country data

During the year, thanks to CETP support, the IEA made substantial progress on improving the coverage and robustness of energy balances data relating to Afghanistan, Barbados, Guinea and Papua New Guinea. New data sources were found and a better understanding of existing data was gained. Whilst the data were not released in the 2022 edition of [World Energy Balances or World Energy Statistics](#), the work should enable the data to be included in the 2023 editions.

We also carried out work to estimate Indian calendar year energy balances (from the fiscal year data that the government of India publishes) in order to make it comparable with other countries' energy balances. We performed detailed mapping of the existing Indian data to identify the period (calendar vs fiscal) and metadata for sources (official ministry data, IEA estimation, etc.) for each relevant data point in the Indian energy balances so we could fully understand the current IEA India energy balance. Where available, we sourced the limited monthly and quarterly data from government websites so that they could be cumulated on a calendar year basis where possible. For flows and reference years that could not be sourced, we applied other indicators and estimations to convert the financial year data. Further validation is required to replace fiscal year-based data with data based on the calendar year. The Indian government is responding by starting to publish more official data on a calendar year basis (for instance, the Ministry of Petroleum and Natural Gas has recently started to publish both fiscal and calendar year-based data in its annual report).

During 2022 we carried out extensive joint work with Eurostat to develop a pilot joint annual questionnaire to collect data on hydrogen. The relevant flows include production by source, stocks, transformation, trade, final consumption and capacity. We also engaged with the Asia Pacific Energy Research Centre (APERC) to ensure that the questionnaire they were developing for their region collected comparable data. IEA member countries will be asked to complete the questionnaire for the 2022 and 2023 reference years. Incorporation of these flows within the energy balance framework, and the removal of hydrogen-related flows from the existing suite of questionnaires, will take place during 2023.

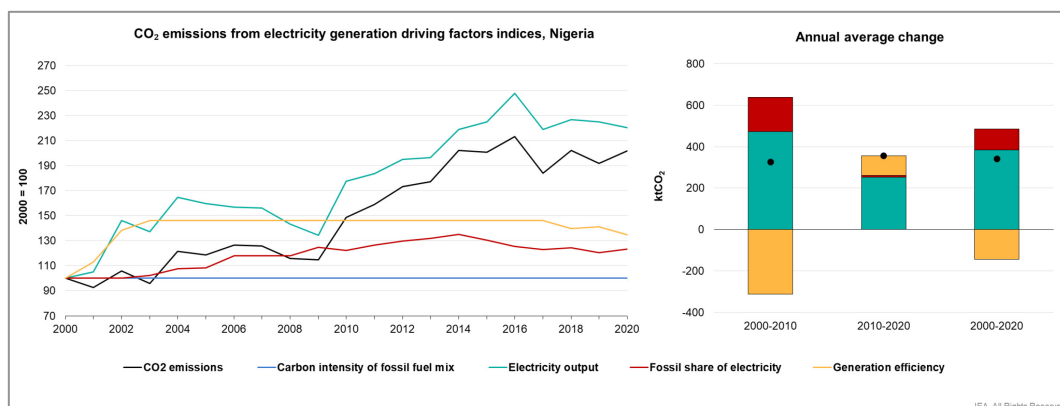
We are gradually introducing data scraping to automate the fuel statistics data collection process for some smaller non-member countries, with a rotational design for a set of around 20 countries. This involved designing a periodic method of estimation for national-level energy statistics; using secondary and international sources where possible; and determining the optimal frequency of data collection for countries selected for rotation. Due to the shocks to the energy system caused by the Covid-19 pandemic, 2020 data was hard to estimate using econometric

methods, and so all the countries were manually calculated for this cycle whilst developing an appropriate methodology. Our work is still continuing, focusing on simulating estimation methods for specific “Country X Product X Flow” combinations, and developing additional logic for hard-to-predict combinations.

We have also implemented automation of data extraction for the [Energy Prices](#) database, a global research-based output released by the IEA in recent years, covering end-use price information at country and sector level, at various frequencies. Weekly extractions for the United States and EU countries have been automated, and initial work has been done for other countries’ data – these data are fed into the IEA monthly oil market reports and the IEA monthly price data releases. This automation pilot looked promising and we are planning the extraction of a broader set of datapoints from different web sources for further automation to optimise procedures. Energy price data have attracted increasing attention from the media, governments and other stakeholders, including for affordability assessments due to the recent crisis. Among users, Google has shown strong interest in integrating information from this database into their applications.

Additionally, we have developed automatised data extractions for a series of third-party data sources (e.g. UNFCCC, ILO, UNFAO and WorldSteel) and have made them available in a centralised repository in the Data Warehouse for all IEA analysts with minimal burden. Finally, we are assessing options to automate the updates of the [Weather for Energy Tracker](#). This would allow weather-related information relevant for energy analysis to be available at DAY+5 (currently we perform quarterly updates).

Emissions data have kept attracting user requests. The IEA [Emissions Factors](#) database, presenting various metrics related to the carbon intensity of the grid, reached an unprecedented level of users, primarily but not only for services related to corporate reporting. With a view to consolidating the IEA’s position as the world reference in this domain, we have undertaken work to assess the feasibility of including broader life cycle assessment information for various electricity technologies, and on other fuels (e.g. oil products) where previous IEA work required harmonisation. The project is ongoing with the support of an intern, and the product is planned for upgrading in 2023. In parallel, we have explored the feasibility of introducing quarterly information on emissions factors to provide more timely information to users. The methodology is being refined and tested, for potential release in 2023.



The CO₂ emissions from electricity generation result from the combined effect of electricity output, generation efficiency, share of fossil in total generation, and carbon intensity of fossil generation.

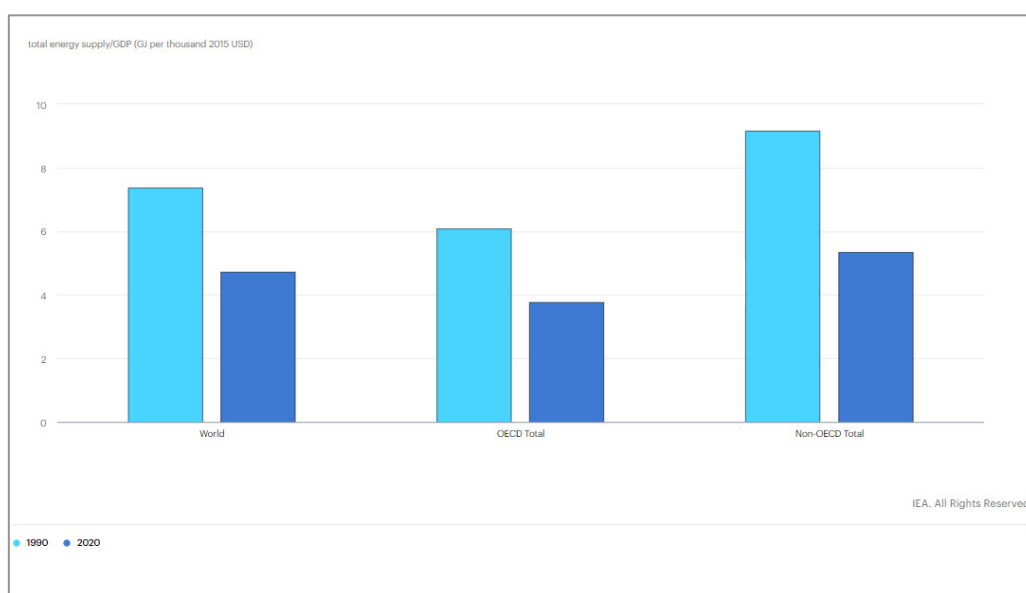
The IEA Energy and Carbon Tracker explores how these factors combined have affected emissions across a range of countries and regions, [IEA Energy and Carbon Tracker 2022](#)

Tracking progress in the transition to low-carbon energy systems provides valuable insight into the steps needed today to achieve both short- and long-term climate goals. The [IEA Energy and Carbon Tracker](#) is an interactive product showcasing a wide set of indicators useful to analyse historical trends of greenhouse gas (GHG) emissions, energy, power and sectoral patterns. The user-friendly design allows visual presentation of a set of analyses which help tracking decarbonisation at country level and globally. With the objective to increase the scope of included greenhouse gas emissions estimations, the IEA has covered in the 2022 edition the broad set of energy-related greenhouse gases accounting for bulk of the category 1 of the 2006 IPCC Guidelines for GHG inventories.

With the objective of enhancing IEA members' ability to plan and track their energy transitions, and of proposing a harmonised framework to categorise their scenarios, we successfully revamped the country projection questionnaire with simplified balances up to 2050, taking into account input from data providers and experts across the IEA. The questionnaire is linked to the IEA internal committee reporting and country in-depth review process. Notable upgrades include the definition of scenario categories, which are now compatible with those of the *World Energy Outlook*; the option for countries to submit data for multiple scenarios; the inclusion of data from emerging technologies (e.g. hydrogen, CCUS); a better interface, with CSV import/export and graphical visualisation features; and the development of comprehensive guidelines for the data compilers. We held a webinar to promote the new questionnaire and had a good response from member countries. The 2022 data collection led to the design of a new data product, [Energy Projections of IEA Countries, with extended transitions indicators](#), including a broad set of transition indicators to 2050. This was delivered in November and the same approach has

area been applied to non-member countries. For example, with the accession process, Colombia submitted their projection data for the first time.

Demand-side data and end-use efficiency indicators are essential for monitoring transitions. To assist data counterparts at a global level to set up their data collection systems, we have also developed [Demand-side data and energy efficiency indicators, A guide to designing a roadmap for demand-side data and energy efficiency indicators](#) (published in the first quarter 2023), introducing a conceptual framework based on consultation across national administrations. This work is highly innovative as it moves beyond methodological guidance and addresses strategies for national energy information systems. Mexico, through CONUEE and SENER, has already expressed interest in working on a national data roadmap based on this framework.

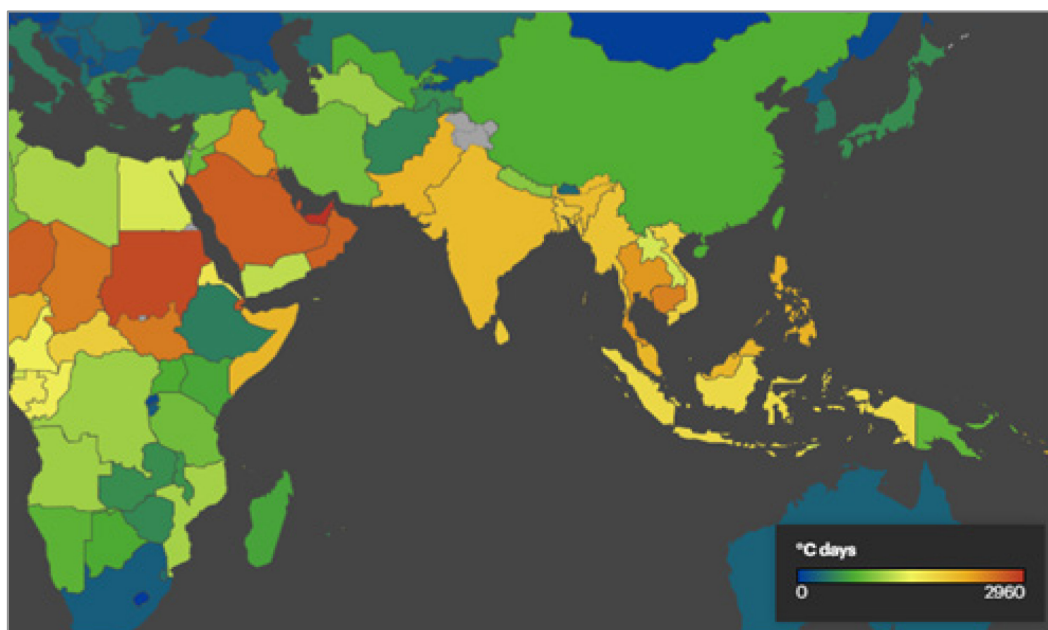


Global energy intensity, 1990 vs 2020, [Energy Efficiency Indicators Data Explorer](#), IEA, 2022

A new data explorer has increased user accessibility and visualisation of the [IEA Energy Efficiency Indicators database](#). We have expanded the geographical coverage of the database, focusing efforts on the Asia Pacific region, thanks to collaboration with our APEC counterpart, which produced country-specific assessments on efficiency data for 13 APEC economies and a set of new training materials to estimate end-use data from a variety of sources, initially presented at a joint APEC-IEA workshop. More work in this area is planned for 2023. Collaboration with key association countries, such as Brazil, has successfully continued through data exchange and active participation in their international discussions (e.g. our contribution to an international workshop on efficiency data with key stakeholders).

At the analytical level, we have developed a new global database on value added by sector and sub-sector, also including energy and carbon value added indicators, useful for structural analysis and assessment of economic efficiency trends. The database, derived by merging and harmonising partial data from across different sources, is now in peer review with external stakeholders. It is already accessible in the IEA Data Warehouse and was presented to teams around the IEA. Interest has been shown by users in the economic domain (e.g. central banks for economic analysis) and the industrial sector (e.g. the UNIDO community), as well as internal users. Dissemination is planned for the first quarter of 2023.

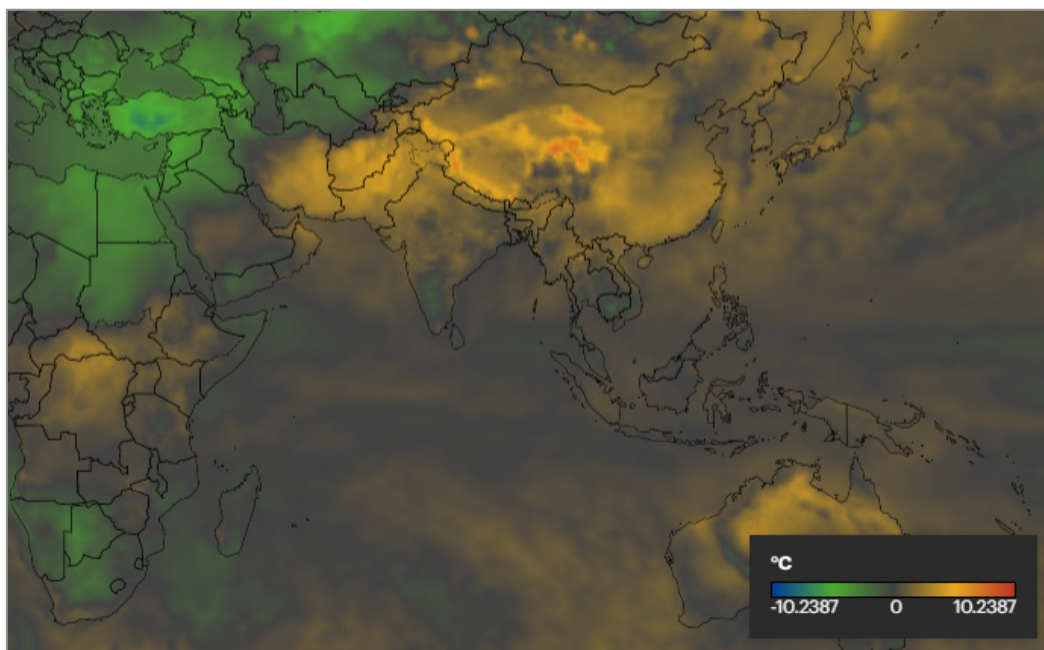
As energy supply and demand are significantly affected by weather conditions, we have consolidated, updated and improved user access to the [Weather for Energy Tracker](#) data by creating a customised download option, and adding more formats. The database is widely used by IEA analysts to inform modelling and analyses, and by external users. It includes over 20 variables that are relevant for energy analysis (e.g. heating degree days, cooling degree days, solar insolation). Variables are computed both at a high geographical resolution and also averaged at a national level – to relate with national energy data.



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

2022 Cooling Degree Days, 21°C, national average: the Weather for Energy Tracker includes weather indicators at national level aggregated by population, closely linked to heating and cooling needs. Cooling degree days were in 2022 large in Saharan Africa, Middle East, India and Southeast Asia.
[Weather for Energy Tracker, IEA, 2022](#)

Based on information from the [Weather for Energy Tracker](#) and additional research, we have developed global indicators of extreme weather events and climate hazard statistics at country level. This information is fed into the OECD International Programme for Action on Climate platform and will also be displayed in a joint IEA-OECD module on the “Climate Hazards Exposure Tracker”, to be finalised in Q2 2023. The module will focus on energy-related indicators, but will also include visualisation for a broader set of climatic hazards.



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

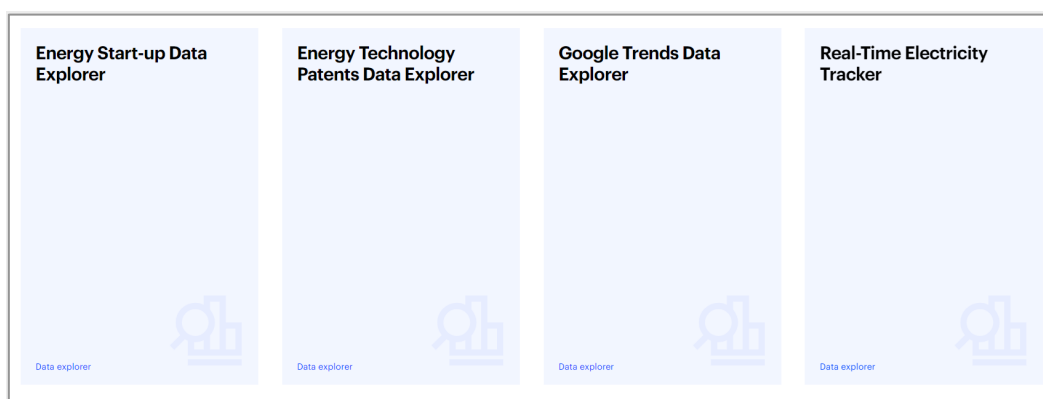
March 2022 temperature anomaly, grid: the Weather for Energy Tracker includes granular weather data at grid level, in March and April 2022 a severe heat wave hit India and Pakistan, those months showing large positive temperature anomaly.
[Weather for Energy Tracker](#), IEA, 2022

Due to the importance of weather conditions on energy demand, we have assessed the feasibility of seasonal forecasts for national temperature and precipitation data. Questions include how to produce seasonal tendency forecasts by country one month ahead, and for which countries the scientific forecast would be meaningful (with signals above noise based on verification of past forecasts). Results are expected to be implemented in the IEA Data Warehouse for piloting in 2023.

For the critical minerals area, an assessment of data availability and timeliness for different critical minerals has been started with broad geographical coverage. Assessment of data quality from different sources (trade correspondence, supply-demand country balance) is ongoing. We are currently working on creating scrapers from different sources of information to support market and security analysis in this area.

Experimental work on key indicators and timeliness

We successfully delivered a database on indicators related to factors that have important implications for clean energy transitions. The indicators we developed include measures related to technological invention, early-stage financing, firm entry and exit, renewables integration, and market search. These indicators are of value not only in relation to increasing the quality of data on clean energy transitions, but also more broadly for the assessment of the effect of policy settings on outcomes in energy markets. The database has been designed to allow for future developments with refinements to existing indicators and the inclusion of new indicators as demand arises. Moreover, it has been developed with low-cost replicability of indicators year after year through the use of automated processes for data generation. A user-friendly data portal was created, with data cutting across three dimensions (country, year, sector/technology).

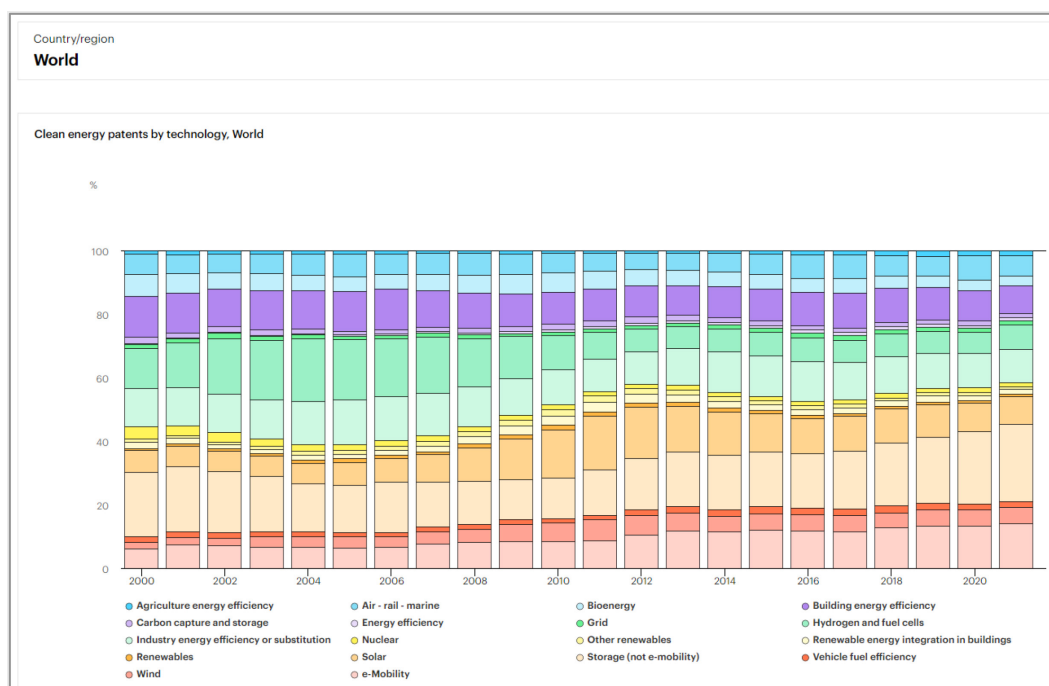


IEA. CC BY 4.0.

Experimental Indicators of the Clean Energy Transition content
Source: www.iea.org/reports/experimental-indicators-of-the-clean-energy-transition

This work has involved the derivation of indicators from a variety of micro-data sources. In many cases we have applied sophisticated analytical techniques, involving the matching of many underlying data sets. The case of indicators related to corporate R&D is a case in point, drawing upon two distinct data sets and involving the development of innovative methods to allocate R&D across very granular technology fields.

To give an idea of the richness of the data, the figure below presents data on “high-value” clean energy patents by technology field. This data is available for all country–year combinations, including all CETP focus countries and regions.



IEA. CC BY 4.0.

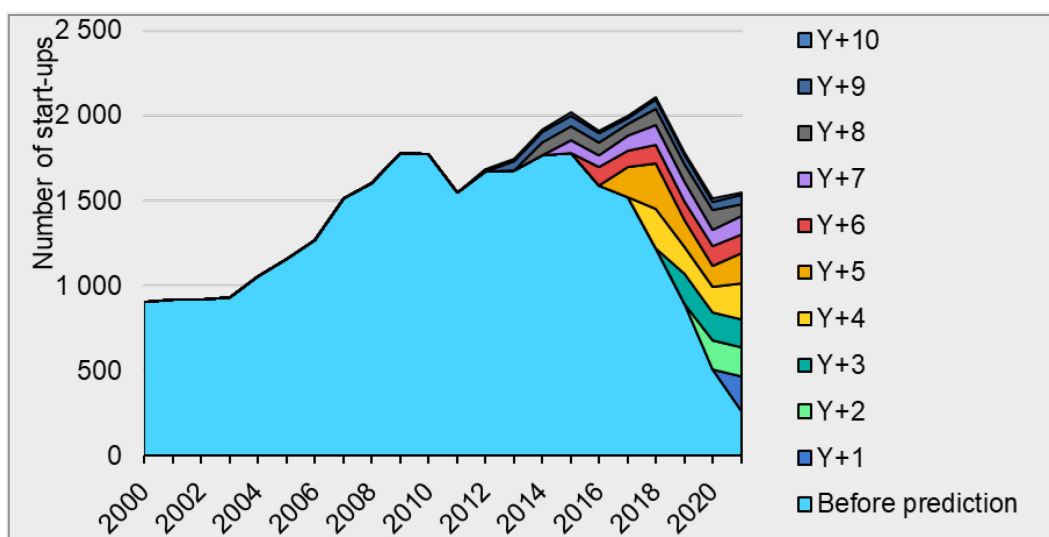
*Clean energy patents by technology, world, 2000-2021
IEA, based on extractions from the EPO PATSTAT (2022)
database.*

In addition, recent market turmoil has underlined the value of “timely” energy-related data for policy makers and other stakeholders. Simultaneously, the IEA is making efforts to reduce the lag between the compiling and dissemination of data collected using traditional methods (e.g. based on data published by national statistics offices) while exploring other means of data collection and treatment methods to generate robust data that is as “close to real time” as feasible. It must be emphasised that the two activities are complementary. Three distinct initiatives have been implemented:

- The generation of “real-time” energy data through “web scraping”.
- The generation of “nowcasted” observations for data series for which it is possible to estimate recent data based on time series.
- The generation of “leading indicators” of energy market developments through the tracking of early proxy measures identified by internet searches.

As an example, in the figure below the area in light blue represents the observed number of energy start-ups by year in the database at the point in time that the data were extracted (early 2022). However, the true figure will be much higher, given the lag in incorporating existing start-ups into the database. It is possible to estimate what this “true” value is likely to be based on the number and characteristics of the start-ups that are actually observed. As can be seen,

start-ups that were founded as long as 10 years prior will eventually be included in the database. Having this more accurate picture of the unknown “true” observation is much more valuable than data that only cover the light blue area.



IEA. CC BY 4.0.

Nowcasting energy start-ups. IEA analysis based on [Crunchbase](#), 2022.

These efforts are summarised in the report *Generating Timely Energy Market and Behavioural Data with Innovative Methods*, available at [Experimental Indicators of the Clean Energy Transition – Analysis – IEA](#).

Statistics training

The IEA Energy Data Centre has designed a series of online training videos and biannual online training courses to teach the essential definitions, methods and tools for developing and reporting national energy balances. The statistical training brings great value to the countries that attend, builds skills that support better quality of data and helps them meet international standards required for energy reporting, and ultimately benefits IEA through expansion of the network of data providers. It also contributes to the career development of statisticians, so demand for training is regularly very high. For the first time in 2022 the IEA decided to reduce the number of participants to 75 for each training course, to ensure meaningful interaction with the virtual participants. A total number of 152 statisticians from 16 countries took part in two training sessions. In addition to the training sessions, the online videos of the training material attracted more than 4 000 viewers throughout 2022.

The quality and usefulness of the training received praise from the participants. In the satisfaction surveys after the training, almost 80% of the participants considered the content very relevant to their daily work. Over 70% of the

Critical minerals

Building on the inaugural report [The Role of Critical Minerals in Clean Energy Transitions](#) and the ministerial mandate in March, the IEA has been expanding its work on critical minerals in numerous ways with support from the CETP. Based on the six policy recommendations for a new, comprehensive approach to mineral security presented in the special report, a concrete work programme has been adopted in the areas of modelling improvement, market monitoring, policy tracking and ESG standards.

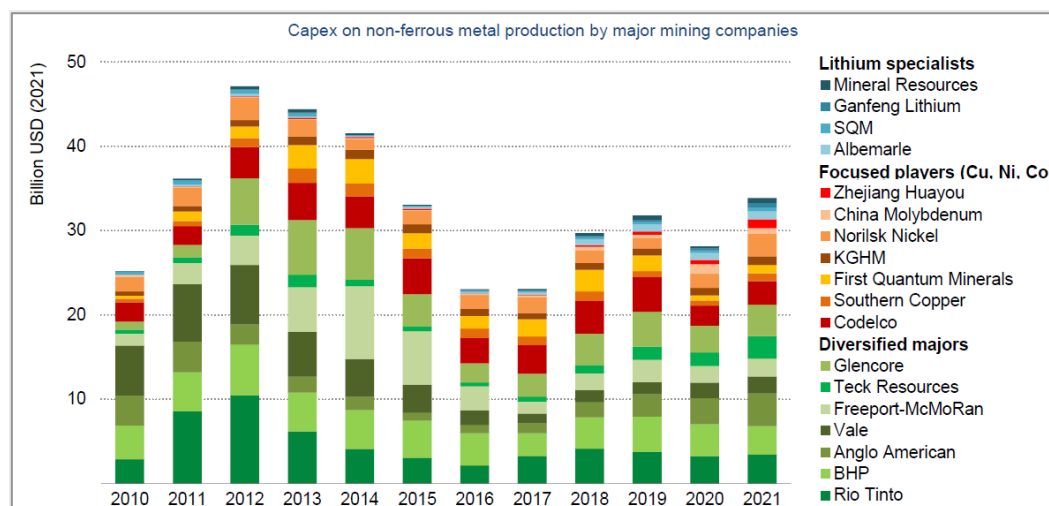
Modelling improvement and in-depth analysis of critical mineral supply chains

The IEA has further improved the critical minerals model to project future mineral requirements under different scenarios and varying technology evolution trends, based on the latest policy and technology trends. The model has been expanded to track production and investment trends and better assess the potential impacts of recycling on primary supply requirements. Work is underway to strengthen modelling capacity for supply projections. The model has been fully integrated into the IEA's long-term energy modelling tools so that the results can be updated regularly in line with the IEA's latest energy projections. IEA projections for critical minerals were one of the most cited results in various policy notes, research and media. They also allowed policy makers to better understand potential bottlenecks in advancing clean energy transitions and make informed decisions to ensure security of mineral supplies.

Based on the improved modelling framework, CETP support also allowed us to produce various analyses of the opportunities and challenges related to critical minerals. This fed into analytical outputs such as [Global EV Outlook 2022](#) (May), [World Energy Investment 2022](#) (June) and [World Energy Outlook 2022](#) (October). In particular, for the first time [World Energy Investment 2022](#) had a dedicated chapter on critical minerals, which included a detailed review of market and investment trends for critical minerals. In [World Energy Outlook 2022](#), the analysis of critical minerals constituted a major pillar of the IEA's ten guidelines for energy security during clean energy transitions.

In May, with Russia's invasion of Ukraine and surging material prices, we produced [further analysis](#) to provide timely assessments on the impacts of the war and the implications of surging material prices on clean energy technology costs. The analysis revealed that raised prices for critical minerals led to a reversal of a decades-long trend of cost declines for clean energy technologies, such as solar panels, wind turbines and batteries.

The team also produced region-specific analyses through dedicated sections on critical minerals in the [Southeast Asia Energy Outlook 2022](#) (May), [Africa Energy Outlook 2022](#) (June) and [An Energy Sector Roadmap to Net Zero Emissions in Indonesia](#) (September).



IEA, CC BY 4.0.

Extract from [Word Energy Investment 2022](#)

Critical Minerals Policy Tracker

In order to track progress on the implementation of policies related to critical minerals and encourage the sharing of best practices, we have developed a new policy tracking tool, the [Critical Minerals Policy Tracker](#). Launched in November, it is intended as a tool to help governments explore new critical mineral policies in the three key policy areas of:

- Ensuring supply reliability and resiliency.
- Promoting exploration, production and innovation.
- Encouraging sustainable and responsible practices.

Currently, the tracker includes nearly 200 policies and regulations from 25 countries and regions worldwide, including key emerging economies like Argentina, Brazil, Chile, China, Colombia, India, Indonesia and South Africa. These policies address many different goals, including ensuring supply reliability and resilience, promoting exploration, production and innovation and encouraging sustainable and responsible practices.

Region People's Republic Of China				
	Strategic plans ?	Strategic mineral lists ?	International coordination mechanisms ?	Stockpiling mechanisms ? Public investment ?
Ensuring supply reliability and resiliency	3	1	1	2
	Financing ?	Tax incentives ?	Geological surveys ?	Recycling support ? Innovation funding ?
Promoting exploration, production and innovation			1	
	Environmental standards ?	Transparency norms ?	Due diligence obligations ?	Inclusivity and gender policies ? Permitting regimes ?
Encouraging sustainable and responsible practices	1			

IEA. CC BY 4.0.

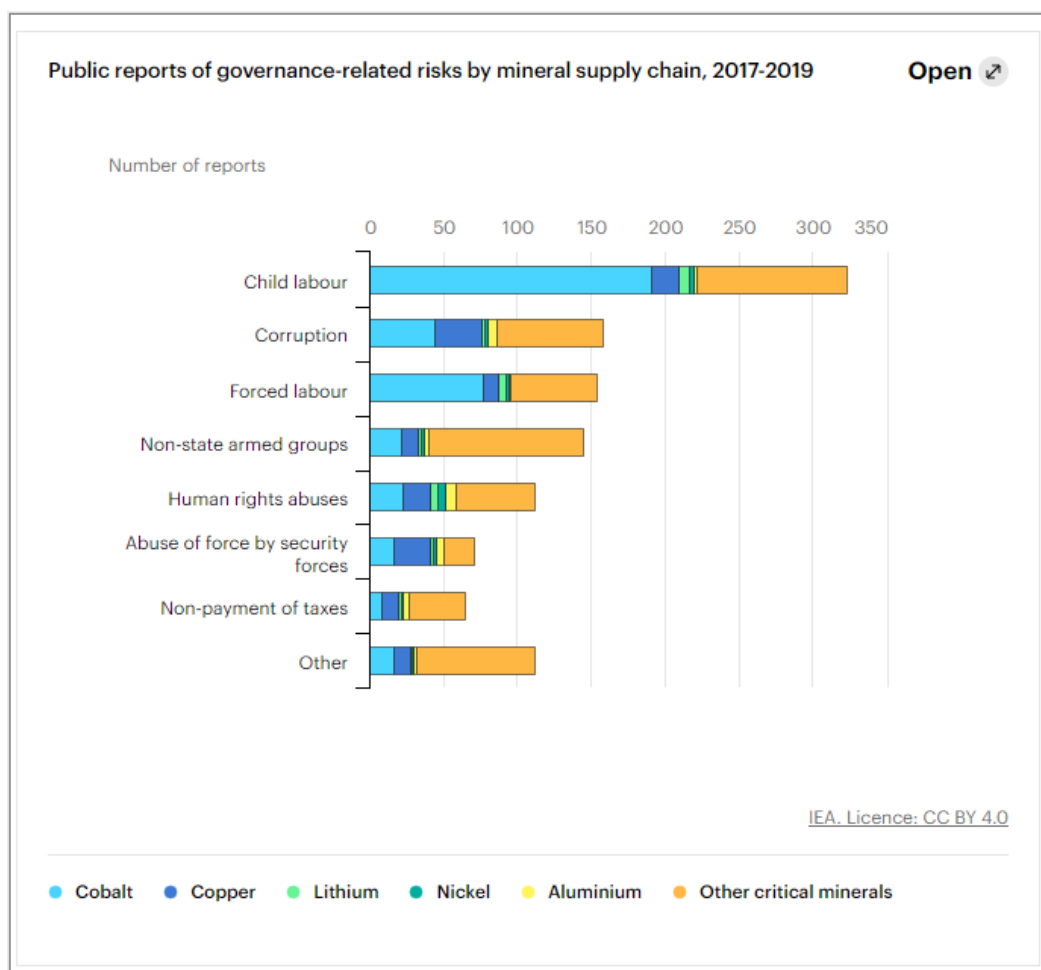
Snapshot of policies related to critical minerals in China, [Critical Minerals Policy Tracker](#), IEA, 2022.

The launch of the tracker was accompanied by a short report presenting key findings from the data on the three key policy areas listed above.

ESG considerations for critical minerals

There is growing recognition among countries that critical minerals must be produced sustainably and responsibly. High ESG standards are increasingly needed to attract investment and to obtain – and maintain – a social licence to operate. This can also support supply chain security and resiliency because ESG-related failures can lead to short-term supply disruptions.

In order to support policy makers in reinforcing the ESG aspects of the critical mineral supply chains, last year we produced analysis of the [impact of extractive industries on groundwater resources](#) (March) and [the importance of ESG factors to critical mineral supplies](#), with ways to address ESG-related failings that can impact clean energy transitions (September). In addition, we are tracking a number of ESG-related policies as part of the [Critical Minerals Policy Tracker](#) referenced above, including environmental standards, transparency norms, due diligence obligations, and inclusivity and gender policies.



IEA. CC BY 4.0.

[*Why is ESG so important to critical mineral supplies, and what can we do about it?*, IEA, 2022](#)

Future work under the critical mineral workstream will further focus on ESG performance tracking and raising awareness with policy makers of the nexus between ESG and security of supply. This is to help ensure that policies on critical minerals and clean energy transitions do not generate unintended consequences that may harm affected populations and limit the supply of critical minerals and metals. The IEA will continue to work closely with international partners in this area, including the OECD, the Extractives Industries Transparency Initiative (EITI), and the Intergovernmental Forum on Mining, Minerals, Metals and Sustainable Development (IGF).

Digitalisation

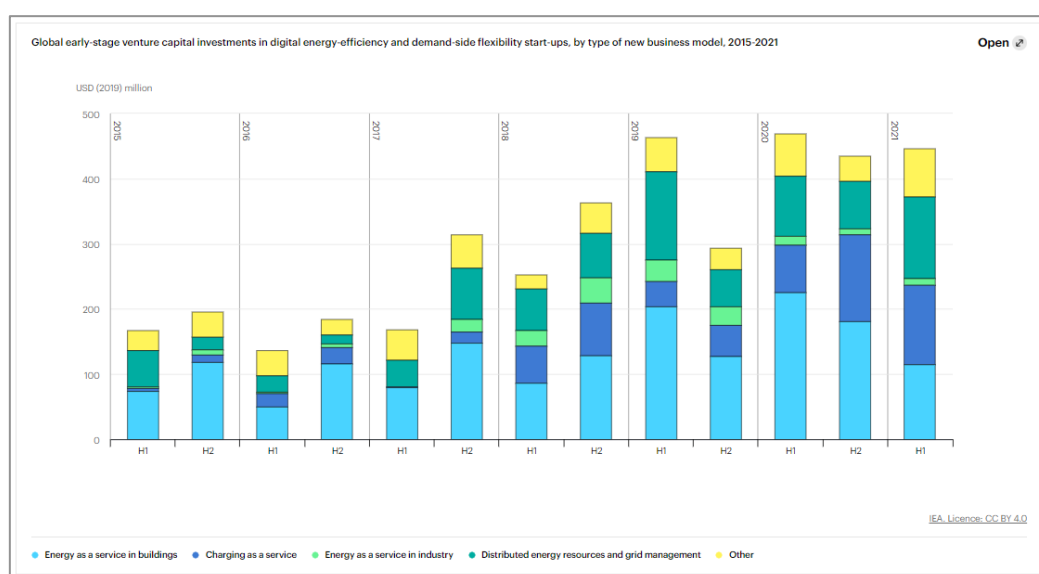
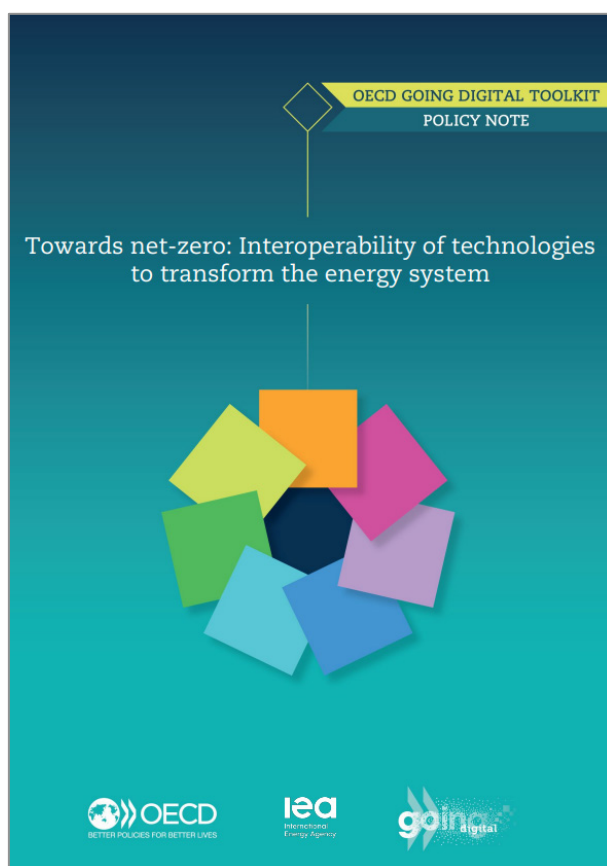
In light of persistent challenges and the support needed in EMDEs to advance power system modernisation, decarbonisation and digitalisation, the IEA, together with the Italian Ministry of the Environment and Energy Security, launched the [IEA Digital Demand-Driven Electricity Networks Initiative \(3DEN\)](#) under the CETP.

3DEN is developing guidance and analysis to help inform policy making in EMDEs, notably on opportunities to scale up investment in power infrastructure, ensuring the benefits associated with digital investment are widely shared. At the same time, the IEA is convening a series of high-level and expert events and workshops, and supporting the creation of a community of practice around these topics. 3DEN is also contributing to expanding global analysis of power system digitalisation across IEA workstreams.

3DEN has a global focus, with initial country priorities being Brazil, Colombia, Morocco, Tunisia, India, Indonesia, South Africa and the regions of Latin America, Africa and Southeast Asia. Building on a successful 2021, where 3DEN and its analysis on how to empower cities for a net zero future were recognised in the [G20 Energy-Climate Joint Ministerial Communiqué](#), in 2022 we focused on research, engagement and drafting to create impactful 3DEN intermediate and final outputs, published throughout 2022.

In particular, we completed work on best practices in digitally enabled data collection and analysis, deployment of connected devices, global and regional smart metering roll-outs, and the adoption of smart grids and grid edge technologies for better integration and management of distributed solar PV. These are feeding both into 3DEN and broader IEA publications.

We published two main outputs in 2022, namely [The Potential of Digital Business Models in the New Energy Economy – Speeding efficiency gains and increasing demand-side flexibility](#) and [Towards Net-Zero: Interoperability of technologies to transform the energy system](#). An in-depth report on smart grids for reliable and efficient power systems in EMDEs is being finalised in Q2 2023, and a collection of articles on smarter grids for decarbonised power systems is expected to be published in the remainder of 2023.



[*The potential of digital business models in the new energy economy, IEA, 2022*](#)

We are further strengthening IEA coverage of the topic of digitalisation and the importance of digital technologies for energy decarbonisation, clean energy transitions and net zero across a multitude of publications, including [Tracking Clean Energy Progress](#) on [Digitalisation](#), [Demand Response](#) and [Smart Grids](#), [Global Electric Vehicle Outlook 2022](#), [Africa Energy Outlook](#), [Tracking SDG7: The](#)

[Energy Progress Report](#), [World Energy Investment 2022](#), [Electricity Market Report](#), [The Future of Heat Pumps](#), [Climate Resilience for Energy Security Report](#), [Energy Efficiency 2022](#) and the [Grid Integration of Electric Vehicles Manual](#). In addition, modelling and analysis of electricity networks was enhanced in the [World Energy Outlook 2022](#) report, which led to the introduction of a key theme on networks in the Electricity Sector Outlook chapter, emphasising planning, investment and making sure grids are smarter to support energy transitions. The report also provided a highly visible platform for digitalisation-related analysis for policy makers, industries and thought leaders around the world.

We are also ensuring that the topic of digitalisation for decarbonisation and resilience is a priority topic at high-level international and national discussions. At COP27, we organised with Italy and UNEP the side event [Digitalisation: Strengthening collaboration towards smart power systems](#). The event was opened by the Italian Minister for the Environment and Energy Security and by the IEA's Chief Economist, and saw the participation of high-level experts from The Energy and Resources Institute India, Morocco's Eaux Minérales d'Oulmès, Enel Group, UNEP, International Smart Grid Action Network (ISGAN) and Green Powered Future Mission. At the Global Clean Energy Action Forum, the IEA, the Italian Ministry for the Environment and Energy Security, the Information Technology and Innovation Foundation – Center for Clean Energy Innovation, Mission Innovation Green Powered Future Mission, ISGAN and UNEP co-organised the side event “Demo! Scalable and replicable demonstration projects to accelerate decarbonisation worldwide”. Experts from the United States, UNEP and India joined the panel discussion.

3DEN also successfully continued its participation in and contribution to Mission Innovation Green Powered Future Mission (GPFM) – a public-private partnership that involves governments, the private sector and international organisations, including from Brazil, China and India. 3DEN participated in periodic meetings and provided inputs into ongoing work and into the action plan for 2022-2024. The IEA also participated in a seminar organised by China and GPFM on 5 December 2022. The IEA and GPFM also strengthened collaboration by jointly organising a number of events and by supporting dissemination of relevant events and publications, namely at 2022 Global Clean Energy Action Forum and at COP27.



IEA. All right reserved.

H. E. Gilberto Pichetto Fratin, Minister of the Environment and Energy Security of Italy and Tim Gould, Chief Economist of the IEA at the COP27 side event “Digitalisation: Strengthening collaboration towards smart power systems”

<https://www.linkedin.com/company/green-powered-future-mission>.

During the IEA’s 7th Global Conference on Energy Efficiency on 8 June, we co-led a dedicated session on [innovation for next-generation efficiency](#) with participation from both public and private sector speakers, including from Brazil and India.

We have established partnerships, collaborations and exchanges with leading smart grid and demand-side related initiatives under 3DEN, including [ISGAN](#), [GPfM](#), [User-Centred Energy Systems TCP](#), [Energy Efficient End-Use Equipment TCP](#), and EMDE stakeholders such as the [India Smart Grid Forum](#) and the [Africa Renewable Energy Initiative](#). This is allowing us to support co-ordination efforts to increase global impact.

We created a consultative group under 3DEN to advise on technical issues, provide inputs into key deliverables and support dissemination activities. It includes 37 organisations from 14 countries, including from Brazil, Chile, China, Colombia, India and DRC, representing governments, the private sector and research community.

In parallel, we facilitated peer-to-peer exchange among EMDEs and learning on digitalisation challenges and opportunities, and organised more than 10

workshops and technical exchanges, an example being the joint IEA-ISGAN expert workshop on [flexibility for resilience in integrated systems](#), which brought together in person in Paris more than 30 participants from over 20 countries, including from Brazil, Chile, Ghana, India, Indonesia, Morocco and Tunisia. This opportunity allowed us to identify common challenges among countries and to create stronger links among international experts on the topic. In 2022, four pilot projects from Brazil, Colombia, India and Morocco were awarded, as a result of an international call for proposals launched during the Pre-COP26 in Milan and managed by UNEP with support from the Italian Ministry of the Environment and Energy Security. The objective of these pilots is to test innovative approaches to support the uptake of smarter digital power infrastructure in emerging economies. Lessons learnt and findings gathered on the ground will be included in further CETP-funded IEA analysis produced under the 3DEN project.



IEA. All right reserved.

Participants at the IEA-ISGAN workshop: Flexibility for resilience in integrated systems

Energy employment and skills

The IEA's first [World Energy Employment](#) report provided a first-of-its-kind estimate of how many workers are employed in the global energy sector. The report provided unprecedented detail by sector, region and supply chain segment of the energy workforce, while highlighting key challenges facing the industry regarding recruitment and labour shortages, and transition opportunities for workers. This historical baseline was accompanied by projections of future labour demand by sector and region under different scenarios, in order to support policy makers, industry, labour representation and educators better develop strategies and approaches to manage the large shift already underway in the global energy industry. Detailed results were included in other IEA reports, such as: the [World Energy Outlook 2022](#), [An Energy Sector Roadmap to Net Zero Emissions in Indonesia](#), [Coal in Net Zero Transitions](#), [Africa Energy Outlook 2022](#), [Skills Development and Inclusivity for Clean Energy Transitions](#), and the [Energy Efficiency Market Report 2022](#).

Fuel supply, power and end use sectors are key sources of employment across every region

Employment by region and energy sector in thousands of employees, 2019

	North America	Central and South America	Europe	Africa	China	India	Other Asia Pacific	Rest of world	Global
Supply: coal	100	<50	100	200	3 400	1 400	800	300	6 300
Supply: oil and gas	1 900	1 100	600	1 600	1 100	700	1 100	3 800	11 800
Supply: bioenergy	100	800	300	600	300	500	600	<50	3 300
Power: generation	1 000	600	1 400	400	3 800	1 200	1 800	1 000	11 300
Power: grids	900	400	1 200	500	2 300	1 500	1 200	600	8 500
End uses: vehicle	1 800	600	2 700	200	4 500	1 200	2 100	600	13 600
End uses: efficiency	2 000	300	1 100	400	3 800	1 500	1 400	400	10 900
All energy	7 900	3 800	7 500	3 800	19 200	7 900	8 900	6 600	65 700

Notes: Grids includes transmission, distribution, and storage. Vehicles includes the manufacturing of all road vehicles (two- and three-wheelers, passenger vehicles, light-duty commercial vehicles, buses, and trucks) and batteries for electric vehicles. Efficiency refers to energy efficiency in buildings (covering retrofits, heating, ventilation and air conditioning equipment, as well as appliances); and in industry. Values may not sum due to rounding.

IEA. CC BY 4.0.

Extract from the IEA [World Energy Employment 2022](#) report

The report has contributed substantially to advancing the IEA's objective of placing greater focus on designing energy transition policy to be people-centred. Ensuring that clean energy transitions produce tangible benefits for citizens is central to the world making continuous progress on achieving its climate goals, the kind that can endure political cycles. The findings supported a number of important real-world outcomes. The findings on today's employment, and future job creation and loss featured in the IEA's regional roadmaps (Africa and Indonesia) and in the [Coal Net Zero report](#), which was prominent in international agreements (e.g. Indonesia's

Just Energy Transition Plan) and joint statements on the importance of maximising the creation of good local jobs.

The report provided key inputs to the International Labour Organization's technical meeting on the future of work in the oil and gas industry, which reached a tripartite agreement between governments, labour and employers on just transition principles for the industry.

The IEA report and analytical team helped a number of national administrations with their own secondary labour surveys to inventory the number of workers currently in energy supply chains in their regions.

The report has also been referenced in a number of other publications from prominent international and national authorities, providing a baseline for analysis surrounding just energy transitions, addressing labour shortages and supplying growing clean energy supply chains with skilled labour.

People-centred clean energy transitions

As more countries set ambitious goals to accelerate the shift to clean energy, the success of clean energy transitions will depend on efforts to enable citizens to benefit from them and to navigate any disruption. With this in mind, the IEA has increased its activities on the issues at the heart of people-centred clean energy transitions, including stronger policy recommendations and data analysis.

We have built on the work of the [Global Commission on People-Centred Clean Energy Transitions](#), an independent panel convened by the IEA's Executive Director, bringing together 30 members who worked together to produce a series of actionable recommendations in advance of COP26 in 2021. At the 2022 IEA Ministerial we organised a ministerial roundtable on "Ensuring a people-centred and just clean energy transition", led by Danish Minister for Climate, Energy and Utilities, Dan Jørgensen, to showcase inspiring best-practice case studies led by governments and civil society groups from around the world that have ensured people-centred clean energy transition pathways.

In March the IEA Executive Director convened a new [IEA Clean Energy Labour Council](#), bringing together representatives of national trade unions to foster dialogue between the IEA, its stakeholders and the labour sector. The first meeting was co-chaired by Sharan Burrow, former General Secretary of the International Trade Union Confederation (ITUC) and Bheki Ntshalintshali, former General Secretary of the Congress of South African Trade Unions (COSATU). A second meeting is planned for February 2023.

In April we collaborated with the Indonesian Ministry of Energy and Mineral Resources (MEMR) as part of Indonesia's G20 presidency to organise a high-level

workshop on “Ensuring people-centred transitions for all”. Drawing on successful examples from around the world, this workshop focused on employment and government support for communities and workers in the coal supply chain, including job creation programmes, and mechanisms for reskilling, upskilling and redeployment.

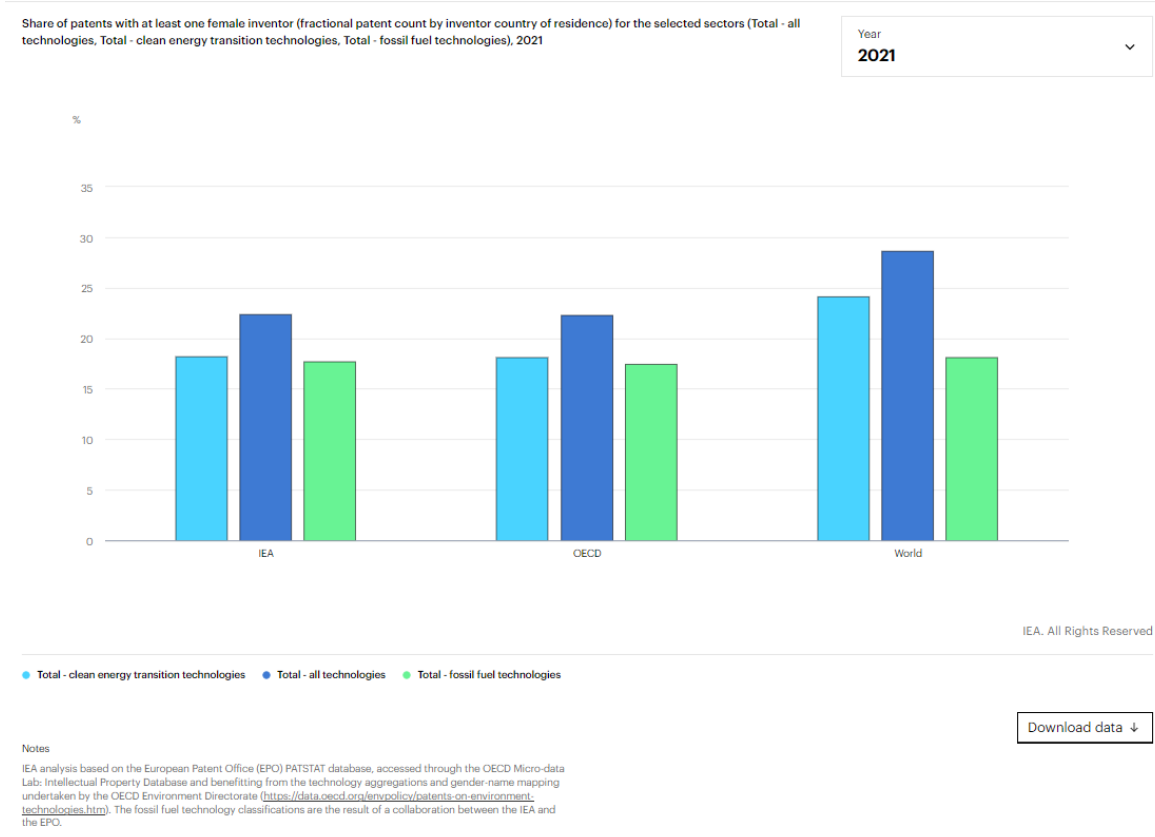
The IEA was commissioned by the US Department of Energy, Natural Resources Canada and the European Commission (DG Employment, Social Affairs and Inclusion) as part of the CEM’s Empowering People Initiative to develop analysis and guidance on the key topic of “Skills development for the clean energy transition”. This was to better understand the labour market needs associated with clean energy transitions; and to explore the related training and education needs for maximising the job creation potential of clean energy policies. As part of this collaboration, we launched a new report on [Skills Development and Inclusivity for the Clean Energy Transition](#) at a side event organised at the [Global Clean Energy Action Forum](#) on 22 September, which brought together key stakeholders on the issue from the United States, Canada and the European Commission, including the Deputy Minister of Natural Resources Canada.

At the Global Clean Energy Action Forum, in collaboration with the US Center for Strategic and International Studies, we organised a high-level roundtable on “Repurposing coal infrastructure and diversifying local economies to enable a just transition in coal regions”. The event explored practical lessons learned from regional governments and coal companies on a just transition away from coal, and brought together senior officials and representatives from Europe, India and the United States, including Kate Gordon, Special Advisor to the US Secretary of Energy, and Vinay Ranjan, Director IR and HR, Coal India Ltd.

In November we organised a “Global dialogue on the labour implications of a people-centred clean energy transition” at COP27, which, drawing on successful examples from diverse countries, particularly South Africa, India and Indonesia, explored some of the key labour implications at the heart of a people-centred clean energy transition.

Additional work under the Clean Energy Transitions Programme consisted of support for governments’ efforts to enhance gender equality and diversity in the energy sector. This work included facilitating countries and stakeholders participation in the Clean Energy Ministerial [Equality in Energy Transitions Initiative](#) (including with Indian Smart Grid Forum) as well as contributing to a side-event during United Nations High-Level Political Forum on Sustainable Development in June 2022. IEA’s participation led to a closer dialogue with UN agencies and other relevant organisations on the strengthened collaboration on disaggregated gender data for the energy sector by linking up relevant workstreams to each other. The [Gender and Energy Data Explorer](#) was an

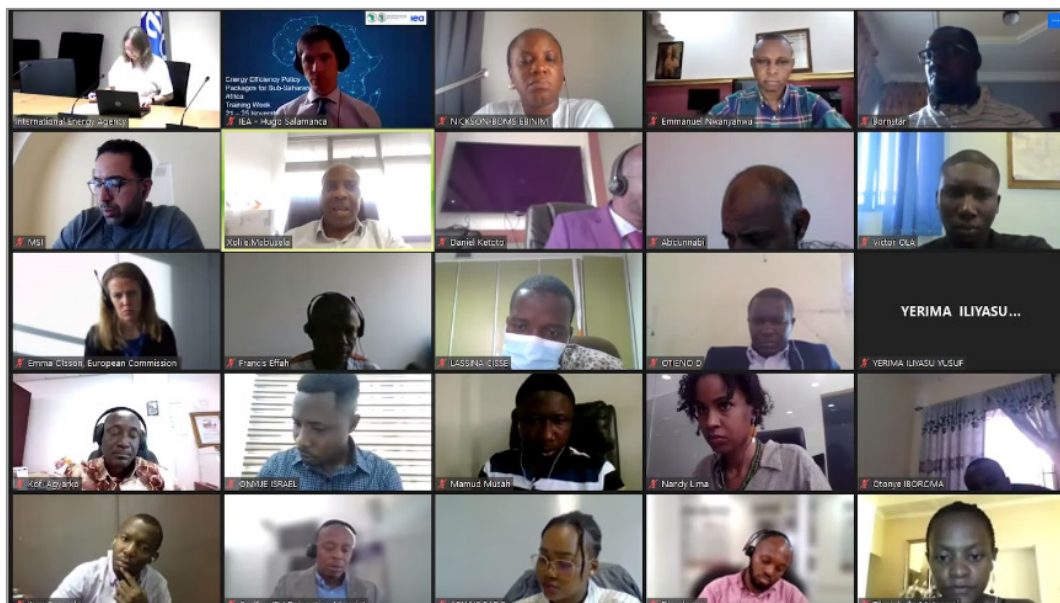
important input of the IEA to this work and could hopefully be expanded over the next years through this collaboration.



Extract from the [Gender and Energy Data Explorer](#), IEA, 2022

Energy efficiency training

In November the IEA and AfDB delivered the first [online energy efficiency training for sub-Saharan Africa](#), which gathered nearly 300 regional policy makers and energy professionals. It presented a detailed introduction to energy efficiency policy packages, followed by sector-based sessions focused on appliances, buildings, industry and transport. In line with [SDG7](#), the training aimed to support the development and implementation of policies that can lower energy costs and carbon emissions while supporting economic growth.



IEA. All right reserved.

IEA and African Bank Deliver First Online Energy Efficiency Training for Sub-Saharan Africa, November 2022

The section on energy efficiency policy was based on the [IEA's policy package approach](#) and highlighted best practices both from around the world and within the sub-Saharan Africa region, building on the successful launch of the [IEA Africa Energy Outlook 2022](#) and the [IEA initiative to promote clean energy transitions in Africa](#) through enhanced regional collaboration.

Throughout the five-day course, expert speakers shared international and regional experiences, with insights from South Africa, Kenya, Ghana, Nigeria, India, Australia, Mauritius, the Economic Community of West Africa States (ECOWAS), the European Union, UNIDO, UNEP, AfDB and the IEA. Online polls were used throughout the week to engage with participants.

Energy technology and innovation

Innovation policies

On innovation the IEA continued to engage with stakeholders in priority countries at a high level, and disseminate new analytical material to governments around the world, filling important knowledge gaps on innovation policies. Work focused on three areas in the final project period:

- Case study analysis of how governments support clean energy start-ups.
- Work to connect priority countries and other emerging market energy innovation policy experts to share experiences.

- Continued engagement with Brazil on regulatory developments related to innovation funding.

More specifically, activities included the launch of the publication [How Governments Support Clean Energy Start-ups: Insights from selected approaches around the world](#), comprising two parts:

- A summary of countries' approaches, structured around the primary types of policy intervention.
- A set of 14 detailed policy case studies from around the world.

The report has been translated into [Spanish](#) and [Portuguese](#), and these versions made available on the report website.



We also presented the publication in five international forums, [including to a Peruvian audience](#) and [governments on the CERT committee \(including Indian government representatives\)](#), where it received very positive feedback.

We held three follow-up calls with India's Clean Energy International Incubation Centre (CEIIC) in February and May to discuss the findings of the report on government support for start-ups and how it can inform CEIIC strategy.

These were followed by three further calls, at the initiative of the IEA, to discuss the findings and implications of the report for government support to start-ups and how it can inform future collaboration. The calls were held with representatives of existing government and government-funded initiatives in the area of international co-operation on clean energy technology incubation, from CEIIC (India), the

National Renewable Energy Laboratory (United States), Energy Systems Catapult (United Kingdom) and Mission Innovation.

In February, March and May we held a set of virtual group knowledge-sharing events with innovation policy experts from EMDEs, followed by a [final meeting](#) on 7 July. Government representatives and experts from the following countries participated in the group knowledge-sharing events: Argentina, Brazil, China, Colombia, Ethiopia, India, Kazakhstan, Kenya, Mexico, Morocco, Nigeria and South Africa. Government officials were the key contacts in two of these countries, with academics and innovation institutes playing the lead role in the others. There were 22 preparatory meetings in support of these events with the organising partner, IIT Delhi School of Public Policy.

As part of these group knowledge-sharing events, we developed a case study template and refined it to help participants take a consistent approach to thinking about the policy problem and to ensure a broad conception of innovation policy and the potential for cross-country comparison. We held 15 preparatory and informational bilateral meetings with national country teams (Argentina, Brazil, Colombia, Kazakhstan, Kenya, Mexico, Morocco and South Africa).

To showcase the challenges and learnings from these events, a final output – a [public side event at the Global Clean Energy Action Forum](#) hosted by the US Department of Energy in Pittsburgh – took place on 23 September. The objective was to stimulate discussion between Mission Innovation governments about appropriate formats for possible future innovation co-operation that can enhance innovation capacity in all countries. The CETP supported presentations from Brazil, India, Morocco and Nigeria.

Measuring and tracking energy technology innovation

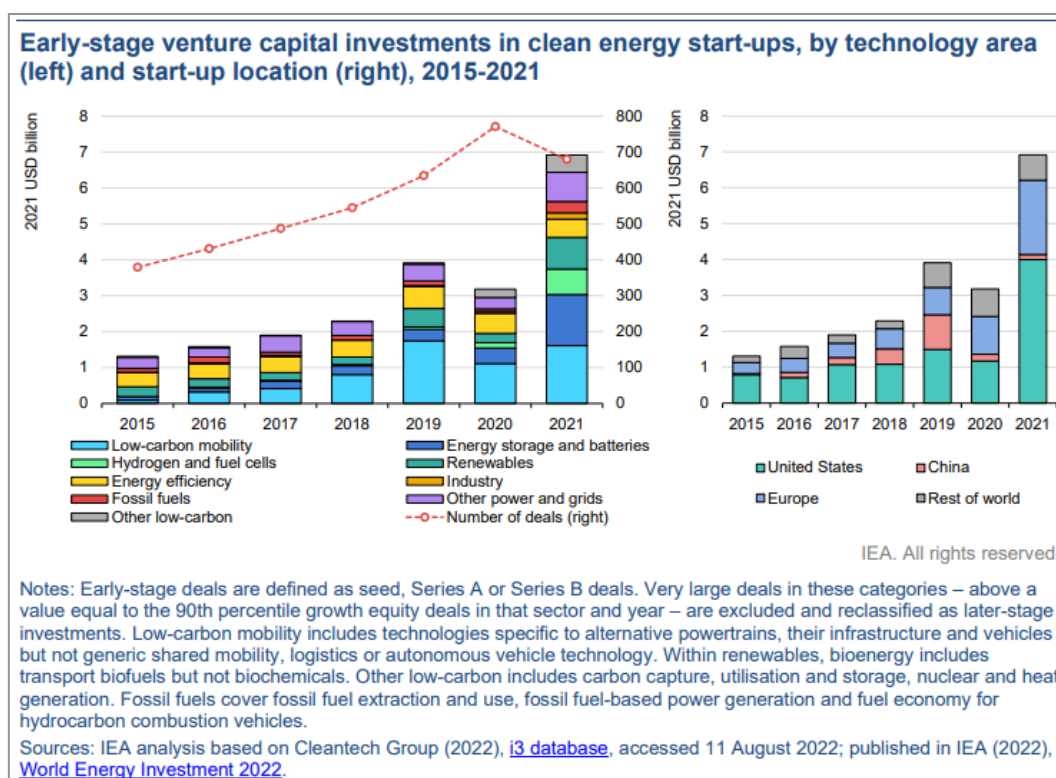
The IEA continued to produce a unique set of metrics on innovation that includes key EMDEs, thanks to CETP support. In addition, we focused our effort on documenting effective practices in innovation data collection in order to provide global stakeholders with the inspiration and materials needed to develop their own processes. Highlights included:

- Enhancement of IEA tracking of spending on clean energy innovation, including analysing the latest trends in priority countries and globally for the most recent year (2021).
- Support to Brazil's INOVA-e platform for measuring and mapping energy technology innovation in support of policy planning.
- A thorough review of options for tracking business-sector innovation activities, a critically important part of the innovation landscape without any guides or consensus on how to measure it (instigated by Brazil).

- Continued dissemination of the work on mapping China's energy innovation system.

More specific activities included:

- Researching, drafting, peer reviewing and launching the publication [Tracking Clean Energy Innovation in the Business Sector: An Overview](#), including a pre-release presentation to Brazil's Energy Research Office (EPE).



- Publication of data, trends and analysis in the innovation chapter of the IEA flagship publication [World Energy Investment](#) in June. In particular, this work built on methodological improvements to the estimation of corporate R&D spending and more granular technology tracking of venture capital deals.
- Increased user data accessibility and enhanced visualisation for the expanded global public RD&D spending dataset. This included designing a [new data exploration tool](#).
- A workshop with Brazil and Chile on [Enhancing Public RD&D Data Collection: The Experience of Latin American Countries](#). This Brazil-led initiative illustrates the regional relevance of themes developed under the CETP.
- Participation in a [public side event at the Global Clean Energy Action Forum](#) organised by the US Department of Energy in Pittsburgh to discuss next steps for global innovation data.
- Publication of the report [Tracking Clean Energy Innovation: Focus on China](#) in March, following inputs from the Chinese Ministry of Science and Technology and sharing drafts with the ministry for review. The report has been [translated into Chinese](#).

- A launch event for the publication [Tracking Clean Energy Innovation: Focus on China](#), co-organised with the European Union-China Energy Cooperation Platform (ECECP). This was accompanied by an [article](#) published by the ECECP and an IEA workshop summary.
- Completion of mapping the international clean energy innovation collaborations and partnerships in which China is involved, with the objective of informing IEA analysis and international understanding of China's activities.
- Publication of [Tracking Public Investment in Energy Technology Research: A Roadmap](#) in the final weeks of the project. The report describes the variety of approaches countries use to track their entire national public energy RD&D activity. It is intended not only as a guide for countries near the beginning of their journey towards the collection of energy RD&D, but also for countries with more advanced systems looking to strengthen specific areas. The roadmap is the product of interviews held with representatives of 20 governments between November 2021 and March 2022. The objective of the publication is to serve as a reference and inspiration for experts in this important area of tracking clean energy transitions and to allow experiences to be added in the future.
- Continued collaboration with the MI secretariat to align data collection processes for non-IEA member countries and IEA member countries, and support MI members to gather and share data.
- Continued dialogue with the Brazilian government on the INOVA-e platform development, including two calls with officials on patent analysis.

Enhancing multilateral innovation partnerships

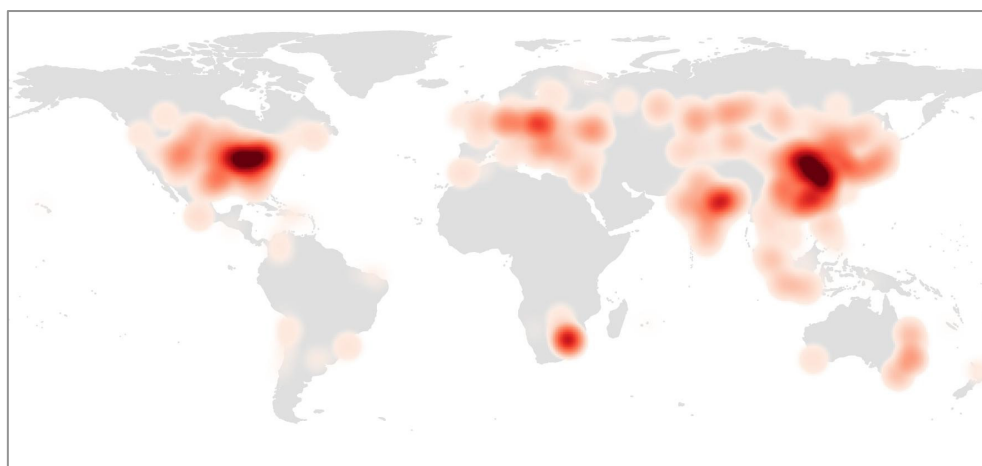
Funding support from the CETP has allowed the IEA to enhance the development of the IEA Technology Collaboration Programme (TCP) in 2022, with a focus on enabling greater participation from emerging countries. Bilateral dialogue has been established with certain countries to present the work of the various TCPs, such as with the Chilean Ministry of Energy, to explore how the TCPs can support governments' policy ambitions and priorities. The IEA has also given its support to individual TCPs and their engagement with new members and sponsors. One example is the support for the Equality in Energy Transitions Initiative's process to invite the Indian Smart Grid Forum to become a "Sponsor" of the initiative. The CETP has also on several occasions supported IEA desk officers with material to share with contacts in IEA partner countries with the aim of increasing knowledge of the TCP network. The funding support from CETP was instrumental in sustaining and developing the TCP network.

Phasing out coal emissions

Coal is by some margin the largest source of energy-related CO₂ emissions and, far from declining, global coal demand has been static for a decade. On the back of the global energy crisis in 2022, global coal demand looks to have reached a record level. At the same time, the coal sector is deeply embedded in a number of

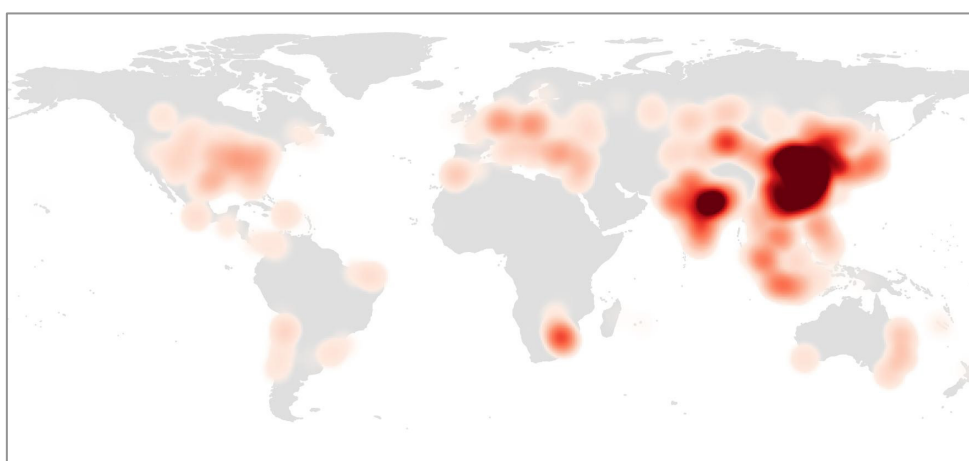
countries' economies, labour markets and regional patterns of specialisation. This makes reducing emissions from coal use particularly challenging.

In the light of this, the IEA published a first-of-its-kind special report focusing exclusively on the role of reducing coal emissions in the context of net zero energy transition. [Coal in Net Zero Transitions: Strategies for Rapid, Secure and People-Centred Change](#) provides policy makers with an integrated toolkit to accelerate transitions away from coal, with analysis of the various components of coal transitions including energy security, affordability, investment and regional economic diversification. In this way the IEA report has enhanced the availability of evidence for policy making to support and accelerate coal transitions in major coal-using emerging market economies



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

Emissions from existing coal power plants, cumulative emissions, 1990-2021; Extract from the [Coal in Net Zero Transitions: Strategies for Rapid, secure and People-Centred Change](#) report



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

Risk of locked-in emissions, 2022-2100. Extract from the [Coal in Net Zero Transitions: Strategies for Rapid, secure and People-Centred Change](#) report

Implementing policies for clean energy transitions

Road transport in emerging economies

CETP support helped the IEA to start developing a first-of-its-kind report that focuses on how governments in major emerging economies can achieve the IEA's scenarios in road transport. The report *Implementing Clean Energy Transitions: Focus on Road Transport in Emerging Economies* addresses Brazil, China, India, Indonesia, Mexico and South Africa – with particular attention paid to India and Indonesia.

Against a backdrop of rapidly increasing demand for the transport of people and goods, the CO₂ emissions from road transport in these major emerging economies increased from 14% of global road transport CO₂ emissions in 2000 to around 25% in 2021 – in absolute terms they have more than doubled. The transformation of the transport sector in line with the goals of the Paris Agreement will therefore require a range of ambitious and swift government decisions over the coming decades.

In response, the report lays out in detail the challenges and opportunities ahead in the clean energy transition of road transport in these major emerging economies. It provides an overview of existing and new policy approaches to implement a road transport transition, takes a close look at how to finance such a transition and illustrates six key road transport policy interventions to accelerate decarbonisation in the sector. Our aim is for it to be a go-to resource for transport policy makers in major emerging economies and help them accelerate the rate of ambitious policy implementation. Publication is scheduled for Q2 2023.

Private and public sector investment

Financing clean energy transitions

Building a clean energy system is crucial to meet rising demand for energy services in the developing world in a sustainable way. The economics behind these investments have been enhanced by the energy crisis and the high and volatile prices seen for fossil fuels. But the crisis has also complicated the investment environment, with higher indebtedness in many EMDEs, increasing energy poverty, rising inflation driving up borrowing costs and increasing risks to the financial sustainability of utilities that typically have a crucial role in the development of grid infrastructure and as offtakers.

Against this background, the objective of the investment workstream has been to raise awareness of the risk of shortfalls in clean energy investment in EMDEs and offer solutions that unlock capital through enhanced market and regulatory design, fostering electricity system optimisation from an institutional perspective and facilitating more attractive investment and financing conditions to accelerate sustainable energy transitions in the power sector. Our activities have focused on countries in Southeast Asia and ASEAN and have included case studies, new data on the cost of capital and analyses of other EMDEs as well as global activities. The IEA has produced several reports that raised awareness and advanced understanding and expertise on these topics and launched the Cost of Capital Observatory to increase transparency in the energy sector and inspire investor confidence, especially in emerging and developing countries where data on financing costs is scarcer.

The IEA [World Energy Investment 2022 report](#), published in June, provides a picture of global energy investment in 2021 and full-year estimates of the outlook for 2022. The report provides a detailed analysis of the amount of investment needed in clean energy by sector, energy source and provider, estimating that investment in clean energy in EMDEs needs to expand more than seven times, to above USD 1 trillion annually by 2030, to put the world on track to reach net zero emissions by 2050. The report has also increased understanding of important features of the new investment landscape that are already visible, including the energy security lens through which many investments are now viewed, widespread cost pressures, and burgeoning expectations in many countries that investment will be aligned with solutions to the climate crisis.

The IEA also published the report [Climate Infrastructure Investing: Risks and Opportunities for Unlisted Renewables](#) in co-operation with Imperial College Business School in March. The report looks at the financial performance of unlisted renewables assets and the broader unlisted infrastructure assets globally and in EMDEs. This analysis evaluates risk-adjusted returns on investing in unlisted renewables assets at an index level, as well as the diversification benefit when added to an investment portfolio and the return behaviours in the context of changing credit, macro and commodity price conditions.

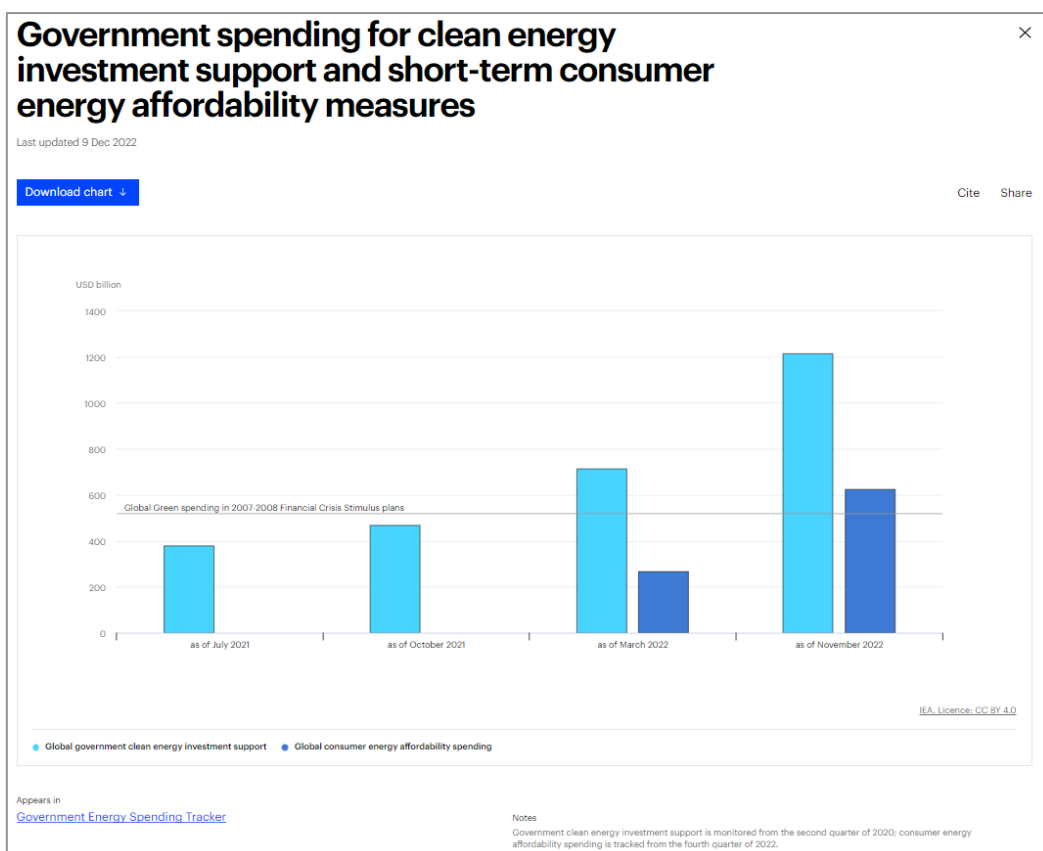
Tracking government energy spending

The IEA [Government Energy Spending Tracker](#) was updated twice in 2022, and continued its tracking of the latest approved policies and their fiscal contributions to energy, which consistently measured the size, sectoral orientation and impacts of newly announced government policies including financial support for clean energy, fulfilling the request made in by the G20 Rome Leaders' Declaration, and the Joint G20 Energy-Climate Ministerial Communiqué. In 2022, the Tracker was expanded to cover government financial support to consumers in response to the global energy crisis.

The Tracker relies on extensive policy analysis conducted by the IEA, and looks into 1 600 energy-related government policies and spending programmes from 67 countries. Support from the CETP was instrumental in enabling the development and upkeep of the Tracker.

The latest data shows governments have allocated an unprecedented USD 1 215 billion to clean energy investment support since the start of the Covid-19 pandemic. This government spending is set to mobilise substantial flows of private investment, which based on today's policies would raise global clean energy investment to over USD 2 trillion annually in 2030.

However, the Tracker also highlights worrying geographical imbalances, with many emerging and developing economies at risk of being left behind due to shrinking fiscal leeway and rising debt levels. Advanced economies account for nearly 95% of the clean energy investment support tracked. Emerging and developing economies have directed their more limited resources to short-term measures to keep transport, electricity and cooking fuels affordable. In addition, the Tracker unpacks affordability spending implemented to protect households and businesses from rising energy bills since autumn 2021, where once again, 80% of spending tracked is in advanced economies.



Extract from the [Government Energy Tracker](#)

The findings from the Tracker are used in a number of other IEA publications, including the [World Energy Outlook 2022](#), where it was used to calibrate the latest Stated Policies Scenario. Government spending tracker was also featured in [World Energy Investment 2022](#), [Energy Efficiency 2022](#) and [Renewables Energy Market Update – May 2022](#). The dataset has also been used by a number of organisations, including universities, private energy companies, and international organisations such as the World Bank and UNCTAD.

Reducing methane emissions

Methane is a potent GHG with important implications for climate change. Methane tends to receive less attention than CO₂, but reducing energy sector methane emissions is critical for avoiding the worst effects of climate change. Fossil fuel operations generated around one-third of all methane emissions from human activity and action on methane is therefore one of the most effective steps the energy sector can take to mitigate climate change. Policy makers have at their disposal well-established policy tools that have already been demonstrated in multiple contexts to drive these emissions reductions. To encourage the adoption of policy solutions, in 2021 the IEA released [Driving Down Methane Leaks from the Oil and Gas Industry: A Regulatory Roadmap and Toolkit](#).

In 2022 the CETP supported the dissemination of this Regulatory Roadmap and Toolkit to regulators around the world. To date, the IEA has translated and released versions in [Arabic](#), [Chinese](#), [French](#), [Spanish](#), [Portuguese](#) and [Russian](#). To promote these translations, the IEA hosted virtual roundtable events with specific regional focuses, including China, Central Asia, and Latin America. The CETP also supported the design of capacity-building exercises based on the roadmap, which were used as the basis for one-on-one country outreach with Ghana, Kazakhstan, Mozambique and others. Further outreach activities are anticipated throughout 2023, including a specific focus on Arabic-, French- and Portuguese-speaking African countries.

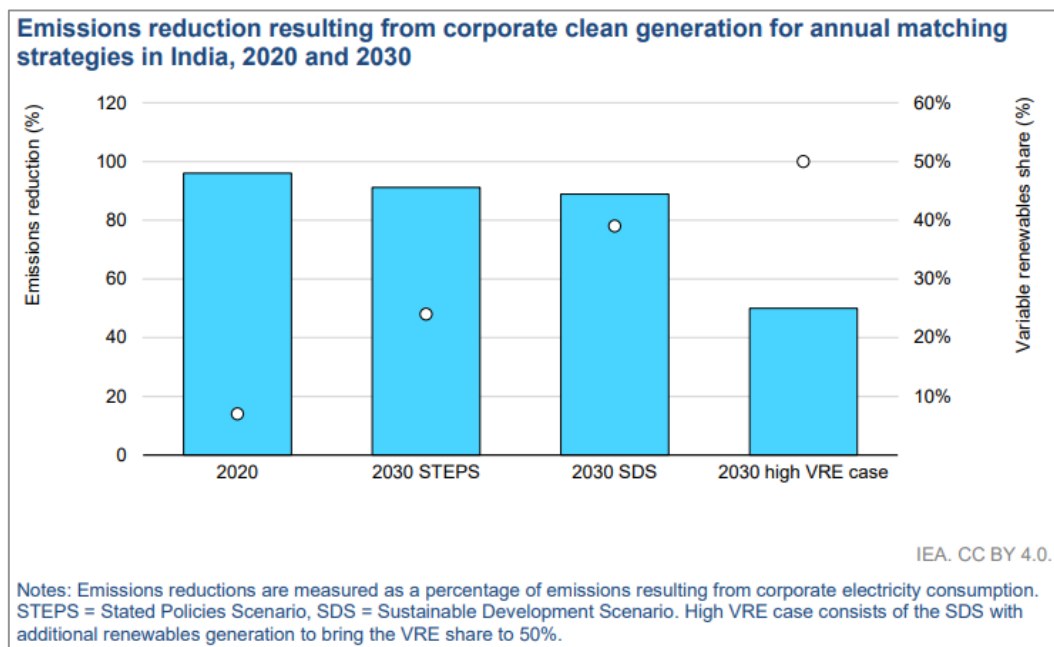
Secure power systems transformation

Support from the CETP allowed the IEA to develop analysis on the application of advanced methodologies to power system planning, including a case study for China. The case study illustrates to policy makers and regulators the importance of new methodologies to ensure system adequacy in power systems with increasing shares of variable renewable energy.

Corporate procurement of renewable energy

We developed methodologies for assessing the power system impact of renewables procurement by corporate purchasers following different types of clean electricity goal, applying them to the IEA's regional India model to investigate

the power system and cost impacts of different procurement strategies. We presented the analysis in an article published in July, [Methodology to assess the system value of different corporate procurement strategies in developing economies](#).



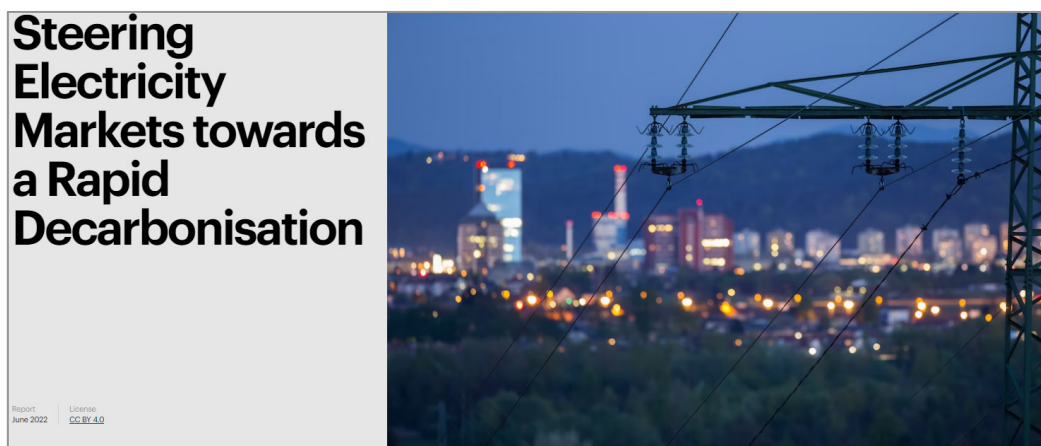
Further support allowed us to [develop a detailed report](#) covering options for corporate procurement, regional barriers and examples for enablement in different countries, and the impacts of different corporate clean electricity goals on procured technologies and emissions. The work extends previous modelling for India and also introduces modelling for Indonesia. The report presents key recommendations for policy makers, system operators, regulators and companies undertaking procurement based on research, stakeholder interviews and the power system modelling. We published the report in November 2022 and presented it at two events in COP27, “24/7 Carbon-Free Energy Compact – Accelerating Decarbonisation of the World’s Electricity Grids” (8 November) and the “Launch of the Asia Clean Energy Coalition: Accelerating Corporate Renewable Electricity Procurement in Asia” (11 November). The report was also reported on by [major energy news](#). This work will form the basis of a series of workshops in 2023.

Decarbonisation of electricity markets

Thanks to CETP support, the IEA published [Steering Electricity Markets towards a Rapid Decarbonisation](#) in June. The report looked in detail at key principles for electricity market design, focusing on clear policy and regulatory improvements to ensure both cost-effective electricity supply and the decarbonisation of power systems.

The report analysed experiences from countries with varying degrees of power market liberalisation, looking at how specific improvements in planning, market

operation, distributed energy resource deployment and retail tariff design can accelerate the deployment of clean electricity technologies. The cases in this report focus on measures that need to be prioritised in the next five to ten years as part of the wider transformation to net zero emissions. Moreover, the emphasis on applied experiences from across the world has provided the basis for consolidating key messages and policy recommendations to accelerate low-carbon transitions while ensuring compatibility with market structures and current policy objectives. The findings of this report have been used for dissemination activities in Brazil, China, India, Indonesia and Thailand.



CETP contribution to IEA flagship analysis

- In addition to the numerous reports and articles mentioned in above, many major IEA publications have benefited from improved data, analysis and collaboration with priority countries and other emerging economies. The CETP directly supported various IEA flagship analytical products including the [World Energy Outlook](#) (WEO), released in October 2022. The 2022 edition of the IEA flagship report focused on the first truly global energy crisis, and the implications of this profound and ongoing shock to energy systems across the globe. CETP support allowed a radical deepening of the analysis of these implications. The report identified a shocking setback on energy access- for the first time in decades, the number of people without access to electricity is set to increase in 2022 due to price and economic pressures. Rigorous analysis of supply and demand trends also enabled the Agency to answer a question that became central in 2022- whether the crisis would derail clean energy transition trends- by identifying demand peaks would materialise in the course of the decade for all fossil fuels.
- CETP support also made possible the update of the IEA roadmap to Net Zero Emissions by 2050, and central modelling ameliorations. From 2022 onwards, the WEO will be supported by a new integrated modelling framework, the IEA's Global Energy and Climate (GEC) Model, generating detailed sector-by-sector and region-by-region long-term scenarios across IEA's publications.
- WEO 2022 reached an ever-growing audience: only on its launch day, the report was downloaded more than 14 000 times, mentioned by media outlets over 550 times and its live-streamed press conference attracted around 15 000 viewers.

Other major reports enhanced thanks to CETP support included:

- [Nuclear Power and Secure Energy Transitions: From Today's Challenges to Tomorrow's Clean Energy Systems](#) – a special report released in June 2022, which studied the role of nuclear energy in transitions and looked at how nuclear energy, for those countries open to the technology, could help address two major crises – energy and climate – facing the world today. The findings were distributed through media outlets around the world. In doing so, the report has helped to maintain the place of nuclear power in the global conversation on energy transitions, supporting the broadest suite of low-emissions energy technologies to ensure the most secure and affordable transitions possible.
- [The Future of Heat Pumps report, November 2022](#)
- A special chapter on the ASEAN region in the [Energy Efficiency Market Report 2022](#)

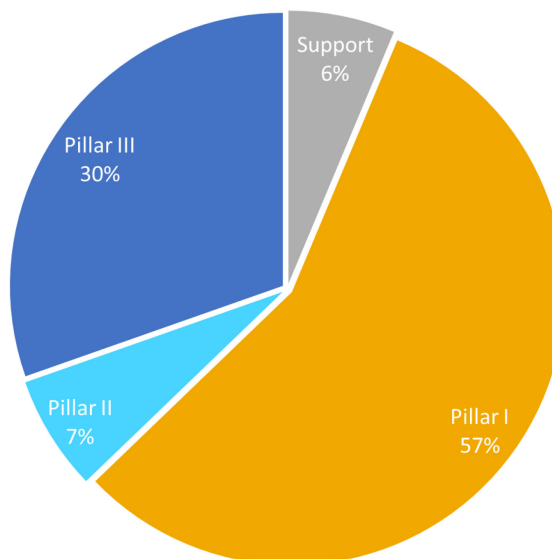
- Sections of [Tracking Clean Energy Progress](#) on [Digitalisation](#), [Demand Response](#) and [Smart Grids](#)
- [Global Electric Vehicle Outlook 2022](#)
- [Electricity market report](#)
- [Climate Resilience for Energy Security Report](#)
- [Grid Integration of Electric Vehicles Manual](#)

Funding

The CETP expenditure grew by a significant 23% in 2022, from ~EUR 11.2 million in 2021 to ~EUR 13.8 million in 2022, with a simultaneous large-scale increase in impact. For 2022, following the signature of the Joint Commitment and the launching of the Strategic Framework as detailed above, the IEA has mapped expenditure against the new structure. In keeping with requests from the Strategic Co-ordination Group, Pillar I has the largest budget allocation in the programme, with 57% of the total directed there, followed by Pillar III with 30% and Pillar II with 7%. Support is currently at 6%, staying lower than the long-term average of 7-12%.

Note: These figures 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

Allocation of the CETP budget, 2022



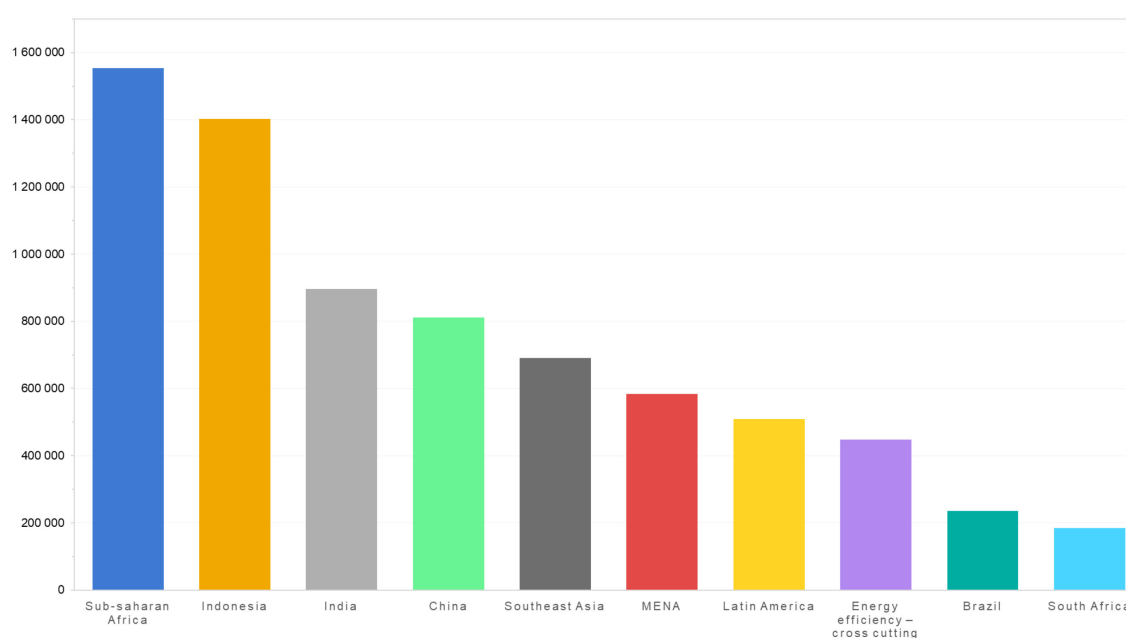
IEA. CC BY 4.0.

Taking a closer look at Pillar I, the largest country programme was Indonesia. Given Indonesia's chairmanship of the G20, the IEA delivered a number of key analytical outputs and reports that both advanced Indonesia's energy transition and fed into the overall discourse at the G20 level. The most notable was [Indonesia's Net Zero Roadmap](#), which provided the critical input into their Just

Energy Trust Partnership (JETP) negotiations and ultimate approval. After Indonesia, the second area of large-scale effort was sub-Saharan Africa, a critical region for the energy transition, including the delivery of energy access to spur economic development and poverty alleviation.

At the other end of the spectrum, 2022 saw a lower budget allocation to Latin America, including Brazil. The allocation for this important region has been rectified in 2023 thanks to increased flexibility in funding, which has come at a crucial time as Brazil will host the G20 in 2024. In addition, the change of government has already resulted in a step-change in efforts to fight climate change in Brazil and across the region.

Allocation of the Pillar I budget, 2022

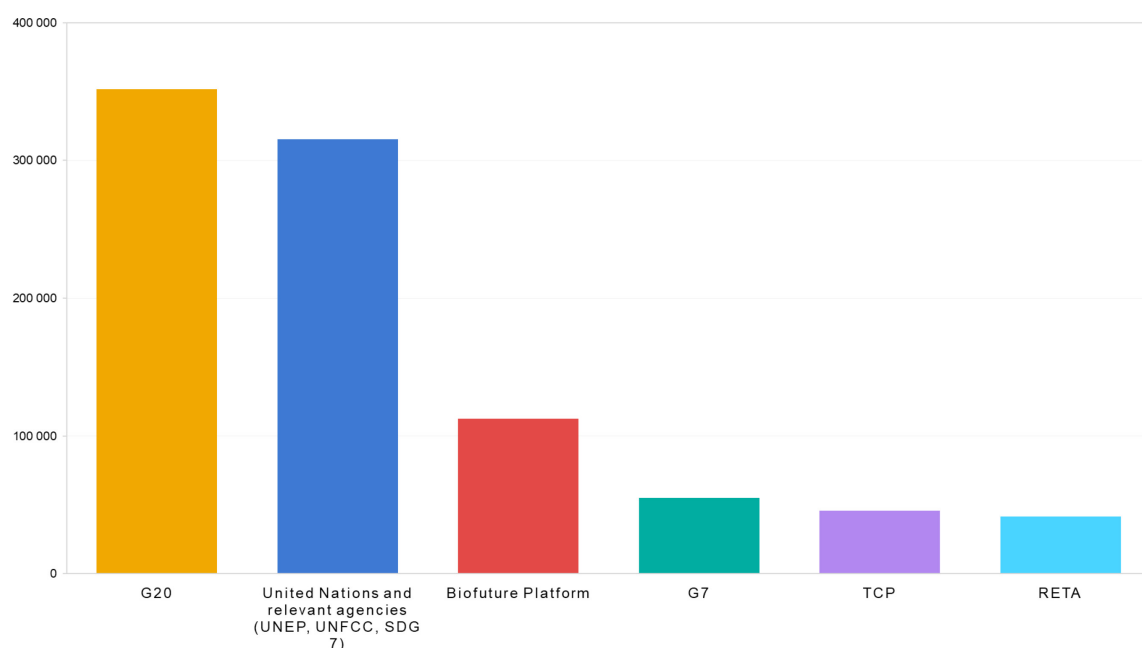


IEA. CC BY 4.0.

Note: MENA = Middle East and North Africa.

For Pillar II, the two largest workstreams were the G20 and the IEA's work with UN agencies, followed by a relatively even distribution across the remaining four workstreams. This is in line with the programme's recent emphasis, the large volume of work delivered with Indonesia under its G20 presidency, and the programme's engagement with the UN Environment Programme (UNEP), the UNFCCC Conference of the Parties, and the IEA's work on Sustainable Development Goal 7 (SDG7).

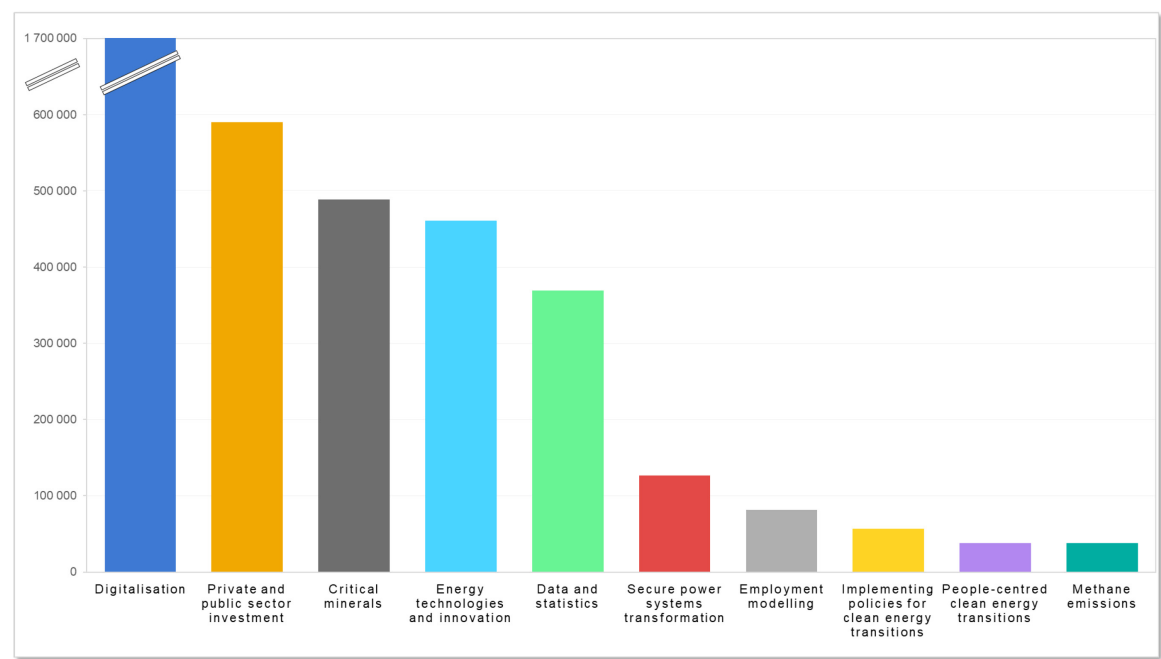
Allocation of the Pillar II budget, 2022



IEA. CC BY 4.0.

The largest workstream under Pillar III was digitalisation, funded through an earmarked voluntary contribution (VC) from Italy. Other major workstreams, which have also benefited from dedicated earmarked funding plus flexible funding, include data and statistics, private and public sector investment, and critical minerals. Additional workstreams also received important support in 2022, and the CETP is set to build on these initial investments in 2023 to scale up activity and further accelerate clean energy transitions.

Allocation of the Pillar III budget, 2022



IEA. CC BY 4.0.

Dissemination

In 2022 the CETP directly supported the publication of 128 reports, models, policy briefs and data products. It has also allowed the IEA to enhance nine flagship publications. CETP-related content attracted over 430 000 users in total, including over 250 000 new users, receiving over 700 000 page views in 2022. The programme's content continues to generate engagement, especially for flagship reports such as [World Energy Outlook 2022](#), [World Energy Investment 2022](#), [Africa Energy Outlook 2022](#) or [Critical Minerals Policy Tracker](#).

CETP website traffic was bolstered by promotions on the IEA's social media channels (Facebook, Twitter, LinkedIn, Instagram and YouTube) and newsletters, including launch events and videos. In total, social media posts and newsletters generated about 12% of the traffic to CETP pages and attracted over 60 000 users and over 108 000 views. Likewise, an ever-growing number of referrals from third-party websites (including large and small news organisations, government and non-governmental sources, activists and advocacy groups) across the Internet drove even greater traffic to CETP's work.

The users came from almost all countries across the world, with the highest number originating from IEA member countries. Importantly, CETP priority countries – India, China, Indonesia and Brazil – were represented in the first 20 places of the ranking and the geographical coverage included all CETP focus regions.

Users and page views by country, IEA.org website statistics for CETP output, 1 January-31 December 2022

	Country	Users...	Pageviews		Country	Users...	Pageviews
1.	United States	57,802	93,720	11.	Spain	10,123	20,800
2.	United Kingdom	30,500	58,093	12.	Netherlands	8,814	14,933
3.	India	29,694	51,049	13.	Indonesia	7,440	13,968
4.	France	21,857	42,591	14.	South Korea	6,911	14,047
5.	Germany	16,479	31,769	15.	Türkiye	6,436	12,329
6.	Japan	14,563	38,865	16.	Brazil	5,458	10,691
7.	China	13,360	28,214	17.	Norway	5,392	9,832
8.	Canada	12,092	22,677	18.	Singapore	5,365	10,810
9.	Italy	10,440	23,589	19.	Belgium	5,273	9,475
10.	Australia	10,334	19,624	20.	Sweden	5,022	9,303
1 - 10 / 183 < >				11 - 20 / 183 < >			

IEA. CC BY 4.0.

Source: Google Analytics.

Acknowledgements, contributors and credits

The CETP's achievements would not be possible without the leadership and support of IEA member governments and other partners, including Australia, Belgium, Canada, Denmark, France, Germany, Ireland, Italy, Japan, the Netherlands, Spain, Sweden, Switzerland, the United Kingdom, the United States and the European Commission, acting on behalf of the European Union. We want to recognise and thank the officials of these partners for playing an invaluable role in providing strategic guidance and oversight to this important IEA programme. The first five years of the CETP represent a collective achievement that we all share in.

The CETP Core Team would like to extend their thanks to Dr Fatih Birol (IEA Executive Director) for his guidance, to Mary Warlick (Deputy Executive Director) for her direct oversight of the programme last year, and to the other members of IEA leadership: Keisuke Sadamori (Director, Energy Markets and Security), Claire Bouteille (Director, Office of Management and Administration), Pascal Laffont (Chief Legal Counsel), Tim Gould (Chief Economist), Laura Cozzi (Chief Modeller), as well as Rebecca Gaghen, Masatoshi Sugiura, and Toru Kajiwara (Office of Global Energy Relations) for their continuous support.

The CETP Annual Report 2022 was prepared by the programme's Core Team (Adam Ward and Magdalena Sanocka) and was led by Dan Dorner, head of the Strategic Initiatives Office. Inputs were provided by colleagues throughout the IEA. We would like to thank all workstream leaders and their respective teams for their efforts and for their contribution to this report: Joerg Husar and Alejandra Bernal Guzman (Brazil, Latin America), Rebecca McKimm (China), Nicole Thomas and Hana Chambers (India), Kieran Clarke and Ranya Oualid (Indonesia, Southeast Asia), Arnaud Rouget, Syrine El Abed and Rita Madeira (South Africa, Sub-Saharan Africa), Ali Al-Saffar and Nadim Abillama (Middle East and North Africa), Paolo Frankl and Jeremy Moorhouse (Biofuture Platform), Sylvia Beyer (G20 and G7), Pablo Heví Koch (Secure power systems transformation), Enrique Gutierrez (Regulatory Energy Transition Accelerator), Per Anders Widell (Technology Collaboration Programme), Kieran McNamara and Jinsun Lim (United Nations and relevant agencies), Tae-Yoon Kim (Critical Minerals), Nick Johnstone, Erica Robin, Roberta Quadrelli and Julian Prime (Data and Statistics), Vida Rozite and Emi Bertoli (Digitalisation), Olivia Chen and Daniel Wetzel (Energy Employment and Skills), Blandine Barreau (Government Energy Spending Tracker), Melanie Slade (Energy Efficiency), Timur Gül, Simon Bennett and Jean-Baptiste Le Marois

(Energy Technology and Innovation), Christophe McGlade and K. C. Michaels (Reducing Methane Emissions), Brian Motherway and Matthieu Prin (People-Centred Clean Energy Transitions), as well as Jonathan Coppel (Private and Public Sector Investment). Special thanks to Simone Landolina (Senior VC Strategy Coordinator) and Rasmus Ringgaard (Senior CETP Advisor) for their guidance and support in the delivery of the programme.

Special thanks are due to colleagues in IEA Corporate Services who have provided invaluable support to the CETP, notably, Rachael Boyd and Evan Pelz (Office of Legal Counsel), Deborah Barry-Roe and Ruth Fishwick (Financial Administration), Fleur Grimaud (Human Resources) as well as Jad Mouawad and Curtis Brainard (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 this report. The report was edited by Justin French-Brooks.

Abbreviations

ACE	ASEAN Centre for Energy
AERN	ASEAN Energy Regulatory Network
AfDB	African Development Bank
AFD	Agence Française de Développement
ANEEL	Brazilian Electricity Regulator
APEC	Asia-Pacific Economic Cooperation
BEE	Bureau of Energy Efficiency
CCUS	carbon capture, utilisation and storage
CEEW	Council on Energy, Environment and Water
CEIIC	Clean Energy International Incubation Centre
CEM	Clean Energy Ministerial
CERT	Committee on Energy Research and Technology
CETP	Clean Energy Transitions Programme
COP	Conference of the Parties
CONUEE	National Commission for the Efficient Use of Energy
CORFO	Chilean Economic Development Agency
DRC	Democratic Republic of the Congo
ECECP	European Union-China Energy Cooperation Platform
EGAT	Electricity Generating Authority of Thailand
EMDE	emerging market and developing economies
ENS	Eco-Niwas Samhita
EPE	Energy Research Office
ERI	Energy Research Institute
ESCO	energy service company
ESG	environmental, social and governance
ETS	emissions trading system
EV	electric vehicle
GEF	Global Environment Facility
GER	Office of Global Energy Relations
GHG	greenhouse gas
GoI	Government of India
GPFM	Green Powered Future Mission
G7	Group of Seven
G20	Group of 20
IFC	International Finance Corporation
IIT Delhi	Indian Institute for Technology
IMF	International Monetary Fund
IPG	International Partners Group
ISGAN	International Smart Grid Action Network
JETP	Just Energy Transition Partnership
MEE	Ministry of Ecology and Environment

MEFED	MENA Europe Future Energy Dialogue
MEMR	Ministry of Mineral Resources and Energy
MENA	Middle East and North Africa
MEPS	minimum energy performance standards
MI	Mission Innovation
NEA	National Energy Administration
NDC	nationally determined contribution
NDRC	National Development and Reform Commission
OECD	Organisation for Economic Co-operation and Development
OLADE	Latin American Energy Organization
OVP	Nigeria's Office of the Vice President
PAT	Perform, Achieve and Trade
R&D	research and development
RD&D	research, development and demonstration
RETA	Regulatory Energy Transition Accelerator
SDC	Swiss Agency for Development and Cooperation
SDG	Sustainable Development Goal
SEAD	Super-efficient Equipment Appliance Deployment
SENER	Secretary of Energy of Mexico
TCP	Technology Collaboration Programme
TERI	The Energy Resources Institute
TGO	Thailand Greenhouse Gas Management Organization
UN	United Nations
UNEP	UN Environment Programme
UNFCCC	UN Framework Convention on Climate Change
UNIDO	UN Industrial Development Organization
UNSD	UN Statistics Division
VC	voluntary contribution
WRI	World Resources Institute
3DEN	IEA Digital Demand-Driven Electricity Networks Initiative

International Energy Agency (IEA).

This work reflects the views of the IEA Secretariat but does not necessarily reflect those of the IEA's individual Member countries or of any particular funder or collaborator. The work does not constitute professional advice on any specific issue or situation. The IEA makes no representation or warranty, express or implied, in respect of the work's contents (including its completeness or accuracy) and shall not be responsible for any use of, or reliance on, the work.



Subject to the IEA's [Notice for CC-licensed Content](#), this work is licenced under a [Creative Commons Attribution 4.0 International Licence](#).

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

Unless otherwise indicated, all material presented in figures and tables is derived from IEA data and analysis.

IEA Publications
International Energy Agency
Website: www.iea.org
Contact information: www.iea.org/contact

Typeset in France by IEA - March 2023
Cover design: IEA
Photo credits: © Shutterstock

