Energy Efficient
End-Use Equipment
International Energy Agency

IEA Technology Collaboration Programme on
Energy Efficient End-Use Equipment (4E)

Annual Report 2020

Technology Collaboration Programme
by iea

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Chair's Statement

As for most organisations, 2020 has delivered many challenges for 4E, not least of which has been how to maintain effective collaboration across our 15 Members spread across the globe.

Our physical meetings twice a year have been a cornerstone of engagement amongst representatives, enabling colleagues to reach a deeper understanding of different points of view and experiences and brainstorm ideas.

When I took over the Chair of 4E mid-way through 2020, I was concerned that we might struggle to maintain momentum through only virtual communications. However, I am pleased to report that 4E is busier than ever, with a record number of projects underway, all of which are yielding useful results.

This is important, since it is clear that the role of energy efficiency has never been more vital than in helping to rebuild economies recovering from their economic downturn. The combination of replacing lost employment opportunities with new jobs in a labour-intensive energy efficiency industry, while reducing the financial stress for households and businesses is a compelling policy option – and one which is being taken seriously by many governments. The 2020 Energy Efficiency Report from the IEA highlights many interesting examples of economic stimulus packages that have energy efficiency embedded within them.

In this context, I believe that 4E plays a small but necessary role, working on the nuts and bolts of energy efficiency policy. It is now common knowledge that 'standards and labelling' programs are amongst the most effective and cheapest of all the energy efficiency initiatives run by governments. What is less well understood is that these also provide the basic building blocks for a raft of other policy measures, such as white certificates, tax breaks and financial incentives. 4E's work to develop more robust test methods and track the performance of different appliances and equipment is a key enabler of all these policy options.

As awareness of the future role of residential heat pumps in providing cooling and heating has grown, we launched an ambitious new project in 2020 to improve how the performance of these products are measured. Building a number of related regional investigations, 4E's aim is to make sure that policy measures for these products maximise real savings and drive industry to develop more efficient products.

4E's ability to effectively contribute to policy development is frequently acknowledged but has never been more evident than in the case of lighting, where our work undertaken on the effects of 'flicker' in LEDS has been used by the EU, Australia, South Africa, Kenya and Central America to inform their lighting regulations.

As in this case, much of 4E's work is used by Members and has immediate impact; however one of the strengths of 4E is the pooling of resources to examine areas of future potential. I have been pleased by the development of a 'technology readiness roadmap' for new semiconductor technologies in power electronic applications, and look forward to our work with industry to take this forward.

Digitalisation is another frontier area of significant importance to energy efficiency and one where the role of policy is still emerging. Through our work on connected devices and motors, we are helping to inform our Members, and the ongoing global discussion, on where policy measures will be needed in order to maximise energy efficient outcomes.

4E also began exploring in 2020 the application of regulations to energy-using systems. As governments ramp up ambition, the potential scale of savings offered by making energy-using systems more efficient is the logical next step, but it also poses many challenges. Through a number of workshops, 4E has benefitted from the collective experience of 4E Members to develop new thinking and approaches that are truly exciting!

As you look through this report, I am confident that you will see the ways in which 4E continues to provide leadership and a vital contribution to many areas of policy development in the energy efficiency field. I am also certain that, as the world emerges from the pandemic, 4E's role in enabling our Members' efforts to collaborate and share expertise will be increasingly valuable.

None of this would be possible without the commitment and dedication of our 4E Members and my sincere thanks go to all of them. I know they will join me in wishing all readers a safe 2021.

Jamie Hulan
Chair 4E
February 2021

Key 4E achievements in 2020

January

EDNA
Policy Brief
Energy Harvesting Technologies for IoT

EDNA
Policy Brief
Wireless Charging Energy Use

EDNA
Policy Brief
The Role of Connected Devices in the Digitalisation of the Energy System

March

SSL
Report
Visual perception under energy efficient light sources detection of the stroboscopic effect under low levels of SVM

4E
Report
Domestic Air Conditioner Test Standards and Harmonisation

April

EDNA
Policy Brief
Upstream Consequences from Connected Devices

EDNA
Policy Brief
The Wasted Energy of Connected Devices

4E
Report
4E Annual Report

May

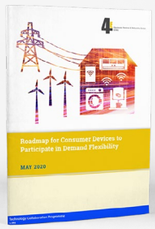
EDNA
Report
Policy Guidance for Smart, Energy-Saving Consumer Devices

PECTA
Report
Wide Band Gap Technology: Efficiency Potential and Application Readiness Map

June

EDNA
Webinar
Smart, Energy-Saving Consumer Devices

4E
Webinar
Test Methods for Residential Air Conditioners



EDNA
Report
Roadmap for consumer devices to participate in demand flexibility

July

EMSA
Report
Test Standards for Advanced Motor Technologies

October

SSL
Report
Test reports issued to 38 laboratories in SSL Interlaboratory Comparison

November

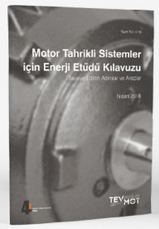
EMSA & PECTA
Workshop
International Motor Summit

4E
Workshop
Energy-using Systems

SSL
Report
Public draft of Quality and Performance Requirements for LED Lighting Products

December

PECTA
Policy Brief
Energy Audit Guide for Motor Driven Systems: Turkish version



EMSA
Report
Energy Audit Guide for Motor Driven Systems: Turkish version

The Technology Collaboration Programme on Energy Efficient End-Use Equipment (4E)

> Global improvements in energy efficiency have been declining since 2015. The Covid-19 crisis adds an extra level of stress. As a result of the crisis and continuing low energy prices, energy intensity improved by only **0.8% in 2020**; roughly half the rates, corrected for weather, **for 2019 (1.6%)** and **2018 (1.5%).** This is well below the level needed to achieve global climate and sustainability goals.
>
> **IEA Energy Efficiency 2020**

The role played by 4E

4E aims to promote energy efficiency as the key to ensuring safe, reliable, affordable and sustainable energy systems.

As an international platform for collaboration between governments, the 4E TCP provides policy guidance to its members and other governments concerning energy using equipment and systems. The 4E TCP prioritises technologies and applications with significant energy consumption and energy saving potential within the residential, commercial and industrial sectors (not including transport).

In order to stimulate internationally accepted approaches that promote energy efficient equipment, 4E harnesses the expertise of governments, industry, experts and other TCPs to:

1. **Collect data, analyse information, share expertise and pool resources**
2. **Support and strengthen government policy and regulation**
3. **Disseminate information to develop greater understanding and promote government actions that encourage the uptake of energy efficient equipment**

Through international collaboration, 4E enables national energy efficiency programmes to be consistently evaluated and improved so that they are ambitious, internationally aligned and effective. The 4E platform provides the means to achieve this at least cost to member governments through the pooling of resources.

4E's international comparisons of appliance performance levels are used by policy makers to set national thresholds which enable their citizens to access the best performing products, now and into the future.

The 4E platform encourages countries to quickly expand their programme coverage by leveraging off the work of other members. Similarly, sharing the learnings of different implementation and administrative approaches enables countries to better understand and copy from strengths of other programmes.

As economies increasingly seek the opportunities to meet future energy demand through the more efficient use of current energy resources, there is huge potential to learn from the experiences of others and to collectively explore some of the technological and policy challenges ahead. This is particularly evident in the field of appliances and equipment, a large proportion of which are internationally traded.

> The Covid-19 crisis has increased households' interest in new appliance purchases, with at least some appliances replacing older, inefficient models.
>
> **IEA Energy Efficiency 2020**

Overview of 4E Structure and Activities

> We estimate that the efficiency-related stimulus spending announced to date could generate the equivalent of 1.8 million full-time jobs between 2021 and 2023, nearly two-thirds of which would be in the buildings sector.
>
> **IEA Energy Efficiency 2020**

Executive Committee

4E is managed by an Executive Committee (ExCo) comprising one voting delegate from each of the 15 Members. The ExCo meets twice yearly to manage the work programme of 4E, including the dissemination of 4E's research results. Secretariat functions for the ExCo are provided by the Operating Agent, funded by annual membership fees.

During 2020, the 4E office-bearers comprised:

Chair of 4E:

- John Cymbalsky (USA) - acting Chair
- Jamie Hulan (Canada) – Chair from June 2020

Vice-chairs of 4E:

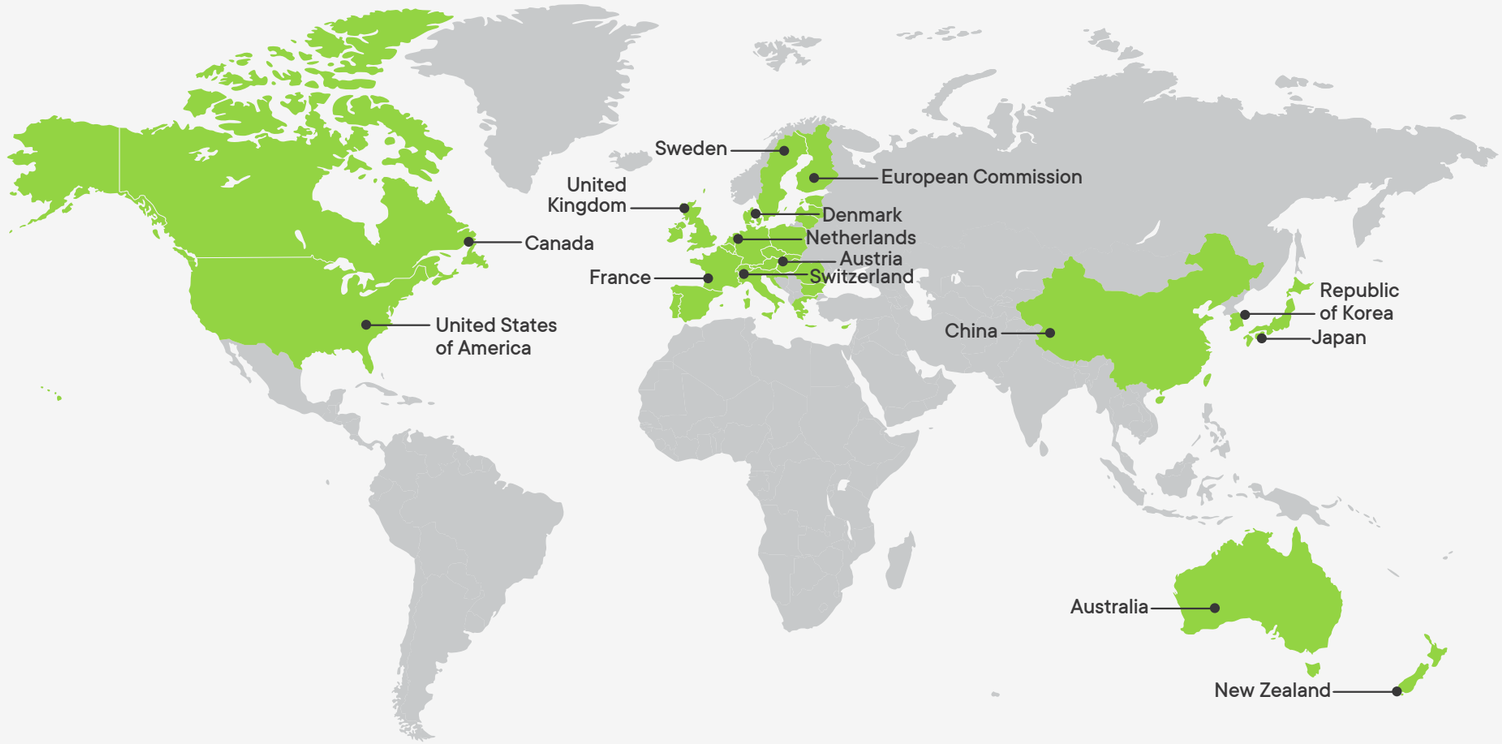
- Hans-Paul Siderius (Netherlands)
- John Cymbalsky (USA)
- Catherine Zerger (Australia)

The 25th and 26th meetings of the Executive Committee (ExCo) were held online. Attendance at these meetings is shown in the table on the right. A full list of the 15 Members of the ExCo during 2020 is shown in Attachment 1.

Attendance at 2020 ExCo meetings

	25th ExCo Online	26th ExCo Online
Australia	✔	✔
Austria	✔	✔
Canada	✔	✔
China	✔	✔
Denmark	✔	✔
European Commission	✔	ABSENT
France	ABSENT	✔
Japan	✔	✔
Korea	✔	✔
Netherlands	✔	✔
New Zealand	✔	✔
Sweden	✔	✔
Switzerland	✔	✔
United Kingdom	✔	✔
United States of America	✔	✔
Observers	IEA	IEA

2020 ExCo members



Future ExCo meetings

- **27th ExCo**: April, 2021, Online
- **28th ExCo:** November 2021, TBC

Annexes

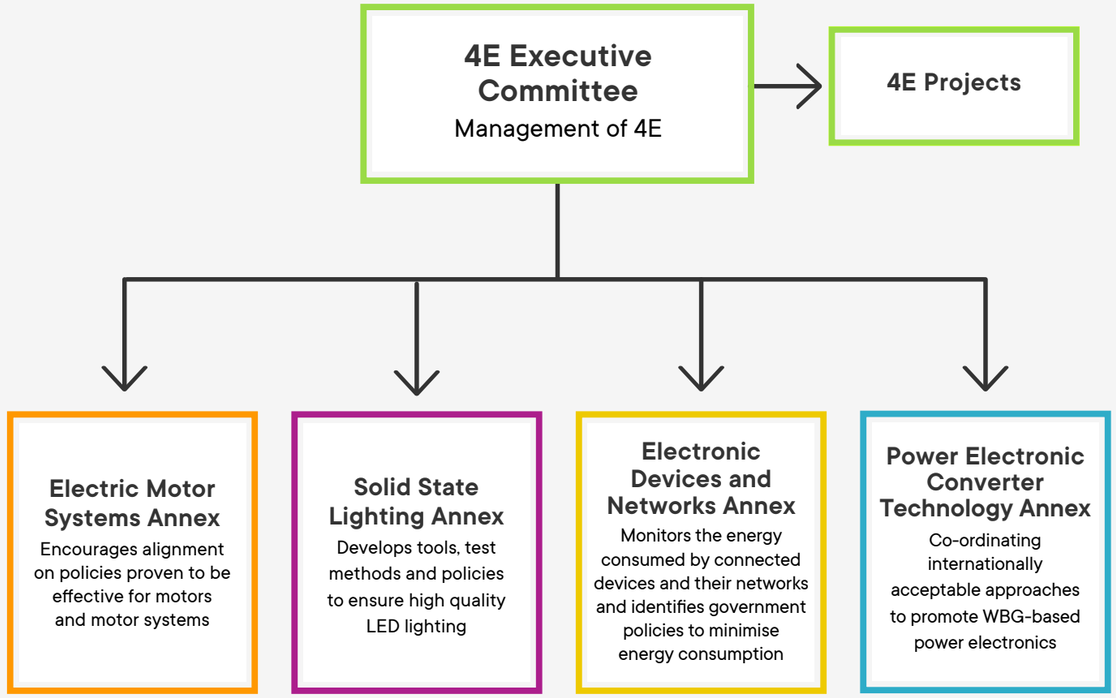
Annexes provide a mechanism for collaborative research amongst 4E Members on particular technologies or topics.

Targeted collaborative research and development activities under 4E are undertaken within our Annexes, each of which has a particular focus and agreed work plan.

These work plans, and their respective budgets, are typically set for a three year period and are negotiated amongst the participating countries. The 4E structure is shown alongside, and this highlights the four existing Annexes:

- **Electric Motor Systems Annex (EMSA)**, launched in October 2008 and chaired by Switzerland
- **Solid State Lighting (SSL) Annex**, launched in June 2010 and chaired by Sweden
- **Electronic Devices and Networks Annex (EDNA)**, launched in 2014 and chaired by the Netherlands in 2019
- **Power Electronic Conversion Technology Annex (PECTA)**, launched in 2019 and Chaired by Sweden and then Switzerland

Updates on all currently operating Annexes are included later in this report.



> As urban leaders, you are on the front lines of the solutions. We are seeing increasing commitments by you to adopt energy efficiency and transition to renewable energy and clean transport. You know this makes sense for the health of your economy and your citizens.
>
> **UN Secretary-General António Guterres, 7 October 2020**

4E Projects

4E projects are developed and funded by the Executive Committee to support policies for efficient end-use equipment.

These research activities cover a wide range of topics, but all benefit from the collective insights provided by all 4E Members.

Active projects in 2020 included:

- Policies for Energy Efficient Systems
- Domestic Air Conditioner Test Standards and Harmonization
- Achievements of Appliance Energy Efficiency Standards and Labelling Programmes – a global assessment
- Product Energy Efficiency Trends (PEET)
- IEA Publications
- Monitoring, Verification and Enforcement

PROJECT

Policies for Energy Efficient Systems

4E's Strategic Work Plan for 2019-24 highlights with need to address systems:

"Key challenges for 4E governments include the need to devise policy solutions to address the energy consumed by systems of equipment, digitalisation and rapidly evolving products such as electronic devices.

The work will be strengthened with particular emphasis on engagement with industry and the development of policy approaches to systems.

During 2020, 4E has made considerable progress with its work on the regulation of energy-using systems.

An important role of the 4E TCP is to investigate new ways for governments to expand energy efficiency policies for appliances and equipment to deliver greater quantities of energy savings. It has long been recognized that energy-using systems represent a largely untapped potential for additional energy savings, and their regulation could provide increased flexibility in ways that industry can meet policy requirements. However, to date it has proved difficult to use traditional energy efficiency regulations for most systems.

This 4E project aims to clarify the challenges for regulating energy-using systems, identify potential solutions and highlight those systems that are most suitable for the next generation of energy efficiency regulation.

In May 2020, 4E published an internal discussion paper, and held two workshops for all 4E Members towards the end of the year. Several illustrative case studies raised issues about the performance verification of equipment if assembled on-site before it can function, as well as who should be legally responsible for compliance of an installed system.

For the purposes on this project, 4E has agreed to use the definition of an energy-using system shown in the box.

This project will continue in 2021 with an internal paper and potentially the development of public information.

4E Definition of Energy Systems for Regulation

The following definition is used by 4E

A system is a functional unit that consists of two or more physical parts that need to be assembled at the location where the system is used.[1]

A ***part*** is a single, identifiable item that provides a certain sub-function to the function of the system.

The parts in the definition are the parts that need to be assembled on location.

A system can consist of other parts that are already assembled[2] in a factory.

Notes:

[1] In contrast, a product can be defined as a functional unit of which the parts are assembled in an industrial process, i.e. in a factory.

[2] Assembly of a system means putting together the parts of a system in order to build a functional unit that can be installed. Installation of a system means connecting the system to another system in the environment, e.g. an energy grid.

In practice assembly and installation are sometimes used interchangeable, but here the distinction is important. Note that also products must be installed. What are sometimes called "installed products" are products that need installation by a professional.

PROJECT

Policy Domestic Air Conditioner Test Standards and Harmonization

4E undertook substantial work on air conditioner (AC) test methods in 2020, in recognition of the growing contribution made by cooling to a growing share of energy consumption and peak demand in many locations.

In March 2020, 4E published the findings of a detailed examination of current AC test procedures and metrics across 4E Member countries. This publication made recommendations to improve international alignment and noted the work underway in several regions to develop new methods for testing variable capacity ACs. The report highlighted the significant challenges for manufacturers and regulators in accurately testing these products and suggested international round robin testing as a means to better align differences in current test methods.

Speakers from the USA, Canada and Europe explained government initiatives in the testing of inverter AC performance and related government policies in a Webinar held in June 2020. A representative of a major AC manufacturer also provided insights into problems caused by the lack harmonisation in test methods. This webinar was held jointly with the IEA and attracted 220 participants from 59 countries.

Building on the first project and a number of regional initiatives, 4E commenced work on a second more ambitious project in September 2020, to develop practical load-based testing regimes for ACs and heat pumps. This project will run from September 2020 to October 2022 and include a series of round-robin tests in laboratories selected by 4E Members.

PROJECT

Regulators Forum on Monitoring, Verification and Enforcement (MV&E)

MV&E is a vital component of regulatory policies to ensure that expected energy efficiency gains are realised in practice. Building on the considerable experience of 4E Members and their national MV&E programmes, 4E provides a unique mechanism for regulators to raise issues of concern and share approaches to market surveillance and enforcement in confidence.

4E provides a unique forum for regulators to meet face-to-face alongside ExCo meetings to share information on topical issues relating to compliance and enforcement.

PROJECT

Energy Efficiency Standards and Labelling Achievements Reports

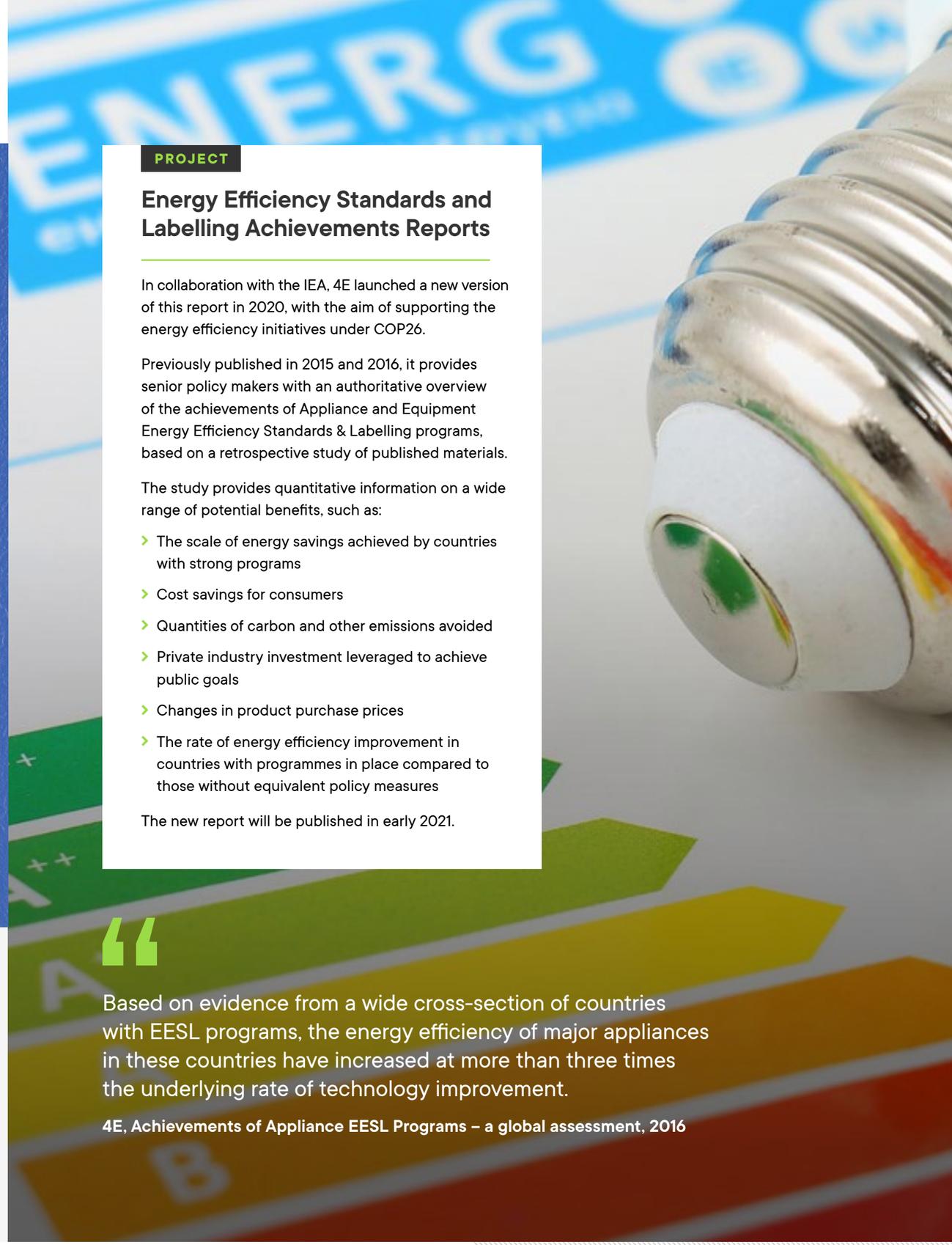
In collaboration with the IEA, 4E launched a new version of this report in 2020, with the aim of supporting the energy efficiency initiatives under COP26.

Previously published in 2015 and 2016, it provides senior policy makers with an authoritative overview of the achievements of Appliance and Equipment Energy Efficiency Standards & Labelling programs, based on a retrospective study of published materials.

The study provides quantitative information on a wide range of potential benefits, such as:

- The scale of energy savings achieved by countries with strong programs
- Cost savings for consumers
- Quantities of carbon and other emissions avoided
- Private industry investment leveraged to achieve public goals
- Changes in product purchase prices
- The rate of energy efficiency improvement in countries with programmes in place compared to those without equivalent policy measures

The new report will be published in early 2021.



> Based on evidence from a wide cross-section of countries with EESL programs, the energy efficiency of major appliances in these countries have increased at more than three times the underlying rate of technology improvement.
>
> **4E, Achievements of Appliance EESL Programs – a global assessment, 2016**

PROJECT

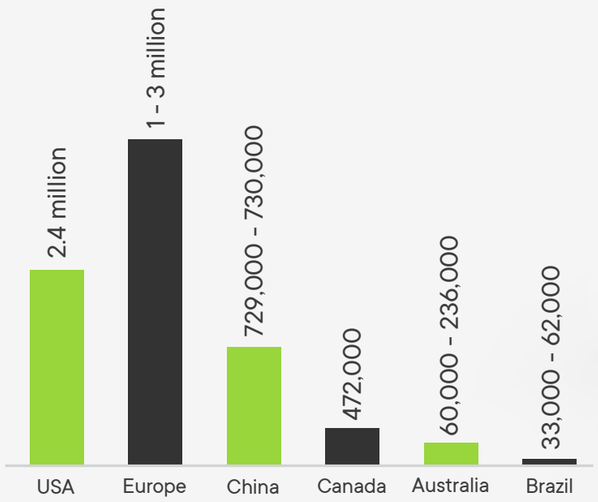
IEA Publications

4E works closely with the IEA on topics of common interest, and provides expert input to many reports, including combining on joint publications and events. This gives high level visibility to much of 4E's research work.

4E makes a significant contribution to the Appliance & Equipment sections of the Energy Efficiency Market Report, the IEA's flagship publication on energy efficiency, including in 2020. This quantifies the latest trends, tracks global progress, and examines key drivers and market issues.

Further examples of collaborative work with the IEA and other TCPs are shown later in this report.

Efficiency-related jobs (pre Covid-19 crisis)



Source: IEA Energy Efficiency 2020

"

In the short term, the Covid-19 pandemic is likely to have improved the technical efficiency of the appliance stock, as increased time spent at home appears to have boosted purchases of new appliances, which tend to be more efficient than older models.

IEA Energy Efficiency 2020

PROJECT

Product Energy Efficiency Trends (PEET)

The PEET project is designed to assist 4E Members in assessing the performance of major products within their market compared to those in other major economies and regions, thereby identifying future policy opportunities.

During 2020, 4E conducted a detailed analysis of the changes in policies and test methods for nine types of equipment in each 4E Member country. Where differences in test methods exist, a methodology for comparing the results has been developed. This methodology and the results of the trend analysis for 2018/19 will be published in early 2021.

Co-ordination with IEA and other organisations

As one of 38 Technology Collaboration Programmes established under the framework of the International Energy Agency (IEA), 4E has a particularly close relationship with the IEA Secretariat.

Some examples of collaborative activities in 2020 include:

- Joint project with IEA Secretariat: *'Achievements of Energy Efficient Standards and Labelling Programmes, 2021 update'*. To assist in the development of support for energy efficiency initiatives under COP26
- Joint webinar with IEA Secretariat on *'Air Conditioner Test Methods'* with over 200 attendees from governments and industry (June 2020)
- Contribution and review of *'Energy Efficiency 2020'* publication
- Contribution and review of *'Energy Technology Perspectives'* 2020 publication
- Contribution of case study to Today in the Lab – Tomorrow in Energy? *'New semiconductor materials will deliver significant energy savings'* (Nov 2020)
- Attendance and/or presentations at the following IEA meetings and workshops:
  - CERT discussion on energy efficiency and digitalisation (Feb 2020)
  - High-level expert consultation on digitalisation, energy efficiency and smart grids (March 2020)
  - TCP Chairs meeting (Oct 2020)
- 4E also provides regular progress reports to IEA member governments. The IEA's Energy Efficiency Division provides a report to each meeting of the 4E Executive Committee and often participates in discussions at these meetings

4E also regularly liaises with other Technology Collaboration Programmes

- Ongoing liaison in 2020 with the Heat Pump Technology TCP on *'4E Test Methods for Air Conditioner & Heat Pump Project'*
- Joint webinar with the Users TCP (May 2020).
- Joint project with the UsersTCP on *'Plug & Play Devices'* (initiated May 2020)
- Participation in the IEA Building Coordination Group meetings (Jan 2020)

User-Centred Energy Systems

IEA HPT

4E and Industry

4E has extensive contact with a variety of industry organisations and companies. We run regular workshops to gain industry input to 4E's work. These tend to focus on private sector companies related to our workstreams, such as suppliers of motor systems, solid state lighting, power electronics, ICT equipment and air conditioning. During 2020 all of these have been online, drawing hundreds of participants from all over the globe.

4E continues to fund the Connected Devices Alliance that provides a unique forum for dialogue between industry and government representatives on issues relating to digitalisation.

Depending on the topic, we may also seek industry comments on our published materials or conduct formal consultation processes.

4E Members also participate in many formal standardization processes, contributing the results of work undertaken by 4E, which has often been commissioned specially to inform standards development.

G20 ITALIA 2021

ipeec International Partnership for Energy Efficiency Cooperation

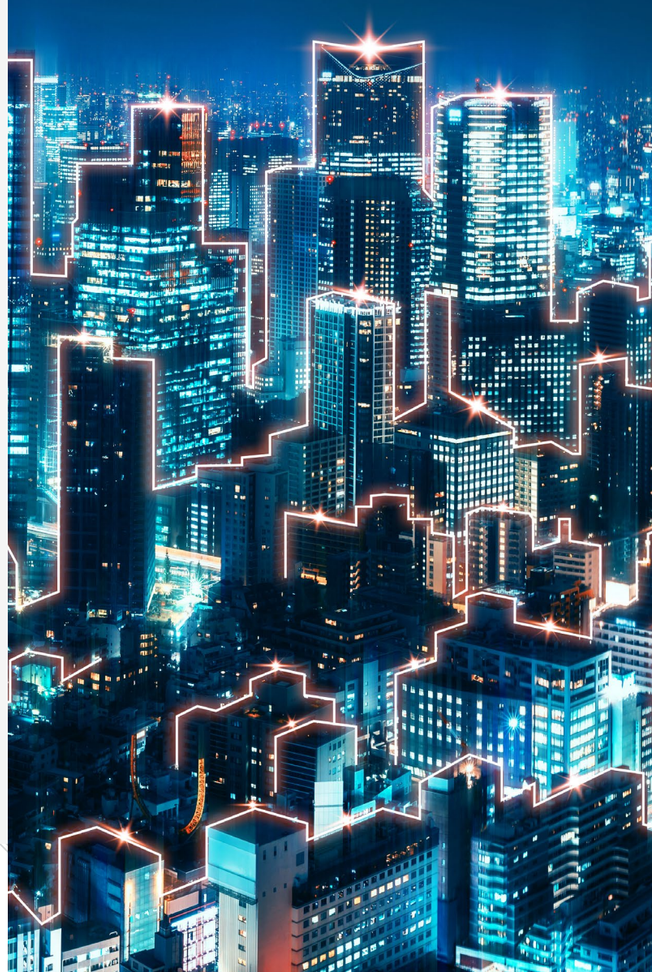
CLEAN ENERGY MINISTERIAL
Accelerating the Transition to Clean Energy Technologies

ISO

IEC

NIS 中国标准化研究院 China National Institute of Standardization

> We are issuing a COP26 Product Efficiency Call to Action to further accelerate the pace of the clean energy transition. Air conditioners, refrigerators, industrial motors and lighting together account for over 40% of current global electricity consumption. Working with partners in the Super-efficient Equipment and Appliance Deployment initiative (SEAD), we are promoting higher product efficiency standards with the aim of doubling the efficiency of these key products sold globally by 2030.
>
> **COP 26 President Designate, Alok Sharma**



Annex Achievements in 2020

> Digitalisation's impact on the demand side is complex. On one hand, digital devices potentially offer large improvements in energy efficiency for the transport, buildings and industry sectors. On the other, the prevalence of more devices—and servers to house the data they produce—could cause large net increases in energy use, if not managed carefully.

Energy efficiency and digitalisation
IEA Article, 20 June 2019

Electric Motor Systems Annex (EMSA)

The Electric Motor Systems Annex (EMSA) targets more than half of the global electricity use, i.e. 53% is contributed by electric motor driven systems.

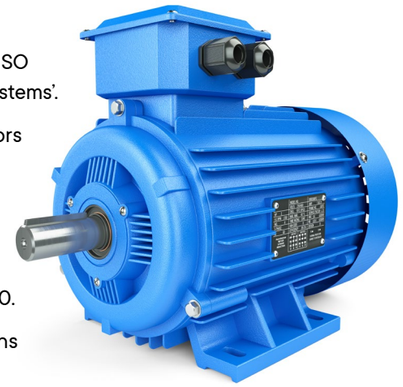
This share is increasing in time through electrification, with economic development and as processes and equipment in industry, buildings and mobility switch from gas to electric. Advanced technologies come to the market in a steady pace, leading to new opportunities for increased energy efficiency in motor systems. However, since a number of diverse market barriers hamper uptake in the market, only through continued involvement by governments, research and NGO's will the market harvest the full savings potential.

EMSA members focus on developing and disseminating best practice information worldwide, participating in and supporting the development of internationally aligned technical standards and providing input for the design and implementation of national policies to improve the energy performance of new and existing motor systems.

EMSA provides a bridge between policymakers, industry, academia and regulators and provides a platform for in-depth technical and policy exchange between members and functions as a vehicle for collaborative projects.

Major Achievements During 2020

- EMSA works on providing more evidence about the energy performance of Variable Frequency Drives through the international Round Robin testing program for converters losses, comprising 10 independent testing labs worldwide.
- This ongoing project compares existing test standards for selected advanced motor technologies, with results fed into the revision of the International Electrotechnical Commission standard IEC 61800-9-2.
- This work is informing the development of an internationally accepted practical testing protocol for converters, which will facilitate the implementation of energy efficiency policies for these products, including the independent verification of their performance.
- EMSA actively contributed to the IEC project: Coordination and Alignment of Standards for Energy Efficient Electric Motor Driven Systems (CAISEMS). The project aims to increase the coordination and alignment of Motor Driven System standards between IEC and ISO.
- In 2020, two CAISEMS working papers have been published, and CAISEMS started the preparatory work for the establishment of an ISO and IEC Joint Working Group: 'Energy Efficient Motor Driven Fluid Systems'.
- Aligned energy efficiency standards for pumps, fans and compressors will result in improved designs at lower cost by manufacturers and system integrators, regulations that are easier to deploy and enforce, and lower energy costs for end users.
- EMSA's network has expanded to nine members with the participation of the European Commission and New Zealand in 2020.
- EMSA members shared their work through a number of presentations at the International Motor Summit in November 2020.



Annex Participants

Solid State Lighting (SSL) Annex

Now in our 11th year, the SSL Annex governments continue to actively engage with each other and exchange research and analysis to support SSL policies and programmes.

Lighting accounts for 16.5% of global electricity end-use, and SSL technology has the potential to cut lighting electricity consumption by half. Therefore the Annex workplan sets out an ambitious agenda which spans four critical areas of cooperation:

1. **SSL product quality and performance;**
2. **SSL testing, metrics and standards;**
3. **Public health, productivity and environmental impacts; and**
4. **Smart lighting, digitalisation and connectivity.**

The SSL Annex covers all key areas related to SSL technologies: regulation, advice and market enforcement. The work complements academic research, international standardisation and R&D work in industry, since it is policy-driven with a focus on how to best implement policy and standards.

For an individual government, the work would be almost impossible to undertake, both in terms of time and resources, as well as for the information exchange and knowledge transfer that are integral to the SSL Annex's work. The body of work is carried out primarily through members' in-kind contributions, with part of the work contracted to experts where necessary.

The SSL Annex provides information and analysis that is highly relevant for current regulatory processes in several countries, as well as for international standardisation work in which several Member governments are engaged.

Testing continues to be a key focus area, and the world's largest interlaboratory comparison for goniophotometers is in its final stretch. In parallel, a new interlaboratory comparison of methods to test light modulation is now being planned.

The performance of SSL products remains important, and an update to the quality and performance recommendations were sent out for public review in late 2020.

The updated tiered SSL product quality and performance recommendations were finalised in November 2020 and are expected to be published in March/April 2021. These are intended to offer a complete set of tiered and harmonised model specifications that can be used for regulations, programme requirements and procurement criteria. These updated specifications will lower the barriers to entry for organisations and governments that want to promote energy efficient quality lighting, while also facilitating global regulatory harmonisation.

Major Achievements During 2020

- 42 Individual Test Reports have been issued to laboratories participating in the interlaboratory comparison for goniophotometers (IC2017). This project brings together participating laboratories from 18 countries to compare and calibrate to one consistent, accurate set of values; and is the largest of its kind conducted anywhere in the world.

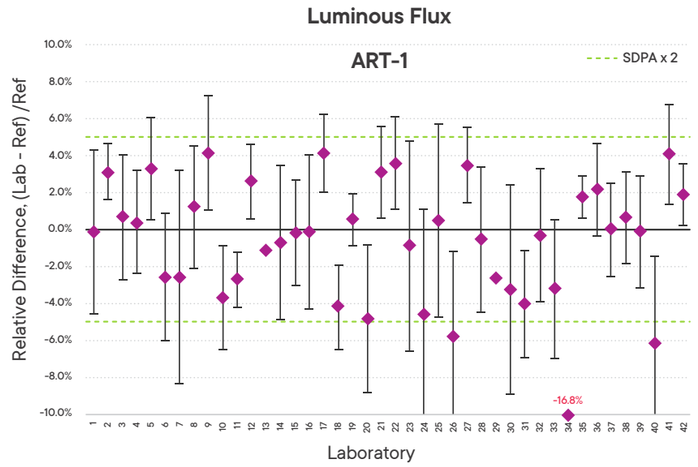
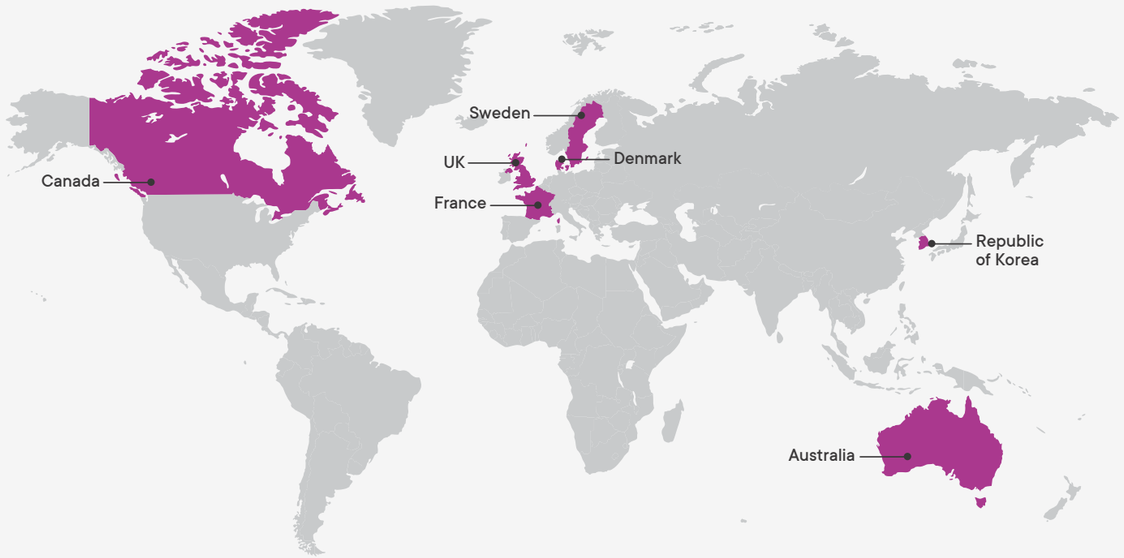


Figure 1. Comparison of Luminous Intensity Distribution of the 42 laboratories, organised by the participant's type of Goniophotometer used in IC 2017.

- This work helps to evaluate the current industry test method (CIE S 025:E) and uncover practical challenges in verifying the performance of SSL lamps and luminaires. The results will indicate whether (cheaper) near-field goniophotometer testing is as accurate as testing conducted on traditional equipment, with the potential to reduce testing costs for laboratories and thereby increase capacity.
- The Final Report from the study to investigate how easily humans can detect stroboscopic light effects (SVM) was published, accompanied by a peer-reviewed, scientific journal article by two of our experts. This work enables policy-makers to make informed choices about requirements, to protect the public health and their markets.
- The final draft of a literature review on lifetime testing of LED products is being prepared for review, and will assist policy makers and market surveillance authorities to verify lifetime claims on packaging to ensure a fair market.

Annex Participants



The Electronic Devices and Networks Annex (EDNA)

Connecting a device to the internet has an energy cost as well as an energy benefit which is derived from “digitalisation”.

The energy cost is due to the device needing to maintain a network connection 24/7, even when it is not providing any useful service to the user. The energy benefit arises from the ability to control the device remotely and to connect it to other devices and sensors, to data sources and to significant processing power “in the cloud”. The intelligence derived from this can be harnessed to optimise a device’s operation - decreasing energy use as well as providing “demand flexibility” functions for the energy grid.

Whilst the energy benefits of digitalisation are significant, they face a complex array of barriers. The energy costs of connectivity are also relatively small per device, but become significant when we take into account the ongoing and expected future proliferation of connected devices. It is in this context that EDNA provides policy guidance to its members, focussed on facilitating the energy benefits of digitalisation whilst minimising the energy costs. EDNA works closely with other international and national bodies to take advantage of synergies between these organisations, to seek the views of industry players and to socialise EDNA’s outputs.

Major Achievements During 2020

In 2020 EDNA published 3 new reports, on a range of topics related to the digitalisation of the energy system. These included an analysis of the high level digitalisation strategies of a range of countries and economies (as they relate to energy) as well as a roadmap for stimulating consumer devices to participate in demand flexibility. Also published was a comprehensive report which provides a policy framework for encouraging the digitalisation of new consumer devices in order to save energy.

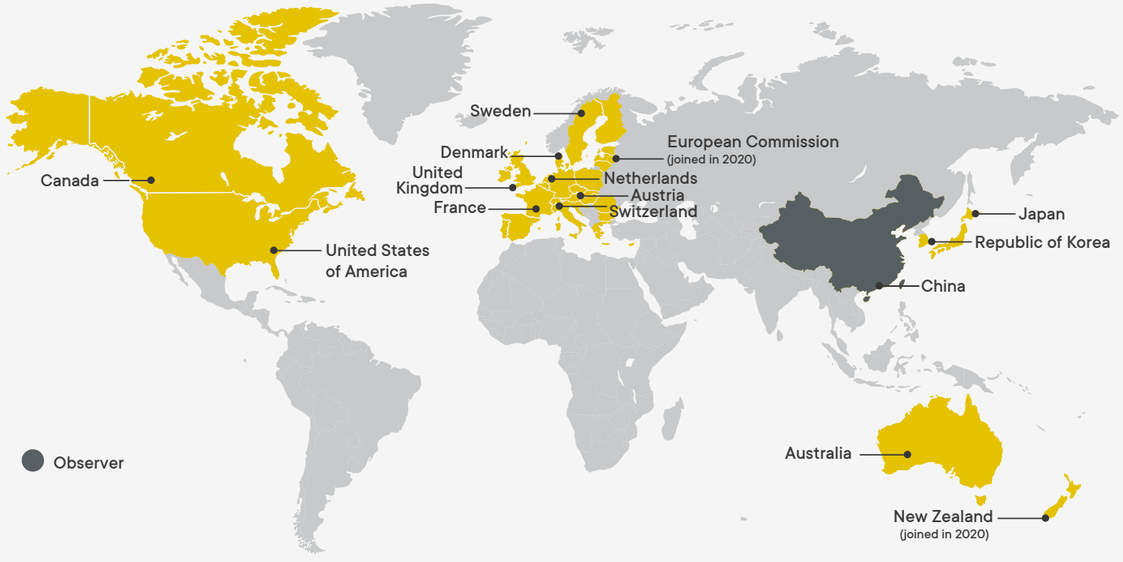
In addition, EDNA consolidated a large quantity of recent work by producing 5 policy briefs. These are short, 2-page documents which provide policy makers with the essential elements to be covered when developing policies for connected devices. The first two policy briefs covered wireless chargers and energy harvesting, whilst three outlined EDNA’s strategic areas:

- The Wasted Energy of Connected Devices
- Upstream Consequences from Connected Devices
- The Role of Connected Devices in the Digitalisation of the Energy System

In 2020 EDNA also launched a range of new investigations, covering small network equipment, communications protocols and the “user-friendliness” of smart devices (a joint task with the IEA Users TCP).

All of EDNA’s activities in 2020 will assist policy makers to develop effective strategies and policies which reduce the energy “costs” of connected devices and stimulate the energy benefits of digitalisation.

Annex Participants



The Power Electronic Conversion Technology Annex (PECTA)

In our modern world most electric applications, devices and machines require power electronic technologies to supply electricity at the required voltage, current and frequency. This energy transformation is one of the key tasks of power electronic semiconductors and circuits, but necessarily causes electrical losses.

The Power Electronic Conversion Technology Annex (PECTA) investigates the efficiency potential of new semiconductor technologies in power electronic applications. PECTA is particularly focused on wide bandgap semiconductors (WBG) based on silicon-carbide (SiC) and gallium nitride (GaN) materials. With their outstanding material characteristics, these WBG might overcome limitations that conventional applications based on silicon (Si) have, for example in MOSFETs (metal oxide field effect transistors) and IGBTs (insulated gate bipolar transistors) and as such the energy savings potential can be significant because such components are commonly used in a wide range of power electronics such as cell phones, laptops, electric vehicle chargers, PV inverters and many other appliances.

PECTA is a unique initiative, serving as an independent knowledge and exchange platform for policy makers and experts exploring the efficiency potential from the integration of existing and emerging WBG technology applications in different sectors.

PECTA engages international experts from industry (e.g., associations such as the European Centre

for Power Electronics (ECPE) or the IEEE Power Electronics Society (PELS), academia from countries all over the world, and government officials, to examine technology adoption and energy efficiency issues, focusing especially on end-use equipment.

Major Achievements During 2020

- PECTA published the report 'Wide Band Gap Technology: Efficiency Potential and Application Readiness Map', that discusses the level of penetration of specific devices in the market over time, considering their maturity and availability.
- This work highlights the applications that could benefit the most from WBG devices and identifies when policy intervention is most needed to see the potential of WBG to be realised.
- PECTA estimates show that the integration of WBG in some major applications could lead to 100 TWh of energy savings worldwide. Due to an increasing demand of specific devices, potential energy savings may be even higher.
- New experts from academia and industry joined PECTA, including from Denmark, one of PECTA's 4 member countries.
- PECTA presented its work to the PCIM 2020 conference, one of Europe's largest power electronics conferences and exhibition, and to the 2020 e-nova Conference.
- A PECTA factsheet and a first policy brief have been published.

Annex Participants

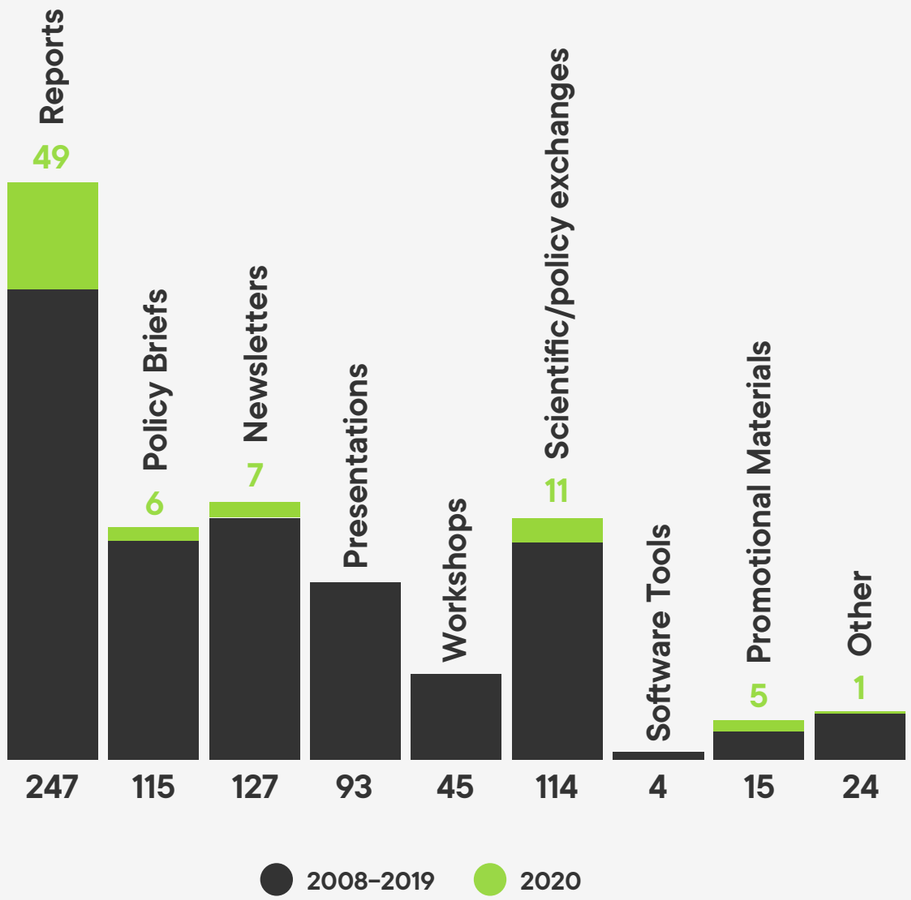
4E Outreach and Communication

4E uses a wide range of channels to reach its target audience, including technical reports, webinars, workshops, 2-page policy briefs, and newsletters.

In addition, 4E delivers presentations at key conferences and combines with other organisations to organise physical and virtual meetings.

The 4E website provides a focal point of communication activities, providing public access to many hundreds of reports, as well as presentations and videos. In 2020, 4E underwent a major re-build of our website to improve the user experience and upgrade to a more modern platform. The 4E website also provides 4E Members with a secure area for the sharing of information and for discussion.

Visit the 4E site **here**.



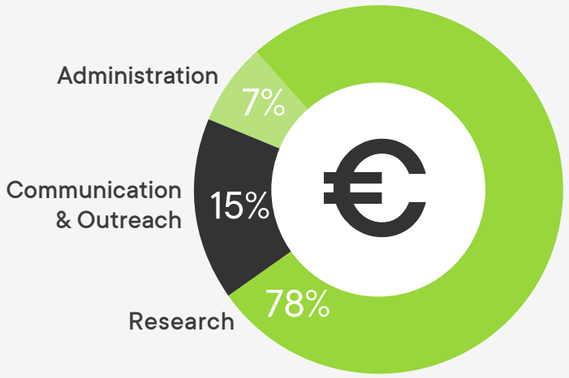
4E Group Finances

4E activities are made possible through the contributions of member countries: taking the form of annual fees and substantial in-kind work by national experts.

In 2020, the total cost of 4E activities is estimated to be €2.1 million, of which 78% were directed towards research. Approximately 15% of funds were used for communication, while only 7% were spent on administration and financial management, the same as in the previous year.

The annual fees and voluntary contributions of the 15 Members funded approximately half of the total expenditure.

Allocation of 4E resources in 2020



4E membership fees, 2020

Annex membership fees are set according to the agreed annual work programme and therefore may vary from year to year. However, the membership fees have not altered since 2016 and are considered by existing Members to represent excellent value for money.

Executive Committee	€20,000
Electric Motor Systems Annex (EMSA)	€15,000
Solid State Lighting Annex (SSL)	€22,000
Electronic Devices And Networks Annex (EDNA)	€15,000
Power Electronic Conversion Technology Annex (PECTA)	€20,000

Attachments

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With the new target to cut EU greenhouse gas emissions by at least 55% by 2030, we will lead the way to a cleaner planet and a green recovery. Europe will emerge stronger from the coronavirus pandemic by investing in a resource-efficient circular economy, promoting innovation in clean technology and creating green jobs.

Ursula von der Leyen
President of the European Commission

Attachment 1: 4E Executive Committee Delegates*

Contracting Party	Nomination	Name & Details
Australia	*Primary*	**Ms Catherine Zerger (Vice-Chair)** Director, GEMS Policy & Legislation Department of Industry, Science, Energy and Resources
	Alternate	**TBA**
Austria	*Primary*	**Dr Adriana Diaz** Ecodesign Company GmbH Engineering and Management Consultancy
	Alternate	**Mr Michael Hübner** Federal Ministry for Transport, Innovation and Technology
Canada	*Primary*	**Mr Jamie Hulan (4E Chair)** Director, Equipment Division Office of Energy Efficiency, Natural Resources Canada
	Alternate	**Ms Kimberly Curran** Chief, Standards Development, Office of Energy Efficiency, Natural Resources Canada
China	*Primary*	**Mr Lin Ling** Director of Resource and Environment China National Institute of Standardization
	Alternate	**Mr Liu Meng** Associate Researcher China National Institute of Standardization
Denmark	*Primary*	**Mr Thore Stenfeldt** (from 17 April 2020) Advisor Danish Energy Agency
	Alternate	**Mr Jakob Wulff Anderson** (from 17 April 2020) Advisor Danish Energy Agency
European Commission	*Primary*	**Mr Niels Ladefoged** (from 29 April 2020) Directorate-General for Energy European Commission
	Alternate	**Mr George Paunescu** Directorate-General for Energy European Commission
France	*Primary*	**Prof. Georges Zissis** (from 10 November 2020) Head of Light & Matter Research Group Universite Toulouse III/LAPLACE
	Alternate	**Ms Therese Kreitz** Responsible for International Affairs ADEME
Japan	*Primary*	**Mr Masanori Kobayashi** Director, Head of International Project Group, Energy Conservation Technology Department, NEDO
	Alternate	**Ms Erika Minagawa** Chief Officer, Energy Conservation Technology Department, NEDO
Republic of Korea	*Primary*	**Mr Hyeong-Jung Kim** General Manager, Korea Energy Agency
	Alternate	**Mr Kyung-Ho, Jo** Assistant Manager, Korea Energy Agency
Netherlands	*Primary*	**Mr Hans-Paul Siderius (Vice-Chair)** Senior Expert Netherlands Enterprise Agency
	Alternate	**Mr Justin Rosing** Ministry of Economic Affairs
New Zealand	*Primary*	**Mr Brian Fitzgerald** Standards and Regulations Energy Efficiency and Conservation Authority (EECA)
	Alternate	**TBA**
Sweden	*Primary*	**Dr Peter Bennich** Policy Officer, Energy Efficiency Department The Swedish Energy Agency, Testlab
	Alternate	**Mr Carlos Lopes** Coordinator for Ecodesign and Energy Labelling The Swedish Energy Agency, Testlab
Switzerland	*Primary*	**Dr Michael Moser** Scientific Advisor, Energy Research Section Swiss Federal Office of Energy (SFOE)
	Alternates	**Mr Roland Brüniger** R. Brüniger AG Consultant, Swiss Federal Office of Energy (SFOE)
		Mr Markus Bleuer Appliances and Competitive Tenders Section Swiss Federal Office of Energy (SFOE)
United Kingdom	*Primary*	**Mr Sam Balch** Deputy Director, Home and Local Energy Department for Business, Energy and Industrial Strategy
	Alternates	**Mr Suleiman Faruqi** Senior Policy Advisor, Home and Local Energy Department for Business, Energy and Industrial Strategy
USA	*Primary*	**Mr Jeremy Dommu** Electronic Products Manager Building Technologies Office, US Department of Energy
	Alternate	**Mr John Cymbalsky** Building Technologies Office US Department of Energy

** As at December 2020*

Attachment 2: All 4E publications, 2020

Date	Source	Title
January	EDNA	Policy Brief – Wireless Charging Energy Use
		Policy Brief – The Role of Connected Devices in the Digitalisation of the Energy System
		Policy Brief – Energy Harvesting Technologies for IoT
February	PECTA	Huge energy savings by WBG semiconductors
	SSL	Detection of the stroboscopic effect by young adults varying in sensitivity
March	SSL	Final Report: Visual Perception under Energy-Efficient Light Sources – Detection of the Stroboscopic Effect under Low Levels of SVM
	4E	Domestic Air Conditioner Test Standards and Harmonization
April	4E	4E 2019 Annual Report
		System-level Energy Efficiency Policy (internal)
	EDNA	Policy Brief – The Wasted Energy of Connected Devices
		Policy Brief – Upstream Consequences from Connected Devices
April–December	SSL	Individual test reports prepared and issued to 38 laboratories that participated in IC2017
May	EDNA	Policy Guidance for Smart, Energy-Saving Consumer Devices
	PECTA	Wie der Strom effizienter umgewandelt werden kann
		Wide Band Gap Technology: Efficiency Potential and Application Readiness Map
	EMSA	EMSA Newsletter*
June	EMSA	EMSA Newsflash
	EDNA	Roadmap for Consumer Devices to Participate in Demand Flexibility
		Energy Applications within IoT and Digitalisation Strategies
	4E	Bright Spark Newsletter
July	EMSA	CAISEMS Background Documents Ed.2 (internal)
		Report on Test Standards for Advanced Motor Technologies
October	PECTA	PECTA Factsheet
November	PECTA	New semiconductor materials will deliver significant energy savings: Part of IEA's Today in the Lab - Tomorrow in Energy?
		The efficiency potential and application readiness of wide bandgap technology: e.nova 2020 Conference paper
	SSL	Quality and Performance Requirements for LED Lighting Products – Public review Draft
December	EMSA	Energy Audit Guide for Motor Driven Systems: Turkish version
		EMSA Newsflash
	PECTA	PECTA Policy brief

** Published in English, Chinese, Japanese and Spanish*

Attachment 3: 4E workshops and presentations, 2020

Date	Source	Title	Location
May	EDNA	Smart, Energy-Saving Homes: What's Stopping Us?	Online
June	EDNA	Modernising Energy Efficiency through Digitalisation: Policy Guidance for Smart, Energy-Saving Consumer Devices	Online
	4E	Test methods for Residential Air Conditioners	Online
July	PECTA	PCIM Europe – International Exhibition and Conference for Power Electronics, Intelligent Motion, Renewable Energy and Energy Management	Online
September	EMSA	ECEEE Industrial Efficiency 2020	Online
November	EMSA	Motor Summit 2020	Online
	4E	Regulating Energy-using Systems (internal)	Online
	PECTA	Motor Summit 2020	Online
		e.nova 2020 Conference	Online
December	4E	Regulating Energy-using Systems (internal)	Online

Attachment 4: Electric Motor Systems (EMSA) 2020 Record of Activities & Delegates

Record of Activities

	Date	Intended Audience	Location
Publications in 2020			
EMSA Newsletter*	May	Public	
EMSA Newsflash	June	Public	
CAISEMS Background Documents Ed.2 (1-5)	July	CAISEMS members, EMSA	
Report on Test Standards for Advanced Motor Technologies	July	Public	
EMSA Newsflash	December	Public	
Energy Audit Guide for Motor Driven Systems: Turkish version	December	Public	
External Workshops & Conferences in 2020			
Motor Summit	November	Industry, academia, policy, research	Online
ECEEE Industrial Efficiency 2020	September	Industry, academia, policy, research	Online
Management/Experts Meetings in 2020			
23rd EMSA meeting	May	EMSA Members	Online
24th EMSA meeting	October	EMSA Members	Online
CAISEMS meetings	March, September, November	CAISEMS Members	Online
IEC ACEE meetings	April, September	ACEE Members	Online
IEC TC2, TC22, SG22G	numerous	IEC Representatives	Online
External Workshops & Conferences Planned for 2021			
EEMODS 2021	September	Industry, academia, policy, research	Stuttgart
Workshop on EMDS and digitalisation	April	Research, policy	Online
Management/Experts Meetings Planned for 2021			
25th EMSA meeting	April	EMSA Members	Online
26th EMSA meeting	TBD	EMSA Members	TBD

Annex Country Delegates

Country	Name	Organisation
Australia	Simon Newman	Department of the Environment and Energy
Austria	Konstantin Kulterer	Austrian Energy Agency
Denmark	Jesper Ditlefsen Sandie B. Nielsen	Danish Energy Agency DTI
European Commission	Ronald Piers de Raveschoo Georgios Takoudis	EC, DG Energy
Netherlands	Frank Hartkamp Hans-Paul Siderius	Netherlands Enterprise Agency
New Zealand	Brian Fitzgerald Allen Davison	Energy Efficiency & Conservation Authority
Sweden	Glenn Widerström Maja Dahlgren	Swedish Energy Agency
Switzerland	Roland Brüniger	Swiss Federal Office of Energy
USA	John Cymbalsky Jeremy Dommu Sanaee Iyama	US Department of Energy US Department of Energy LBNL

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ANNEX VICE CHAIR	**Frank Hartkamp** Netherlands Enterprise Agency Croeselaan 15, 3521 BJ Utrecht, The Netherlands **E:** frank.hartkamp@rvo.nl
OPERATING AGENT	**Maarten van Werkhoven** TPA advisors Generaal Winkelmanlaan 31 2111 WV Aerdenhout The Netherlands **E:** mvanwerkhoven@tpabv.nl
EMSA COORDINATOR	**Rita Werle** Impact Energy Inc. Gessnerallee 38a, CH-8001 Zurich Switzerland **E:** rita.werle@impact-energy.ch

Attachment 5: Solid State Lighting (SSL) 2020 Record of Activities & Delegates

Record of Activities

	Date	Intended Audience	Location
Publications in 2020			
"Detection of the stroboscopic effect by young adults varying in sensitivity", JA Veitch (National Research Council of Canada) and C Martinsons (Centre Scientifique et Technique du Bâtiment, France); Lighting Research and Technology, 12 February 2020.	February	Scientific community and relevant standards organisations. Indirectly, regulators and key government stakeholders	
Final Report: Visual Perception under Energy-Efficient Light Sources – Detection of the Stroboscopic Effect under Low Levels of SVM	March	Public	
Individual test reports prepared and issued to 38 laboratories (42 reports on individual goniophotometers) that participated in IC2017.	April – December	Participating laboratories	
Quality and Performance Requirements for LED Lighting Products – Public review Draft	November	Lighting industry, policy-makers, testing certification experts	
Management/Experts Meetings in 2020			
Management Committee meeting	February	SSL Annex Members	Online
20th Experts Meeting – Part 1	April	Invited SSL Experts	Online
Management Committee meeting	June	SSL Annex Members	Online
20th Experts Meeting – Part 2	July	Invited SSL Experts	Online
Management Committee meeting	September	SSL Annex Members	Online
21st Experts Meeting	November	Invited SSL Experts	Online
External Workshops & Conferences Planned for 2021			
Webinar presenting Final Report of Interlaboratory Comparison 2017 on Goniophotometers	April - May	Standardisation organisations, lighting metrologists, test laboratories, policy makers	Online
European Council for an Energy Efficient Economy – Summer Study 2021	June	Public, energy-efficiency community	Online
International Commission on Lighting (CIE), Annual Conference - Interlaboratory Comparison 2017 on Goniophotometers	September	Public information: Standardisation organisations, lighting metrologists, test laboratories, policy makers	Online/ in person
Energy Efficient Domestic Appliances and Lighting (EEDAL)	November	Public, energy-efficiency community	Online/ in person
Lighting Sciences 17 (LS17)	November	Public, energy-efficiency community	Online/ in person

Record of Activities

	Date	Intended Audience	Location
Management/Experts Meetings Planned for 2021			
Management Committee meeting	February	SSL Annex Members	Online
22nd Experts Meeting	March–April	Invited SSL Experts	Online
Management Committee meeting	April	SSL Annex Members	Online
Management Committee meeting	June	SSL Annex Members	Online
Management Committee meeting	September	SSL Annex Members	Online
23rd Experts Meeting	October-November	Invited SSL Experts	TBD
Management Committee meeting	December	SSL Annex Members	Online

Annex Country Delegates

Country	Name	Organisation
Australia	David Boughey	Department of Industry, Science, Energy and Resources
Canada	Jamie Hulan	Natural Resources Canada
Denmark	Casper Kofod	Energy Piano
France	Georges Zissis	University of Toulouse – LAPLACE lab
Korea	Ji-eun Choi	Korea Energy Agency
Sweden	Peter Bennich	Swedish Energy Agency
United Kingdom	Suleiman Faruqi	Department for Business, Energy & Industrial Strategy

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OPERATING AGENT SUPPORT	**Michael Scholand** M2S2 Energy Ltd 7 Green Bank London N12 8AS United Kingdom **E:** mscholand@m2s2energy.com

Attachment 6: Electronic Devices and Networks Annex (EDNA) 2020 Record of Activities & Delegates

Record of Activities

	Date	Intended Audience	Location
Publications in 2020			
Roadmap for Consumer Devices to Participate in Demand Flexibility	June	Public	
Energy Applications within IoT and Digitalisation Strategies	June	Public	
Policy Guidance for Smart, Energy-Saving Consumer Devices	May	Public	
Policy Brief – The Wasted Energy of Connected Devices	April	Public	
Policy Brief – Upstream Consequences from Connected Devices	April	Public	
Policy Brief – The Role of Connected Devices in the Digitalisation of the Energy System	January	Public	
Policy Brief – Wireless Charging Energy Use	January	Public	
Policy Brief – Energy Harvesting Technologies for IoT	January	Public	
External Workshops & Conferences in 2020			
Smart, Energy-Saving Homes: What's Stopping Us?	May	Public	Online
Modernising Energy Efficiency through Digitalisation: Policy Guidance for Smart, Energy-Saving Consumer Devices	June	Public	Online
External Workshops & Conferences Planned for 2021			
13th Annex Management Meeting	May	EDNA Members	Online
14th Annex Management Meeting	October	EDNA Members	Online
Management/Experts Meetings Planned for 2021			
15th Annex Management Meeting	April	EDNA Members	Online
16th Annex Management Meeting	November	EDNA Members	TBD

Annex Country Delegates

Country	Name	Organisation
Australia	Catherine Zerger	Dept of Industry, Science, Energy and Resources
Austria	Adriana Diaz	EcoDesign Company
Canada	Kimberly Curran	Natural Resources Canada
Denmark	Thore Stenfeldt	Danish Energy Agency
European Commission	Georgios Takoudis	European Commission, DG ENER
France	Bruno Lafitte	ADEME
Japan	Masanori Kobayashi	NEDO
Korea	Jeon Kwan Taek	Korea Energy Agency
Netherlands	Hans-Paul Siderius	Netherlands Enterprise Agency
New Zealand	Brian Fitzgerald	EECA
Sweden	Peter Bennich	Swedish Energy Agency
Switzerland	Roland Bruniger	Swiss Federal Office of Energy
UK	Suleiman Faruqi	Dept for Business, Energy and Industrial Strategy
USA	Jeremy Dommu	Dept of Energy
ANNEX CHAIR	**Jeremy Dommu** Building Technologies Office US Department of Energy United States **E:** jeremy.dommu@ee.doe.gov	
OPERATING AGENT	**Steven Beletich** Beletich Associates PO Box 56 Northbridge NSW 2063 Australia **E:** steve@beletich.com.au	

Attachment 7: Power Electronics Convertor Technology Annex (PECTA) 2020 Record of Activities & Delegates

Record of Activities

	Date	Intended Audience	Location
Publications in 2020			
Huge energy-savings by WBG semiconductors	February	Public	
Wide Band Gap Technology: Efficiency Potential and Application Readiness Map	May	Public	
Wie der Strom effizienter umgewandelt werden kann	May	Public	
PECTA Factsheet	October	Public	
e.nova 2020 Conference paper – The efficiency potential and application readiness of wide bandgap technology	November	Public	
New semiconductor materials will deliver significant energy savings: Part of IEA's Today in the Lab - Tomorrow in Energy?	November	Public	
PECTA Policy brief 1	December	Public	
External Workshops & Conferences in 2020			
PCIM Europe – International Exhibition and Conference for Power Electronics, Intelligent Motion, Renewable Energy and Energy Management	July	Public	Online
Motor Summit 2020	November	Public	Online
e.nova 2020 Conference	November	Participants, general public	Online
Management/Experts Meetings in 2020			
1st Annex MC Meeting of 2020	January	PECTA Members	Online
1st Group- and Task leaders Meeting	January	PECTA Members and experts	Online
2nd Annex MC Meeting of 2020	February	PECTA Members	Online
3rd Annex MC Meeting of 2020	March	PECTA Members	Online
Internal PECTA Workshop	March	PECTA Members and experts	Vienna & Online
2nd Group- and Task leaders meeting	March	PECTA Members and experts	Online
4th Annex MC Meeting of 2020	April	PECTA Members	Online
5th Annex MC Meeting of 2020	April	PECTA Members	Online
6th Annex MC Meeting of 2020	May	PECTA Members	Online
7th Annex MC Meeting of 2020	June	PECTA Members	Online
8th Annex MC Meeting of 2020	August	PECTA Members	Online
9th Annex MC Meeting of 2020	September	PECTA Members	Online
10th Annex MC Meeting of 2020	October	PECTA Members	Online
Austrian National PECTA/EMSA/SSL Expert Meeting	October	Invitees, PECTA Members and experts	Online
11th Annex MC Meeting of 2020	November	PECTA Members	Online
12th Annex MC Meeting of 2020	December	PECTA Members	Online

Record of Activities

	Date	Intended Audience	Location
External Workshops & Conferences Planned for 2021			
EEMODS 2021	September	Industry, academia, policy, research	Stuttgart
Workshop on EMDS and digitalisation	April	Research, policy	Online
Management/Experts Meetings Planned for 2021			
Periodical Management Committee (MC) meetings	Starting January	PECTA Members	Online
2nd Annex Meeting	November	Invitees, PECTA Members and experts	Vienna

Annex Country Delegates

Country	Name	Organisation
Austria	Adriana Díaz	ECODESIGN company GmbH
Denmark	Jakob Wulff Andersen	Danish Energy Agency
Sweden	Peter Bennich	Swedish Energy Agency
Switzerland	Roland Brüniger	Swiss Federal Office of Energy

ANNEX CHAIR	**Roland Brüniger** Swiss Federal Office of Energy c/o R. Brüniger AG, Engineering & Consulting Zwillikerstr. 8, CH-8913 Ottenbach Switzerland **E:** roland.brueniger@r-brueniger-ag.ch
OPERATING AGENT	**Markus Makoschitz** AIT Austrian Institute of Technology GmbH Giefinggasse 2 1210 Vienna Austria **E:** markus.makoschitz@ait.ac.at

About the IEA

> The TCPs are organised under the auspices of the International Energy Agency (IEA), but the TCPs are functionally and legally autonomous.

About the International Energy Agency (IEA)

The IEA is at the heart of global dialogue on energy, providing authoritative analysis, data, policy recommendations, and real-world solutions to help countries provide secure and sustainable energy for all.

The IEA was created in 1974 to help co-ordinate a collective response to major disruptions in the supply of oil. While oil security this remains a key aspect of our work, the IEA has evolved and expanded significantly since its foundation.

Taking an all-fuels, all-technology approach, the IEA advocates policies that enhance the reliability, affordability and sustainability of energy. It examines the full spectrum issues including renewables, oil, gas and coal supply and demand, energy efficiency, clean energy technologies, electricity systems and markets, access to energy, demand-side management, and much more.

Since 2015, the IEA has opened its doors to major emerging countries to expand its global impact, and deepen cooperation in energy security, data and statistics, energy policy analysis, energy efficiency, and the growing use of clean energy technologies.

IEA Technology Collaboration Programmes

The Technology Collaboration Programme supports the work of independent, international groups of experts that enable governments and industries from around the world to lead programmes and projects on a wide range of energy technologies and related issues. The experts in these collaborations work to advance the research, development and commercialisation of energy technologies. The scope and strategy of each collaboration is in keeping with the IEA Shared Goals of energy security, environmental protection and economic growth, as well as engagement worldwide.

The breadth of the analytical expertise in the Technology Collaboration Programme is a unique asset to the global transition to a cleaner energy future.

These collaborations involve over 6 000 experts worldwide who represent nearly 300 public and private organisations located in 55 countries, including many from IEA Association countries such as China, India and Brazil.