

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

## Annual Report 2016





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## **Chair's Statement**

On November 4th, 2016, the Paris Agreement entered into force, marking a key step towards international efforts to combat climate change. It will be no surprise to many of us that measures to accelerate the energy efficiency of appliances and equipment rank highly amongst the nationally determined contributions (NDCs) submitted by each of the 132 ratifying parties.

It seems highly likely therefore that the Paris Agreement will add further impetus, even beyond current efforts to increase energy security and energy productivity, behind the more efficient use of energy.

Against this backdrop, I have been delighted to become the new Chair of 4E in 2016, taking over from Mike Walker. I, like many others during the course of this year, have learnt for the first time about the work of 4E and been impressed by the contribution it is making to policy development.

2016 saw 4E working closely with the IEA on the Energy Efficiency Market Report and the World Energy Outlook. This marked a new high point in our collaboration with the Secretariat, enabling 4E research to reach an influential audience.

4E's involvement with the G20 Connected Devices Alliance (CDA) also represents a strong collaboration with the IEA, which shares the lead with the UK government. It is pleasing to see that this unique forum for industry and governments on networked devices is now one of the most effective of the G20's energy efficiency initiatives.

Building on the success of the CDA, 4E also launched the G20 Product Policy Exchange Forum in June 2016 in co-operation with the IEA, Super-

efficient Equipment and Appliance Deployment Initiative (SEAD) and China. This exciting new venture provides a platform for the sharing of innovative thinking on appliance policy across all G20 governments.

Policy development is at the heart of 4E, and it is therefore gratifying to see 4E bringing together government and industry experts from every quarter of the world to improve understanding. These dialogues have strengthened during 2016 and continue to inform good policies across a range of technologies and issues.

For example, the seven new performance tiers for LED lighting have been the product of extensive international consultation by the Solid State Lighting (SSL) Annex, resulting in a set of guides that any government can use as the basis for policy. Similarly, the work of Electric Motor Systems Annex (EMSA) in developing the Policy Guidelines for Pumps, Fans and Compressors has benefitted from the involvement of a number of regional experts.

With the increased focus on energy efficiency, the opportunity for 4E to play an important role is also growing. As countries seek further guidance and action on energy efficiency, I see that using our expertise to best effect will be a key challenge for 4E. 2017 marks the midway of our second term and I am personally very excited by the chance to work with all of those involved in 4E to maximise our impact for the benefit of our member countries and others.

### Michelle Croker

Chair 4E February 2017





Policy development is at the heart of 4E, and it is therefore gratifying to see 4E bringing together government and industry experts from every quarter of the world to improve understanding.

## **Key 4E achievements in 2016**



**China Motor System** Energy Efficiency Improvement, Beijing



n

**Own Energy Consumption of** Smart Metering Infrastructure and Energy Monitoring Systems

### REPORT

**Policy Opportunities** for Energy Aware Devices



REPORT New LED performance REPORT Basket-of-Products results

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

INTRA ST

The IEA has identified energy efficiency as a critical "fuel" in the transition to a low-carbon economy. Its analysis has shown that over a third of all emissions reductions needed to reach climate goals by 2040 must come from energy efficiency policies. Efficiency gains in the IEA's member countries were large enough to power Japan in 2015 making efficiency a critical component of a secure, sustainable energy system.

## The world of Energy Efficient Equipment, **Appliances and Lighting (EAL)**





Investment in **efficiency** 

vs conventional power

generation in 2015

The increase in **global** investment in energy efficiency in 2015 vs 2014



Increase in efficiency of residential **buildings** between 2000-2015



Unit average efficiency improvement over the last ten years for major appliances



Avoided new generation **capacity** in IEA countries due to energy savings





Most commonly regulated products



The evidence is clear that mandatory energy efficiency policies have been both expanding and strengthening. But...a still significant share of energy use is not yet subject to these types of policies and the strength of policies varies widely across regions.



Saving in global residential

energy consumption if best-in-class

energy performance standards widely

applied to air conditioning, space

and water heating, and lighting



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## The role played by 4E

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.

Working together through 4E, governments can grow the impact of energy efficiency policies substantially, through:

- Setting policies that reflect changes in technology and market conditions.
- Expanding the scope of policies to cover more appliances and equipment.
- Improving implementation and compliance through learning from the experience of others.

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 on the work of other members. Similarly, the comparison 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. Since 2008, 4E has enabled the twelve member governments to develop collaborations and co-ordinate activities to strengthen and grow their own national programmes.

**Energy efficiency is the** only energy resource possessed by all countries. **Global collaboration and** knowledge exchange will be essential elements of strengthening action on energy efficiency in all countries.

IEA Energy Efficiency Market Report, 2016

# 44

Last year, the global economy grew while global carbon emissions from burning fossil fuels stayed flat. And what this means can't be overstated. We have broken the old arguments for inaction. We have proved that strong economic growth and a safer environment no longer have to conflict with one another; they can work in concert with one another.

## HOME ENERGY

President Obama at COP21 // Paris, November 2015

## **Overview of 4E Structure and Activities**

What I'm saying is that instead of making excuses tomorrow to our children and grandchildren, we should be taking action against climate change today.

David Cameron, UK Prime Minister at COP21 // Paris, November 2015



## **Executive Committee**

4E is managed by an Executive Committee (ExCo) comprising one voting delegate from each participating country. Like al IEA Technology Collaboration Programmes, participation in 4E is open. The executive group 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 2016, 4E office-bearers included:

- Chair of 4E: Mike Walker (UK): retired Michelle Croker (Australia): appointed
- Vice-chairs of 4E: Katherine Delves (Canada); Hans-Paul Siderius (Netherlands); Michelle Croker (Australia):retired.

The 17th and 18th meetings of the Executive Committee (ExCo) were held in London, UK (25 & 26 May 2016) and Ottawa, Canada (17 November 2016). Attendance at these meetings is shown in Table 1. A list of the members of the ExCo during 2016 is shown in Attachment 1.

### Future ExCo meetings will be as follows:

- > 19th ExCo: 28 April 2016, Vienna, Austria.
- 20th ExCo: 17 November 2016, Canberra, Australia.



4E Executive Committee meetings, 2016





## **Attendance at 2016 ExCo Meetings**





## Annexes

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 in the figure below, and this highlights the three active Annexes:

- Electric Motor Systems Annex (EMSA), launched in October 2008 and led 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 Canada in 2016.

Reports on all Annexes are included later in this report.



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## **4E Projects**

4E members initiate projects into areas of research relevant to policies for efficient end-use equipment. These may be special one-off activities or potentially lead to the development of an Annex or other avenues for pursuing more in-depth consideration.

Active projects in 2016 included:

- Mapping & Benchmarking
- G20 Connected Devices Alliance
- ▶ G20 EELP Product Best Practice Policy Exchange Forum
- IEA Energy Efficiency Market Report 2016
- Policy Guidelines for Motor Driven Units
- Achievements of Energy Efficiency Standards and Labelling Programmes
- The Effectiveness of Voluntary Agreements

### Mapping & Benchmarking

International benchmarking enables governments to compare the performance of appliances and equipment in different regions, and better understand the potential for improvement.

Participating 4E countries supply energy/performance data, such as from registration databases, which is then analysed to allow the comparative benchmarking of products over time. The results are reviewed alongside information on government policies and cultural variables in each of the markets. Any lessons learned from the best performing countries are highlighted to help improve product performance elsewhere.

Benchmarking is a key activity of 4E and since 2014 has been undertaken on project basis under the guidance of the ExCo.

## 4E benchmarking analysis guoted by Australia & New Zealand to justify of new regulations

The IEA 4E 2015 Lighting Benchmarking review looked at the status of lighting energy efficiency in a range of countries that had put in place efficiency measures (Australia, Austria, Canada, Denmark, Japan, Republic of Korea, UK, and USA). It found that while intervention had led to a significant reduction in market share of incandescent lamps, the anticipated increase in the average efficacy had not been as high as expected (Australia more effective than all but Republic of Korea). The study identified that the relatively small increases in efficacy appears simply to be that consumers are migrating from the purchase of incandescent lamps to the purchase of marginally more efficient halogen products, resulting in the risk that halogens become the new 'default' lamp of choice for consumers.

E3 Consultation Regulation Impact Statement – Lighting, Commonwealth of Australia, Canberra, November 2016



This analysis compares the policy frameworks and product performance of gas and electrical storage, electrical heat pump and gas instantaneous water heaters available in Australia, Canada, China, Japan, the Republic of Korea, Sweden, and the USA.

In 2016, 4E undertook a major new international benchmarking project for Domestic Water Heaters. This not only included storage, instantaneous and heat pump technologies, but for the first time covered both electric and gas-fired equipment.

Energy consumption of water heater technologies, Australia, Canada, China, Sweden, Japan, Korea and USA.



### G20 Connected Devices Alliance (CDA)

During 2016, 4E continued to provide the Secretariat for the Connected Devices Alliance (CDA), a network of 350 government and industry participants launched in 2014 as one of six key energy efficiency initiatives under the G20.

Led by the United Kingdom and IEA, the CDA provides a unique forum for dialogue between industry and government representatives on this rapidly growing issue of global significance.

In 2016 the CDA's work was applauded and its mandate extended under the Chinese Presidency of the G20.



**Notes:** GPS = global positioning system; SCADA = supervisory control and data acquisition system. Data will be online. Source: IEA (2013b), Energy Efficiency Market Report 2013, OECD/IEA, Paris, www.iea.org/w/bookshop/add.aspx?id=460.

### Key outputs of the CDA in 2016 included:

- The launch of the CDA Voluntary Principles for Energy Efficiency Connected Devices, which provide guidelines for product for designers, manufacturers and policy-makers.
- networks.
- the SEAD 'Global Efficiency Medal'.
- Research projects into Energy Aware Devices, Energy use by Internet of Things (IoT) devices and potential policy responses, undertaken with 4E EDNA.



The population of the CDA Centre of Excellence, to provide governments and industry with an accessible source of information on best practices and energy savings opportunities in networked devices and

> The development of Awards to recognise significant achievements in communication protocols, through

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### G20 EELP Product Best Practice Policy Exchange Forum

Launched under the Chinese Presidency of the G20 in 2016, the Energy Efficiency Leading Program (EELP) includes the Product Best Practice Policy Exchange Forum, co-hosted by the IEA, SEAD and 4E.

Designed to engage efficient product experts from across G20 countries and beyond to share experiences and further understanding on policies to stimulate improvements in the efficiency of appliances and equipment, the Forum includes a series of virtual and face-to-face workshops.

4E hosted the first face-to-face workshop in November 2016 in Ottawa. This highly interactive day included a range of brief presentations from key government experts from china, Netherlands, Sweden, USA and Republic of Korea covering the topics of Innovation in Energy Labelling, and High Efficiency Programs.

### **IEA Energy Efficiency Market Report 2016**

As the IEA focuses its efforts on energy efficiency, The Energy Efficiency Market Report has become a flagship publication, quantifying the latest trends, tracking global progress, and examining key drivers and market issues.

For the first time, the 2016 sections on appliances, equipment and lighting resulted from a unique collaboration between the IEA Secretariat and 4E.

The greatest efficiency gains have been led by policy, and the greatest untapped potentials lie where policy is absent or inadequate.

Drawing on a range of 4E technical and policy experts to undertake analysis and draft key findings, this project represented an unprecedented level of collaboration between the two organisations.

4E will provide similar input to the 2017 Energy Efficiency Market Report.

The IEA is indebted to the 4E TCP for its contribution to the Energy Efficiency Market Report 2016. This strong collaboration enabled the IEA to access the TCP's experts and gain insights on markets, technologies and policies for appliances, equipment and lighting which are reflected in the final publication. I look forward to continuing our collaborative efforts during 2017.

Samuel Thomas, Senior Programme Manager Energy Efficiency Division // International Energy Agency



### **Policy Guidelines for Motor Driven Units**

This project examines the options for harmonising technical standards and regulations for Motor Driven Units (MDUs), focusing on pumps, fans and compressors.

A MDU converts electrical power into rotational mechanical power and may consist of the following individual components: variable frequency drive, electric motor, mechanical equipment (gear, belt, clutch, brake, throttle) and a driven application (pump, fan, compressor, transport).

All motor systems are responsible for over 45% of global electricity consumption; while the global annual energy consumption of pumps, fans and compressors is estimated at 6,560 TWh, which is larger than the total electricity consumption of China.

### **Motor Drive Unit Definition**



= Components that are always part of a MDU

The global annual energy consumption of pumps, fans and compressors is estimated at 6,560 TWh, which is larger than the total electricity consumption of China





The first project report, published in 2016, describes existing standards and regulations for MDUs in Australia, Brazil, Canada, China, European Union (EU28 plus Switzerland, Norway and Turkey), India, Japan, Republic of Korea, Mexico, New Zealand, Russia, Saudi Arabia, South Africa and USA.

It found that in 2016:

- 11 of the 14 countries studied have MEPS for motors.
- 4 countries have MEPS for pumps.
- 3 countries have MEPS for fans.
- 1 country has MEPS for compressors.

However, the current variety of regulated performance requirements across regions impairs the international trade of products. The use of different terminology and definitions related to MDUs across regions also makes it difficult to compare standards and regulations applied in different countries and can lead to confusion.

A second report to be published in 2017 will identify opportunities to improve global alignment in both technical standards and policies for MDUs.

> The current variety of regulated performance requirements across regions impairs the international trade of products



Fan-MDU: motor and fan (Source: ebm papst, 2016)





### **Achievements of Energy Efficiency Standards** and Labelling Programmes

This 2016 update builds on the success of the first 'Achievements' report in 2015 and identifies further evidence of the impacts of government energy efficiency standards and labelling (EESL) programs.

Drawn from over 150 publications that detail the impacts of EESL programs in more than 20 countries, covering more than 30 different product types, this thorough review of the achievements of EESL programs provides overwhelming evidence that:



The most mature national EESL programmes covering a broad range of products are estimated to save between 10% and 25% of national or relevant sectoral energy consumption

- ▶ EESL programs have substantially reduced energy use and CO<sub>2</sub> emissions - very much cheaper than could have been achieved by other clean energy supply options.
- This conclusion takes into account any rebound effect.
- Improved health from higher thermal comfort and/or avoided air pollution; job creation and energy security - provide added justification for these programs.
- All EESL programs have the potential to expand in scope and ambition to deliver more energy and CO<sub>2</sub> savings.
- Governments should note these findings when determining investment options and priorities for meeting energy demand.

The main findings of the 2016 report are included in the box on this page.

In all programmes reviewed, the national benefits outweighed the additional costs by a ratio of at least 3 to 1.



### **Energy Efficiency Savings**

- The energy efficiency of major appliances have increased at more than 3x the underlying rate of technology improvement in countries with EESL programs.
- One-off improvements of more than 30% have been observed.
- The most mature national EESL programs covering a broad range of products are estimated to save between 10% and 25% of national or relevant sectoral energy consumption.

### **Cost-benefit**

In all programs reviewed the national benefits outweighed the additional costs by a ratio of at least 3 to 1. (Note: Impacts take account of likely rebound effect).

### **Cost of Greenhouse Gas Reductions**

- EESL programs deliver energy and CO<sub>2</sub> reductions while also reducing total costs.
- ▶ This compares extremely favourably with the cost of other clean energy options.
- Supports the conclusion: end-use efficiency measures offer the least cost pathway to energy and CO<sub>2</sub> emission reductions.

### **The Effectiveness of Voluntary Agreements**

Many jurisdictions look to Voluntary Agreements (VAs) as an alternative mechanism to regulations to reach similar policy objectives. Amongst the claimed attributes of VAs are that they place a lower regulatory burden on industry, may be quicker to initiate and more adaptable to rapid changes in technology. VAs have a long and varied history.

Starting in 2017, this project aims to provide an authoritative overview of the effectiveness of VAs in improving the energy efficiency of appliances and equipment.

It will describe international experiences, evaluate their effectiveness compared to regulatory instruments in meeting policy objectives, summarise the essential elements of the more successful voluntary agreements and identify lessons learned.

### **Impact on Appliance Prices**

- Appliances and equipment covered by EESL programs have not only dramatically improved in efficiency over the past 20 years, but are also cheaper to purchase.
- While EESL programs may have caused small changes in prices close to the implementation of new energy efficiency measures, they appear to have had little long- term impact on appliance price trends.
- EESL programs are very good at fostering innovation.
- Findings suggest that it is often cost-effective to be more ambitious in setting performance thresholds.

### **Additional Impacts**

- ▶ EESL programs deliver very significant cobenefits such as:
  - Job creation
  - Improved air quality
  - Savings in health costs
- ▶ These may be very large and further enhance the cost-benefit case for EESL programs.
- The contribution made by increased energy efficiency in these areas can be sufficiently large in their own right to justify EESL programs in some jurisdictions.

## **Co-ordination with other organisations**

As one of 40 Technology Collaboration Programmes established under the framework of the International Energy Agency (IEA), 4E has a particularly close relationship with the IEA Secretariat and provides expert input to many IEA publications on end-use energy efficiency. During 2016, 4E contributed to the World Energy Outlook and the Energy Efficiency Market Report.

4E also provides regular progress reports to IEA member governments and liaises with other Technology Collaboration Programmes. The IEA's Energy Efficiency Division provides a report to each 4E ExCo meeting, and is often represented at these meetings.

During 2016 the relationship with the Super Efficient Appliance Deployment (SEAD) initiative has strengthened. Not only do representatives of SEAD participate in 4E meetings, but 4E experts have provided important input to the SEAD Global Efficiency Medal and Light Challenge.

Through the two G20 initiatives identified in earlier sections, 4E is also working with the International Partnership on Energy Efficiency Co-operation (IPEEC), and the Clean Energy Ministerial (CEM).

In addition, 4E regularly liaises with a range of public and private sector groups with an interest in end-use energy efficiency, including APEC, the World Bank, the World Economic Forum, Sustainable Energy for All, international standards organisations and industry groups. Recognising the unique contribution that each is playing in the development of public policy, 4E continues to engage these organisations to promote a better understanding of issues relating to the efficiency of end-use equipment.

4E also engages with many industry sectors through the work of our Annexes and the CDA.



## Annex Achievements in 2016

# 4

The IEA has identified energy efficiency as a critical "fuel" in the transition to a low-carbon economy. Its analysis has shown that over a third of all emissions reductions needed to reach climate goals by 2040 must come from energy efficiency policies. Efficiency gains in the IEA's member countries were large enough to power Japan in 2015 making efficiency a critical component of a secure, sustainable energy system.



IEA Energy Efficiency Market Report, 2016



## **Electric Motor Systems Annex (EMSA)**

The Electric Motor Systems Annex (EMSA) focuses on improving the efficiency of electric motor systems. Electric motors drive pumps, fans, compressors, industrial production machinery and any auxiliary components to which they may be attached, including variable speed drives, gears, transmission belts and brakes. Motor systems are responsible for over 45% of global electricity use with a savings potential of 20%-30%.

Motor systems are responsible for over 45% of global electricity use with a savings potential of 20%-30%. EMSA helps to:

- Raise awareness on the large energy savings potential in motor systems and showing the way to realise these.
- > Advise policy makers in the design and implementation of coherent motor systems policy instruments.
- Develop sufficiently robust international standards to support policy implementation.
- Enhance international exchange on policy experience, challenges and lessons learned.
- Build capacities of engineers working for motor and machine manufacturers and industrial motor systems users.

Global total final electricity consumption by end-users, 2014



Source: IEA Analysis

EMSA is recognised as an important international group for policy and technology in the field of motor systems efficiency by other organisations and at international fora (e.g. Motor Summit, EEMODS, eceee)



### EMSA plays a unique role in assisting the development and implementation of policies for motors and motor systems:

- The co-operation and exchange between EMSA countries reduces the costs of designing motor system policies and increases the chances of successful implementation. Through its outreach and publications, EMSA makes governments around the world aware of policy opportunities and the latest motor system policy developments in different regions.
- EMSA's involvement in the international standards development process helps to ensure that technical standards are sufficiently robust to support replication and enforcement. This is complemented by work to build testing capacity and performance amongst EMSA's network of public and private laboratories around the world.
- EMSA's work encourages industry, both manufacturers and end users of motor systems, to direct more attention to the issue of motor systems efficiency. Efficient motor systems not only save energy but also reduce the risks and costs of production through optimising processes, reducing waste, lowering emissions and improving equipment performance.
- EMSA makes the larger professional community aware of necessary changes and the implications of improving the energy efficiency in the industrial sector and built environment.

### **Major Achievements During 2016**

- ▶ 4E EMSA published Part 1 of the Policy Guidelines on Motor Driven Units, showing the status of standards and regulations concerning pumps, fans and compressors.
- EMSA as co-host of the Motor Summit which took place on 11 – 12 October 2016 in Zurich. Switzerland, stimulated the global debate of policy makers, standards developers, research, academia and industry concerning the efficiency of electric motor systems.

EMSA supported the IEA in their work on the World Energy Outlook 2016 which has a special chapter on Energy Efficiency Outlook and Electric motor-driven systems.

EMSA representatives from Australia, Switzerland and Denmark work on the IEC efficiency classes and testing

standards for converter-fed motors<sup>1</sup>, and on equivalent IEC standards for motors and converters (motor systems)<sup>2</sup>. EMSA supports the standards development process with independent testing evidence.

- EMSA representatives are advising on the revision of the European motor regulations<sup>3</sup> and fan regulations<sup>4</sup>.
- EMSA and the Danish Technological Institute (DTI) delivered the sixth webinar on efficient electric motor systems through Leonardo Energy. Five were delivered in 2015.
- EMSA participated in the UNEP-GEF Expert Taskforce on Electric Motors, which is delivering a Policy Guide for regulators and policymakers in emerging economies. The Guide will be published in 2017.



### **Annex Participants**



A complete record of EMSA Annex activities in 2016 and participants are included in Attachment 2.

Motor systems can on average consume up to 40% less energy by pursuing a co-ordinated suite of policy measures, including stricter regulation of motors and motor-driven equipment, much larger uptake of variable speed drives and, importantly, other systemwide efficiency measures.

IEA World Energy Outlook, 2016



<sup>1 60034-30-2</sup> and 60034-2-3 2 61800-9-2

<sup>3 (</sup>EC) No 640/2009 (Lot 30). Denmark has also supported the revision of regulation (EC) No 640/2009 (Lot 30) by presenting independent testing evidence on the losses of variable frequency drives

<sup>4 (</sup>EU) No 327/2011



## **Solid State Lighting** (SSL) Annex

The Annex member countries believe that there are significant advantages in engaging in an international collaboration in order to develop a consensus on harmonised approaches to SSL performance and quality. The IEA 4E SSL Annex continues to serve as a hub for information exchange and coordination of research into topics relating to solid state lighting. Member governments who are actively engaged in developing policies addressing the quality and performance of LED lighting make use of the Annex research and expert resources to support their policy outcomes. For example, Australia used the quality and performance tiers in their draft MEPS proposal and is now actively engaged in the interlaboratory comparison for directional lamps and luminaires to help laboratories get NATA (Australian) accreditation before the regulation takes effect.

The SSL Annex Experts meet twice yearly and discuss the various joint light is switched on. activities underway, which include: test method assessment, accelerated lifetime testing, laboratory accreditation, best practices in market transformation and market surveillance, guality and performance tiers, standby-power of smart lighting and benchmarking and product database management. In 2016, the ExCo directed the SSL Annex to review and consider consolidating its work portfolio, which the Management Committee started in December and will continue in early 2017. A few new areas for cooperation were identified including health and safety aspects, updating the life-cycle assessment work from 2014, and dimmer compatibility.

The SSL Annex provided its expertise and publications in support of several global initiatives, including the Global Lighting Challenge, the SEAD Global Efficiency Medal and the UNEP United for Efficiency (U4E) programme. The SSL Annex has also engaged with industry to keep them informed of our work and invited them to provide direct input to our activities.

### **Major Achievements During 2016**

In 2016, there were several major achievements realised by the SSL Annex:

▶ Publication of a pioneering study<sup>5</sup> on the measurement and analysis of standby power from over thirty smart lamps tested. This report was well received by the trade press and media, and the second phase of the research is underway.



Publication of the quality and performance tiers<sup>6</sup> on seven lamps and luminaires: non-directional lamps, directional lamps, downlights, fluorescent tubes, high/low bay luminaires, outdoor/street lighting and planar luminaires. These tiers offer metrics at three different levels, and discussion on the metrics, why they are included and how to measure them.

- Our support of the Global Lighting Challenge resulted in the SSL Annex quality and performance tier criteria being used in the competition as the basis of a 'quality light' source<sup>7</sup>.
- Our support of the SEAD Global Efficiency Medal resulted in the SSL Annex quality performance tier criteria being used in the competition, to ensure only quality light sources apply<sup>8</sup>.
- Australia and New Zealand based their draft national MEPS<sup>9</sup> on the guality and performance tiers.

5 http://ssl.iea-4e.org/news/stand-by-of-smart-lamps

6 http://ssl.iea-4e.org/news/ssl-annex-performance-tiers

7 http://www.globallightingchallenge.org/Choose.aspx

8 http://www.superefficient.org/Global-Efficiency-Medal/Lighting-Awards 9 http://www.energyrating.gov.au/consultation/consultation-ris-lighting

**These (Smart Lamps)** can have substantial standby power use which, depending on hours of use, can even be higher than the energy consumed when the



The minimum (lamp) performance levels will be based on existing international work, primarily from the IEA 4E Solid State Lighting Annex. The work of the IEA 4E Solid State Lighting Annex, supported by 9 countries, including Australia, provides a source of technical and policy guidance relating to performance levels and testing of LED products.

E3 Consultation Regulation Impact Statement Lighting, Commonwealth of Australia, Canberra, November 2016

### **Annex Participants**



A complete record of the SSL Annex activities in 2016 and participants are included in Attachment 3.

The Swedish Energy Agency made a strategic choice to focus on education and work through municipal actors and advisors as the channel to retailers and consumers.

4E SSL Annex: Lessons Learned Bringing LEDs to Market, 2016

The Global Lighting Challenge is promoting existing sets of high-efficiency and high-quality specifications to be used as lighting product procurement guides...The (specifications) tiers will align with the 4E Solid State Lighting Annex's voluntary product performance specifications...

The Global Lighting Challenge is a campaign of the Clean Energy Ministerial ©2015

















## The Electronic Devices and Networks Annex (EDNA)

The EDNA Annex remains the sole international platform for government policy makers to discuss the energy implications and opportunities presented by connected devices - the large numbers of appliances and equipment that are fast becoming connected to each other and to the internet. If not properly managed, the "energy cost" of connecting devices can be high, however with connectivity comes opportunities to control systems of devices in an efficient manner (known as "intelligent efficiency"). EDNA focuses on both of these topics, working closely on several initiatives with the Connected Devices Alliance (CDA), which adds an industry perspective. The Annex also liaises closely with member governments who are actively developing policies in this area, engaging with the various preparatory studies that underpin their development of policy. EDNA has also worked with other IEA TCPs where there is overlap of subject matter (for example The International Smart Grid Action Network (ISGAN).

## es connec

## The number of devices connected to the internet is growing rapidly and has already surpassed the world's human population.



In 2016 EDNA moved significantly from start-up to an implementation phase; launching, continuing and even completing a number of tasks. The primary focus of these tasks was to inform government policy in the area of connected devices, and this included developing some of the policy-focussed ideas emanating from the CDA.

Engagement with its members is a primary focus for the EDNA annex, and in 2016 all 12 EDNA member countries contributed to its outputs. This is in part due to the fact that tasks are primarily member-led and structured to engage members to the fullest extent possible. The worldwide network-related standby energy consumption of the IoT devices considered in this report is growing by 20% p.a.



### **Major Achievements During 2016**

During 2016 EDNA completed its two inaugural tasks as well as executing and launching several others:

- Completion of Task I Smart Meters and Energy Monitoring Systems - studying and making policy recommendations for the "own" energy use of these devices.
- Completion of Task II Energy Efficiency of the Internet of Things including technical and policy reports along with a policy brief.
- Completion of Task II Energy Efficiency of the Internet of Things including technical and policy reports along with a policy brief.
- Ongoing execution of Task III Policy Opportunities for Intelligent Efficiency - including a joint government/industry workshop held in Canada in November.
- Launch of Task IV Study of "Always-On" devices.
- Launch of Task V bottom-up development of Network Standby Power Targets.
- Launch of Task VI study of opportunities for Energy Harvesting to power network connectivity.
- > Ongoing execution of the CDA Centre of Excellence an on-line platform for policy white papers in the area of connected devices - 44 papers hosted to date.
- Ongoing execution of "Basket-of-Products" testing to undertake basic, large-scale testing of the standby power consumption of connected devices.
- Completion of a policy study for Energy Aware Devices examining the policy opportunities for encouraging devices to become "energy aware".

A number of these initiatives follow on from the 4E-sponored Connected Devices Alliance, including Task III (intelligent efficiency), Task V (Network Standby Power Targets), the CDA Centre of Excellence and Energy Aware Devices.

The emergence of ICT technologies such as connected sensors, data analytics and cloud computing have made it possible to continuously optimise the performance of complex systems





## The selection of appropriate communication technology options, that demand the least power, would reduce the network standby energy.

### **Annex Participants**



A complete record of EDNA activities in 2016 and participants are included in Attachment 4.

**IoT expands** the concepts of 'anytime' and 'any place' to the connectivity of 'anything'





## **4E Outreach** and Communication

Between 2008 and the end of 2016, there have been a total of 750 publications, workshops, presentations and other outreach activities undertaken by 4E.



4E operates a group of linked websites that are the hub of 4E's communication activities, providing access to all 4E publications and notice of forthcoming events.

The location of 4E's site traffic is extremely geographically diverse, with visitors from around 150 separate countries. 50% of website traffic comes from countries that are not current members of 4E, with high usage by organisations based in India, Germany, Brazil and China.

The majority of newsletters and Policy Briefs have been published in several languages, including Japanese, Korean, German, French and Chinese.

4E communication activities, 2008-16



4 (

50% of website traffic comes from countries that are not current members of 4E, with high usage by organisations based in India, Germany, Brazil and China.





## **4E Group Finances**

In 2016, the total cost of 4E activities is estimated to be €1.95 million, 3% higher than in 2015.



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 2016, the total cost of 4E activities is estimated to be €1.95 million, 3% higher than in 2015.

The annual fees and voluntary contributions of the 12 members countries and SEAD funded approximately 42%.

Voluntary contributions were received from the UK, Netherlands and Sweden for the G20 CDA and Achievements of EEDL Programmes.

70% of resources were directed towards research, while expenditure on communication and outreach activities accounted for 22%. The share of resources devoted to administration and financial management has fallen compared to 2015 to only 8% of total costs.

### Allocation of 4E resources in 2015

While Annex membership fees can vary from year to year depending upon the agreed work programme, all membership fees are the same in 2016 as they were in 2015.





Research

Communication & Outreach

### 4E membership fees, 2016

**ELECTRIC MOTOR SYSTEMS ANNEX (EMS** SOLID STATE LIGHTING ANNEX (SSL)

## **Over 70% of resources** were directed towards research





Administration

	€20,000
A)	€15,000
	€22,000
NNEX DNA)	€15,000





## Attachments

# 44

**Energy efficiency** is the one energy resource that all countries possess in abundance. I welcome the improvement in global energy efficiency, particularly at a time of lower energy prices. This is a sign that many governments push the energy efficiency policies, and it works. Dr Fatih Birol, IEA Executive Director.

## Attachment 1: 4E Executive Committee Delegates

Contracting Party	Nomination	Name & Details	Email/Telephone
AUSTRALIA	Primary	<b>Ms Michelle Croker (Chair)</b> Appliance Energy Efficiency Branch Department of the Environment and Energy	Michelle.Croker@environment.gov.au <b>Tel:</b> +61 2 6275 9031
	Alternate	<b>Mr Rick Miles</b> Appliance Energy Efficiency Branch Department of the Environment and Energy	Rick.Miles@environment.gov.au <b>Tel:</b> +61 2 6275 9070
AUSTRIA	Primary	<b>Mr Michael Hübner</b> Federal Ministry for Transport, Innovation and Technology	michael.huebner@bmvit.gv.at <b>Tel:</b> +43 1 711 62 652922
	Alternate	<b>Dr Adriana Diaz</b> Ecodesign Company GmbH Engineering and Management Consultancy	diaz@ecodesign-company.com <b>Tel:</b> +43 1 40 35 611-33
CANADA	Primary	<b>Ms Debbie Scharf</b> Director, Equipment Division Office of Energy Efficiency Natural Resources Canada	Debbie.Scharf@canada.ca <b>Tel:</b> +1 613 996 4359
	Alternate	<b>Ms Katherine Delves (Vice-Chair)</b> Chief, Standards Development Office of Energy EfficiencyNatural Resources Canada	Katherine.Delves@canada.ca <b>Tel:</b> +1 613 947 1207
DENMARK	Primary	Mr Peter Nielsen Senior Policy Advisor Construction and Energy Efficiency Danish Energy Agency	pen@ens.dk <b>Tel:</b> +45 3392 6735
	Alternate	Mr Bjarke Hansen Construction and Energy Efficiency Danish Energy Agency	bjh@ens.dk <b>Tel:</b> +45 3392 7588
FRANCE	Primary	Mr Alain Anglade (from 3 October 2016) Senior Expert, Building Department ADEME	alain.anglade@ademe.fr <b>Tel:</b> +33 493 957 935
	Alternate	Ms Therese Kreitz Responsible for International Affairs ADEME	therese.kreitz@ademe.fr <b>Tel:</b> +33 493 957 984
JAPAN	Primary	<b>Mr Takeo Natsume (from 1 April 2016)</b> Director General Energy Conservation Technology Department, NEDO	natsumetko@nedo.go.jp <b>Tel:</b> +81 44 520 5284
	Alternate	<b>Ms Arisa Numata</b> Chief Officer Energy Conservation Technology Department, NEDO	numataars@nedo.go.jp <b>Tel:</b> +81 44 520 5284
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	Alternate	<b>Ms Joo-hee Son</b> Korea Energy Agency	jhson@energy.or.kr
	Alternate	<b>Mr Je En Kim</b> Ministry of Knowledge Economy	jekim@mke.go.kr

<b>Contracting Party</b>	Nomination	Name & Details	Email/Telephone
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	Alternate	Mr Andrew Gilheany (from 11 April 2016) Head of Sustainable Energy-Using Products Department for Energy and Climate Change	Andrew.Gilheany@decc.gsi.gov.uk <b>Tel:</b> +44 300 068 6285
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	Alternate	Mr John Cymbalsky (from 26 October 2016) Building Technologies Office US Department of Energy	john.cymbalsky@ee.doe.gov <b>Tel:</b> +1 202 287 1692
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## Attachment 2: All 4E publications, 2016

Date	Source	Title			
March	4E	2015 4E Annual Report			
		Newsletter: G20 Connected Devices Alliance			
		Report: Development of Conversion Factors and Overall Approach for International Comparisons of Water Heaters			
April	EDNA	Report: Energy Efficiency of the Internet of Things (IoT).			
Мау	EDNA	Policy Brief: Energy Efficiency of the Internet of Things (IoT): Technology and Energy Assessment			
	EMSA	Newsletter: 1/2016			
June	EDNA	Report: Own Energy Consumption of Smart Metering Infrastructure and Energy Monitoring Systems - Technical Report			
August	4E	Report: Achievements of Appliance Energy Efficiency Standards and Labelling Programs: A Global Assessment in 2016			
	EDNA	Report: Energy Efficiency of the Internet of Things - Policy Options			
		Report: Network Connected Audio Products - Measurements and Analysis of Network Standby Consumption			
September	SSL	Report: Smart Lighting – New Features Impacting Energy Consumption			
	4E	Newsletter : Bright Spark Ed 11			
October	4E	Policy Guidelines: Motor Driven Units - Part 11			
		Presentation: EESL Achievements - updated 2016			
		Policy Brief: Policy Guidelines for Motor Driven Units - Part 1			
	EDNA	Report: Energy Aware Devices - Study of Policy Opportunities			
November	EMSA	Newsflash			
	4E	Newsletter: G20 Connected Devices Alliance			
	SSL	Product Quality and Performance Tiers – Non-Directional Lamps			
		Product Quality and Performance Tiers –Directional Lamps			
		Product Quality and Performance Tiers – Downlight Luminaire			
		Product Quality and Performance Tiers – Fluorescent Lamp			
		Product Quality and Performance Tiers – Outdoor Lighting			
		Product Quality and Performance Tiers – High and Low-Bay Luminaires			
		Product Quality and Performance Tiers – Planar Luminaire			
	EDNA	Basket-of-Products - test results			
December	EMSA	Newsletter: 2/2016			

## Attachment 3: Workshops, Conferences and Meetings, 2016

Date	Source	Title	Location
February	SSL	Annex Management Committee	Teleconference
March	EDNA	Annex Management Committee	Teleconference
	SSL	Strategies in Light, 2016	California, USA
		CIE 2016 Lighting Quality and Energy Efficiency Conference	Melbourne, Australia
		PERIFEM – French Distribution and Trade Association	Paris, France
April	SSL	12th Experts meeting	Beijing, China
		Annex Management Committee	Teleconference
	EMSA	Participation at International Policy Workshop on China Motor System Energy Efficiency Improvement	Beijing, China
	EDNA	5th Annex management meeting	Teleconference
Мау	EMSA	15th Annex Management Committee	Teleconference
		15th EMSA Annex Meeting	London, UK
	EDNA	5th EDNA Annex Meeting	London, UK
	4E	18th Executive Committee Meeting	London, UK
		CDA Networked Devices Workshop	Paris, France
June	SSL	Annex Management Committee	Teleconference
August	EMSA	Participation at UNEP-GEF U4E Expert Taskforce Workshop on efficient motors	Paris, France
	EDNA	Annex management meeting	Teleconference
September	EMSA	Participation in eceee Industrial Summer Study	Berlin, Germany
October	SSL	Philips Lighting Application Centre (Industry and SSL Annex experts information exchange meeting)	Eindhoven, The Netherlands
		Annex Management Committee	Teleconference
	EMSA	Motor Summit 2016	Zürich, Switzerland
		16th Management Meeting	Zürich, Switzerland
	EDNA	6th Annex Management Committee	Teleconference
November	4E	18th Executive Committee Meeting	Ottawa, Canada
		Product Best Practice Policy Exchange Series under the G20 Energy Efficiency Leading Program	Ottawa, Canada
	EDNA	6th EDNA Annex Meeting	Ottawa, Canada
		Appliance & Equipment Energy Policies for a Connected World	Ottawa, Canada
	SSL	Nordic light quality – International standards	Roskilde, Denmark
		13th Experts meeting	Roskilde, Denmark
December	SSL	Annex Management meeting	Teleconference
		Swiss Photonics Conference SSL / LASSIE-FP7 Workshop	Lausanne, Switzerland
	EMSA	EMSA participation at UNEP-GEF U4E Expert Taskforce Workshop on efficient motors	Bangkok, Thailand
		EMSA introduction at Asociación Nacional de Normalización y Certificación (ANCE)	Mexico City, Mexico



## **RECORD OF ACTIVITIES**

Contracting Party	Date	Intended Audience	Location		
PUBLICATIONS IN 2016					
EMSA Newsletter 1/2016*	Мау	Subscribers & Public			
4E EMSA Policy Guidelines for Motor Driven Units - Part 1: Analysis of standards and regulations for pumps, fans, and compressors	October	Public			
4E EMSA Executive Summary - Policy Guidelines for Motor Driven Units - Part 1	October	Public			
EMSA Newsflash	November	Subscribers & Public			
EMSA Newsletter 2/2016*	December	Subscribers & Public			
OUTREACH IN 2016	<u>`</u>				
EMSA participation at International Policy Workshop on China Motor System Energy Efficiency Improvement	April	Invited experts	Beijing		
EMSA visit to fan plant	Мау	Invited experts	London		
EMSA participation at UNEP-GEF U4E Expert Taskforce Workshop on efficient motors	August	Invited experts	Paris		
eceee Industrial Summer Study - EMSA participation	September	Public	Berlin		
EMSA co-hosting the Motor Summit 2016 Zurich	October	Public	Zürich		
EMSA participation at UNEP-GEF U4E Expert Taskforce Workshop on efficient motors	December	Invited experts	Bangkok		
EMSA introduction at Asociación Nacional de Normalización y Certificación (ANCE)	December	Invited experts	Mexico City		
MANAGEMENT/EXPERTS MEETINGS HELD IN 2016	·				
15th EMSA meeting	Мау		London		
16th EMSA meeting	October		Zürich		
OUTREACH PLANNED FOR 2017	·				
Austrian national motor conference	April	Public	Vienna		
EMSA at EEMODS'17	September	Public	Rome		
MANAGEMENT/EXPERTS MEETINGS PLANNED FOR 2	2017				
17th EMSA meeting	April		Vienna		
18th EMSA meeting	September		Rome		

\*The EMSA Newsletter has around 5,000 subscribers from over 70 different countries and is published in English, Chinese, Japanese and German.

## **COUNTRY DELEGATES**

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Lead Country		Switzerland		
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## **RECORD OF ACTIVITIES**

Contracting Party	Date	Intended Audience	Location
PUBLICATIONS IN 2016			
Smart Lighting – New Features Impacting Energy Consumption. First Status Report	September	Policy Makers, Researchers, Industry, Public	
Product Quality and Performance Tiers – Non-Directional Lamps	November	Policy Makers, Industry, Public	
Product Quality and Performance Tiers –Directional Lamps	November	Policy Makers, Industry, Public	
Product Quality and Performance Tiers – Downlight Luminaire	November	Policy Makers, Industry, Public	
Product Quality and Performance Tiers – Fluorescent Lamp	November	Policy Makers, Industry, Public	
Product Quality and Performance Tiers – Outdoor Lighting	November	Policy Makers, Industry, Public	
Product Quality and Performance Tiers – High and Low-Bay Luminaires	November	Policy Makers, Industry, Public	
Product Quality and Performance Tiers – Planar Luminaire	November	Policy Makers, Industry, Public	
OUTREACH IN 2016			
Strategies in Light, 2016 (SSL Annex presentation)	March	Industry, Public	California, USA
CIE 2016 Lighting Quality and Energy Efficiency Conference (SSLAnnex presentation)	March	Academics, Researchers, Industry	Melbourne, Australia
PERIFEM – French Distribution and Trade Association (SSLAnnex presentation)	March	Retailers, Industry, Public	Paris, France
Philips Lighting Application Centre (Industry and SSL Annex experts information exchange meeting)	October	SSL Annex Experts	Eindhoven, Netherlands
Nordic Light Quality Conference (Several presentations by SSL Annex experts)	November	Researchers, Industry, Public	DTU Fotonik, Denmark
Swiss Photonics Conference SSSL / LASSIE-FP7 Workshop (SSL Annex presentation)	December	Researchers, Industry, Public	Lausanne, Switzerland
MANAGEMENT/EXPERTS MEETINGS HELD IN	í 2016		
SSL Annex Management Committee	February		Calliflower Conference Call
SSL Annex Management Committee	April		Calliflower Conference Call
SSL Annex 12th Experts Meeting	April		NLTC, Beijing, China
SSL Annex Management Committee	June		Calliflower Conference Call
SSL Annex Management Committee	October		Calliflower Conference Call
SSL Annex 13th Experts Meeting	November		DTU Fotonik, Roskilde, Denmark
SSL Annex Management Committee	December		Calliflower Conference Call

Contracting Party	Date	Intended Audience	Location		
OUTREACH PLANNED FOR 2017					
Peter Blattner, CIE Division 2 Activities	Мау	SSL Annex Experts	Stockholm		
ExCo Side Event – IC 2017 Overview	April	ExCo	Vienna		
MANAGEMENT/EXPERTS MEETINGS PLANNED FOR 2017					
14th SSL Annex Experts Meeting	Мау		Swedish Energy Agency, Stockholm		
15th SSL Annex Experts Meeting	October		To Be Determined		
4–6 Management Committee meetings expected	2017		Conference call		
Ad Hoc expert meetings on IC 2017			Conference calls		

## **COUNTRY DELEGATES**

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AUSTRALIA	David Boughey	Department of the Environment and Energy	David.Boughey@environment.gov.au	+61 2 6274 982
DENMARK	Signe Friis Christensen	Danish Energy Agency	sfc@ens.dk	+45 3392 6748
FRANCE	Bruno Lafitte	ADEME	bruno.lafitte@ademe.fr	+33 4 93 95 72 56
REPUBLIC OF KOREA	Seung-Gyu Ji	KEMCO	sgchi@energy.or.kr	+82-31-260-4242
SWEDEN	Peter Bennich (Chair)	Swedish Energy Agency	peter.bennich@ energimyndigheten.se	+46 16 544 22 78
UNITED KINGDOM	Mike Rimmer	Department for Business, Energy & Industrial Strategy	mike.rimmer@beis.gov.uk	
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Lead Country		Switzerland		
ANNEX CHAIR		Mr Peter Bennich Coordinator for Lighting The Swedish Energy Agency, Test Sweden Email: peter.bennich@energimyr Tel: +46 73 625 6782	tlab Idigheten.se	
OPERATING AGENT		Mr Nils Borg Borg & Co. AB Sveavägen 98, 4 tr, 113 50 Stockh Email: SSL.Annex@gmail.com Tel: +46 70 585 31 74	nolm, Sweden.	



## Attachment 6: Electronic Devices and Networks Annex (EDNA) 2016 Record of Activities & Delegates

## **RECORD OF ACTIVITIES**

Contracting Party	Date	Intended Audience	Location			
PUBLICATIONS IN 2016						
Energy Efficiency of the Internet of Things - Technology and Energy Assessment Report	April	Public				
Energy Efficiency of the Internet of Things - Policy Brief	Мау	Public				
Own Energy Consumption of Smart Metering Infrastructure and Energy Monitoring Systems - Technical Report	June	Public				
Energy Efficiency of the Internet of Things - Policy Options Report	August	Public				
Network Connected Audio Products - Measurements and Analysis of Network Standby Consumption	August	Public				
Energy Aware Devices - Study of Policy Opportunities	October	Public				
Basket-of-Products - test results	November	Restricted to members				
OUTREACH IN 2016						
Workshop: Appliance & Equipment Energy Policies for a Connected World (Intelligent Efficiency)	November	Public	Ottawa, Canada			
MANAGEMENT/EXPERTS MEETINGS HELD IN 2016						
5th Annex Management Meeting	Мау		London, UK			
6th Annex Management Meeting	November		Ottawa, Canada			
MANAGEMENT/EXPERTS MEETINGS PLANNED FOR 2017						
7th Annex Management Meeting	April		Vienna, Austria			
8th Annex Management Meeting	November		TBA			

## **COUNTRY DELEGATES**

Country	Name	Organisation	Email	Phone	
AUSTRALIA	Ms Michelle Croker	Department of the Environment and Energy	Michelle.Croker@environment.gov.au	+61 2 6275 9031	
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CANADA	Ms Katherine Delves	Natural Resources Canada	katherine.delves@canada.ca	+1 613 947 1207	
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FRANCE	Mr Alain Anglade	ADEME	alain.anglade@ademe.fr	+33 493 957 935	
JAPAN	Mr Takeo Natsume	NEDO	natsumetko@nedo.go.jp		
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SWEDEN	Ms Johanna Whitlock	Swedish Energy Agency	Johanna.Whitlock@energimyndigheten.se	+46 16 544 23 19	
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## **About the IEA**

The IEA works to ensure reliable, affordable and clean energy for its 29 member countries and beyond.



## About the International **Energy Agency (IEA)**

The International Energy Agency (IEA) is an autonomous organisation which works to ensure reliable, affordable and clean energy for its 29 member countries and beyond.

Founded in response to the 1973/4 oil crisis, the IEA's initial role was to help countries co-ordinate a collective response to major disruptions in oil supply through the release of emergency oil stocks to the markets.

While this continues to be a key aspect of its work, the IEA has evolved and expanded. It is at the heart of global dialogue on energy, providing authoritative statistics and analysis.

An autonomous organisation, the IEA examines the full spectrum of energy issues and advocates policies that will enhance the reliability, affordability and sustainability of energy in its 29 members countries and beyond.

The four main areas of IEA focus are:

- Energy security: Promoting diversity, efficiency and flexibility within all energy sectors;
- **Economic development:** Ensuring the stable supply of energy to IEA member countries and promoting free markets to foster economic growth and eliminate energy poverty;
- Environmental awareness: Enhancing international knowledge of options for tackling climate change; and
- Engagement worldwide: Working closely with non-member countries, especially major producers and consumers, to find solutions to shared energy and environmental concerns.

## **IEA Technology Collaboration Programmes**

There are no quick fixes to long-term energy challenges. To find solutions, governments and industry benefit from sharing resources and accelerating results.

The IEA energy technology network is an ever-expanding, co-operative group of more than 6,000 experts that support and encourage global technology collaboration. At the core of the IEA energy technology network are a number of independent, multilateral energy technology initiatives - the IEA Technology Collaboration Programmes (TCPs) (formally known as Implementing Agreements).

Through these TCPs, of which there are currently more than forty including 4E, experts from governments, industries, businesses, and international and non-governmental organisations from both IEA member and non-member countries unite to address common technology challenges and share the results of their work.

Each Implementing Agreement has a unique scope and range of activities. Further information is available here.

A video explaining the role of TCPs is can be viewed here.





**The International Low-Carbon Energy Technology Platform (Technology** Platform) is the IEA's chief tool for multilateral engagement on clean technologies among its member and partner countries, the business community and other international organisations.

