



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

2018

ANNUAL REPORT

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Chair's Statement

2018 has seen several major trends in the world of appliances and equipment that directly influences the work of 4E. A greater range of equipment is using electricity, and the integration of distributed renewable energy sources and storage in buildings highlights the need for more flexible electricity systems. Connectivity continues to drive product development and offers greater functionality.

Two key questions for all 4E governments is whether these trends will yield energy efficiency and demand response improvements, and what roles do governments have in ensuring beneficial outcomes?

Developing informed responses to these questions forms a significant theme of our work, as has been evident over 2018 as we make plans for our next five-year term. The positive engagement of our Member governments in this process demonstrates to me that collaboration is going to be vital in tackling these tricky universal issues during the transition to cleaner energy systems.

The ability of 4E to provide an important platform for international co-operation was given a significant boost in 2018 with the addition of China, through the National Institute of Standardization, bringing our membership to 13 countries. Given China's position in the global supply of appliances and equipment, I particularly welcome their engagement and look forward to their active involvement in future years.

The following pages of 4E's 2018 Annual Report provide a record of all our activities throughout the year, and illustrate 4E's practical involvement in the development of solutions for many of the most challenging areas for policy makers. Towards this end, 4E has engaged with industry groups, the International Energy Agency and other Technology Collaboration Programmes, Standardisation bodies and many others; producing a wide range of publications that are freely available to those outside 4E.



Michelle Croker
Chair 4E
February 2019



Two key questions for all 4E governments is whether these trends will yield energy efficiency and demand response improvements, and what roles do governments have in ensuring beneficial outcomes?

Key 4E achievements in 2018

FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	OCTOBER	NOVEMBER	DECEMBER
<p>REPORT Electric Vehicle Supply Equipment Study</p>	<p>REPORT Smart Homes case study of barriers and solutions</p>	<p>China joins 4E</p>	<p>REPORT 2017 Annual Report</p>	<p>WORKSHOP Swiss IoT</p>	<p>REPORT Energy Harvesting Technologies for IoT Edge Devices</p>	<p>CAPACITY BUILDING CDA Centre of Excellence 25 new papers</p>	<p>WORKSHOP Motor Summit</p>	<p>REPORT IC 2017 Nucleus Laboratory Comparison</p>
		<p>REPORT Network Standby Power Basics</p>	<p>REPORT Policy Guidelines for Motor Driven Units - Part 2</p>	<p>REPORT Energy Audit Guide for Motor Driven Systems</p>			<p>CAPACITY BUILDING Results of the Global Round Robin testing program for converters</p>	
							<p>WORKSHOP G20 CDA Network Zero</p>	



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



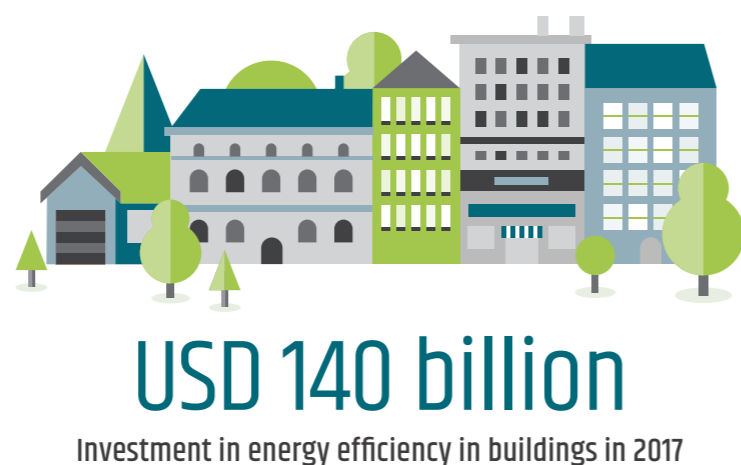
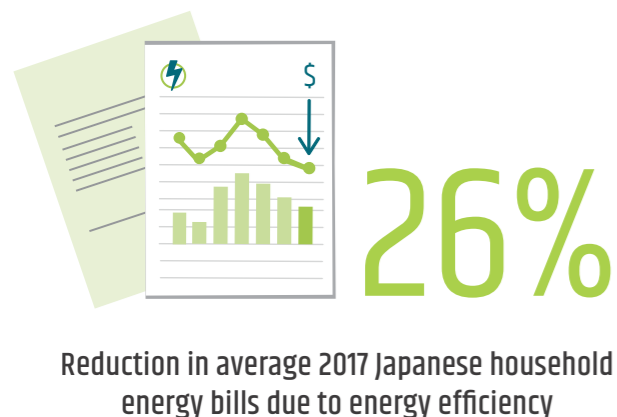
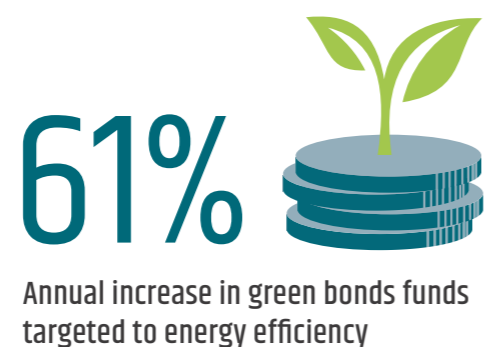
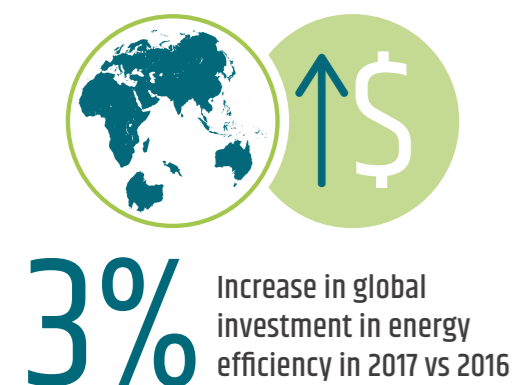
Over 70% of global energy investments will be government-driven and as such the message is clear – the world's energy destiny lies with decisions and policies made by governments.

Dr Fatih Birol, Executive Director, IEA

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

G7 members recognized the need to continue developing sustainable energy resources in order to meet growing demand, and the vital role of energy efficiency as the most cost-effective way to curb energy demand, reduce greenhouse gas (GHG) emissions, generate energy savings and improve the security, accessibility and sustainability of energy systems.

Chair's Summary: G7 Energy Ministers' Meeting Halifax, 21 September 2018



34% MANDATORY POLICIES
18% ENERGY UTILITY OBLIGATIONS

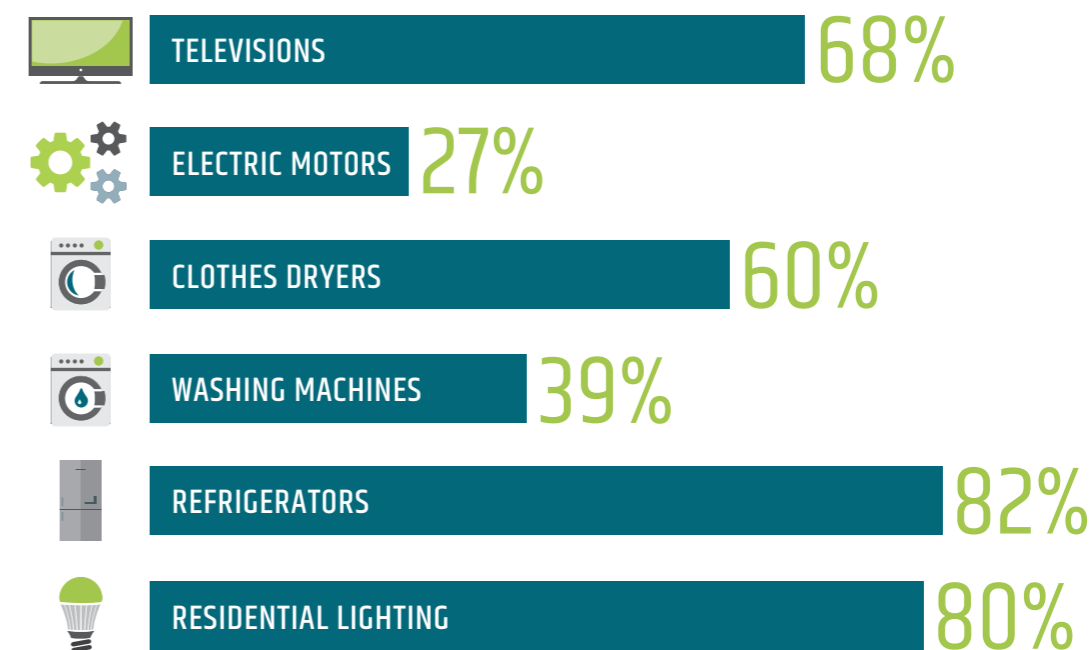
Policy coverage of global energy use



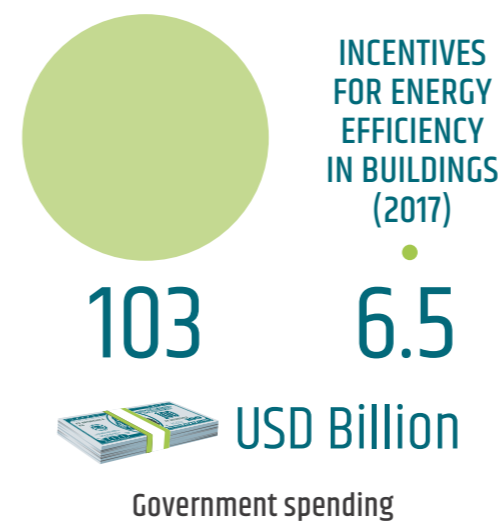
0.5%

Increase in stringency of mandatory policies in 2017

Share of global equipment use covered by mandatory policies in 2017

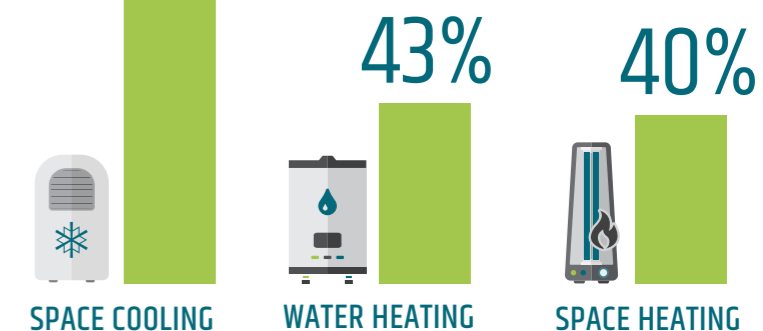


FUEL SUBSIDIES (2016)



100%

Potential for energy efficiency improvement by 2040



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.

4E membership covers 28% of world population and over 60% of global GDP



Through international collaboration, 4E enables national energy efficiency programmes to be consistently evaluated and improved so that they are ambitious, internationally aligned and effective.

World Energy Outlook 2018
International Energy Agency



Overview of 4E Structure and Activities



Energy efficiency will need to account for almost half of all the greenhouse gas emission reductions necessary through 2040 to limit the global increase in temperature to 2 degrees Celsius.

World Energy Outlook 2018
International Energy Agency

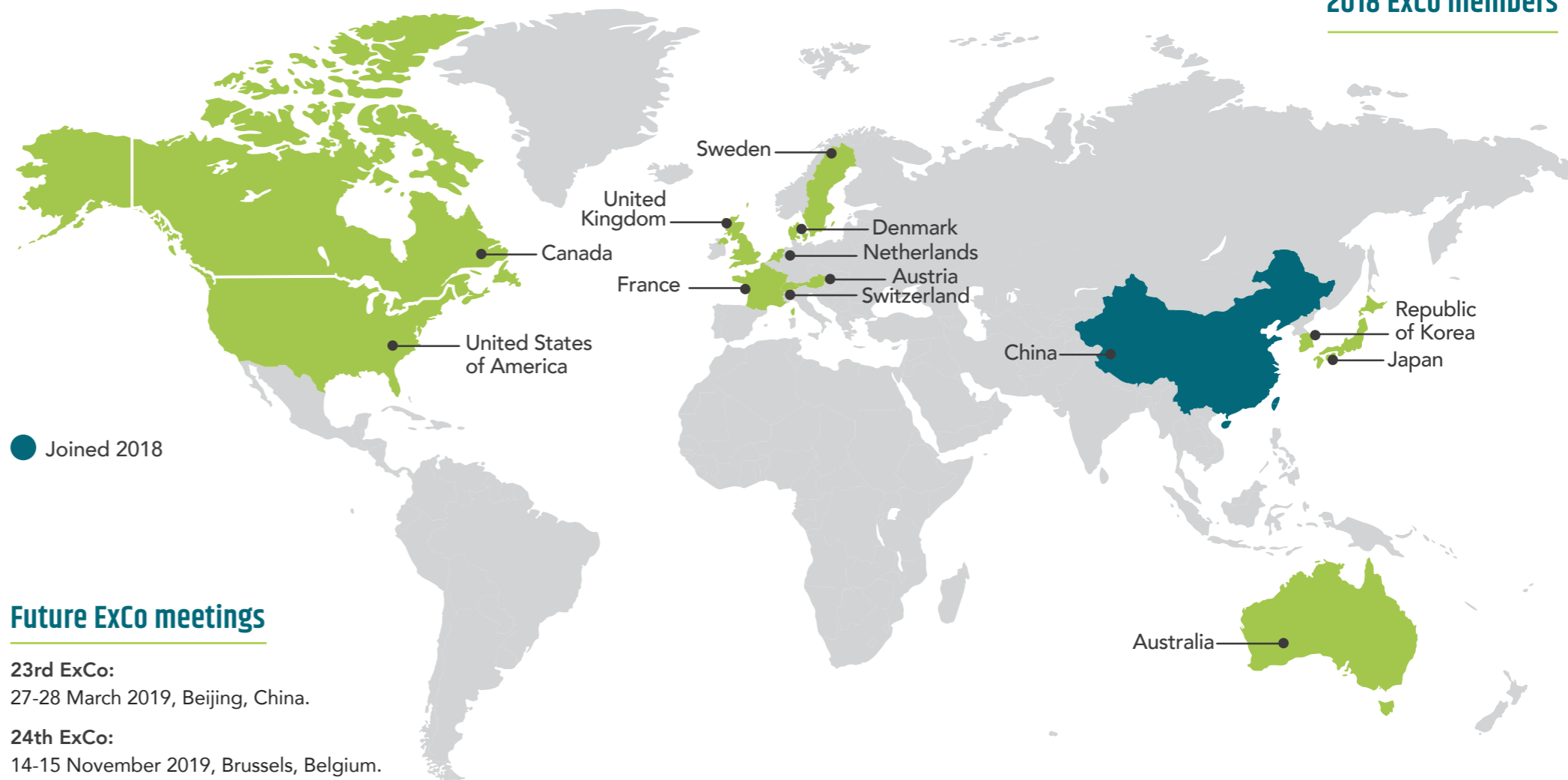
Executive Committee

4E is managed by an Executive Committee (ExCo) comprising one voting delegate from each participating country. Like all IEA Technology Collaboration Programmes, participation is open to all countries. 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 2018, the following 4E office-bearers were re-elected for a 2-year period:

- **Chair of 4E:** Michelle Croker (Australia)
- **Vice-chairs of 4E:** Katherine Delves (Canada); Hans-Paul Siderius (Netherlands), Ashley Armstrong (USA to October 2019), John Cymbalsky (USA from 28 November 2018).

The 21st and 22nd meetings of the Executive Committee (ExCo) were held in Schaffhausen, Switzerland (28 April 2018) and Stockholm, Sweden (28-29 November 2018). Attendance at these meetings is shown in Table 1. A list of the members of the ExCo during 2018 is shown in Attachment 1.



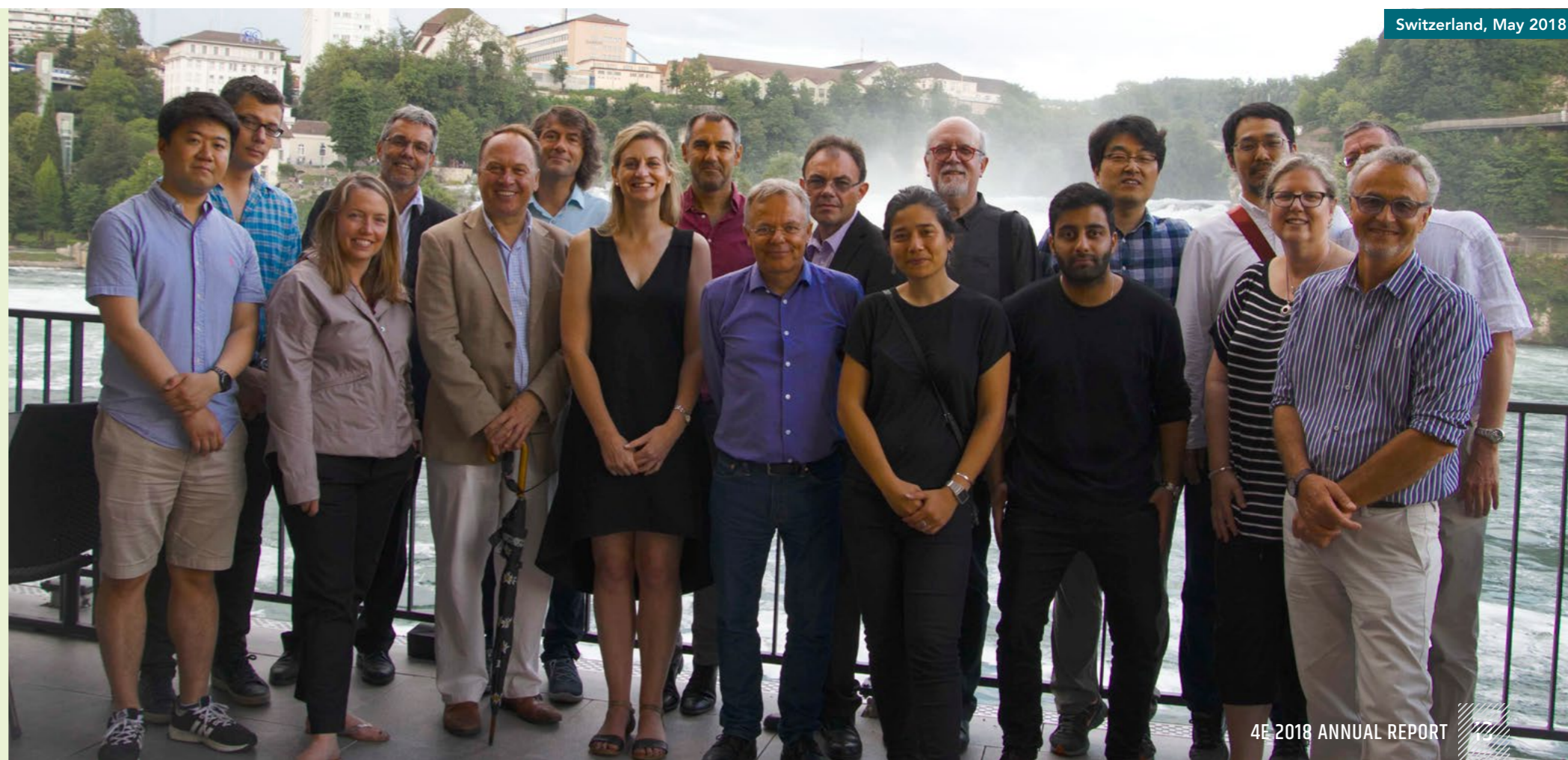
Future ExCo meetings

23rd ExCo:
27-28 March 2019, Beijing, China.

24th ExCo:
14-15 November 2019, Brussels, Belgium.

TABLE 1: Attendance at 2017 ExCo meetings

Contracting Party	21st ExCo - Schaffhausen	22nd ExCo - Stockholm
Australia	✓	✓
Austria	A	✓
Canada	✓	✓
China	—	✓
Denmark	✓	✓
France	✓	✓
Japan	✓	✓
Republic of Korea	✓	✓
Netherlands	✓	✓
Sweden	✓	✓
Switzerland	✓	✓
United Kingdom	✓	✓
United States of America	✓	✓
Observers	IEA, EC,	IEA, EC

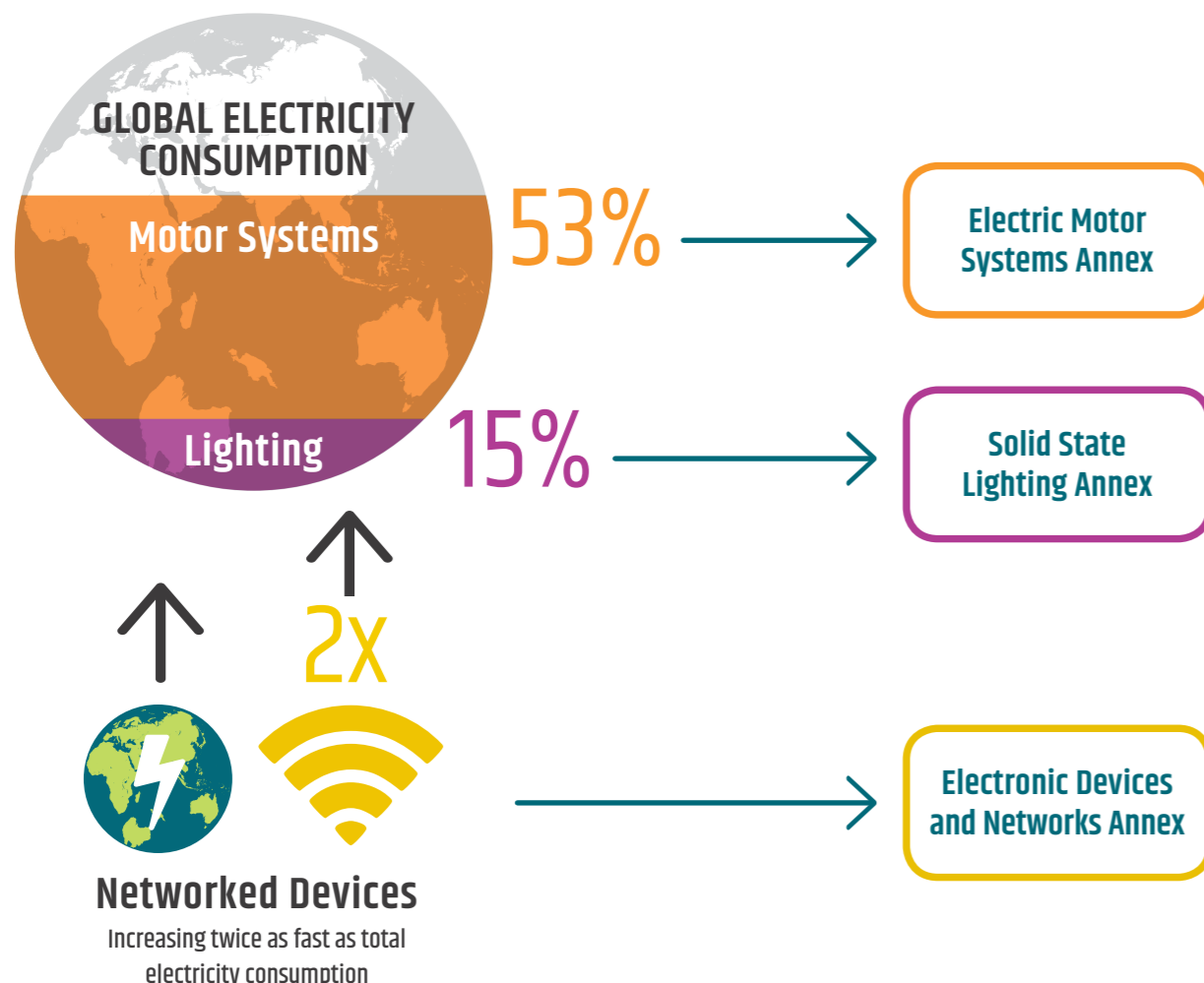


Switzerland, May 2018

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-five year period and are negotiated amongst the participating countries.



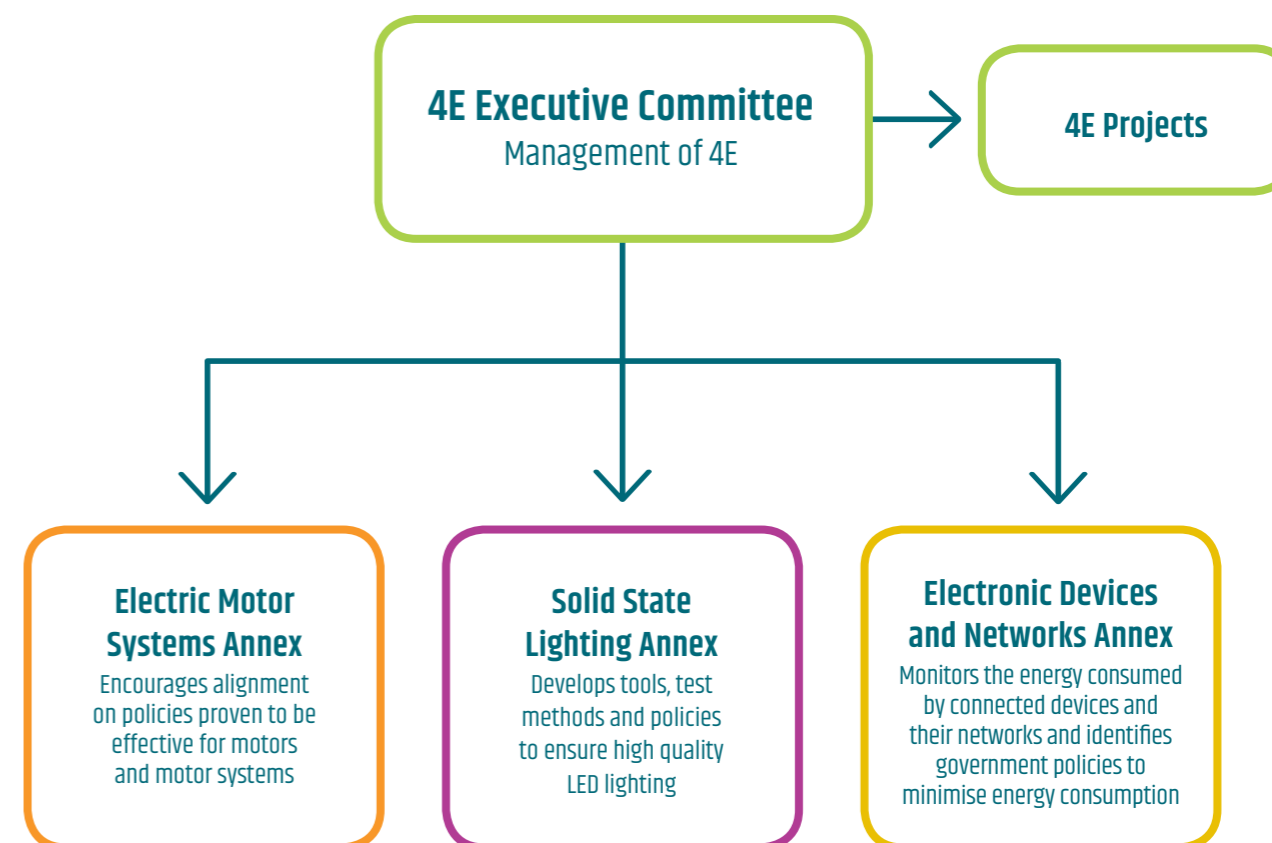
The 4E structure is shown below, and this highlights the three active Annexes:

- **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 the Canada and the Netherlands in 2017.

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

During 2018 under the leadership of Switzerland, the groundwork was laid for the Power Electronic and Converter Technology Annex (PECTA), which will be launched in 2019. Power semiconductors are a horizontal technology used globally for a wide range of applications, including end-use equipment. There is the potential for technological improvement leading to significant energy savings, however there are few policy drivers in this field, and no overall roadmap to guide further research.

4E Structure



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 2018 included:

- Policy Guidelines for Motor Driven Units
- G20 Connected Devices Alliance
- IEA Energy Efficiency Market Report 2018
- Energy Efficient Systems
- Monitoring, Verification and Enforcement

Policy Guidelines for Motor Driven Units

This project examined the options and the potential benefits from closer alignment of standards and regulations for pumps, fans and compressors within the major markets. Together these three products consume over 35% of global electricity, equivalent to the combined annual electricity consumption of China, India and Japan. This is likely to double by 2040 according to the International Energy Agency.

Pumps, fans and compressors are considered to be motor driven units (MDUs), comprising a motor and its electrical controls, any gears or belts and the equipment used to move air, fluid or gas.

The major findings from this report include the following key observations for policy makers:

- **Minimum Energy Performance Standards (MEPS)** for pumps, fans and compressors are either in force, currently under revision or consideration within China, the European Union and the United States.
- **Substantial energy savings are available** through the adoption of 'best practice' policies in these regions. In general, cost-effective savings will be maximised by:
 - Adopting metrics that include the energy performance of the pump, fan, or compressor MDU and which encourage energy savings from using controls and/ or more efficient components;
- Ensuring the regulation targets the most common products sold on the market;
- Optimising the stringency of MEPS, for example on the basis of least life cycle cost within each market;
- Enabling consumers to make purchasing decisions based on which products best match their needs;
- Applying minimum requirements for the pump, fan, or compressor when it is included in another product.
- The International Electrotechnical Commission (IEC) and the International Organization for Standardization (ISO) can lead the way in developing technical standards that support better-aligned policies for these products, to reduce costs for manufacturers, end-users, regulators and market surveillance authorities.
- For the IEC and ISO technical standards to be used as the basis for energy efficiency policies, as widely occurs in the case of motors, the standards development process needs to incorporate regulatory objectives. This could be achieved through the participation of more government or independent members in the relevant standards committees.
- A range of further recommendations specific to pumps, fans and compressors are included within the publications that can be downloaded from www.iea-4e.org/publications

G20 Connected Devices Alliance (CDA)

During 2018, 4E continued to provide the Secretariat for the Connected Devices Alliance (CDA) through the support of EDNA.

Led by the United Kingdom, the IEA, Canada and The Netherlands, the CDA provides a unique forum for dialogue between industry and government representatives on an issue that is rapidly gaining global significance.



This role was illustrated at a November 2018 workshop in Stockholm to discuss the potential for connected devices to use zero energy for connectivity. More than 50 members from both industry, government and academia attended, and several presenters highlighted the opportunity to introduce new drivers for technology innovation over forthcoming years. Participants also discussed a range of hurdles to achieving "Network Zero" along with potential long term solutions.

Further CDA activities in 2018 included:

- The addition of 25 new peer-reviewed papers to 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 networks.
- Research projects into the barriers to the uptake of smart home systems and potential policy measures in response, and investigations into energy harvesting technologies and their potential to power connected devices.



Currently enacted best practice policies ■

PRODUCT TYPE	CHINA	EU	USA
 PUMP	CLEAN WATER	Pump only	MDU
	MEPS STATUS	In effect	In effect (under revision)
 FAN	INDUSTRIAL FANS	Fan only	MDU
	MEPS STATUS	In effect	In effect (under revision)
 COMPRESSOR	STANDARD AIR	Compressor package	Compressor package
	MEPS STATUS	In effect	Under development

Note: This information is based on the status of MEPS in 2017. The regulations for fans in the USA and compressors in the EU are in draft stage, therefore not highlighted in this table.



Building codes and appliance standards have been key policy measures, preventing 10% more energy use by buildings in 2017. However, policy coverage is variable. Two out of three countries lack mandatory building energy codes and 60% of the energy use for appliances is not covered by standards.

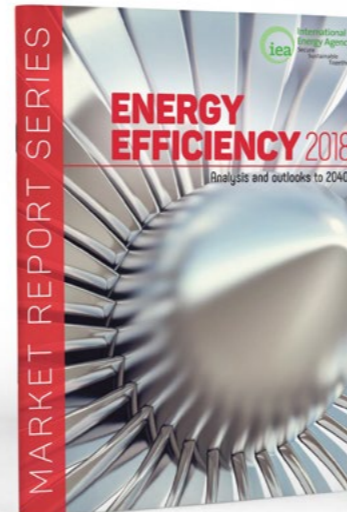
International Energy Agency, Energy Efficiency 2018

IEA Energy Efficiency 2018

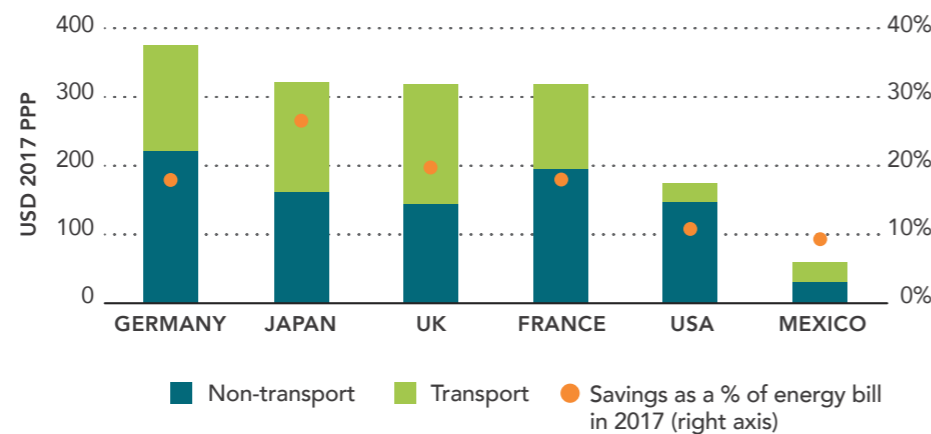
As the IEA's flagship publication on energy efficiency, *Energy Efficiency 2018* quantifies the latest trends, tracks global progress, and examines key drivers and market issues.

It noted that global energy demand grew by 2% in 2017 after two years of low growth, however, demand would be much higher if not for progress on energy efficiency. Efficiency gains since 2000 prevented 12% more energy use in 2017.

The sections on appliances, equipment and lighting drew on a range of 4E technical and policy experts to undertake analysis and draft key findings, representing an effective collaboration between the IEA Secretariat and 4E.



Average household savings per capita on energy expenditure in 2017 due to efficiency gains since 2000.



Source: IEA Energy Efficiency 2018

Energy Efficient Systems

The expansion of energy efficiency policies for appliances and equipment is at the core of 4E's mission and so investigating the potential for policies that target energy-using systems is a good fit.

4E is already exploring ways in which policies for integrated products can be broadened to cover certain equipment-systems. For example, EMSA analyses policies for motor driven units, such as for pumps, fans and compressors; while the SSL Annex is looking at luminaires and smart lighting. EDNA considers how the connection of devices to other equipment and the internet can save energy in larger systems.

To date, energy efficiency appliance and equipment policies have tended to focus on individual or integrated products that are sold ready-to-install, and less on equipment that needs to be assembled on-site before it can function. However, since this equipment-system level has the potential to deliver greater energy savings and increased flexibility, it is the area most relevant to 4E.

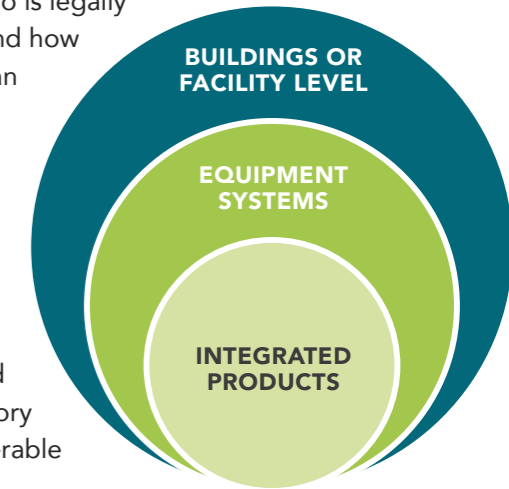
While these provide some insights towards a more system-based approach to regulation, we recognise that these are only the first steps and therefore during 2018 4E held two workshops to begin to explore a more holistic system-based approach.

Amongst the main issues that 4E will investigate over the next few years are:

- How can regulations for equipment-systems be enforced? Product policies have traditionally focused on items that are sold as a mass-produced packaged ready-to-operate products, whose performance is based on testing the product by the manufacturer or independent laboratory under representative conditions. In this situation, it is possible to regulate minimum energy performance standards and labelling because it is clear what the performance of the product is, who is legally responsible and how compliance can be checked.

- Testing, monitoring and enforcing policies for equipment-systems that are assembled outside a factory poses considerable challenges.

- Can system policies encourage better installation, more appropriate control systems and correct design, without creating an excessive burden for regulators and/or manufacturers.



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. The two face-to-face meetings in 2018 were held alongside each ExCo.



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.

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.

Through the 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 SEAD, 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.

To gain input from relevant industry sectors to 4E's work, we run regular workshops and meetings in most regions. Depending on the topic, we may also seek industry comments on our published materials or conduct formal consultation processes.



Energy efficiency alone could cause greenhouse gas emissions to peak before 2020, a key target of the Paris Agreement on climate change

Dr. Fatih Birol, Executive Director, IEA
Energy Efficiency 2018





Annex Achievements in 2018

“

Singapore's main strategy is to focus on energy efficiency, through design, urban planning and the use of advanced materials.

In an increasingly carbon-constrained future, improving energy efficiency will do more than just help companies reduce their costs of production. More importantly, this can open up new competitive advantages and business opportunities, both locally and internationally. Our companies will also stand to benefit from a smaller base of carbon emissions and hence lower carbon tax liability.

Speech by Minister Chan Chun Sing at the 11th
Singapore International Energy Week 2018

Electric Motor Systems Annex (EMSA)

Electric motor systems are responsible for 53% of the world's total electricity consumption.

These systems are operated in industrial plants, infra-structure applications and buildings; and drive pumps, fans, compressors and other equipment. The application of new efficient technologies offers the potential to reduce the energy demand of motor systems across the global economy by 20% to 30%. The know-how to realise these energy savings by market parties and government, through a set of suitable policies, exists but is not yet widely applied.

The 4E Electric Motor Systems Annex (EMSA) promotes the opportunities for energy efficiency in motor systems by disseminating best practice information worldwide. It supports the development of internationally aligned technical standards and the implementation of national policies to improve the energy performance of new and existing motor systems.

EMSA's work focuses on the following areas:

- **International Standards.** EMSA contributes to the development of internationally aligned and globally applicable technical standards for motor systems:
 - » EMSA stays up-to-date with the activities of, and contributes independent research results for, relevant International Electrotechnical Commission (IEC) standards committees, in which some EMSA members participate directly.
 - » EMSA runs an international round robin testing programme for converters in cooperation with IEC.
 - » EMSA researches advanced technology motors.
- **Digitalization and motor systems.** EMSA explores the potential for energy savings through ICT technologies in motor systems, identifies barriers and possible solutions.
- **Motor Systems Tool.** EMSA has developed this independent user-friendly software tool to assess the efficiency of a complete motor system.

Major Achievements During 2018

- EMSA members stimulated the global debate of policy makers, standards developers, research, academia and industry concerning the efficiency of electric motor systems and possible market transformation avenues at the Motor Summit 2018 International on 14 – 15 November in Zurich.
- EMSA in cooperation with IEC has launched an international Round Robin testing program for converters losses, to inform the revision of IEC 61800-9-2. The goal is to review the currently defined reference losses and efficiency classes of converters in the standard.
- EMSA organised in cooperation with IEC SC22G WG18 an international workshop in November 2018 to present the preliminary results of Phase 1 of the Round Robin for converters.
- EMSA contributed to 4E's major study analysing potentials for international alignment of technical standards and regulations for Motor Driven Units, focusing on pumps, fans and compressors in the EU, China and USA.
- EMSA representatives worked in IEC ACEE (Advisory Committee on Energy Efficiency), coordinating efficiency classification and testing standards for Motor Driven Units between IEC and ISO.
- EMSA representatives contributed comments to the European Commission's revision of motor regulation (EC) No 640/2009 (Lot 30).
- EMSA and IHS Markit cooperated with the IEA on input for models on electric motor markets and regulations on motors and motor driven units.

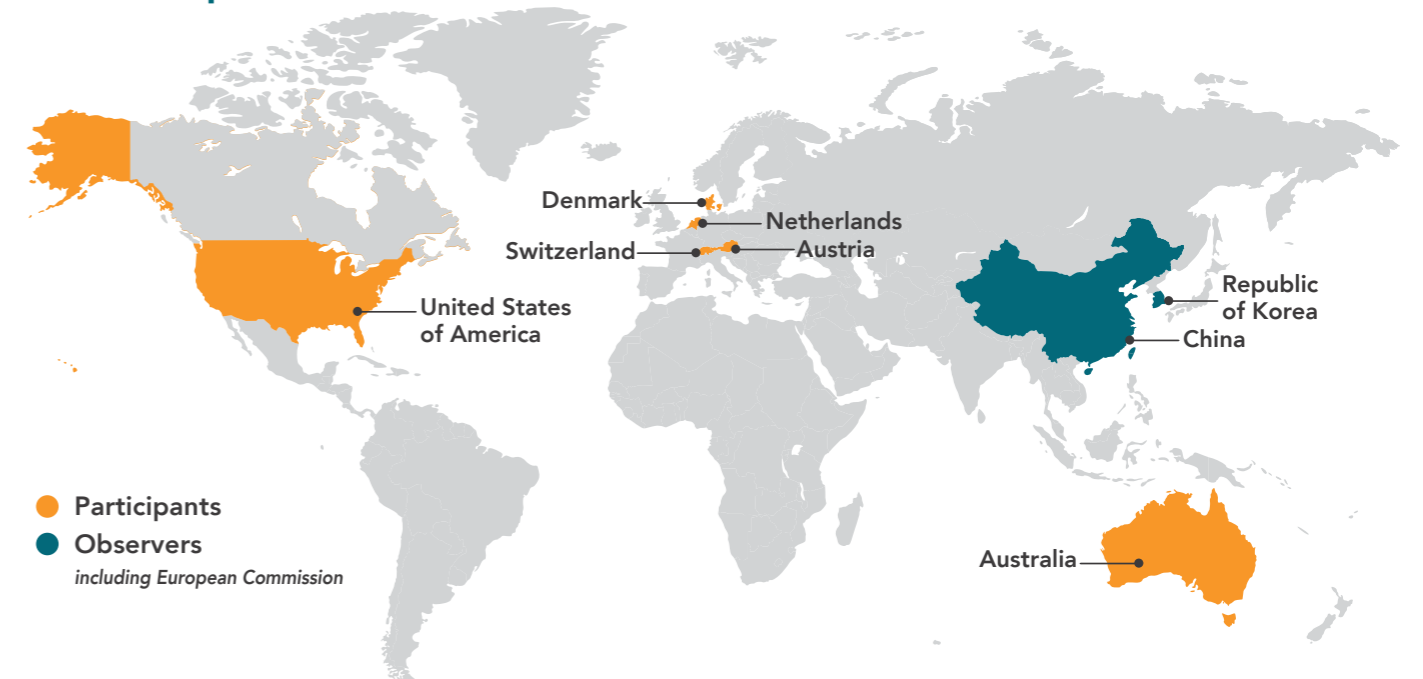


Participants in EMSA Workshop: Round Robin Converter losses, Zurich, November 2018

EMSA provides a platform for an in-depth technical and policy exchange between members and is a vehicle for collaborative projects.



Annex Participants



A complete record of EMSA Annex activities in 2018 and participants is included in Attachment 4.

Solid State Lighting (SSL) Annex

The IEA 4E SSL Annex serves as a hub for our member governments to share policy-related information and coordinate research into topics relating to solid state lighting.

The SSL Annex has a multidisciplinary approach covering technical and policy-related topics, which are not covered by other international organisations.

The SSL Annex evaluates standards and testing, assesses the applicability of existing standards for policy measures and supports laboratory accreditation to international standards for LED lamps and luminaires. We provide feedback to the standardisation organisations on our findings and offer recommendations that strengthen the standards. The SSL Annex publishes quality and performance tiers which support regulatory harmonisation.

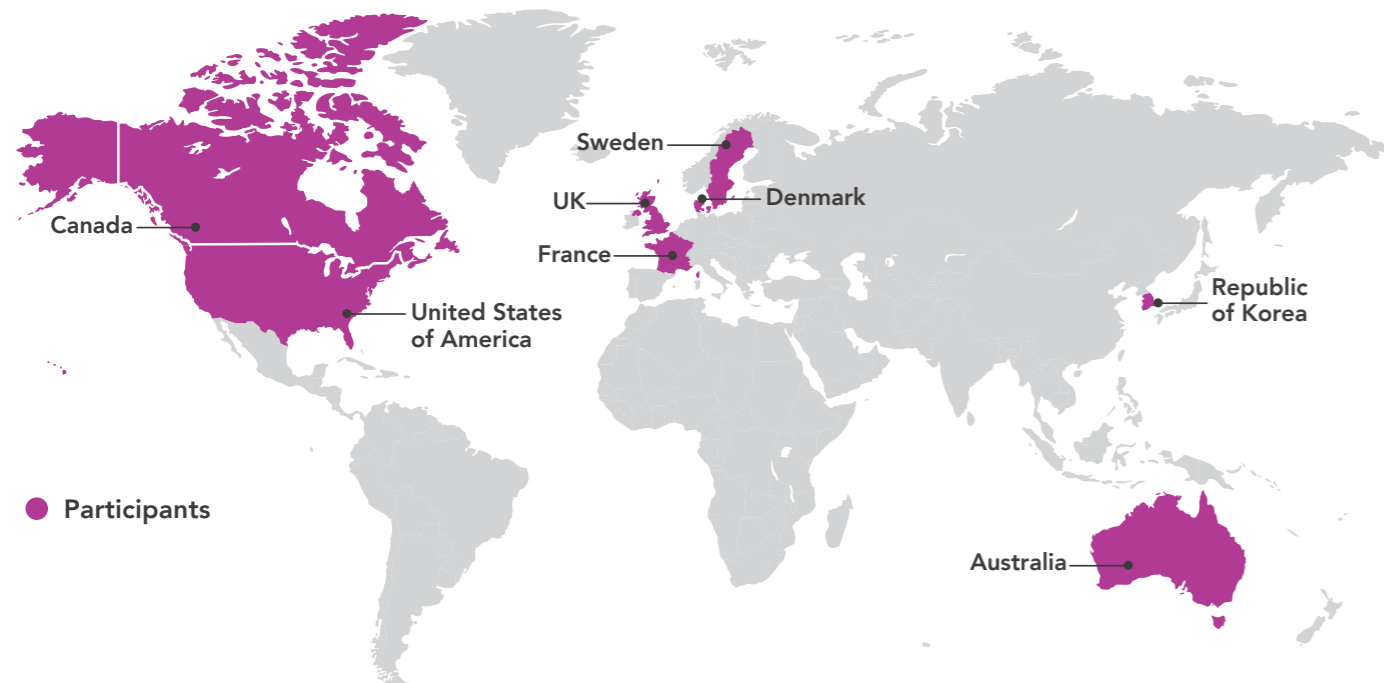
The Annex also studies the health and environmental aspects of SSL, conducting original research and reviewing published literature to identify best practice

and make recommendations for government policy use.

Recent examples of how the member countries have used the Annex research and expert resources include:

- Several member countries participated in a shared research initiative on flicker, of particular relevance to European regulatory processes.
- The interlaboratory comparison (IC 2017) for luminaires and directional lamps is promoted to accreditation bodies as a proficiency test for CIE S 025 in many countries around the world.
- Member countries used the internal LED product database to assess LED performance in relation to national regulatory proposals.

Annex Participants



A complete record of SSL Annex activities in 2018 and participants is included in Attachment 5.

Major Achievements During 2018

- Completing three rounds of testing for the Interlaboratory Comparison 2017 (IC 2017). This comparison is a three-year project that supports laboratories to improve the testing LED luminaires and directional lighting products. The work will assist laboratories to gain accredited to the international test standard for LED lamps, luminaires and modules (CIE S 025), which will reduce the cost of testing and make more accredited laboratories available to manufacturers for testing.



- Launched a study on temporal light modulation ("flicker") in light sources. An Interim Report was circulated to the members of the European Regulatory Committee in support of their vote on the new lighting regulation for Europe. This important research will contribute to global knowledge about the detection of stroboscopic flicker.
- Prepared and launched an *internal* product database of LED lamps and luminaires based on test and catalogue data. This database will help countries assess real performance developments and will, among other things, be used in developing the performance tiers at realistic performance levels.



SSL Experts Meeting in Ottawa, 30 Oct- 1 Nov 2018 at the National Research Council, Canada.

“The interlaboratory comparison (IC 2017) for luminaires and directional lamps is promoted to accreditation bodies as a proficiency test for CIE S 025 in many countries around the world.”

The Electronic Devices and Networks Annex (EDNA)

EDNA is focussed on a horizontal subset of energy using equipment and systems - those which connect to a communications network.



These so called “connected devices” are proliferating rapidly, and it is possible that almost all devices might be connected to the internet in future.

Device connectivity has both pros and cons in term of energy consumption. Devices and “systems of devices” being interconnected means that they can be controlled and operated intelligently in order to save energy. The down side is that they will also use more energy to remain connected 24/7, even when they are not providing their primary functions. We call this energy use “network standby” energy.

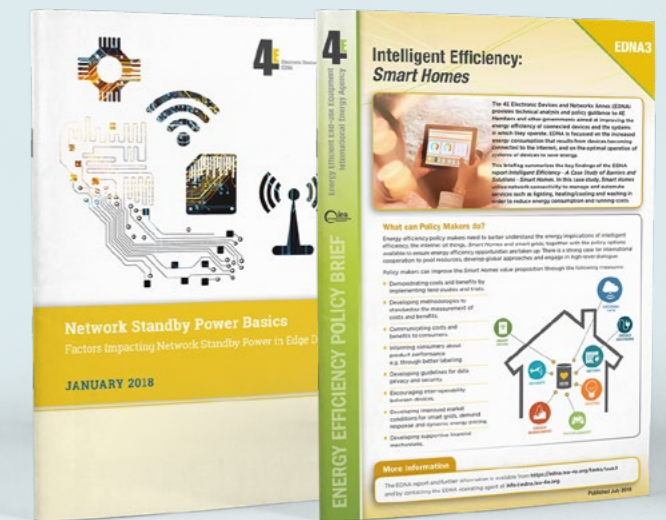
EDNA is the only international policy body focussed on the increased energy consumption that results from devices becoming network connected.

EDNA provides a platform for collaboration between governments to undertake technical analysis, with the ultimate aim of providing succinct policy guidance. EDNA also collaborates extensively with industry and other international agencies to take advantage of synergies and avoid any duplication.

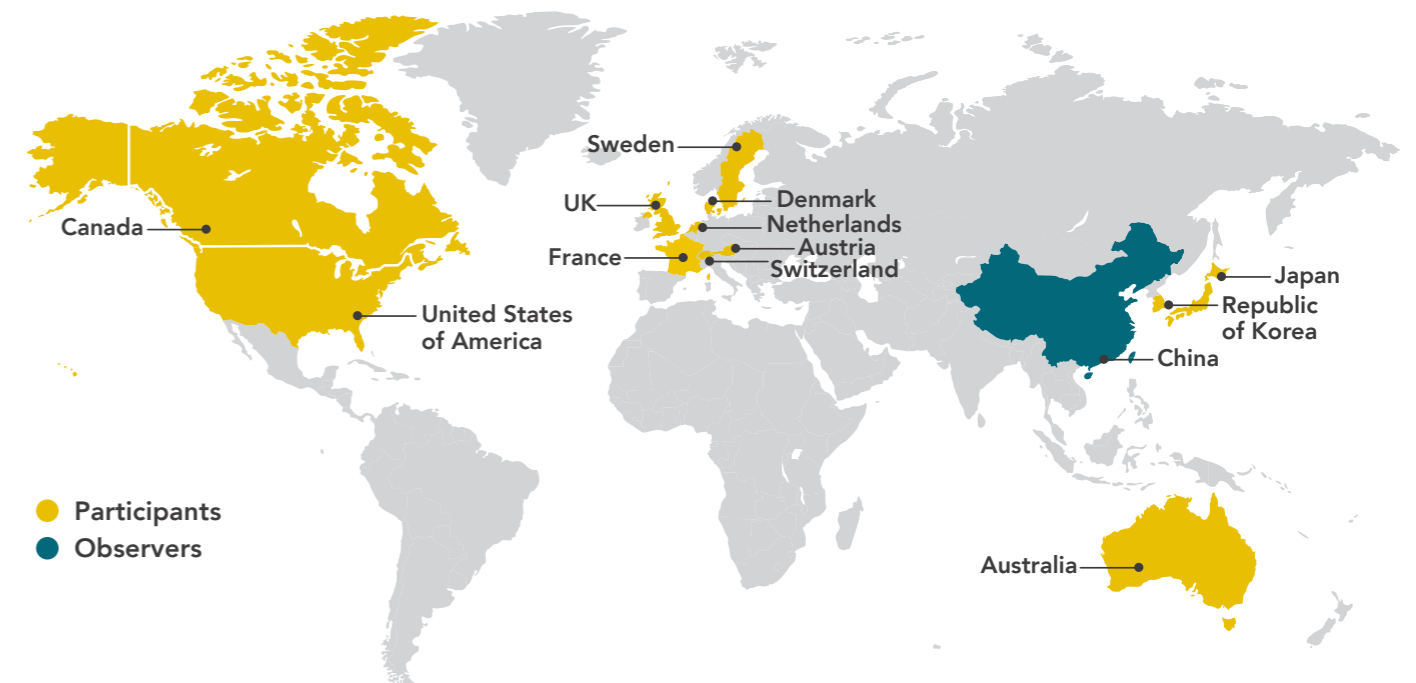
In 2018 EDNA worked on multiple, diverse tasks. Energy modelling of the entire connected device space was undertaken; test procedures for network standby were compared and analysed; the applicability of mobile device efficiency to stationary devices was examined; and the “upstream” energy implications of connected devices was modelled for the first time. EDNA also published a study of energy harvesting technologies and their application to connected devices, and began to consider if energy harvesting can be harnessed so that devices use no energy to remain network connected.

Major Achievements During 2018

- In November 2018 EDNA held a ground-breaking “Network Zero” workshop. At this workshop, policy makers and key industry representatives began to discuss how connected devices might be encouraged to use zero energy for network standby. The workshop was very well attended and stimulated a number of ideas for approaching “Network Zero” as a long term, aspirational goal for connected devices.
- In 2018 EDNA published a flagship report, Network Standby Power Basics. This report - the first of its kind - develops a framework for policy makers to understand the technical factors which influence network standby power.
- EDNA’s report on Smart Homes addressed two areas that are central to the concerns of policy makers: the barriers which prevent the uptake of smart home systems and potential policy measures to overcome these barriers.
- EDNA’s report on Energy Harvesting assesses various energy harvesting technologies and investigates their potential to power connected devices.
- The EDNA scoping study on the Energy Efficiency of Electric Vehicle Supply Equipment gathers available knowledge on the existing and emerging policy approaches for connected vehicle chargers and their potential energy impacts. This is a first step for developing future policy in this area.
- EDNA published three policy briefs in 2018, aimed at providing policy makers with insights into energy aware devices, smart homes and networked audio products.
- During 2018 EDNA also funded the Connected Devices Alliance (CDA) which is an international policy collaboration forum for government and industry, as well as the CDA Centre of Excellence, an online library for policy papers relating to connected device energy use.



Annex Participants



A complete record of EDNA activities in 2018 and participants is included in Attachment 6.



4E Outreach and Communication

“

We need to consider what the energy transition can deliver beyond lower carbon emissions, such as job creation, the health benefits of cleaner air, and energy security and resilience.

World Economic Forum Annual Meeting, 2019

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4E communication activities, 2008-18

Between 2008 and the end of 2018, 4E has published over 500 reports and newsletters; and run or participated in 330 workshops, webinars and policy exchanges.

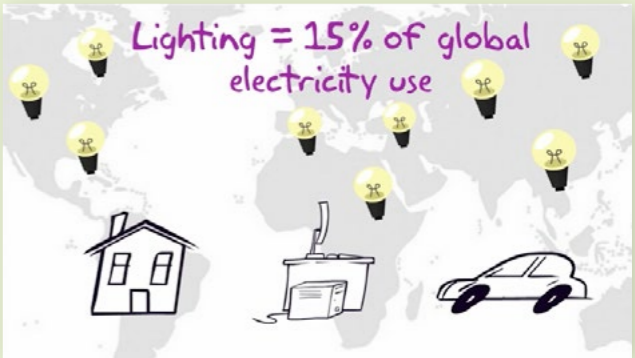
4E uses a wide range of channels to reach its target audience and operates a group of linked websites that are the hub of 4E's communication activities, providing access to all 4E publications and notice of forthcoming events.

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 and Brazil.



The 4E TCP has produced 4 short videos to explain the 4E TCP, the work of the SSL Annex, EDNA and the CDA.



4E Group Finances



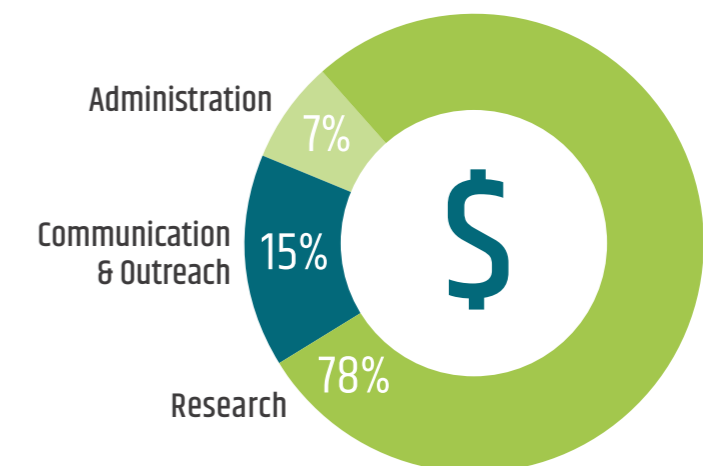
4E activities are made possible through the contributions of member countries: taking the form of annual fees and substantial in-kind work by national experts.

In 2018, the total cost of 4E activities is estimated to be €1.9 million, 12% lower than the previous year.

The annual fees and voluntary contributions of the 13 members countries funded approximately 36% of the total expenditure.

78% of resources were directed towards research, while communication and outreach activities accounted for 15% of costs. The share of resources devoted to administration and financial management has fallen compared to only 7%.

Allocation of 4E resources in 2018



4E membership fees, 2018

While Annex membership fees can vary from year to year depending upon the agreed work programme, all membership fees are the same in 2018 as they were in 2017 and 2016.

EXECUTIVE COMMITTEE	€20,000
ELECTRIC MOTOR SYSTEMS ANNEX (EMSA)	€15,000
SOLID STATE LIGHTING ANNEX (SSL)	€22,000
ELECTRONIC DEVICES AND NETWORKS ANNEX (DNA)	€15,000



Attachments



Energy efficiency has been prioritised by G20 members and has also become one of the pillars of the 2030 Agenda for Sustainable Development, due to its contribution to energy security, industrial competitiveness, emissions reduction, economic growth, job creation and others social benefits when introduced in a cost-effective manner.

International collaboration, including through the G20, is critical to effectively support the design and implementation of national energy efficiency policies and programmes.

G20 ENERGY MINISTERS COMMUNIQUÉ
15 June 2018, Bariloche, Argentina

Attachment 1: 4E Executive Committee Delegates

Contracting Party	Nomination	Name & Details	Email/Telephone
AUSTRALIA	Primary	Ms Michelle Croker (Chair) Appliance Energy Efficiency Branch Department of the Environment and Energy	Michelle.Croker@environment.gov.au Tel: +61 2 6275 9031
	Alternate	Mr Rick Miles Appliance Energy Efficiency Branch Department of the Environment and Energy	Richard.Miles@environment.gov.au Tel: +61 2 6275 9070
AUSTRIA	Primary	Dr Adriana Diaz Ecodesign Company GmbH Engineering and Management Consultancy	diaz@ecodesign-company.com Tel: +43 1 40 35 611-33
	Alternate	Mr Michael Hübner Federal Ministry for Transport, Innovation and Technology	michael.huebner@bmvit.gv.at Tel: +43 1 711 62 652922
CANADA	Primary	Mr Jamie Hulan (from 1 December 2018) Director, Equipment Division Office of Energy Efficiency, Natural Resources Canada	Jamie.Hulan@canada.ca Tel: +1 613 996 4359
	Alternate	Ms Katherine Delves (Vice-Chair) Chief, Standards Development Office of Energy Efficiency Natural Resources Canada	Katherine.Delves@canada.ca Tel: +1 613 947 1207
CHINA	Primary	Mr Lin Ling (from October 2018) Director of Resource and Environment China National Institute of Standardization	linling@cnis.gov.cn Tel: +86 10 58811737
	Alternate	Mr Liu Meng (from October 2018) Associate Researcher China National Institute of Standardization	liumeng@cnis.gov.cn Tel: +86 10 58811128
DENMARK	Primary	Mr Jesper Ditlefsen (from 24 May 2018) Advisor Danish Energy Agency	jdi@ens.dk Tel: +45 3395 5815
	Alternate	Mr Thore Stenfeldt (from 24 May 2018) Advisor Danish Energy Agency	tst@ens.dk Tel: +45 3392 7704
FRANCE	Primary	Mr Alain Anglade Senior Expert, Building Department ADEME	alain.anglade@ademe.fr Tel: +33 493 957 935
	Alternate	Ms Therese Kreitz Responsible for International Affairs ADEME	therese.kreitz@ademe.fr Tel: +33 493 957 984
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	Alternate	Ms Erika Minagawa (from 1 June 2018) Chief Officer, Energy Conservation Technology Department, NEDO	minagawaerk@nedo.go.jp Tel: +81 44 520 5284

Contracting Party	Nomination	Name & Details	Email/Telephone
REPUBLIC OF KOREA	Primary	Mr Hyeong-Jung Kim (from 12 March 2018) General Manager, Korea Energy Agency	jakekim@energy.or.kr Tel: +82 31 260 4240
	Alternate	Mr Kyung-Ho, Jo (from 12 March 2018) Assistant Manager, Korea Energy Agency	jokh@energy.or.kr Tel: +82 31 260 424
NETHERLANDS	Primary	Mr Hans-Paul Siderius (Vice-Chair) Senior Expert Netherlands Enterprise Agency	hans-paul.siderius@rvo.nl Tel: +31 88 602 2609
	Alternate	Mr Justin Rosing Ministry of Economic Affairs	j.a.rosing@minez.nl
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	Alternate	Mr Carlos Lopes Coordinator for Ecodesign and Energy Labelling The Swedish Energy Agency, Testlab	carlos.lopes@energimyndigheten.se Tel: +46 70 550 3430
SWITZERLAND	Primary	Dr Michael Moser Scientific Advisor, Energy Research Section Swiss Federal Office of Energy (SFOE)	michael.moser@bfe.admin.ch Tel: +41 58 465 36 23
	Alternates	Mr Roland Brüniger R. Brüniger AG Consultant, Swiss Federal Office of Energy (SFOE)	roland.brueiniger@r-brueiniger-ag.ch Tel: +41 44 760 0066
		Mr Markus Bleuer Appliances and Competitive Tenders Section Swiss Federal Office of Energy (SFOE)	markus.bleuer@bfe.admin.ch Tel: +41 58 462 69 24
UNITED KINGDOM	Primary	Mr Sam Balch (from 16 May 2018) Deputy Director, Home and Local Energy Department for Business, Energy and Industrial Strategy	sam.balch@beis.gov.uk Tel: +44 300 068 6661
	Alternate	Ms Samuela Bassi (from 16 May 2018) Policy Manager – Energy Using Products Department for Business, Energy and Industrial Strategy	samuella.bassi@beis.gov.uk Tel: TBC
USA	Primary	Mr Jeremy Domm Electronic Products Manager Building Technologies Office, US Department of Energy	jeremy.domm@ee.doe.gov Tel: +1 202 586 9870
	Alternate	Mr John Cymbalsky Building Technologies Office US Department of Energy	john.cymbalsky@ee.doe.gov Tel: +1 202 287 1692

Attachment 2: All 4E publications, 2018

Date	Source	Title
FEBRUARY	EDNA	EVSE Scoping Study
		Network Standby Power Basics
		Policy Brief: Energy Aware Devices
MARCH	EDNA	Intelligent Efficiency: A case study of barriers and solutions - Smart Homes
	EMSA	Newsletter
APRIL	EDNA	Network Standby Power Basics (revised)
MAY	4E	Policy Guidelines for Motor Driven Units - Part 2
		Annual Report 2017
	EMSA	Energy Audit Guide for Motor Driven Systems
JUNE	EMSA	Newsletter
JULY	EDNA	Energy Harvesting Technologies for IoT Edge Devices
SEPTEMBER	EMSA	Policy Brief: EMSA Overview
		Briefing for COMUEE Staff
	EDNA	Policy Brief: Networked Audio Products
		Policy Brief: Intelligent Efficiency - Smart Homes
OCTOBER	EDNA	CDA Centre of Excellence – 25 additional papers hosted in 2018
NOVEMBER	SSL	Product Database of tested and catalogue LED lamps and luminaires
	EMSA	Round Robin Converter losses Phase1
DECEMBER	EMSA	Newsletter
	SSL	IC 2017 Nucleus Laboratory Comparison Report
		Interim Report: Visual Perception under Energy-Efficient Light Sources - Detection of the Stroboscopic Effect Under Low Levels of SVM

Attachment 3: 4E workshops and presentations, 2018

Date	Source	Title	Location
JANUARY	EDNA	EDNA Management Meeting	Conference call
FEBRUARY	SSL	SSL Annex Management Committee	Conference call
MARCH	EMSA	ECI Motors Workshop	Roma
	SSL	16th Experts Meeting	Toulouse, France
	EDNA	EDNA Management Meeting	Conference call
9th EDNA Meeting		Schaffhausen, Switzerland	
MAY	SSL	SSL Annex Management Committee	Conference call
	EMSA	19th EMSA Meeting	Schaffhausen, Switzerland
JUNE	4E	Swiss IoT Workshop	Schaffhausen, Switzerland
JULY	EDNA	EDNA Management Meeting	Conference call
AUGUST	EDNA	EDNA Management Meeting	Conference call
OCTOBER	SSL	SSL Annex Management Committee	Conference call
		17th Experts Meeting	Ottawa, Canada
OCTOBER	EDNA	CDA Centre of Excellence – 25 additional papers hosted in 2018	Conference call
NOVEMBER	EDNA	Network Zero Workshop	Stockholm, Sweden
		Demand Flexible Appliances and Equipment	Stockholm, Sweden
		10th EDNA Meeting	Stockholm, Sweden
	EMSA	20th EMSA Meeting	Zurich, Switzerland
	EMSA	Motor Summit: Presentation of 4 papers	Zurich, Switzerland
		Round Robin Converter losses Workshop	Zurich, Switzerland
	SSL	SSL Annex Management Committee	Conference call

Attachment 4: Electric Motor Systems (EMSA) 2018 Record of Activities & Delegates

RECORD OF ACTIVITIES

Contracting Party	Date	Intended Audience (e.g. public, restricted to members, etc.)	Location
PUBLICATIONS IN 2018			
Policy Guidelines Motor Driven Units Part 2	May	Policy makers, industry, public	
EMSA Newsletter 1/2018*	March	Subscribers & public	
EMSA: Energy Audit Guide for Motor Driven Systems (2018)	April	Policy makers, industry, public	
EMSA Newsletter 2/2018*	June/July	Subscribers & public	
Electric Motor Systems Annex Overview 2019-2024	September	Subscribers & public	
EMSA Newsletter 3/2018*	December	Policy makers, industry, public	
WORKSHOPS & CONFERENCES IN 2018			
ECI Motors Workshop -EMSA participation	March	Public, participants WS	Roma
Motor Summit 2018 International	November	Public	Zurich, Switzerland
EMSA Workshop Round Robin Converter losses Phase1	November	Participants	Zurich, Switzerland
MANAGEMENT/EXPERTS MEETINGS HELD IN 2018			
19th EMSA meeting	May	EMSA Members	Schaffhausen, Switzerland
Meeting with CONUEE	September		Mexico City, Mexico
20th EMSA meeting	November	EMSA Members	Zurich, Switzerland
WORKSHOPS & CONFERENCES PLANNED FOR 2019			
EEMODS 2019	September	Participants, public	Tokyo, Japan
IEC ACEE Workshop Aligned Standards for Electric Motor Driven Systems (EMDS)	September	Participants	Tokyo, Japan
EMSA Workshop Round Robin Converter losses Phase2	September	Participants	Tokyo, Japan
MANAGEMENT/EXPERTS MEETINGS PLANNED FOR 2019			
21st EMSA meeting	May	EMSA Members	Utrecht, Netherlands
22nd EMSA meeting	November	EMSA Members	Brussels, Belgium

COUNTRY DELEGATES

Country	Name	Organisation	Email	Phone
AUSTRALIA	Michelle Croker	Department of the Environment and Energy	Michelle.Croker@environment.gov.au	+61 2 6275 9031
	Rick Miles		rick.miles@environment.gov.au	+61 2 6275 9070
AUSTRIA	Michael Hübner	Ministry for Transport, Innovation and Technology	michael.huebner@bmvit.gv.at	+43 1 711 62 65292
	Konstantin Kulterer	Austrian Energy Agency	konstantin.kulterer@energyagency.at	+43 1 586 15 24 114
DENMARK	Bjarke Hansen	Danish Energy Agency	bjh@ens.dk	+45 3392 7588
	Sandie B. Nielsen	Danish Technological Institute	sbn@teknologisk.dk	+45 72 20 10 00
NETHERLANDS	Hans-Paul Siderius Frank Hartkamp	Netherlands Enterprise Agency	hans-paul.siderius@rvo.nl frank.hartkamp@rvo.nl	+31 88 602 2609
SWITZERLAND	Michael Moser Roland Brüniger	Swiss Federal Office of Energy	michael.moser@bfe.admin.ch roland.brueeniger@brueniger.swiss	+41 44 760 0066
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	Sanaee Iyama	LBNL	ssiyama@lbl.gov	+1 510-486 6604
	John Cymbalsky	Department of Energy	chad.gallinat@hq.doe.gov	+1 202 287 1692
Lead Country		Switzerland		
ANNEX CHAIR		Roland Brüniger Swiss Federal Office of Energy c/o R. Brüniger AG, Engineering & Consulting Zwillikerstr. 8, CH-8913 Ottenbach Switzerland Email: roland.brueeniger@r-brueniger-ag.ch Tel: +41 44 760 00 66		
ANNEX CHAIR		Frank Hartkamp Netherlands Enterprise Agency Croeselaan 15, 3521 BJ Utrecht, The Netherlands Email: frank.hartkamp@rvo.nl Tel: +31 (0)88 042 42 42		
OPERATING AGENT		Maarten van Werkhoven TPA advisors Generaal Winkelmanlaan 31 2111 WV Aerdenhout Netherlands Email: mvanwerkhoven@tpabv.nl Tel: +31 23 536 80 90		
EMSA COORDINATOR		Rita Werle Impact Energy Inc. Gessnerallee 38a, CH-8001 Zurich Switzerland Email: rita.werle@impact-energy.ch Tel: +41 44 226 20 10		

Attachment 5: Solid State Lighting (SSL) 2018 Record of Activities & Delegates

RECORD OF ACTIVITIES

Contracting Party	Date	Intended Audience (e.g. public, restricted to members, etc.)	Location
PUBLICATIONS IN 2018			
16th Experts Meeting Webpage and Presentations	April	SSL Members	
16th Experts Meeting Report (Toulouse)	April	SSL Members	
Draft Third Term Topics for ExCo	May	ExCo/Members only	
Product Database of tested and catalogue LED lamps and luminaires	November	SSL Members	
17th Experts Meeting Webpage and Presentations	November	SSL Members	
17th Experts Meeting Report (Ottawa)	November	SSL Members	
IC 2017 Nucleus Laboratory Comparison Report	December	SSL Members	
Interim Report: Visual Perception under Energy-Efficient Light Sources - Detection of the Stroboscopic Effect Under Low Levels of SVM	December	Primarily European Commission Regulatory Committee and Consultation Forum	
Draft Third Term Workplan for MC/Experts	December	SSL Members	
MANAGEMENT/EXPERTS MEETINGS HELD IN 2018			
Management Committee Meeting	February	SSL Members	Conference call
16th Experts Meeting (3 days)	March	SSL Members & Experts	Toulouse, France
Management Committee Meeting	May	SSL Members	Conference call
Management Committee Meeting	October	SSL Members	Conference call
17th Experts Meeting (3 days)	Oct/Nov	SSL Members & Experts	Ottawa, Canada
Management Committee Meeting	November	SSL Members	Conference call
WORKSHOPS & CONFERENCES PLANNED FOR 2019			
SSL Technology Workshop	April	Lighting industry/ Stakeholders	Seoul, Republic of Korea
Flicker Workshop	June	International Standardisation Organisation (CIE)	Washington DC, USA
MANAGEMENT/EXPERTS MEETINGS PLANNED FOR 2019			
Management Committee Meeting	Feb/Mar	SSL Members	Conference call
18th Experts Meeting	April	SSL Members & Experts	Seoul, Republic of Korea
Management Committee Meeting	May/June	SSL Members	Conference call
Management Committee Meeting	Aug/Sept	SSL Members	Conference call
Management Committee Meeting	Oct/Nov	SSL Members	Conference call
19th Experts Meeting	Oct/Nov	SSL Members & Experts	To be determined
Management Committee Meeting	December	SSL Members	Conference call

COUNTRY DELEGATES

Country	Name	Organisation	Email	Phone
AUSTRALIA	David Boughey (Deputy Chair)	Department of the Environment and Energy	David.Boughey@environment.gov.au	+61 2 6243 7661
CANADA	Katherine Delves (Chair)	Natural Resources Canada	katherine.delves@canada.ca	+1 613 947 1207
DENMARK	Signe Friis Christensen	Danish Energy Agency	sfc@ens.dk	
FRANCE	Bruno Lafitte	Environment and Energy Management Agency (ADEME)	bruno.lafitte@ademe.fr	+33 4 93 95 72 56
REPUBLIC OF KOREA	Mr. Min-Koo Park	Republic of Korea Energy Agency	mkpark@energy.or.kr	
SWEDEN	Peter Bennich	Swedish Energy Agency	peter.bennich@energimyndigheten.se	+46 16 544 22 78
UNITED KINGDOM	Suleiman Faruqi	Department for Business, Energy & Industrial Strategy	suleiman.faruqi@beis.gov.uk	
USA	John Cymbalsky	US Department of Energy (US DOE)	John.Cymbalsky@EE.Doe.Gov	
Lead Country		Canada		
ANNEX CHAIR		Katherine Delves Natural Resources Canada, Canada Email: katherine.delves@canada.ca Tel: +1 613 947 1207		
ANNEX CHAIR		David Boughey Department of the Environment and Energy, Australia Email: David.Boughey@environment.gov.au Tel: +61 2 6243 7661		
OPERATING AGENT		Mr Nils Borg Borg & Co. AB Sveavägen 98, 4 tr, 113 50 Stockholm, Sweden. Email: SSL.Annex@gmail.com Tel: +46 70 585 31 74		
OPERATING AGENT SUPPORT		Michael Scholand		

Attachment 6: Electronic Devices and Networks Annex (EDNA) 2018 Record of Activities & Delegates

RECORD OF ACTIVITIES

Contracting Party	Date	Intended Audience (e.g. public, restricted to members, etc.)	Location
PUBLICATIONS IN 2018			
Policy Brief - Energy Aware Devices	February	Public	
Scoping Study on Electric Vehicle Supply Equipment	February	Public	
Intelligent Efficiency - A Case Study of Barriers and Solutions - Smart Homes	March	Public	
Network Standby Power Basics	April	Public	
Energy Harvesting Technologies for IoT Edge Devices	July	Public	
Policy Brief - Networked Audio Products	September	Public	
Policy Brief - Intelligent Efficiency: Smart Homes	September	Public	
CDA Centre of Excellence – 25 additional papers hosted in 2018	October	Public	
WORKSHOPS & CONFERENCES IN 2018			
Network Zero	November	Government and industry	Stockholm, Sweden
MANAGEMENT/EXPERTS MEETINGS HELD IN 2018			
9th Annex Management Meeting	May	EDNA Members	Schaffhausen, Switzerland
10th Annex Management Meeting	November	EDNA Members	Stockholm, Sweden
MANAGEMENT/EXPERTS MEETINGS PLANNED FOR 2019			
11th Annex Management Meeting	March	EDNA Members	Beijing, China
12th Annex Management Meeting	November	EDNA Members	Brussels, Belgium

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
AUSTRIA	Dr Adriana Diaz Triana	EcoDesign Company	diaz@ecodesign-company.com	+43 1 40 35 611 33
CANADA	Ms Katherine Delves	Natural Resources Canada	katherine.delves@canada.ca	+1 613 947 1207
DENMARK	Mr Thore Stenfeldt	Danish Energy Agency	tst@ens.dk	+45 3392 7704
FRANCE	Mr Alain Anglade	ADEME	alain.anglade@ademe.fr	+33 493 957 935
JAPAN	Mr Takeo Natsume	NEDO	natsumetko@nedo.go.jp	+81 44 520 5284
REPUBLIC OF KOREA	Mr. Kyungho Jo	Korea Energy Agency	jokh@energy.or.kr	+82 31 260 4249
NETHERLANDS	Dr Hans-Paul Siderius	Netherlands Enterprise Agency	hans-paul.siderius@rvo.nl	+31 88 602 2609
SWEDEN	Dr Peter Bennich	Swedish Energy Agency	peter.bennich@energimyndigheten.se	+46 16 544 22 78
SWITZERLAND	Mr Roland Brüniger	Swiss Federal Office of Energy	roland.brueiniger@r-brueiniger-ag.ch	+41 44 760 00 66
UNITED KINGDOM	Mr Suleiman Faruqi	Dept for Business, Energy and Industrial Strategy	Suleiman.Faruqi@beis.gov.uk	+44 2072 153 127
USA	Mr Jeremy Dommu	Dept of Energy	Jeremy.Dommu@EE.Doe.Gov	+1 202 586 9870
Lead Country		Netherlands		
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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 member 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.



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.

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 at: www.iea.org/tcp

A video explaining the role of TCPs is available from the above site.

