“The cheapest energy is the one we do not consume”
EUROPEAN COMMISSION Brussels, 22 June 2011
Is there a national leader that hasn’t made a statement in 2011 about Clean Energy Technology? It certainly appears that many countries are banking on green technology to pull them out of the economic doldrums. For those of us wanting greater recognition for energy efficiency’s role in delivering economic and energy security solutions as well as environmental benefits, this is a welcome development. But smarter technologies alone will not be enough. Experience shows that without effective policies to help them gain a toehold in competitive markets, technologies with great potential often fall by the wayside.

4E has been busy examining which energy efficiency policies really work, and this edition of Bright Spark features several publications that are vital reading for governments aiming to kick start their own clean energy revolution. By comparing approaches and achievements of policies for lighting, motor systems and electronics spanning most major economies, the information produced by 4E forms a sound basis for better national and international policies in the future.

Of course, 4E’s job doesn’t end with the publication of these reports – we need to make sure that the messages reach key members of governments and industry. As a result, over the next year 4E will release a series of “policy briefs” that synthesise the major findings of our research and highlight the conclusions for national and international policy makers.

I am delighted that the first two documents in this series relate to one of 4E’s central activities – the international benchmarking of products. These have now been released for download from our website, and will shortly be joined further policy briefs covering the full range of topics dealt with by 4E.

Policies guided by these documents will, we believe, stimulate the development of Clean Energy Technology and lead to the type of economic recovery foreshadowed by many governments.

Sincerely,

Hans-Paul Siderius – Chairman 4E
As we recover from this recession, the transition to clean energy has the potential to grow our economy and create millions of jobs - but only if we accelerate that transition. Only if we seize the moment.”

- PRESIDENT BARACK OBAMA

We’ve known about the dangers of our oil dependence for decades. Presidents and politicians of every stripe have promised energy independence, but that promise has so far gone unmet. That has to change. And while there are no quick fixes, we have one critical, renewable resource that the rest of the world cannot match: American ingenuity.

To make ourselves more secure and to control our energy future, we will need to harness that ingenuity. This will be no small endeavor, but if we build on the historic progress the Administration has made over the last two years, we won’t just spark new jobs, industries and innovations. We will leave this generation and future generations with a country that is stronger, healthier, and more prosperous.

BLUEPRINT FOR A SECURE ENERGY FUTURE
White House - March 30, 2011
SHEDDING LIGHT ON PHASE-OUT POLICY
PROGRESS WITH THE 4E MAPPING AND BENCHMARKING ANNEX

“The lighting market in many parts of the world is going through a significant period of transition as a result of both regulations to phase-out inefficient lighting and the entrance of new products into the market,” says Maggie Charnley, Deputy Chair of the Mapping and Benchmarking Management Annex. “This provides a unique opportunity to use the Mapping and Benchmarking process to give policy makers an insight into the effects of policy during the implementation phase and to get an early idea if policy revision is required.”

Instead of the more usual approach of examining the comparative efficiencies of the individual products, the Mapping and Benchmarking exercise for lighting compared the different policy approaches and their outcomes on the market as a whole.

The results of the exercise, which covered the phase-out policies of Annex members Australia, Austria, Canada, Denmark, France, the Republic of Korea, the UK and the USA, along with those of the EU and Taiwan, provide interesting food for thought for policy makers.

POLICY APPROACHES

Broadly speaking, the regulatory actions in the countries studied are very similar in that they:

▶ Don’t explicitly ban a particular technology – although the performance limits set may have the result of eliminating certain technologies.

▶ Have exclusions that allow less efficient lamps to be sold – normally based on applications where no alternative efficient light source is currently available.

▶ Are implemented incrementally over time – normally based on lamp wattage or light output.

▶ Include a range of performance characteristics in addition to efficacy.

▶ With the exception of Taiwan and Canada, prohibit the sale or import of lamps, not the manufacture or use.

A summary of the stringency and timings of the policies investigated is shown in the figure on the following page.

However when looked at in more detail, some stark differences in the approaches become apparent, in terms of:
The **overall regulatory approach** to performance levels.

The **stringency** at which the required performance levels are set and the associated **phasing or speed** with which the required actions come into force.

The **range of light outputs and products** included in the regulations.

The **products exempted** or requiring lower performance levels.

These variations may lead to significant differences in the outcomes of policy, with some countries/regions achieving significantly higher efficiency levels of installed lamps compared to those installed elsewhere. Furthermore, the exercise suggests that regulations based on a continuous and smooth efficacy curve rather than a discrete stepped function are likely to result in higher energy savings and reduce a number of the risks to effective policy implementation.

It also appears that there is significant opportunity for harmonisation across countries and regions (see inset box).

---

**HARMONISATION OF REGULATIONS**

The benchmarking report suggests that the alignment of regulatory requirements (and the various scopes and exclusions) between jurisdictions should be technically relatively simple if the political environment allows and would:

- Help achieve substantial additional energy savings.
- Enable better understanding of, and compliance with, requirements by suppliers.
- Improve the potential for local and cross border enforcement actions.

- Facilitate increased global trade and potentially, reductions in cost to the consumer.

To give a powerful example, if an additional 1 Watt saving was achieved per lamp by harmonising regulations, then when the 6,682 million incandescents installed in the EU’s 27 countries and the USA are replaced, this would result in additional savings of over 2.4 TWh/year or approximately 1.95 million tonnes/year of avoided CO₂ emissions.
Encouragingly, this exercise found clear evidence to suggest that policies to remove less efficient lamps from the market are proving successful in Australia, Korea and the UK (the three countries with the most advanced phase-out programmes). In these countries the average efficacy of lamps sold has risen by up to 50% in three years, despite the fact that most recent policies are not yet 100% implemented in any of these countries. The following figure shows the actual improvements achieved.

Beyond this broad statement of overall impact, the benchmarking report contains a number of observations that policy makers may wish to consider when monitoring the impact of policies as they come into effect, or when developing or revising existing policies, as follows:

- It appears that regular and well signposted regulatory revision of the lighting market is highly successful.
- Significant delays between the date of announcement and the date at which regulations come into force may result in a short to medium term market effect completely at odds with the intention of the policy action (due to consumer backlash in the form of increased incandescent lamp purchasing prior to regulations taking effect). For example in Austria, incandescent sales doubled in the year before regulations came into force.
- In countries where recent regulation is most advanced (Australia and the UK), there is clear evidence that a higher proportion of the market than expected is migrating from traditional incandescent lamps to halogen lamps rather than CFLs. For example, sales of mains voltage lamps jumped from 5% to 21% in Australia in 2009 and from 9% to 14% in the UK in 2010.
Contrary to popular belief, at the time or preparation of the benchmarking there was little actual penetration of LEDs into the domestic lamp sector.

As a result of the phase-out of inefficient lighting, the total number of lighting products sold will fall dramatically (due to the replacement of (generally) short lifetime inefficient lamps with more efficient, longer life alternatives).

Beyond regulatory policy, there is strong evidence that voluntary labelling programmes and promotion/subsidy support has had an impact on the Canadian, Danish and USA sales of CFLs.

**VIGILANCE**
The benchmarking report recognises that opportunities exist for consumers and suppliers to ‘side-step’ the spirit of the regulations. To combat this, it suggests that policy makers may wish to ensure that sufficient market monitoring is in place to quickly identify if:

- Consumers are switching to smaller or larger lamps that may be outside the scope of the regulations.
- Suppliers are bringing ‘new’ products to market that are simply modifications of existing products that in some way exempt them from the regulation and enable their sale, thereby confounding the intent of the policy.

For more information, the full benchmarking report, *Impact of Phase-Out Regulations on Lighting Market*, is publically available on the Mapping and Benchmarking website.
BEST PRACTICE MOTOR SYSTEMS POLICIES

How do policy makers know what has been done in other countries to improve energy efficiency and more importantly, assess what has been successful? For electric motor systems the answer is simple – by reading the new Electric Motor Systems Annex “Motor Policy Guide”.

“The handbook is designed as a reference guide to successful programmes and policies for implementing motor systems efficiency all over the world,” says the author, Konstantin Kulterer from the Austrian Energy Agency. “We want policy makers to be able to share information on what is needed to make a programme successful, including the pitfalls to be avoided, and to understand what mix of policies and programmes are needed to achieve particular goals.”

To this end, the Motor Policy Guide collected information on relevant programmes in Australia, Austria, China, the Netherlands, Sweden, Switzerland, the United Kingdom and the United States, along with details of the EU Motor Challenge Programme. The guide enables readers to compare the main elements of the different programmes, such as type of policy, enforcement methodology, how savings are calculated and evaluated, financial considerations and programme outcomes.

The guide also describes the main policy instruments used by the participating countries to tackle motor systems efficiency (see inset box) and identifies the elements that make a successful programme.

Drawing conclusions from the guide, a good electric motor systems policy scheme includes a combination of three major instruments:

1. Mandatory requirements with minimum energy performance standards (MEPS) for motors and systems (pumps, fans, compressors).
2. Information, training and capacity building (e.g. software tools such as Motor Master+1 and the EMSA Motor System Tool) to help industrial users optimize motor systems.
3. Financial incentives to help overcome the barriers impeding market diffusion of efficient motor systems.

Copies of the Motor Policy Guide can be downloaded from the EMSA website at www.motorsystems.org

---

1 www1.eere.energy.gov/industry/bestpractices/software_motormaster.html
“Without consistent and reliable testing methodologies, it is impossible to accurately and fairly compare the performance of different motors,” says Roland Brüniger, Chair of the Electric Motor Systems Annex Management Committee. “The recent IEC international round robin testing exercise is an encouraging step towards improving the robustness of international standards for motors and will give policy makers, manufacturers and consumers greater confidence when sharing information on motor efficiencies.”

The aim of this exercise was to gain experience with new procedures added to the International Electrotechnical Commission (IEC) test standard, IEC 60034-2-1, ‘Rotating electrical machines - Part 2-1: Standard methods for determining losses and efficiency from tests’ in 2007, and to provide an objective assessment of any uncertainties in the procedure.

It took place between 2008 and 2010 and involved 17 laboratories from 11 countries, carrying out a total of 194 individual test sets on 75 different motors. EMSA representatives Andrew Baghurst (Australia) and Conrad U. Brunner (Switzerland) both participate in the IEC working group (TC2 WG 28) responsible for the development of IEC 60034-2-1 and the oversight of this testing exercise.

The testing was carried out in three stages:

- **Part 1**: A series of tests in the same laboratory on a single motor.
- **Part 2**: A series of tests in the same laboratory on motors of the same design from different manufacturing cycles, using the same test method.
- **Part 3**: A series of tests by different laboratories on the same motor.

This made it possible to identify and quantify any inconsistencies resulting from material tolerances, manufacturing procedures and the different ways of interpreting the procedures defined in the standard.

### Results for Part 2 - A series of tests in the same laboratory on motors of the same design, from different manufacturing cycles, using the same test method

![Diagram showing output power and tolerance percentage](chart.png)
The preliminary conclusion drawn on completion of the testing is that the standard should have only one preferred testing method for every size and type of motor. For all 3-phase motors up to 1000 kW this will be the direct torque measurement with Summation of Losses determined from Residual Losses (see table below). It is anticipated that ‘preferred’ methods will be used for type tests and for determining compliance with national energy efficiency regulations. Revision of IEC 60034-2-1 is already well under way based on this report and other findings.

According to a new report of the International Energy Agency (IEA) motor systems are responsible for 45% of global electricity consumption.

The IEA report\(^1\), which is the first global assessment of motor energy consumption, states that it is both feasible and cost-saving to save 20 – 30% of the total electricity consumption of motors which corresponds to 9 – 14% of global electricity consumption. The IEA report will considerably contribute to raising awareness, at least regarding motors.

It fills an important gap in the energy- and climate change discussion, bringing pure facts under the sun on a topic for which independent assessments and analyses were not available up to now. However, it also clearly points out that the decision makers are the ones who must recognise the savings potentials and take action.

Joe Hogan
Chief Executive Officer, ABB
30 June 2011

Besides comparing hardware measurements in different laboratories the Australian EMSA team also initiated a Round Robin to compare the software used to evaluate test results amongst 10 international laboratories. The software Round Robin showed a deviation from the average of +/- 0.15%, which could be avoided if the mathematical explanations in the standard were clearer and better understood.

Australia has also prepared a Guide to help laboratory staff to follow a prescribed sequence of tests under the current standard IEC 60034-2-1.

More information on this work is available here.

BLOWING AWAY INEFFICIENCY

Savings of 34 TWh in 2020 are estimated to result from regulations to be introduced in the European Union for fans driven by electric motors between 125 W and 500 kW. According to European Union figures, the total annual electricity used by these fans is now 410 TWh and, if current market trends continue, this is likely to rise to 660 TWh in 2020 unless policy measures are implemented.

“Involvement in the development process for these regulations has been a priority for EMSA,” says Conrad U. Brunner, Operating Agent of the Electric Motor Systems Annex (EMSA). “They are important because it is the first time that fans have been regulated in this way and it could provide a template for regulation in other countries. It is the beginning of a process for extending minimum requirements from simple motors to broader motors systems in order to maximise the energy savings.”

---

1 See Snippets on page 15
The EMSA role has been one of consultation and co-ordination – the Annex has solicited and collated input from technical experts in the Annex member countries and fed these views into the EU consultation process. Conrad U. Brunner has been personally active in the expert group advising the European Commission on the draft in collaboration with ECOS, a group of key NGOs.

Although the motors that drive fans are already subject to minimum energy efficiency requirements under the motor provision in existing EU regulations for electric motors², until this new regulation was approved in April 2011, fans used in combination with motors were not covered. Set to take effect in January 2013, the new regulation covers fans driven by motors with an electric input power between 125 W and 500 kW, including those that form part of another product, with a few exclusions based on operating environment and functionality.

The regulation establishes two performance tiers, with the initial minimum energy efficiency requirements (shown in the figure) replaced by more stringent requirements on 1 January 2015.

EU Regulations for Fans* from 1 January 2013

To ensure consistency for comparison purposes, the regulation includes details of how manufacturers can calculate the energy efficiency of their fans. For those who prefer to directly measure the energy efficiency, it also signposts the harmonised standards adopted by the European standardisation bodies.

Importantly, it also sets out the verification procedure for market surveillance purposes and, to further aid comparisons and compliance checks, specifies details of the product information that must be displayed on all technical documentation for the fans.

The new regulation can be viewed [here](#).

---

A HELPING HAND FOR LOW POWER NETWORKS

“Over the past five years the growth of networks has been remarkable and this is set to continue rapidly into the future,” says Shane Holt, Chair of the Standby Annex Management Committee. “Indeed, it’s conceivable that within ten years nearly all products will be connected to some form of network and the possible implications for increased energy consumption cannot be overstated. It is therefore essential that we have a clear picture of the nature of the problem and a strategy to address it.”

Providing this focus and direction is a core feature of the Standby Power Annex and to this end a scoping study was commissioned in conjunction with the APP (Asia Pacific Partnership) Alignment of National Standby Power Approaches project. The resulting report, Standby Power and Low Energy Networks: Issues and Directions, was published in September 2010. It provides an overview of the technical issues regarding power consumption of appliances and equipment that are connected to networks and describes the challenges ahead if this consumption is to be constrained.

These challenges fall into three broad areas. Firstly, there is a general absence of information about the scale of energy consumption in networked products and the technological possibilities to reduce it.

Secondly, there is a lack of engagement between network developers and energy policy makers, which means that network protocols (and the equipment that operates on networks) rarely have energy minimisation as a key design parameter. This is due to many factors, including energy experts and network developers having little understanding of each others’ fields and the rapid pace of technology development of networks in recent years. It is further exacerbated by the complexity and interdependency of the multiple devices and products on a network, which creates significant challenges for effective energy management.

Thirdly, coverage of networked products in existing policies that deal with low power modes has been limited. The current policy approach of setting simple power limits by mode needs to be adapted to cater for more complex energy requirements as networked products are likely to have multiple modes of operation beyond a simple on/off state. Furthermore, the equipment which makes up the network infrastructure itself is generally not covered at all by current policies.

To achieve low energy networks and eliminate excessive standby power, the report recommends an integrated policy framework containing the following key components:

- Guiding principles for good network design.
- Incorporating power management as the default product design.
- Capping power for all functions to existing reasonable levels within the technology bounds.
- Setting power limits for all secondary functions through a horizontal standby requirement.
Underpinning this, the report proposes a series of eight research projects to enhance knowledge and understanding in many critical areas. Some of these will gather information on existing products and the best available technologies on the market, while others will look at where technical standards and protocols should be developed. The figure below demonstrates how each of these projects will become a building block leading to the development of a practical and workable policy framework.

**IMPLEMENTATION STRATEGY FOR PROPOSED PROJECTS**

The ultimate goal of all the projects is to enable the development of comprehensive and manageable policy which can deliver energy savings and reduce needless energy waste in networked products and network equipment.

**To download a full copy of the report, visit the Standby Power Annex website.**
FOCUS ON QUALITY STANDARDS

“The Solid State Lighting Annex is focused on enabling Governments and consumers to quickly and confidently identify which SSL lighting products have the necessary efficiencies and quality levels to effectively reduce the amount of energy consumed by artificial lighting,” says Marc Fontoynont, Operating Agent of the Annex. “We strongly believe that developing a common approach to quality assurance is fundamental to this process.”

Launched in 2010, the SSL Annex brings together global technical experts and test laboratories with the following 8 Governments: Australia, Denmark, France, Japan, Netherlands, Sweden, UK and USA.

Already underway is a ‘round-robin’ amongst leading lighting laboratories in Asia, North America and Europe designed to check the reproducibility of tests for some of the key characteristics of SSLs. Further round-robins are planned to assist countries to develop the technical capacity for the accurate measurement of the performance of SSLs and, where necessary, highlight areas where test methodologies require improvement.

Work has also begun on the task of identifying key performance characteristics and suites of corresponding minimum performance values that could be used to by national governments when establishing their own energy efficiency program criteria. Reflecting the priorities of the Annex members, the initial focus is on directional lamps, ceiling downlights street luminaires and replacements for linear lamps.

Based on a review undertaken by Annex experts, existing international or national standards, SSL characteristics used to define better performing lamps and luminaires include some or all of the following:

- System luminous efficacy
- Lumen depreciation and failure rate
- Light stability and flicker
- Colour rendering and colour temperature
- Power factor and harmonic distortion
- Glare, UV and blue light hazards
- Maximum device temperature
- Safety and conformity marking
- Recyclability
- Guarantee/warrantee

In parallel with these activities, the Annex has collected and analysed considerable quantities of information relating to the Life Cycle Assessment and photobiological safety issues for SSLs and other lighting technologies, which is made available to member governments.

Meetings of Annex experts are scheduled for Stockholm in September 2011 and Tokyo in March 2012.

More information on this work can be found on the SSL Annex section of the 4E website.
SNIPPETS

**4E 2010 ANNUAL REPORT**
The 4E 2010 Annual Report, which contains a record of the activities and achievements undertaken by the 4E Implementing Agreement during 2010, is now available to download from the 4E website.

**EUROPEAN COMMISSION ENERGY EFFICIENCY PLAN 2011**
On 8 March 2011, the European Commission launched a comprehensive new Energy Efficiency Plan which will form a key strand in the European Union strategy to meet its energy savings target of 20% by 2020. Full details of the Plan, which covers all sectors except transport, can be found on the European Commission Europa website.

**4E POLICY BRIEFS**
The first in a series of 2-page policy briefs that summarise the main findings of work undertaken by 4E are now available. These comprise an overview of the Mapping & Benchmarking Annex (available here), and conclusions from the international benchmarking of Refrigerators & Freezers (available here).

**4E MOTOR POLICY GUIDE**
A new guide to policy instruments for efficient motor systems in Australia, China, Europe and the USA has been published by EMSA, the 4E Annex targeting energy efficient motor systems. In addition to providing the results of the survey, the Motor Policy Guide - Part 1: Assessment of Existing Policies assesses relevant policy elements and gives recommendations for successful policy design. The guide is available free of charge.

**IEA MOTOR DRIVEN SYSTEMS REPORT**
This report shows how nearly 4,000 TWh of electricity could be saved in 2030 through the adoption of policies to encourage best available technologies for motor-driven systems. The report can be downloaded here.
4E CONTACT DETAILS:

Mr Hans-Paul Siderius  
Chair, 4E  
NL Agency  
P.O. Box 8242  
NL-3503 RE  
Utrecht  
Netherlands  
Tel: +31 88 602 26 09  
e-mail: hans-paul.siderius@agentschap.nl

Mr Shane Holt  
Vice-chair, 4E  
Department of Climate Change and Energy Efficiency  
GPO Box 854  
Canberra, ACT 2601  
Australia  
Tel: +61 26 159 33 26  
e-mail: shane.holt@climatechange.gov.au

Mr Mark Ellis  
Operating Agent, 4E  
Mark Ellis & Associates  
44 Albert St,  
Wagstaffe, NSW 2257  
Australia  
Tel: +61 243 60 29 31  
Mobile: +61 424 26 40 14  
e-mail: mark@energyellis.com

LINKS
Pg 7  http://mappingandbenchmarking.iea-4e.org/matrix
Pg 8  http://www.motorsystems.org  
http://www1.eere.energy.gov/industry/bestpractices/software_motormaster.html  
http://www.motorsystems.org/files/otherfiles/0000/0075/hatch_testing_centres_12092011.pdf
Pg 11 http://standby.iea-4e.org/files/otherfiles/0000/0023/Network-Standby-2010-09-final.pdf
Pg 13 http://www.iea-4e.org/files/otherfiles/0000/0178/4E_Policy_Brief_M_B0_revised_lores.pdf
Pg 14 http://www.iea-4e.org/files/otherfiles/0000/0179/4E_Policy_Brief_M_B1_revised_lores.pdf
For more information on
IEA Implementing Agreement
Efficient Electrical End-Use
Equipment (4E), visit
www.iea-4e.org