



European Metrology Research Programme

Sustainable Energy

An overview of the first funded projects, from the Targeted Programme Energy.

The aim of these projects is to help establish a sustainable European energy system through measurement research.

Focus is placed on technologies that enable greatly reduced greenhouse gas emissions, whilst also ensuring the security of Europe's energy supply.

Making power plants more efficient

Better measurement gives better control

Despite the important and necessary increase of renewable energy in the EU, large-scale power plants continue to form the backbone of secure energy supply, generating around 80 % of electricity. It is evident that improvement in the energy efficiency of these fossil fuel and nuclear plants would greatly contribute to energy conservation, natural resource preservation, emissions reduction and environmental protection.

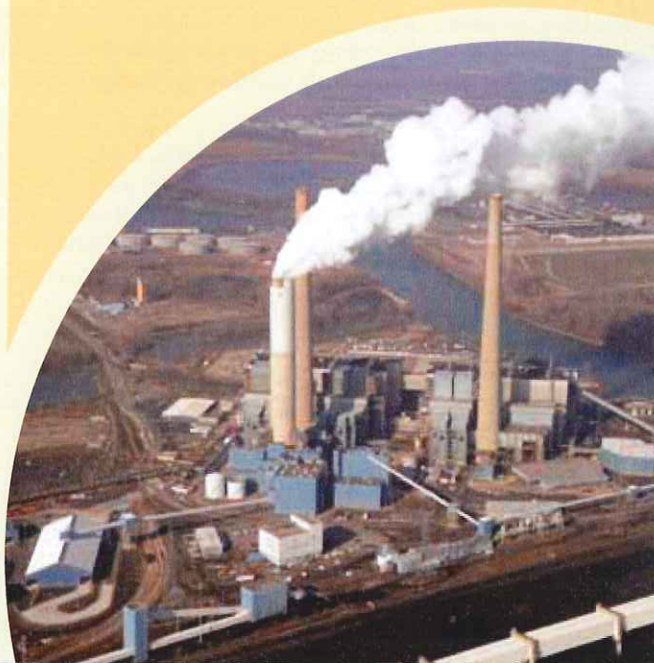
This project will develop methods and technologies to increase the efficiency of large-scale power plants by reducing the measurement uncertainty of several critical parameters, including temperature and electrical output. Research will also be carried out into advanced materials that could be used to build more energy-efficient turbines in the future.

Support will be needed from policy makers and legal bodies to ensure that power plant operators are able to put the research results into practice, and all EU citizens will eventually benefit from potential increases in energy efficiency.

Project ENG06 Metrology for Improved Power Plants

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Modernising electricity grids

Making smart grids smarter

As power generation becomes decentralised, with increasing numbers of wind turbines and solar panels, the electricity grid needs to evolve into a system capable of both giving and taking back energy, known as a 'smart grid'.

The current system distributes power outwards from a central source to more and more remote areas, where electricity demand decreases and infrastructure quality degrades. Today, these remote areas are generating electricity from small-scale renewables, and transmitting some of this back into the grid, along power lines not designed to carry it.

Smart grids will solve this problem, but whilst the hardware required to implement them is available, the theoretical and practical knowledge required to ensure their stability is not. The ability to measure is essential for any developing technology, and this project aims to improve the accuracy of on-site measurements, vital for maintaining the quality of electricity supply and guaranteeing fair trade of energy.

Project ENG04 Smart Electrical Grids

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Fuels for the future

Making biofuels part of the European fuel mix

For biofuels to penetrate a fuel market dominated by petroleum-based products, they need to be able to mix with traditional fuels and form blends that can be used without affecting vehicle engine performance, reliability or safety. More accurate measurements, and a greater understanding of biofuel properties, will allow this and improve public confidence in the low-carbon fuels.

This project will provide validated, reliable and traceable methods to measure the physical and chemical properties of biofuels, particularly those used in the automotive and aviation sectors. These methods will help ensure the sustainable contribution of biofuels to EU energy supply.

The results of the research will also accelerate the expansion of new technologies, such as engines designed to run efficiently on biofuels. Furthermore, the development of tracing methods for biofuels will help prevent economic subsidy fraud, where subsidies for producers are falsely claimed, and improve investor confidence.

Project ENG09 Metrology for Biofuels

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Greener alternatives to natural gas

Enabling alternative and renewable gaseous fuels to be used in the European gas pipeline system

Natural gas resources in the EU are declining and the public gas networks need to include alternative energy gases, such as biogas, to ensure a reliable and sustainable supply.

To enable gases from non conventional sources to be used like natural gas, without any modification to existing equipment, the measurement infrastructure needs to be developed in order to characterise these gases.

The current standards of measurement for natural gas will be tested for their suitability for measuring the properties of the alternative gases. Important measurements include gas composition, calorific value (energy content) and humidity, which are all needed to ensure efficient trade, safe use and transportation. Certain known impurities, such as ammonia and siloxanes, also need to be measured and closely monitored as they can cause problems during gas processing and use.

Project ENG01 Characterisation of Energy Gases

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Feeding electricity grids

Enabling the efficient transmission of electricity generated by remote renewable energy sources

Suitable sites for renewable energy generation are often remote, for example solar panels work best in deserts and wind turbines work best offshore or in mountainous regions. The challenge is getting electricity from these remote areas to where it is needed. High-Voltage Direct Current (HVDC) offers a solution by enabling power transmission along electricity 'super highways', and distributing energy thousands of kilometres away from where it was generated.

HVDC provides low energy losses, enhanced grid stability and the economically viable transmission of electricity, but no metrology infrastructure currently exists to support the technology at the proposed 800 kV working levels. Consequently, HVDC cannot be reliably measured for operational or billing purposes, its quality cannot be monitored and energy losses cannot be determined and reduced.

This project will develop a new measurement framework, new calibration capabilities and equipment such as prototype DC energy meters that will assist the widespread implementation of HVDC transmission.

Project ENG07 Metrology for High-Voltage Direct Current

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Feeding gas grids

Enabling natural gas trading between countries not served by pipelines

The trade of natural gas, between countries not served by pipelines, is made more economically viable by the process of liquefaction, which greatly reduces the volume required for transport. The natural gas is liquefied at the beginning of its journey, loaded onto specially designed cryogenic tankers for transport and then regasified at its destination, where it can be pumped as normal through gas networks.

When Liquefied Natural Gas (LNG) is traded, measurements are taken of volume, density and calorific value to calculate the amount of energy transferred, but measurement uncertainties are currently too high to guarantee fair trade.

This project will test a variety of methods for making these measurements, compare them to one another and suggest improvements.

The project will strengthen the measurement framework for LNG, with an expected halving of measurement uncertainties, and will also disseminate knowledge through training, workshops and contribution to international standards and guidelines.

Project ENG03 Metrology for Liquefied Natural Gas

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New Nuclear

Enabling a new generation of nuclear power stations

Nuclear power will inevitably form part of EU energy strategy, as member states clamour to meet the ambitious target of a 20 % reduction in CO₂ emissions by 2020. It remains the leading low-carbon energy technology and a new generation of reactors will further improve efficiency.

The environment inside a nuclear reactor requires constant monitoring to maintain safe temperatures and control fission reactions. Taking such measurements is inherently difficult, but the increased operating temperatures of the proposed 'Generation IV' designs will complicate things further. Existing measurement methods may not be accurate at higher temperatures, and existing reactor building materials, coolants and fuels may not operate as desired in the new conditions.

This project aims to address the measurement challenges posed by 'Generation IV' designs, by testing temperature measurements and materials for suitability, and ensuring sufficient nuclear data and radiation measurement techniques are available.

Project ENG08 Metrology for New Generation of Nuclear Power Plants

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Harvesting waste energy

Developing sources of sustainable energy from human activity and natural processes

Portable electronics and communications devices form a crucial part of our technological society, but they require power from batteries that contain toxic chemicals and limit their minimum size or maximum lifetime - as batteries eventually need to be recharged or replaced.

The harvesting and utilisation of only a small fraction of energy wasted as heat and vibration from human and environmental processes could potentially power such devices and contribute to a reduction in CO₂ emissions. This project aims to develop new technologies, devices and measurement methods that enable the exploitation of waste energy to provide small, but reliable and sustainable, power sources.

The potential for substituting batteries for these technologies, including microgenerators and nanogenerators, will be assessed by measuring efficiency and effectiveness across a variety of applications, and a measurement framework will be developed to provide the essential, traceable and reliable data required for product development.

Project ENG02 Metrology for Energy Harvesting

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The Future of Lighting

Enabling the uptake of low energy Solid State Lighting (SSL)

SSL uses light emitting diodes (LEDs) to produce light, and is up to ten times more efficient than conventional light bulbs. Its implementation could significantly reduce EU energy demand, as lighting is responsible for 20 % of electricity use. However, neither professional users nor the public have embraced SSL technology because current measurement systems provide unreliable performance data and low energy lighting is widely considered to be less effective than traditional light bulbs.

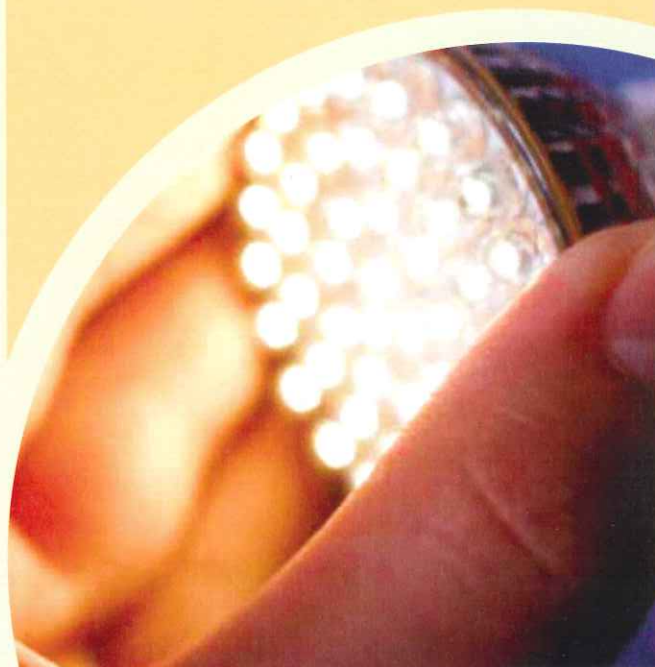
This project will support the implementation of SSL throughout Europe with the validation of new guidelines and standards. These will enable benefits to be quantified and clearly communicated, with specific attention paid to measurements of colour rendition and visual comfort, as well as light quality measurements important for applications such as street lighting, where safety is key.

The research aims to help realise the potential of SSL and reverse the negative public perception of low energy lighting.

Project ENG05 Metrology for Solid State Lighting

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Europe's National Measurement Institutes working together

The majority of European countries have a National Measurement Institute (NMI) that ensures national measurement standards are consistent and comparable to international standards. They also investigate new and improved ways to measure, in response to the changing demands of the world. It makes sense for these NMIs to collaborate with one another, and the European Association of National Metrology Institutes (EURAMET) is the body that coordinates collaborative activities in Europe.

EURAMET has implemented the European Metrology Research Programme (EMRP), a project programme organised by 22 NMIs and supported by the European Union, which will have a value of over 400M€. The EMRP facilitates the formation of joint research projects between different NMIs and other organisations, including businesses industry and universities. This accelerates innovation in areas where shared resources and decision-making processes are desirable because of economic factors and the distribution of expertise across countries or industrial sectors.

EURAMET wants to involve European industry and universities at all stages of the programme, from proposing Potential Research Topics to hosting researchers funded by grants to accelerate the adoption of the outputs of the projects.

Full details can be found at: www.euramet.org

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EMRP

European Metrology Research Programme
■ Programme of EURAMET



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