
Publishable Summary for 20NET01 Clean Energy Support for a European Metrology Network for Clean Energy

Overview

One goal of the European Green Deal is to put Europe on a more sustainable path by reducing net emissions of greenhouse gases to zero by 2050. A transition towards 'Clean' energy, defined as CO₂-neutral (and – reduced) technologies with a high level of economic viability, environmental sustainability and competitiveness is essential to achieve this goal. The future European Metrology Network (EMN) for Clean Energy aims to support the objectives of the Green Deal through coordinating actions to provide metrology solutions to industry and societal needs, addressing a broad range of topics not currently addressed by existing EMNs, including generation, storage, conversion, and utilisation of renewable energy. This project aims to support the establishment of this EMN by defining its scope and by focusing on the development of a long-term ongoing dialogue between the metrology community and the whole field of clean energy stakeholders.

Need

The European Green Deal commits the EU to becoming climate-neutral by 2050 whilst promising to help companies to become world leaders in clean products and green technologies. One element of the policy framework is described in the European Green Deal section 2: "Transforming the EU's economy for a sustainable future". Therein, the development of an energy sector based mainly on renewable energy sources is demanded. It also refers to smart integration of renewables and energy efficiency, as well as other sustainable solutions across sectors. The framework fosters the development of innovative technologies and infrastructure, such as smart grids, hydrogen networks, carbon capture, storage and utilisation, energy storage and sector integration.

The clean energy transition is a major technological challenge. New or improved technologies are needed for clean and efficient energy generation (e.g., wind, hydro, geothermal, biomass, photovoltaics, hydrogen-assisted production, fuel cells, batteries, liquid synthetic fuels), transport, storage and use.

The breadth of technologies as well as the number and variety of stakeholders means that individual National Metrology Institutes (NMI) and member state actions, and even sectoral approaches, cannot identify the common metrology research needs and capabilities needed to most effectively and efficiently address the highest priority needs. There is therefore a clear need for a network to coordinate the metrology community's response.

The future EMN for Clean Energy will cover a broader range of areas by keeping an overview across the energy system as a whole - including energy generation, conversion, storage systems and technologies, industrial processes, energy efficiency and coupling of sectors. It is designed to fill the gap between the existing EMNs on Energy Gases and on Smart Electricity Grids, both putting emphasis on specific distribution networks among other adjacent topics.

Objectives

The aim of this project is to focus on the development of a long-term ongoing dialogue between the metrology community and clean energy providers and stakeholders. This dialogue will support the collection of needs from stakeholders to inform research and other activities and the take-up of research outputs from the metrology community. In addition, the project will focus on developing a plan for a joint and sustainable European metrology infrastructure for clean energy via a future European Metrology Network.

The project addresses the following objectives:

1. To identify and approach the key stakeholders in the fields of "Clean Energy" and establish a regular dialogue between them and the project to identify their needs and promote cooperation. This will encompass industry, regulatory bodies, research organisations and standards developing organisations, as well as existing and new networks, and will start from initially prioritised areas aligned to the European Green Deal policy area "Clean Energy".

2. To develop a Strategic Research Agenda and roadmaps for clean energy considering the activities covered by the existing EMNs and taking into account feedback and the metrological needs of stakeholders identified in Objective 1.
3. To develop a Strategic Agenda, including the organisational requirements for transnational joint use of unique metrological infrastructures, coordination of smart specialisation, and targeted capacity building.
4. To establish a contact point for all matters of metrology related to clean energy for stakeholders, which may include web-based tools. The contact point will be developed in a manner that allows it to be maintained by a future EMN.
5. To develop a plan for a multidisciplinary and sustainable European Metrology Network for clean energy. The plan will be completed within 12 months of the start of the project and will:
 - (i) identify the scope of the EMN, with respect to the remits of other EMNs such as the Energy Gases EMN and the Smart Electrical Grids EMN,
 - (ii) use coordination and smart specialisation of capabilities,
 - (iii) align with other running initiatives and projects
 - (iv) promote the development of emerging member states, and
 - (v) consider how to extend collaboration to third countries.

Results

Objective 1: Identification of stakeholders and their metrology needs

The project produced a stakeholder analysis summary report including a stakeholder engagement strategy. The stakeholders included in this strategy cover the areas of industrial application, regulation and standardisation, platforms, and associations, as well as research and academia and policy makers. The main topic areas that were considered within the scope of the future EMN are:

- Clean energy generation via photovoltaic, wind, biomass, geothermal, hydro, marine, thermal power plants,
- Electrical and electrochemical energy storage systems and energy conservation, Power-to-X, mechanical, thermal, and cryogenic energy storage, production, transport and use of liquid organic hydrogen carriers and liquid synthetic fuels,
- Industrial areas, decarbonization of processes and technologies,
- Energy distribution and transport, coupling the electricity sector with the heating and the mobility sector,
- Energy efficiency and saving covering the building sector, industrial processes/manufacturing, and lighting.

As clean energy is a very broad subject area, this project will initially focus on a limited number of these topics. The topics were deemed as most important by the EMN members, in consultation with other stakeholders, NMIs and DIs. This includes metrology related to i) the generation (conversion from solar and wind energy) and utilization (conversion to mechanical energy, light etc.) of clean energy, ii) temporary storage of energy in, for example, batteries. While subsequently filling the gap between existing energy related EMNs, the proposed EMN for Clean Energy is designed to evolve with topics added as needed to demonstrate the effectiveness and added value for its members, partners and stakeholders.

Based on the categorisation, the project developed category specific tailored communication plans for the future EMN networking activities to ensure a sustainable dialogue, considering the existing EMNs. Moreover, a questionnaire on stakeholder needs for clean energy was created and will be sent in October 2023. Additional information concerning knowledge dissemination material at the NMIs/DIs has been collected by a survey.

Objective 2: Develop a SRA and roadmaps

The project developed a draft SRA that will be finalised with close stakeholder involvement such as via a stakeholder workshop. This workshop will be held remotely in November 2023. Tailormade questionnaires will be sent out in advance to maximise outputs for attendees and the EMN. The SRA prioritises the measurement research needs in complementary clean energy fields. The topics of interests are detailed below:

- A more complete understanding of degradation, aging processes and durability of materials,
- In-situ / operando characterisation and measurement techniques,
- Hybrid / multidimensional characterisation and measurement techniques,

- Improvement of calibration standards (e.g., samples) and reference measurement techniques,
- Characterisation techniques under dynamic conditions,
- Measurement methods to rate the energy system efficiency to increase the reliability,
- Uncertainty evaluation based on traceable measurements,
- Metrology for single elements such as wind turbines, PV, battery storage and coupled energy systems
- Cross-cutting themes, e.g. lifecycle assessment (LCA).

The identification of metrological capability requirements has been carried out through a gap analysis which will be continuously updated and transferred to the future EMN. A process to develop roadmaps based on this analysis will be developed and implemented, by the provision of one exemplary priority roadmap included in the SRA.

Objective 3: Develop a SA

The project developed an initial draft strategic agenda (SA) for the EMN with the following goals for the metrology community:

- Understanding fundamental technological barriers and the exploration of novel technologies,
- Acceleration and transfer of scientific solutions into the application; industrial innovation for clean energy production, transformation, and storage,
- Development and implementation of metrology support for regulation and standardization (legal metrology and safety aspects),
- Strategy for smart specialisation and joint use of unique facilities,
- Identification of synergies in metrology capabilities,
- Provision of knowledge transfer and capacity building in smaller and emerging NMIs.

The SA will identify and map the metrology capabilities within (EURAMET) NMIs and DIs and will be aligned to the SRA. Information concerning the capabilities of NMIs and DIs were already collected by a survey and evaluated so that gaps and overlaps can be defined. The SA will include a strategy for engagement with stakeholders from across all sectors but will focus particularly on policy makers and associations. The SA will set out the organisational requirements for transnational joint use of unique metrological infrastructures, coordination of smart specialisation and targeted capacity building or 'roadmaps' necessary for the EMN to become self-sustaining after the project finishes.

Objective 4: Develop a web-based contact platform

This project will develop a central contact point for all matters of metrology related to clean energy. This will be supported by a web-based tool through which stakeholders can ask questions. The contact point will help users to find existing metrology solutions and to share their needs for further developments and to put in requests for input from the metrology community into policy and R&D road mapping. A mock-up for a future website for the NMIs and DIs has already been created.

Objective 5: Develop a plan for a European metrology infrastructure for Clean Energy via an EMN

This project developed an initial plan for a joint and sustainable EMN for Clean Energy including a governance structure. Based on this, a proposal was submitted to EURAMET, which identified the scope of the EMN with respect to the remits of other EMNs such as the Energy Gases EMN, the Smart Electrical Grids EMN and where relevant the Climate and Ocean Observation EMN. Focus is on:

- Use of coordination and smart specialisation of capabilities,
- Alignment of the activities of the EMN as much as possible with other initiatives to create maximum synergy,
- Ensuring that the EMN will be a genuine pan-European effort, combining the metrology capabilities in the field of clean energy from all EURAMET member states; and, where possible, alignment with other similar initiatives world-wide.

Impact

The project strategy and results have been presented at the EURAMET-TC-T (Thermometry), TC-MC

(Metrology in Chemistry) meetings, and Board of Directories of EURAMET. The consortium presented results at video conferences of IRENA (International Renewable Energy Agency), the General Meetings of the EMN Energy gases and Smart Electricity Grids, the international Simposio Metrología (Mexico) and the NanoInnovation conference (Italy). The project was also presented with a poster at the CIM 2023 (France) in the EURAMET EMN conference booth and the Danish Metrology Day 2023, which is a yearly one-day symposium on metrology-related topics with attendees from the Danish NMI as well as Danish DI's, Universities and industry. This year the theme was measurements of energy and energy efficiency. A poster presentation was made at the ALTECH Symposium 2021.

This project, through supporting the development of the EMN for Clean Energy, will impact on society by directly supporting the transition to Clean Energy and the objectives of the European Green Deal. The network will enable the metrology community to effectively and efficiently support the development and adoption of Clean Energy technologies, providing the capacity across Europe to support innovation and commercialisation of novel technical solutions and the capability to validate and verify their environmental performance.

The network will bring clear economic benefits supporting innovation and quality in order to achieve and to preserve competitiveness and thus also substantial employment in Europe. The enhancement of industrial capabilities to generate, convert, store, save and transport energy in more efficient ways in Europe will enhance energy security, support decentralized energy generation and deliver a more resilient energy system. There will be clear environmental benefits from the project through supporting the transition to cleaner energy with the benefits from supporting efforts to tackle climate change and improve air quality.

To maximise the impact of the project on the broadest range of stakeholders, including Clean Energy technology developers, adopters, end users and policy makers, a structured approach for analysis and categorisation of relevant stakeholder groups will be adopted. This will ensure key stakeholders are identified and liaised with throughout the project, enabling the project to identify and address measurement needs from across all areas of Clean Energy. The key stakeholders will be approached as soon as the network is established. The communication channels being established by the project will act in both directions: to offer a forum for the implementation of stakeholder needs and suggestions into the EMN formation, and to inform the stakeholders on a continuous basis on the progress and activities of the EMN following systemic and cross-disciplinary approaches.

The impact on specific stakeholder groups will include the identification of common measurement needs, the coordination of metrology support to address these and the ability to move the state-of-the-art forward for industrial stakeholders. The efficient implementation of Clean Energy policy goals will be impacted by the identification and removal of key blocks to technical implementation. Regulatory stakeholders will be impacted by the development of the tools that are required to demonstrate the performance and environmental credentials of Clean Energy technologies. This will be supported by the impact on the standardisation community through the provision of metrology support by the development of methods and documentary standards in the area of Clean Energy.

The impact on the metrology community will be to enhance its effectiveness by focussing on metrological capabilities in the different areas of clean energy across Europe. Synergies will be leveraged by the joint use of unique facilities, coordinated and smart specialization and by capacity building in smaller emerging NMIs and DIs. The project will enhance the overall impact by delivering the tools to enable the efficient operation of the EMN, for example the provision of easy access to a database of metrological services and related capabilities across European institutes.

Furthermore, the impact of the project will be to define the optimal scope, size, structure and mode of operation of the Metrology Network. The development of a rigorous and in-depth strategic research agenda together with a gap analysis will relate metrological stakeholder needs to existing NMI/DI capabilities and facilities. The future EMN will support improvements beyond the state-of-the-art in stakeholder communities by providing a means to identify where collaborative research can produce the greatest impact and by enabling the community to identify and access research programmes. To foster the increased involvement of external stakeholders in the European Partnership on Metrology R&D Calls, with balanced consortia in relevant topics, regular meetings will be scheduled to ensure target-oriented preparation of the Energy calls will have the desired impact among the Clean Energy community.

The future EMN will coordinate efforts to develop sector-coupling technologies and systemic solutions for a sustainable and clean energy transition in Europe. Through the involvement of data-driven innovations by the digital transformation of energy systems, better analysis of the existing energy system and solutions across the energy sectors will be promoted and performance claims will be validated. The strong line-up of the partners within and around the network, driven by a sustainable dialogue, allow for synergies to be used and for knowledge transfer to be made. This, in addition, leverages the potential of small and emerging NMIs, and the industrial partners in their countries.

The future EMN will aim at a special partnership between EURAMET and the EU to advise on regulation, support the implementation of regulation such as through conformity assessment, and harmonise the implementation of regulation on the national level. The metrological methods in the area of clean energy being developed in metrology research projects funded under EURAMET will be promoted in the respective standardisation organisations (ISO, CEN/CENELEC) by this supporting JNP and the future EMN for Clean Energy. Vice versa the standardisation needs formulated by stakeholders on the international level will be accumulated within the future EMN and communicated to the metrology community.

List of publications

n/a.

Project start date and duration:		01 May 2021, 36 months	
Coordinator: Dr. Fabian Plag, PTB EMN website address: n/a		Tel: +49 (0)531 592 2006	E-mail: fabian.plag@ptb.de
Internal Funded Partners: 1. PTB, Germany 2. BAM, Germany 3. DFM, Denmark 4. INRIM, Italy 5. IPQ, Portugal 6. NPL, United Kingdom 7. VSL, Netherlands	External Funded Partners: n/a	Unfunded Partners: n/a	