

Publishable Summary for 18NET01 Energy Gases Support for a European Metrology Network for energy gases

Overview

Driven by EU legislation on renewable energy (2009/28/EC) and by the ratification of the Paris agreement, which aims at a zero-carbon economy, and recently by the EU's Green Deal ambition to become climate neutral by 2050, renewable energy gas sources are gradually entering the market. The European Metrology Network (EMN) for Energy Gases, with a broader remit than traditional metrology, has demonstrated to be the glue that attracts the European measurement community active in energy gases and related stakeholders.

This project has supported the EMN for Energy Gases in its initial tasks, thus providing the basis for a harmonised and sustainable European measurement infrastructure to catalyse the energy transition. Specifically, it contributed to create a strong EMN brand and to set up the tools for the network to continue to operate in the future. The Strategic Research Agenda for energy gases metrology, in combination with a successful stakeholder engagement, has led to the identification and prioritisation of research topics in the metrology research programme. A platform of measurement services, embedded in the newly created network website, has created the opportunity to showcase the EMN member capabilities in energy gases including calibration, reference materials, training and proficiency testing. A report on the main outputs of metrology research projects in the field of energy gases was developed to enhance awareness of the role of metrology and to support standardisation activities in energy gases. Furthermore, potential synergies for collaborative schemes have been identified and worked out, that will facilitate an integrated European metrology for energy gases.

Need

The energy gases stakeholders have established national and European platforms to address the fundamental challenges caused by the diversification of energy sources and by the fluctuations in renewable energy supply and demand. In July 2020, the European Commission released the Hydrogen Strategy for a Climate-neutral Europe as part of its efforts to deliver the European Green Deal. The strategy defines a target of 1 million tonnes of hydrogen and an electrolyser capacity of 6 GW by 2024, and 10 million tonnes and 2x40 GW by 2030. Lately the European REPowerEU plan was published to rapidly reduce dependence on Russian fossil fuels and fast forward the green transition.

The robustness of the measurements performed in these areas is often compromised by a lack of the quality infrastructure: namely of traceable measurement standards and of appropriate quality control, standardisation and procedures. Addressing these needs and bridging the gap between the metrology and end user communities goes beyond the current activities of National Metrology Institutes (NMIs), Designated Institutes (DIs) and technical committees under EURAMET and the International Committee for Weights and Measures (CIPM).

The energy transition needs European harmonisation and implementation, which will extend beyond national boundaries. Therefore, a coordinated effort has been needed to create a strong single metrological point of contact: the EMN for Energy Gases (under the auspices of EURAMET). This coordinated effort facilitates the prioritisation of the energy gases measurement challenges that are of pan-European importance, thus avoids duplication, and generates research that represents good value for money. It addresses the needs for measurement standardisation for renewable gases, such as biomethane and hydrogen, by successfully incorporating EMRP/EMPIR research results into documentary standards, thus ensuring the formal standing and uptake of these results by the relevant stakeholders.

The fragmentation of the measurement capabilities of individual NMIs and calibration and testing organisations in the energy gases sector did not allow the end-user to easily find information, whether it was a calibration

service or a technical question. A centralised point-of-contact for knowledge transfer, support and metrological services, strengthened by the provision of integrated solutions, has now been created to bridge this gap.

Objectives

The overall aim of this project was to enable the EMN for Energy Gases to become the European metrology centre for the energy gas transition, where knowledge, needs and services are identified and easily accessible by the metrology community and the relevant stakeholders' categories. Therefore, the specific objectives were:

1. To develop and publish a strategic research agenda (SRA) with an emphasis on the European energy transition process. The SRA identifies the key measurement gaps and challenges (roadmap) as experienced by regulators and stakeholders working in the energy gases industry and prioritises these, with the aim of focusing European research capacity. The SRA is regularly reviewed to take account of the changes in the market trends and rapid technology evolution.
2. To develop a freely accessible online measurement service platform to boost the dissemination and knowledge transfer of metrological services in the energy gases field to European industry. This platform allows customers to access all available energy gases measurement services in Europe through one easy-to-use platform. The platform advertises all measurement and calibration services, including those developed in the EMRP and EMPIR Programmes. In addition, to develop a brand identity for the "Energy Gases Metrology Network" in close consultation with EURAMET so that the EMN becomes easily recognisable by stakeholders and to facilitate the use of the platform by the whole energy gases industry to find the right measurement service or proficiency testing scheme.
3. To develop processes to create synergies between the NMI/DI signatories of the EMN MoU, stakeholders and other parties to address emerging issues related to energy gas production, trade, transmission and use. These collaborations facilitates the provision of services that cannot be provided by one single party and deliver solutions at a scale relevant to the needs of the sector. Examples of synergies are developed for a training programme, collaborative research, and a proficiency testing scheme.
4. To disseminate results from European metrology research activities related to energy gases (e.g. EMRP, EMPIR) for the benefit of relevant policy makers and regulatory bodies to support their ongoing standardisation activities. This impact activity is achieved through presentations and the distribution of reports at relevant technical committee meetings, through the regular distribution of a newsletter, and through stakeholder workshops. Furthermore, the stakeholder group of the EMN is expanded by the addition of relevant policy makers and regulatory bodies.

Results

The project outputs have ensured the role of the EMN for Energy Gases as a recognised knowledge and metrological service centre for energy gases.

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The development of the strategic research agenda (SRA), first of this project's objectives, has been a key focus point of the project's activities. The SRA was published for the first time on the EMN website in November 2020, followed by the second revision in 2022. The third edition will be soon available. It is an informative document, targeted for the metrology community and relevant stakeholders in energy gases, about the emerging measurement challenges associated with the energy transition. The SRA describes the current energy gases market and legislation in Europe, provides a list of the identified measurement gaps and defines the priority measurement challenges. This document is based on outlook reports published by the stakeholders that are active in the energy gases area, on national and European policies and strategies, on the outcome of specific stakeholders' events organised by the consortium and collaborators (e.g. the workshop on measurement challenges) and a survey.

The EMN for Energy Gases brand, such as the EMN icon, has been developed in close consultation with EURAMET, ensuring recognisability. The EMN has an external website at www.euramet.org/energy-gases/. This website, live since 2021, is the “visit card” of the EMN for Energy Gases. It nicely introduces the EMN concept, members, network events, news and research projects/outputs related to the energy gases covered by the EMN.

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As part of the second objective, this project developed an easily accessible and easy to navigate measurement service platform to search and visualise the metrological services (e.g. calibration capabilities, trainings, proficiency testing) offered by the members of the EMN for Energy Gases. The platform has been designed in the past two years and implemented on the EMN website in April 2022 for three energy gases, namely natural gas, biogas/biomethane and hydrogen. The services for the remaining gases and gas mixtures: liquified natural gas and biogas, hydrogen enriched natural gas and carbon dioxide were collected and added to the platform in January 2023. This project also developed tools to ensure the quality of the services entered in the measurement service platform and to guarantee their regular update also after the lifetime of the project.

To develop processes to create synergies between the NMI/DI signatories of the EMN MoU, stakeholders and other parties to address emerging issues related to energy gas production, trade, transmission and use. These collaborations facilitates the provision of services that cannot be provided by one single party and deliver solutions at a scale relevant to the needs of the sector. Examples of synergies are developed for a training programme, collaborative research, and a proficiency testing scheme. (Objective 3)

In compliance with the third objective, to create synergy between the EMN members and stakeholders, the project partners developed a collaborative requirements document which provides the framework for establishing collaborations (e.g. workflow and requirements for each type of collaboration, IP and confidentiality, communication and execution steps). Furthermore, a pilot survey of the measurement service needs in the energy gases sector sent out to the relevant stakeholders in the Balkan region (2022) helped identifying the measurement needs. Based on the outcome of the survey and gap analysis of the services provided by the EMN members, new collaborative case studies were developed with the aim of boosting synergies and complementarity between parties. The case studies, which will be implemented outside of this project by EMN for Energy Gases members, addressed collaborative research for, and in cooperation with industrial stakeholders, training programmes and proficiency testing schemes.

To disseminate results from European metrology research activities related to energy gases (e.g. EMRP, EMPIR) for the benefit of relevant policy makers and regulatory bodies to support their ongoing standardisation activities. This impact activity is achieved through presentations and the distribution of reports at relevant technical committee meetings, through the regular distribution of a newsletter, and through stakeholder workshops. Furthermore, the stakeholder group of the EMN is expanded by the addition of relevant policy makers and regulatory bodies. (Objective 4)

Since the start, and in line with the planned activities of the fourth objective, this project has carried 80 impact and networking activities. One of the key-events was the EMN for Energy Gases Launch, which took place in June 2019 at VSL in Delft, The Netherlands. This was a great opportunity to promote the network and to receive stakeholder inputs on the measurement needs they face in view of the energy gas transition.

A stakeholder workshop to identify in depth and then prioritise measurement challenges in support of the development of the SRA was organised in January 2020 at NPL in Teddington, UK. On this occasion, the outcome was a list of priority metrological challenges that constituted the basis for a stakeholder survey.

And a third event, the second stakeholder workshop took place in March 2023 at IPQ, the Metrology institute of Portugal, in hybrid form. The workshop, jointly organised by NEL and IPQ, aimed to highlight EURAMET's support for the energy transition through its research programmes, including EMRP, EMPIR and the European Partnership on Metrology. At all events, the stakeholders were policy makers, standardisation bodies, research associations, the gas industry, as well as gas grid operators and instrument manufacturers.

A promotional video that introduces the EMN for Energy Gases and a short infographic video to explain the role of metrology in the energy gases were produced and they will soon be available publicly.

The project partners and other members of the EMN introduced the network in nine international conferences and a multitude of stakeholder events with posters, presentations, and key-note lectures. Among others, it is worth mentioning the poster at the 25th United Nations Climate Change Conference (COP 25) in Madrid in December 2019, the talks at the 11th EU Innovation Summit lunch debate at the European Parliament in February 2020, at the North Sea Flow Measurement workshop in October 2020, at the IPQ-EURAMET virtual science debate: Climate neutral by 2050 in May 2021, the key-note presentation at the GAS Analysis conference in May 2022 and the round table on hydrogen at the CIM in March 2023.

Through this project, the results of past and on-going EMRP/EMPIR research on energy gases were disseminated to standardisation and regulatory bodies through presentations at Technical Committee (TC) meetings. Around 20 TCs, dealing with energy gases, were identified as possible receivers and they have been being contacted and this project actively engaged with nine. A report on the research projects outputs relevant to Energy Gases was produced and it will be distributed by the EMN to standardisation TCs in the field.

All stakeholders were kept updated on the EMN and its activities through regular e-newsletters. Five issues were published during the lifetime of the project, and they are available on the EMN website. Finally, the engagement with key stakeholders resulted in the establishment of the EMN Stakeholder Council, which is currently made up of four members, representing the energy sector.

Impact

This project, in support of the EMN for Energy Gases, has impact on the societal needs related to the energy transition, enabling the diversification of energy sources and facilitating the introduction of renewable fuels in the European market. The whole energy gases supply chain is targeted from production to transport, to storage and utilisation. Only through a complementary network composition and by focusing on the specific societal challenges associated with energy gases is possible to achieve the “next level” in creating impact, innovation and metrological services, surpassing the possibilities of a single NMI or a EURAMET technical committee.

To create the broadest impact and become the knowledge centre for energy gases measurements, the EMN is very focused on engaging with stakeholders from different fields, namely the (energy) gas and manufacturing industries, energy gases associations, research groups, standardisation and regulatory bodies, and policy makers.

During the lifetime of the project, the project partners in collaboration with the EMN members, have developed a structured engagement with key stakeholders. This has led to multiple collaborations with top European associations such as Hydrogen Europe (HE) and Hydrogen Europe Research (HER), representing the largest group of industries and research organisations respectively involved in hydrogen. The successful engagement has led to a Memorandum of Understanding (MoU) signed by EURAMET and the two associations in March 2023. The project partners established also long term relationship with other European Research groups such as the European Gas Research Group (GERG), which led to a MoU signed by EURAMET in November 2022, and the European Research Institute for Gas and Energy Innovation (ERIG). The EMN has also engaged with energy gas industry and European technical associations, such as MARCOGAZ, with gas grid operators, such as the European Association of gas grid transmission operators (ENTSOG), with policy makers, such as the EC DG-Energy, with international organisations, such as the International Renewable Energy Agency (IRENA) and with standardisation bodies (e.g. ISO and CEN). These engagements resulted in the mutual participation at EMN and stakeholders' events with valuable presentations and contributions.

All these interactions have allowed to align the respective strategic research agendas, to jointly propose new topics for research under the European Partnership on Metrology, to be successful in the project selection, and to establish long-term collaborative relations. Since start of the Clean Hydrogen Partnership in 2022, the chair of the EMN for Energy Gases has become member of the stakeholder group on behalf of EURAMET.

Objective 1: *The identification of a strategic roadmap for future research, (SRA) is key to ensure the best allocation of research funds thereby generating research that represents good value for money. Furthermore, by promoting dedicated research, in collaboration with industry and research groups, the EMN will **strongly impact and support innovation**.* The SRA has proved to be a key tool in defining the role of metrology in the European research arena. The SRA has been taken up by EMN members, EURAMET TCs members and

other stakeholders to align their strategies in the area of energy gases and to scope potential research topics (PRT) in the calls 2021-2023 of the European Partnership on Metrology. As a result, two of the three research proposals derived from the EMN SRA were selected for funding in 2021. In 2022, two virtual joint brainstorming sessions were organised in collaboration with HE and Hydrogen Europe Research (HER) to identify needs and priorities in research for hydrogen using the EMN and the HE/HER strategic research agendas. And in 2023, based on the inputs of key stakeholders, four SRA research topics were prioritised and submitted under the European Partnership on Metrology call.

Objective 2: The added value and strength of this project lies in its cross-cutting approach which will enable the various metrological aspects and challenges in e.g. gas composition, gas transport and flow metering, material data, humidity, temperature, pressure, density, particles and material testing to be simultaneously addressed. The EMN external website gives the opportunity to showcase joint projects, results, news and events that cover the complex field of energy gases measurements. In addition the Measurement Services Platform, part of the website, allows stakeholders to quickly find the services and measurement capabilities of the metrology community. It is expected that this unique and easy-to-access web-based platform of measurement services will enable in the near future the creation of a European “hot spot” for the exchange of knowledge with stakeholders, the identification of research topics and the dissemination of (new) measurement services. By doing this, the project will have a **major impact on industry and on the scientific community** dealing with conventional and renewable/sustainable energy sources.

Objective 3: Building synergies to create collaborative activities between the NMIs/DIs members of the EMN, stakeholders and other parties. It is expected that the framework document that defines collaborative requirements and the developed case studies, such as enabling the calibration of complex equipment as a follow-up of EMRP/EMPIR projects, organising a proficiency testing scheme where more disciplines are involved, providing training courses addressing all relevant metrological aspects, when implemented, will have a strong socio-economic impact. The increased collaboration in research and services will firstly benefit the metrology community, stimulating knowledge transfer and a more efficient use of resources. Secondly, **industrial and testing laboratories** that are involved, for instance, in the production or distribution of energy gases, will be able to efficiently access these services and prove their measurement results or gain know-how at reduced costs and in a shorter time frame.

Objective 4: This project aims at supporting the uptake of specific research results, either from ongoing or previous research activities funded by the European metrology research programmes, by for example feeding them into new documentary standards. This project has promoted the recognition of the EMN for Energy Gases as a knowledge center. As main example, the key hydrogen research challenges reported on the SRA, have been used to feed the standardisation roadmap developed by the European Clean Hydrogen Alliance. The roadmap was published in March 2023 and delivered to CEN/CENELEC for prioritising their standardisation work. The project successes allow the EMN to **strengthen the link with standardisation and regulatory organisations** (e.g., the European Committee for Standardisation (CEN), the International Organisation for Standardisation (ISO), the European Cooperation in Legal Metrology (WELMEC)) and, finally, to hasten the uptake of metrology concepts by users. Finally, it is expected that this will help the energy gases stakeholders to comply with regulation and become more sustainable and competitive in the energy market.

This project and therefore the EMN for Energy Gases, ensure that metrology in the field of energy gases directly meet the requirements of policy makers, industry, networks, associations, and standardisation committees, and thereby society at large during the energy transition.

In broader terms, this project outcome and the EMN contribute to greater societal prosperity by providing diversification of energy sources for a growing global population while finding ways to emit much less carbon dioxide and therefore starting to tackle climate change.

List of publications

Arul et al., 2022, Vision for a European metrology network for energy gases, Environ. Res.: Infrastruct. Sustain. 2 012003; <https://doi.org/10.1088/2634-4505/ac57f6>

This list is also available here: <https://www.euramet.org/repository/research-publications-repository-link/>

Project start date and duration:		1 May 2019, 48 months
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