Version 1.4, 2024-05-23

EURAMET´s

European Metrology Networks

supported by

The European Metrology Programme for Innovation and Research (H2020 EMPIR),

and the

FINANCIAL FRAMEWORK PARTNERSHIP AGREEMENT 2021/METROLOGY/01

European Metrology Networks REPORT
Period: January 2019 – May 2024

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Executive summary

This report summarises the progress towards the implementation of a new organisational structure in EURAMET, the European Association of National Metrology Institutes, called “European Metrology Networks” (EMNs) covering horizontal topics on EU priority areas for EURAMET’s members, which are 39 National Metrology Institutes (NMIs) and 77 Designated Institutes (DIs). It showcases individual highlights including the development of metrology research capabilities, EMNs’ engagement with standardisation and regulation and the EMNs’ co-creation of strategies by collaborating with stakeholders.

EURAMET’s European Metrology Networks have been established to create an efficiently coordinated and shared metrology infrastructure which goes beyond research activities. EMNs enhance stakeholder involvement and enable the European metrology community to create strategic plans which are based on documented stakeholder needs from the outset. Indeed, they are created to build a challenge-driven link to the higher-level key stakeholders of metrology, by pooling European metrology capabilities and providing an agile access to a well-established metrology infrastructure in Europe for stakeholders. **EMNs provide a forum for discussing stakeholder needs** and convert them to metrology challenges which central European Metrology Research Programmes (EMPIR, Metrology Partnership) and EURAMET’s members can pick up to deliver competitive research capabilities. This simplifies the access to stakeholders across borders for small countries and institutes in our community.

EURAMET and its members have strategically analysed the spectrum of EMNs needed and steered their establishment with a focus on the EU priority areas and objectives as expressed in the clusters of Horizon Europe and in EU regulation. The scopes of the EMNs are defined around fundamental challenges (including those defined in the UN SDGs) related to EUs twin transition (green & digital) health, environment, comprehensive European regulation or industrial challenges with clearly defined stakeholder communities. They are established by a subset of EURAMET members and associates signing a Memorandum of Understanding defining the scope and operation of the EMN. Further, the successful development of EMNs is part of the key objectives of the Metrology Partnership.

EMNs provide a central contact point for stakeholders where the results of past projects are brought together, presented as a whole and can be joined together to provide coherent solutions to specific stakeholder needs. Examples show that EMNs place their members in a better position to co-create strategies with their stakeholders in order to include what metrology can offer to those potential end-users.
EMNs support the call processes by facilitating stakeholder-driven project proposals and they form a framework, which creates fit for purpose metrology research capabilities. Further, by collaborating in an EMN its members and partners are better able to spot suitable funding streams inside the metrology community and beyond.
The networks are at different levels of maturity, and while some are already providing these benefits, others are still in the process of shaping successful, long-term networking structures. This is a challenging venture and the successful developments of single EMNs need to be transferred to the remaining and upcoming EMNs in the following years.

Abbreviations, terms, and acronyms

GLOSSARY	
BIPM	International Bureau of Weights and Measures
DI	Designated Institute
DIT	Digital Transformation
EMN	European Metrology Network
EMPIR	European Metrology Programme for Innovation and Research
GRD	Green Deal
JNP	Joint Network Project(s)
JRP	Joint Research Project(s)
MoU	Memorandum of Understanding
NMI	National Metrology Institute
NRM	Pre- and Co-Normative
PRT	Potential Research Topic
RoP	Rules of Procedure
RPT	Research Potential
SA	Strategic Agenda
SRIA	Strategic Research and Innovation Agenda
SRA	Strategic Research Agenda
SRT	Selected Research Topic
TC	Technical Committee
WMO	World Meteorological Organization

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1 EMN landscape 2017 - 2024

1.1 Context

Metrology underpins nearly all aspects of modern life. Traditionally, systems for measurement science and measurement standards were the domain of National Metrology Institutes (NMIs), who have (in many countries with complementary support from additional Designated Institutes (DIs)) primarily served national needs and national stakeholders. In recent decades the complexity and scale of requirements for quality-assured measurements in industry, and those associated with grand societal challenges, has grown and the traditional, fragmented system hindered an effective response. EURAMET's approach was to create a more collaborative European Metrology Research system with critical mass and active engagement at national, European and worldwide level. But the interests for collaboration and coordination go well beyond specific research programmes.

EURAMET has enhanced the joint European R&D metrology resources to support metrology applications and industrial innovation, through the EMPIR-programme and European Partnership on Metrology. There are important steps being taken now to develop a fit-for-purpose and truly coordinated metrology infrastructure in Europe with appropriate use of joint infrastructures and coordinated services.

This report outlines actions EURAMET has taken to improve coordination between its Members and enhance impact activities for metrology in Europe and beyond. These steps represent the first stage of Europe's journey towards its integrated metrology landscape goal. This structural implementation lies within the responsibility of EURAMET and its Delegates to the EURAMET General Assembly.

1.1.1 Motivation and need for EMNs

Models that demonstrate networking and collaboration amongst European NMI/DIs include:

- The Mutual Recognition Arrangements (CIPM-MRA) system (running for more than 24 years and enabling international peer validation of calibration and measurement capabilities)
- The EURAMET Technical Committees (one of the core EURAMET activities, essentially special interest groups)
- EMRP, EMPIR and the Metrology Partnership (the joint European research programmes).

The objectives of the research programmes already include the development of a coordinated/integrated metrology research landscape. Whilst the research projects themselves demonstrate a high level of cooperation and coordination and enable the uptake of new topics, in many cases they are not exploited for the establishment of sustainable, coordinated infrastructures or services.
There is a widely held view within the NMI and DI community that there are many underexploited opportunities for more coordination. Metrology, particularly related to establishing the SI and providing traceability, is global by nature. To improve coherence among member states, to support fundamental European interest as explicitly expressed in EU regulation and to take the lead at an international level, a coordinated European approach in the establishment of the metrology infrastructure is needed. To cope with the related scientific and technological challenges, a collaborative metrology research effort at the European level is essential to maintain and develop an internationally competitive edge. Metrology was traditionally needed to ensure safe and reliable trade and global consistency. However, the role of metrology is broadening, and the metrology community is looking for more collaboration and coordination in application areas which require cross-disciplinary efforts. The EMNs essentially support this coordination. The EMNs have close links with the relevant European level stakeholders and provide a key consultation route to develop their

strategic agendas & strategic research agendas, feed into the overall EURAMET strategy and thereby influence the Strategic Research and Innovation Agenda of the Metrology Partnership and the subsequent work plans. The European Commission supports the development of EMNs by directly helping their engagement of stakeholders, e.g. other EU partnerships, EU missions, etc., funding JNPs and EURAMET secretariat staff and by including the EMNs in the Article 6 (ii) of the Metrology Decision.[1]

The EMNs provide an additional route to impact from the Joint Research Projects (JRPs). Traditional research projects only exist for three years. The consortium comes together to propose the project and deliver it. Once the contract ends, the consortium disbands. The exploitation of the results is left to the individual participants. There may be a series of research projects, but no follow-on project inherits the obligation to curate and promote the results of previous projects. EMNs provide a central contact point for stakeholders where the results of past projects are brought together, presented as a whole and can be joined together to provide coherent solutions to specific stakeholder needs.

The EMNs coordinate the research work in their area that members agree to do, together with their national funding. By discussing national priorities with each other and developing proposals for joint projects to a range of funding sources they will capture new funding sources and develop a way of working that builds metrology infrastructure at the European level. Overall, they seek to ensure effective and efficient use of resources, doing research jointly in a way that develops a coherent and consistent approach across Europe while ensuring that services to customers can be delivered locally and following national priorities.

1.1.2 Concept and overall objectives of EMNs

The vision of EURAMET and its members is to ensure Europe has a world-leading metrology capability, based on high-quality scientific research and an effective and inclusive infrastructure, that meets the rapidly advancing needs of end users. EURAMET's EMNs help to realise this aim. They:

- cover an area of major strategic importance, with a European dimension;
- consist of a core network of NMIs/DIs with a clear commitment to contribute to the network;
- establish close links to a wider stakeholder community;
- strive for scientific excellence;
- plan their activities based on a strategic agenda;
- establish a knowledge, technology transfer and promotion plan;
- plan for sustainable structures;
- develop and coordinate common infrastructure if needed.

EMNs cover fields which are of key importance at the European level, are too wide for individual players or for a single TC, are cross-disciplinary and need capabilities and/or tools beyond the ones which are already established at NMIs and DIs (see 1.2). EMNs are established by a subset of EURAMET members which share a common strategic agenda for the field addressed by the network and commit themselves to contribute to the network within a given framework. The EMNs also include non-research actions such as the establishment of metrological services in addition to the research addressing the development of metrological capabilities. Through their knowledge about accurate stakeholder needs, EMNs can assess the needs for a service and support for an efficient use of resources. A strong leveraging effect is expected, such as through thematically related R&D actions funded by member states and European initiatives and capital investments by member states in service capabilities.

In summary, the EMNs develop joint infrastructures that:

- underpin genuine EU interests, such as those expressed in EU regulation and standardisation, and contribute to coherence among member states in research and infrastructural capabilities

[1] Decision (EU) 2021/2084 of the European Parliament and of the Council of 24 November 2021 on the participation of the Union in the European Partnership on Metrology jointly undertaken by several Member States: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32021D2084

- make JRP results sustainable
- ensure capital investments by the member states – if possible supplemented by structural funds – are coordinated, initiated and leveraged by EMPIR and the Metrology Partnership
- are relevant to collate and understand the needs of stakeholders.

All EMNs found between 2019 – 2024 focus on three key tasks:

Science:
EMNs strive for leadership and scientific excellence in a challenging and competitive field at the forefront of developments. Their aim is to increase visibility and acceptance in the research community active in the field, to reach critical mass and make use of synergies of the partners involved. They provide a single point of reference for information, collaboration and participation regarding metrology research in the covered field. Thanks to new capabilities, scientific excellence and networking, the EMN members will have an increased chance to succeed in project applications in the wider research landscape.

Societal challenges:
EMNs deliver the metrology support for societal challenges. To increase the impact, they provide a single point of contact for metrology questions in their field. They establish the relevant stakeholder network, identify the affected policy areas and mechanisms to contribute. Through research, knowledge transfer and services, the networks underpin regulation and standardisation. Typically, a combination of joint research and the establishment of comprehensive, longer-term infrastructures is needed to respond appropriately.

Infrastructure and services:
To raise the overall level of metrology capability and quality of service, a coordinated approach in the development of the metrology infrastructure is necessary. This is especially true in new fields such as life sciences, or novel materials. The focus of EMNs is also to facilitate complementary development, sharing of resources, avoiding unnecessary duplication, establishing joint facilities and supporting knowledge transfer.

1.1.3 Initiation of the first EMNs in 2018

In 2017, EURAMET´s Board of Directors proposed to implement effective and inclusive network-based infrastructures to meet the rapidly advancing needs of end users, so called “European Metrology Networks” (EMNs).
In 2019, the first six EMNs have been approved by EURAMET’s Delegates. Further networks followed in 2020- 2024. Today we consider the landscape of coordination between European NMIs and DIs as close to final (See 1.2). There are still potential initiatives which consider the proposal of further EMNs (see 1.3). EMNs are interwoven in EURAMETs’ 2030 strategy as an instrument to engage stakeholders for mutual benefit, supporting joint research and development, collaborating with European policymakers and governments and delivering high value to EURAMETs members and associates.

1.1.4 EMNs for the Metrology Partnership

EMNs represent a major element in the Partnership to enhance stakeholder interaction and strategic planning. They play a key role for stakeholder interaction. Indeed, they were created to build a challenge-driven link to the (higher-level) key stakeholders. Some EMNs will also be able to input to the Horizon Europe missions. The scopes of the EMNs are defined around fundamental challenges (including those defined in the UN SDGs) related to health, energy, environment, comprehensive European regulation or industrial challenges with clearly defined stakeholder communities. In the past, stakeholder interaction was often based on individuals. Through the EMNs the metrology community will interact with stakeholders more systematically and comprehensively.

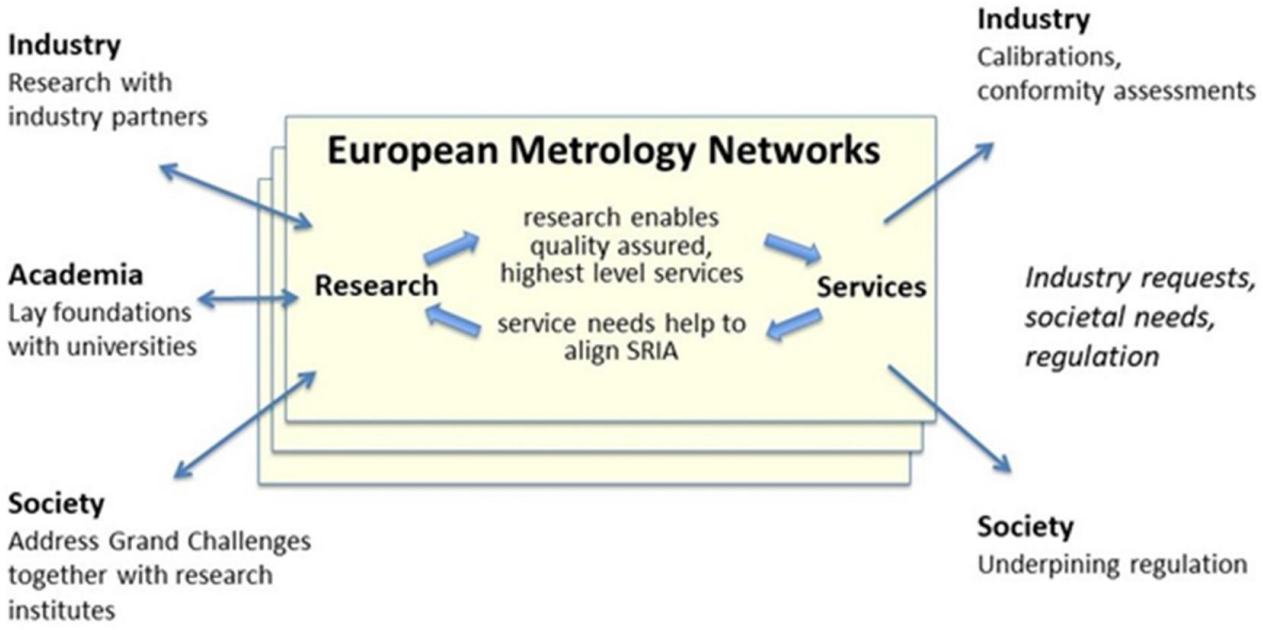

Figure 1: EMNs enable alignment with the most relevant stakeholder communities and challenges in their fields

The EMNs bring manifold benefits with respect to stakeholder interaction:

- By pooling European metrology capabilities EMNs provide access to a broader stakeholder community and higher-level stakeholder organisations like European or international associations. Single institutes or individuals cannot achieve this.
- They provide a forum for discussing stakeholder needs and converting that into proposals for the Metrology Partnerships Strategic Research and Innovation Agenda and other actions (including the development of regulation).
- They facilitate better stakeholder access across borders and for small countries/institutes.

1.2 Landscape of approved EMNs

EURAMET has strategically analysed the spectrum of EMNs needed and steered their establishment with a focus on the EU priority areas and objectives as expressed in the clusters of Horizon Europe and in EU regulation. The EU regulation was analysed comprehensively and 70+ regulations were identified as relevant for metrology. In addition to the “classical” Measurement Instruments Directive (MID) and Non-Automatic Weighing Instruments Directive (NAWID), the In-vitro-Diagnostics Regulation, Medical Devices Regulation, and EURATOM Basic Safety Standards Directive were identified as priorities.

EMNs make an increasing contribution to the work programme of the Partnership and external work programmes (see 2.1.2) based on the inputs they receive from their stakeholder interactions as they use their Strategic Research Agendas. The following twelve EMNs were approved between 2018 and 2024.

In the following short descriptions about the EMN scopes can be found.

Advanced Manufacturing (AdvanceManu)

Members:

- NMIs/DIs in 11 MS (BE, CZ, DK, FI, FR, DE, IT, NL, PL, PT, SE)
- NMIs/DIs in 2 associated countries (UK, CH)
- NMIs/DIs in 1 candidate country (TR)

Selected Liaisons:

Stakeholder Council:

- 8 x industry representatives (6 large enterprises, 1 x industry representative body)
- 1x University representative
- 2 x Partnerships (KDT/Chips & Made in EU)

EMN Partner:

- 1x European research organisation

Description:

Advanced Manufacturing has been identified by the European Commission (EC) as one of six Key Enabling Technologies (KETs) with applications in multiple industries. The KETs are a group of six technologies: micro and nano-electronics, nanotechnology, industrial biotechnology, advanced materials, photonics, and advanced manufacturing technologies. Countries and regions that fully exploit KETs will be at the forefront of creating advanced and sustainable economies. The concept Manufacturing for 2030 states that "Manufacturing, with its approximately 20 industrial sectors, is the backbone of the European economy." and that "Manufacturing 2030 reflects a time scale in which a fundamental change – initiated by research activities and technical innovations – can be reached." The aim of the EMN on advanced manufacturing is to provide a single focus point for metrology across the advanced Manufacturing industrial landscape. To act as the coordinator for the dissemination of key results and developments to the stakeholders, such that the findings can be leveraged into improved industrial processes.

Profile:

- Established in 2020
- SRA draft published for consultations here
- Interim website available here (re-design is in progress)
- Co-organised an open consultation on metrology for Semiconductor Technologies to inform SRA
- Its members are involved in 2 EMP projects
- Initiated collaboration with Chips JU and the planned Partnership on Advanced Materials

Clean Energy (Clean Energy)

Members:

- NMIs/DIs in 11 MS (DK, FR, FI, DE, IT, LT, NL, PL, PT, RO, SP)
- NMIs/DIs in 2 associated countries (CH, UK)

Selected liaisons:

Stakeholder council design being considered with membership from European Associations, Research Centres, Standardization Bodies, Universities and Industry.

Description:

The EMN for Clean Energy focuses on research related to the generation, storage, conversion, and utilisation of renewable energy sources. In the early stages, the EMN will concentrate on the metrology related to the generation and utilisation of solar and wind energy, efficiency of use, and photovoltaic, wind power and temporary energy storage with electrical batteries. The EMN for Clean Energy complements the work of the EMNs for Smart Electricity Grids and Energy Gases. The EMN for Clean Energy will initially focus on developing the metrological framework for generating and utilising renewable energy sources, as well as support future European Green Deal Calls. Cross cutting topics such as Life Cycle Analysis and Energy Efficiency will be tackled.

Profile:

- Established 2024
- Interim website available here (re-design is in progress)
- Workshop in cross cutting topics (prior to launch)
- Coordination support for Green Deal call 2024 and PRTs – 10 submitted to 2024 call
- Draft SRA prepared and consultation starting
- Coordination of a EURAMET Regulation event on Energy, scheduled for June 24, in cooperation with the EMNs for Energy Gases and Smart Electricity Grids

Climate and Ocean Observation (COO)

Members:

- NMIs/DIs in 13 MS (BE, DK, EE, FI, FR, DE, GR, IT, NL, PL, PT, ES)
- NMIs/DIs in 3 associated countries (UK, CH, NO)
- NMIs/DIs in 2 candidate countries (TR, BiH)

Selected Liaisons:

Organising Committee of the Climate Action workshop:

- 2 x institutional liaisons with global research organisations (WMO, BIPM)

Standing Invitees to the EMN General Meeting:

- 3 x representatives from (pan-) global/European research organisations (JRC, ACTRIS, GCOS)

EMN members are active in WMO task teams and in the Committee on Earth Observation Satellites (CEOS)

Description:

Understanding the magnitude, timescale and impact of climate change is one of the most critical issues of our time. The Global Climate Observing System (part of the World Meteorological Organization; WMO/GCOS) has defined a set of Essential Climate Variables (ECVs) that are "physical, chemical or biological variables or groups of variables that critically contribute to the characterisation of the Earth's climate." Long-term data records of ECVs (Climate Data Records) provide the empirical evidence needed to understand and predict climate change, to assess risks and to attribute events to underlying causes. They also underpin climate services, such as the European Copernicus Climate Service and support other societal applications and more general environmental and Earth-system monitoring. Additionally, the broader observational needs for Essential Ocean Variables (EOVs) to support the environmental protection and sustainable economic use of the seas are covered by the ocean section of the EMN.

Metrology enables robust, interoperable and stable observational records and aids users in judging the fitness-for-purpose of such records. The primary aim of this EMN is to understand metrology challenges related to the ECVs and EOVs, establish advice and coordinated services tailored to meet the needs of European (and global) climate and ocean observation related stakeholders. The EMN provides an effective and efficient coordination of the NMI/DI activities to develop a harmonized approach to the stakeholder needs.

Profile:

- Established in 2019
- SRA & Stakeholder Needs Report published here on its re-designed website.
- Co-organised Metrology for Climate Action 2022 workshop with BIPM and WMO
- Members supported the development of the GCOS implementation plan, now including strong role for metrology.
- Contributed to the design of Green Deal Calls 2021 and 2024, Fundamental 2022, IEM 2022 & Normative 2022
- Members are involved in 8 MP projects and 1 H2020 Project ("MINKE") as well as in related activities for the Copernicus Services through ESA and EUMETSAT.
- Currently preparing a follow-up Climate Action workshop with WMO & BIPM 2024

Energy Gases (Energy Gases)

Members:

- NMIs/DIs in 11 MS (CZ, DK, FI, FR, DE, HU, IT, NL, PL, PT, ES)
- NMIs/DIs in 3 associated countries (UK, NO)
- NMIs/DIs in 2 candidate countries (TR, BiH)

Selected liaisons:

Stakeholder Council:

- 4 representatives from industry representing bodies (GERG, HE, HER, Marcogaz)

MoU based liaisons:

- 3 x representatives from institutions behind the Clean Hydrogen joint undertaking (Hydrogen Europe and Hydrogen Europe Research, GERG)

Description:
The main drivers at the European level that push towards energy diversification and towards use of more sustainable energy gas sources, are the European Directives on renewable energy (2009/28/EC), the limitation of gas supplies and the ratification of the Paris agreement (COP21). Regarding the high importance of the transport and distribution of energy gases on a pan-European scale, the European Commission issued EU Regulation 703/2015, setting requirements on harmonized approaches for the measurement of energy traded across Europe.

EMN Energy Gases aims at providing support to the societal needs related to the energy transition towards renewable gaseous fuels. It facilitates addressing metrological issues related to a sustainable and transparent supply of energy from conventional (natural gas, liquefied NG) and renewable energy sources such as biogas/biomethane and clean hydrogen.

Profile:

- Established in 2019
- 2nd version of the SRA is published here on its re-designed website
- Co-creates EU Clean Hydrogen Alliance Roadmap for standardisation
- Contributed to the design of Green Deal Calls 2021 and 2024, IEM 2022 & Normative 2021& 2022
- Members are involved in 5 MP projects and 1 x project under Clean Hydrogen JU
- Revision of SRA & organisation of joint brokerage event with all energy related EMNs for GRD 2024.
- Joint brainstorming for research projects with Hydrogen Europe and Hydrogen Europe research in 2024

Mathematics and Statistics (Mathmet)

Members:

- NMIs/DIs in 10 MS (BE, DK, FR, DE x 2, IT, NL, PL, PT, ES, SE)
- NMIs/DIs in 2 associated countries (UK x 2 , CH)
- NMIs/DIs in 1 candidate country (BiH)

Partners:

- IMS SAS (SK)

Selected liaisons:

Stakeholder Council:

- 1 x representative from an industry representing body (ENBIS)
- 1 x representative from industry (Infineon)
- 1 x representative from an accreditation body (UKAS)

- 5 x research representing bodies (WELMEC, EuroLab, EuraChem, TNO, CFM)
- 1 x representative from an EMN (EMN COO)

Description:
Confidence in measurement increasingly relies on trusted algorithms and software. New measurement capability relies on new analytical and computational approaches. The development, validation, dissemination and delivery of new computational science is well suited to collaborative approaches but requires an organizational structure — a network — to make it happen.
Mathmet is a network for mathematics and statistics in metrology. It is established to address cross-disciplinary needs for collaborative research on mathematical and statistical methods for all metrology fields, since increasingly metrology requires expert knowledge of, and support from, the areas of applied mathematics, statistics, numerical computation and state-of-the-art computational tools.

Profile:
- Established in 2019
- SRA published here on its re-designed website.
- Contributed to Normative 2021 and 2024, Digital Transformation 2022 and 2024, Health 2022, IEM 2022 & RPT 2022, GRD 2024.
- Members involved in 18 MP projects, 1 H2020 Project (“MINKE”) and 1 HORIZON Project (“DigiCell"), see more details further down.
- Development of quality assurance tools (for software, data and guidelines) and corresponding e-learning course
- Development of measurement uncertainty training material

Joint Research Projects with a strong involvement of MATHMET members (from 2018 – 2024)

- CASoft - Software to maximize end user uptake of conformity assessment with measurement uncertainty (2018-2021) - **SIP**

- EMUE - Advancing measurement uncertainty - comprehensive examples for key international standards (2018-2021) **- NRM**

- MET4FoF - Metrology for the Factory of the Future (2018-2021) - **IND**

- SmartCom - Communication and validation of smart data in IoT-networks (2018-2021) - **IND**

- MIMAS: Procedures allowing medical implant manufacturers to demonstrate compliance with MRI safety regulations (2018-2021) - **IND**

- RaCHy - Radiotherapy coupled with hyperthermia - adapting the biological equivalent dose concept (2019-2022) - **HEALTH**

- QUIERO - Quantitative MR-based imaging of physical biomarkers (2019-2022) - **HEALTH**

- MedalCare - Metrology of automated data analysis for cardiac arrhythmia management (2019-2022) - **HEALTH**

- TracPETperf - Software for evaluating PET cardiac perfusion imaging uncertainties for more accurate diagnosis (2020-2022) - **SIP**

- ATMOC - Traceable metrology of soft X-ray to IR optical constants and nanofilms for advanced manufacturing (2021-2024) - **IND**

- iMET-MRI - Improved metrology for quantitative MRI (2021-2024) - **NRM**

- Met4H2 - Metrology for the hydrogen supply chain (2022-2025) - **GRD**

- STASIS - Standardisation for safe implant scanning in MRI (2022-2025) - **NRM**

- MAIBAI - Developing a metrological framework for assessment of image-based Artificial Intelligence systems for disease detection (2023-2026) - **HEALTH**

- A4IM - Affordable low-field MRI reference system (2023-2026) - **HEALTH**

- QUMPHY - Uncertainty quantification for machine learning models applied to photoplethysmography signals (2023-2026) - **HEALTH**

- FunSNM - Fundamental principles of sensor network metrology (2023-2026) - **DIT**

- ViDiT - Trustworthy virtual experiments and digital twins (2023-2026) - **DIT**

Pollution Monitoring (PolMo)

Members:

- NMIs/DIs in 11 MS (BE, CZ, HR, FI, FR, DE, GR, NL, PT, SI, ES)
- NMIs/DIs in 3 associated countries (UK, NO, CH)
- NMIs/DIs in 3 candidate country (BIH, HR, TR)

Selected liaisons:

Stakeholders council members (actual and foreseen):

- 1 x EU Directorate (DG ENV)
- 1 x representative from IAEA
- 3 x European representing bodies (AQUILA; EuroLab; EuraChem)
- 2 x EU partnership on Chemical Risk Assessment (PARC), Water4all
- 2 x representatives from national reference laboratories (AQUAREF; LCSQA)
- 6 x academic research institutes & universities (Czech Technical University; Vytautas Magnus University LT; University of Oulu FI, University of Wageningen NL)
- 4 industries (Air liquid, Nuvias, Sensmet, Optoseven)
- 3 national associations of testing laboratories (VUP DE), national association of accredited laboratories (RELACRE PT), association of environmental protection companies (GR)
- 4 x National policy makers & Ministries (EA UK; DEFFRA UK; Ministry of Environment and Energy GR;)
- 1 national standardisation body (NEN)

Description:

Europe has set up an ambitious environmental program through a wide set of restrictive regulations and strategic plans: the action plan towards zero pollution for Air, Water and Soil, the EU chemical strategy towards a non-toxic environment, the EU Soil Strategy for 2030, the Farm to Fork Strategy, the Biodiversity Strategy etc.
Environmental pollution monitoring is mainly **driven by regulation**. Several dozen main directives dealing with chemicals and radionuclides pollutants monitoring exist (*e.g.* Air Quality Directive, Marine Strategy Framework Directive, Water Framework Directive, Groundwater Directive, Drinking Water Directive, Urban Waste Water Treatment Directive, Waste Framework Directive, Industrial Emissions Directive, IPPC Directive, Sewage Sludge Directive, Nitrate Directive, Directive Safety standards to ionizing radiation, etc.). Some of these directives have been undergoing a revision process in order to harmonise methodologies, increase consistency between them, and set new requirements in line with the Green Deal Objectives.

The aim of the EMN on pollution monitoring is to be the metrological reference for a sustainable infrastructure dedicated to support European and international regulation and directives targeting pollution monitoring. EMN PolMo, as a unique focal point in pollution monitoring landscape, seeks to establish a regular and sustainable dialogue between NMIs/DIs and stakeholders. The overarching goal is to become a centre of excellence and be a reference for advanced metrology capabilities in pollution monitoring for end-users. Therefore, the EMN ambitions are to define the place and role of metrology in the monitoring measurement chain and to demonstrate its added value and benefits, notably to the European Commission.

Profile:

- Established in 2022

- Identification of metrology challenges in 25 regulations & key directives (e.g. Water – DWD, FWD, UWWD, Air-AAQD, Soil -SFD)
- Common Stakeholder needs report & NMI/DI capabilities survey available in 2023.
- 1st SRA draft prepared in 2024.
- Contributed to the design of
- Green Deal Calls 2021 & 2024, IEM 2022, Normative 2022 2023 & 2024
- Members are involved in 5 MP projects

Quantum Technologies (Quantum)

Members:

- NMIs/DIs in 11 MS (CZ, DK, EE, FI, FR, DE, IT, PL, PT, SE)
- NMIs/DIs in 3 associated countries (UK, NO, CH)
- NMIs/DIs in 1 candidate country (TR)

Selected liaisons:

- 4 x high level representatives from the Quantum flagship
- 1 x representative from standardisation development organisation (ETSI ISG-QKD)
- 3 x representative from industry (Toshiba Europe Ltd., Thales Research & Technology, TNO)
- 3 x representatives from research organisations (Jülich, Univ. Geneva, innovate UK)

Description:

Quantum technologies and devices have started to have impact in industry, and several large companies have started to develop quantum devices or started to integrate them in their products. It will be important for industry to have a contact/reference point for their quantum-related metrological and technological requirements. Especially at the beginning of the development of new technologies and products, standardisation is one of the key elements for the commercial success of any new technology. The development of globally accepted standards and an anticipatory approach would facilitate the growth of the Quantum Technologies (QT) market worldwide. National metrology institutes (NMIs) expect in the immediate future large demands from industry, standardisation bodies and governments, which single NMIs will not be able to respond adequately. For this reason, the European Metrology Networks on Quantum Technologies (EMN-Q) has been established. An important focus of this EMN is to be the focal point of contact to the European QT-Flagship and its successor initiatives (FPA schemes for QT, QuiC, etc.), and to foster the metrology engagement with standardisation also CEN CENELEC.

Profile:

- Established in 2020
- Draft SRA published here on its re-designed website.
- Highly engaged with standardisation organisations – e.g., participation in development of Standardisation roadmap for quantum technologies
- Participating in Roadmaping for the FPA on quantum testing and Participation in the FPA Qu-Test.
- Contributed to the design of the IEM call 2022
- Members are involved in 2 MP projects

Radiation Protection (EMN RP)

Members:

- NMIs/DIs in 14 MS (BE, CZ, HR, FI, FR, DE, IT, PL, PT, RO, MD, SI, SK, SE)
- NMIs/DIs in 1 associated country (UK)
- NMIs/DIs in 2 candidate countries (SRB, BIH)

Selected liaisons:

MoU based liaisons:

- 1 x International Commission (ICRP)

Stakeholder Council:

- 4 high level representatives (ICRP, BIPM, IAEA, WHO)

Standing Invitees to the EMN General Meeting:

- 1 x representatives from global/European research organisations (IAEA, BIPM, WHO)

1 x EURATOM partnership “Pianoforte”

EMN Partners:

- 3 x quality assurance laboratory (BfS, CLOR, DHS)
- 1 x representative from industry (Eckert & Ziegler Nuclitec GmbH)
- 1 x academia (HSMA)
- 1x European Association

Description:

Equal quality of metrology services and activities in radiation protection for all Europeans can only be achieved if each member state applies equal metrological based quality assessment (QA) for all radiation protection issues. However, the costs to maintain all these facilities in future are excessive. As a logical consequence the work should be divided, smart specialisation should be encouraged, and unique facilities should be shared. With the released measurement capacities new challenges can be addressed according to the stakeholders needs.

In the long history of radiation protection regulation, starting from the EURATOM Treaty in 1957, the feedback process on the legislation turned out to be the most challenging. Various regulations were implemented whose metrological implications were not considered. The implementation was done without asking feedback from the metrology institutes due to missing communication strategies.

The Council Directive 2013/59/EURATOM sets out basic safety standards for protection against the dangers arising from exposure to ionising radiation for workers, the public, and the environment. Compliance with the corresponding legislation has become more complex due to stricter legal dose assessments, exposure limits and activity concentrations as well as new technological developments and emerging complex practices. A European Metrology Network is established to address those issues and form a single point of contact to cover all the metrological needs related to radiation protection and maintain reliable quality assurance.

Profile:

- Established in 2020
- Draft SRA is under preparation (supporting the Council Directives and the Euratom Treaty) and its re-designed website.
- Members are involved in 3 MP projects.
- Contributed to EURATOM Research and Training Programme
- Contributed to ICRP Strategy: ICRP Vancouver call for action

Safe and Sustainable Food (EMN Food)

Members:

- NMIs/DIs in 6 MS (FR, DE, GR, IT, PL, SI,)
- NMIs/DIs in 2 associated countries (UK, CH)
- NMIs/DIs in 2 candidate country (TR, BiH)

Selected liaisons:

Informal liaisons with:

- Joint Research Centre (JRC)
- METROFOOD
- Alert System for Food and Feed (RASFF)
- European Food Safety Authority (EFSA)
- EU Food Fraud Network

Description:

Safe and high-quality food is the fundamental prerequisite for human health. Food production has evolved considerably during the past decades in many aspects. Relevant changes are being observed in the society: healthier habits and life styles produce emerging requests for food safety assurance, food quality, and healthy diets in order to prevent human diseases. On the other hand, feeding disorders and diseases arising from incorrect diets and/or low quality foods assumptions are also increasing. Diet diseases cause yearly death of about two millions of people at global level, according to the World Health Organization (WHO).
The European Metrology Network on Safe and Sustainable Food (EMN-SSF) aims to develop a network among European National Metrology Institutes (NMIs), Designated institutes (DIs), standardization bodies, European Reference Laboratories (EURLs), National Reference Laboratories (NRLs) and the regulation bodies in order to improve the EU food system along the food chain and to support the efforts in ensuring traceability to SI units of all food related measurements. The implementation of a strategy to support food safety and sustainability, through an interdisciplinary and innovative cooperation involving the metrology community, will help to increase confidence among the consumers.

Profile:

- Established in 2022
- SRA under preparation, 1st draft in 2023.
- Members are involved in 1 MP project.
- Interim website available here

Smart Electricity Grids (SEG)

Members:

- NMIs/DIs in 13 MS (CZ, DK, EE, FI, FR, DE, GR, IT, NL, PL, ES, SI, SE)
- NMIs/DIs in 3 associated countries (UK, NO, CH)
- NMIs/DIs in 2 candidate countries (TR, BiH)

Selected liaisons:

Invites from organised open consultations:

- 1 x grid operator
- 2 x University representative

EMN Partners:

- 2 x institutional representations research (CIRCE, SUN)

Description:
Building a low-carbon, climate resilient future will require secure, clean and efficient energy. The transition towards a more sustainable energy supply has a profound effect on electricity grids – the backbone of modern society. The EMN on Smart Electricity Grids (SEG) aims to provide a single point of contact for stakeholders and stakeholder organisations, to realise a coherent NMI response to their measurement challenges, and to maximise the impact of R&D activities in the field. Especially

the interaction with stakeholder organisations and policy makers is expected to significantly profit from the EMN, which is the first recognizable entity that represents the metrology community in discussions on measurement issues related to the future of the electric grid and the energy transition Europewide.

Profile:

- Established in 2019
- Draft SRA published here on its re-designed website.
- Contributed to Normative 2021/2022, IEM 2022 & RPT 2022, Green Deal 2021/2024.
- Members involved in 6 MP running projects
- Excellence Training courses 9 to 25 May 2022; The event was jointly organised by Politecnico di Torino and INRiM

Smart Specialisation in Northern Europe (Smart North)

Members:

- NMIs/DIs in 7 MS (DK, SE, NO, FI, LT, LV, EE)
- NMIs/DIs in 1 associated country (NO)

Selected liaisons:

Description:

The network for Smart Specialisation in Northern Europe aims to strengthen the metrology infrastructure in the region through increased collaboration. By sharing national strategies to form a common strategy for Northern Europe, as well sharing facilities and exploiting research strengths of each participating institute, the network works to improve the quality of available metrological services for the broad spectrum of stakeholders.

Through this new network, EURAMET hopes to promote more efficient metrology services – including R&D, calibrations, inter-comparisons and training – that can better support successful business in industry and a sustainable society for Northern Europe.

Profile:

- Established in 2019
- Strategic Agenda here

Traceability in Laboratory Medicine (TraceLabMed)

Members:

- NMIs/DIs in 7 MS (FR, DE, PL, GR, IT, NL, SI)
- NMIs/DIs in 2 associated countries (UK, CH)
- NMIs/DIs in 1 candidate country (TR)
- JRC

Selected liaisons:

EMN Partners:

- 3 x representative from quality assurance organisations (Instand e.V., SPMD-RfB, WEQAS, ReF4U)
- 1 x representative from university (UniGent)

Informal liaisons:

- IFCC
- ICHCLR
- EQALM

Description:
Laboratory testing is at the heart of modern health care: an estimated 70% of medical decisions depend on in vitro diagnostics (IVDs). Benefits for patients, healthcare providers and the IVD industry are improved when robust and metrologically traceable IVDs are used to provide accurate test results irrespective of the laboratory, the IVD provider, or the instrumentation used for testing.

Metrological traceability of IVDs enhances validity of diagnosis, supports further treatment, and lowers the financial burden on healthcare systems by avoiding nonessential testing. Traceability is also an important aspect of regulatory schemes: IVD manufacturers need to comply with legal requirements for traceability to gain and maintain market access.

These requirements are defined in the regulation on in vitro diagnostic medical devices EU 2017/746 (IVDR) and include metrological traceability of calibrator and control material values along with testing of high-risk IVDs by EU reference laboratories. The EMN on Traceability in Laboratory Medicine (TraceLabMed) was established to build a coordinated metrology-based quality infrastructure in an area that affects almost every European citizen.

Profile:

- Established in 2019
- Re-designed website here.
- An SRA is under elaboration and complementary documents are under preparation:
- A strategy for a joint European response to the IVDR, and
- A joint strategy for the prioritisation of clinical measurands and R&D needs
- Members involved in 1 MP Project

1.3 Considered EMNs

- Medical use of Ionising Radiation (JNP start date: 01 June 2020; duration: 48 months)
- Medical Devices with Measuring Function (No JNP)
- Autonomous Transport (formerly: Geodesy, Navigating, Timing and Positioning) (No JNP)

2 EMN achievements

The requirements for investment in the future of the European measurement infrastructure will always far outstrip the resources available from governments to fund it. It is important that EURAMET and European NMIs and DIs understand and prioritise investment needs in the European measurement infrastructure to address the present and future priorities of economy, government and society. EMNs have been established to strengthen existing and establish new relationships in priority application areas. In addition, there is an example of a first network focusing on smart specialisation in a specific region – things our members can achieve in cooperation with their close neighbours. Through EMNs EURAMET fosters stakeholder involvement, to better understand existing metrology needs and to anticipate future requirements.

2.1 Joint research capabilities at European and international level

EMNs provide an infrastructure to foster the development of joint research capabilities with excellence comparable to metrology institutes and organisations from the US, Canada or the Asia-Pacific region, especially China. EMNs communicate with industry, academia and politics to analyse stakeholder needs and define metrology challenges that match with the needs. EMNs prioritise those needs in their Strategic Research Agendas (See 2.4.1) at a level relevant to the EMN community and pool national resources towards those jointly defined goals and facilitate the development of research projects. A full list of EMN motivated research projects in the European Metrology Partnership is in Annex F.

Another route to successfully develop joint research capabilities is to influence and inform other strategies. EMNs advocate for metrology in various advisory boards of their stakeholders: at standardisation developing organisations (SDOs), at the governmental level at national ministries (often with the help of the EMN members), industry related associations and European Partnership advisory boards. These activities often lead to the inclusion of metrology capabilities and needs in external strategies, which opens the door for European metrologists to participate in external calls.

Since the establishment of the first networks in 2019, EURAMET's EMNs have striven towards the development of joint research capabilities. The development of research capabilities can be considered as a long endeavor which needs appropriate preparation, like the identification of needs, prioritization and resources.

The activities described below do not claim to show the complete work done by EMNs. It is a collation of highlights which are of a preparatory nature and EURAMET's long-term perspective is that under the framework of the EMNs new and meaningful joint research capabilities will be produced.

2.1.1 EMNs facilitate research projects

Since 2020, EMNs and EURAMET have organised regular brokerage events, to facilitate establishment of consortia proposing research projects. Based on what the EMNs identified as a prioritised metrology challenge and stakeholder need, potential research topics are proposed and discussed. This is done mainly as a preparation for EURAMET-initiated calls (EMPIR and the Metrology Partnership). Responses to external calls have been prepared in this manner as well, e.g. for the Clean Hydrogen Partnership.

The EMNs' role in the project lifetime can be defined as follows: In the Pre-proposal stage, the EMN facilitates the preparation of project proposals and interaction with stakeholders, by organising brainstorming events, facilitating the formulation of research topics and bringing together NMIs/DIs and stakeholders and potential external partners. At the proposal stage the EMN supports the formation of strong consortia. During the lifetime of the project it increases visibility and impact of the project to stakeholders (e.g. via social media, newsletters, the EMN website, organization of events). After the project lifetime the EMN increases the uptake of project results and keeps the community together. This is especially needed to create a lasting impact on regulations or in standardization.

The following section highlights a selection of projects which have been facilitated under the framework of EMNs (a preliminary list of all Partnership projects with reference to EMNs is in Annex F):

2.1.1.1 EMN Climate and Ocean Observation: European climate research priorities for metrology

EURAMET and the EMN for Climate and Ocean Observation (EMN COO) co-organised a workshop on Metrology for Climate Action, which was hosted by the International Bureau of Weights and Measures (BIPM) and the World Meteorological Organization (WMO) as an on-line meeting in the week of 26-30 September 2022, to:

1. [Theme 1] present progress and identify requirements for further development of advanced measurements, standards, reference data, comparisons, and calibrations supporting the physical science basis for and adaptation to climate change, and
2. [Theme 2] identify stakeholders' metrology needs, assess current metrological techniques, analyses, and modelling capabilities, and identify gaps in quantifying greenhouse gas emissions and uptake for effective actions on mitigating climate change and its impacts.

The workshop attracted 1078 registered participants and showcased 203 pre-recorded presentations and posters. Online questions for pre-recorded materials, interactive online poster sessions and specific topic discussion sessions resulted in the identification of 81 issues on key technical challenge areas for metrology and related areas and 126 recommendations. These issues and recommendations are summarised in the workshop report. The workshop connected totally different fields, best practices could be shared and showed that Europe has a world leading role in climate observation research.

The EMN had significant influence ahead of, during, and after the workshop. The Chair of the EMN-COO acted as metrology co-chair of Theme 1 of the workshop; EMN members acted as chair or rapporteur of four of the five theme 1 topics and of one of the four Theme 2 topics. EMN members were active participants, including being part of the expert teams, for all the different topics covered in the meeting. EURAMET acted as an official partner of the workshop.

The workshop built on strategic work performed by EMN COO in recent years. EMN COO stakeholder needs review report (published in December 2020) and the strategic research agenda (published in September 2022) acted as inputs to the workshop, and the stakeholder connections that EMN-COO had formed brought people and communities to the BIPM-WMO workshop that had not previously interacted with the metrological community. The workshop widened EMN COO members' thinking and made them aware of research priorities which were not covered in the EMN's Strategic Research Agenda (SRA) so far. However, there is a significant overlap of recommendations between the EMN's SRA and the workshop recommendation which validates the EMN direction proclaimed in their research agenda.

The workshop was an international event, that involved scientists from six continents. In this way, the priorities identified in the EMN-COO SRA were tested, expanded, and updated with the benefit of broader community participation, helping the EMN-COO to achieve its mission to be the European contribution to a global effort to bring metrology into climate and ocean observation.

Based on its SRA, the workshop's recommendation and research interests and expertise of its members, EMN COO identified specific actions in relation to Theme 1 and Theme 2. This involves recommendations in Atmospheric Physics and Chemistry, Oceans and Hydrology, Earth Energy Balance, Biosphere Monitoring and Cryosphere Monitoring. For the support of cryosphere monitoring EMN COO is in a strong position to lead initial work, which will be needed to scope and prioritise specific research activities and build necessary collaborative connections between communities. There was a strong emphasis on bringing together both the satellite-observation community and the WMO observation community through common approaches and guidelines, especially given the practical complexities of field work in such remote locations. The Metrology Partnership Green Deal Call in 2024 is currently targeted by EMN-COO to realise some of the recommendations mentioned in the workshops' report.

2.1.1.2 EMN AdvManu & EMN Mathmet & TC-IM: Digital Transformation

EURAMET held an open consultation on metrology for digital transformation on 9 November 2021 together with EMN Mathmet and Advanced Manufacturing and a TC working group called "Metrology for Digitalisation". Reliable measurements, producing data for digital systems, continue to be essential for innovation, productivity, and evidence-based decision making. Metrology fosters the development of tools ensuring that measured and processed data in digital systems is accurate and

reliable - underpinning the value of data and data products for the end user. EURAMET invited stakeholders to share their vision on digital transformation and related measurement science needs. These stakeholder needs helped to guide the development of the 2022 call “Metrology support for Digital Transformation” within the proposed European Partnership on Metrology. Speakers included representatives from EFFRA and the Made in Europe Partnership, ADRA and the AI, Data, and Robotics Partnership, the European Open Science Cloud and the International Data Spaces Association. Two projects have been funded based on this event:

- Trustworthy virtual experiments and digital twins; supporting Europe’s digital transformation
- Fundamental principles of sensor network metrology; Ensuring data quality in modern sensor networks

2.1.1.3 EMN Energy Gases: Measurement infrastructure for hydrogen

Figure 2 shows how EMPIR and the Partnership have supported the measurement infrastructure for the transport and distribution of hydrogen. Since 2021, the EMN on Energy Gases has organised annual brokerage events to facilitate research projects. “Decarb”; a project supporting a transition to distributing alternative fuels over existing gas networks, and “MetHyInfra”; aiming to deliver traceable measurements for market confidence and consumer acceptance of hydrogen as an energy source, were developed under the framework of the EMN for Energy Gases in 2020.

In 2022 the EMN Energy Gases jointly with Hydrogen Europe and Hydrogen Europe Research identified research topics for the Integrated European Metrology (IEM) call of the European Partnership on Metrology and the research programme of the Partnership on Clean Hydrogen. Two joint brokerage events were organised at the beginning of 2022 in preparation of the IEM call of the Metrology Partnership. This resulted in three potential research topics (PRTs):

- Flow measurement traceability for hydrogen in gas networks and storage
- Integrated European Metrology Infrastructure for Hydrogen Quality
- Joint Metrology for Hydrogen Material Compatibility and Storage

A fourth identified topic on “hydrogen release” was considered for the 2023 call organised by the Partnership on Clean Hydrogen with one participating member of EMN Energy gases without receiving funding.

In 2023 a project called “THOTH2” was initiated to assess the metrological performance of flow meters at different hydrogen blending rates in Natural Gas (NG). THOTH2 intends to fill the gaps in normative and standards related to procedures and protocols for assessing the performances and determining the limits and tolerances of state of the art measurement instruments. While not being “born” out of a brokerage event organised by EMN Energy Gases, the EMN Chair was representing EURAMET in the Clean Hydrogen Joint Undertaking stakeholder group indicating the strong link with the metrology community related to this project. Two members of EURAMET are participating in this project.

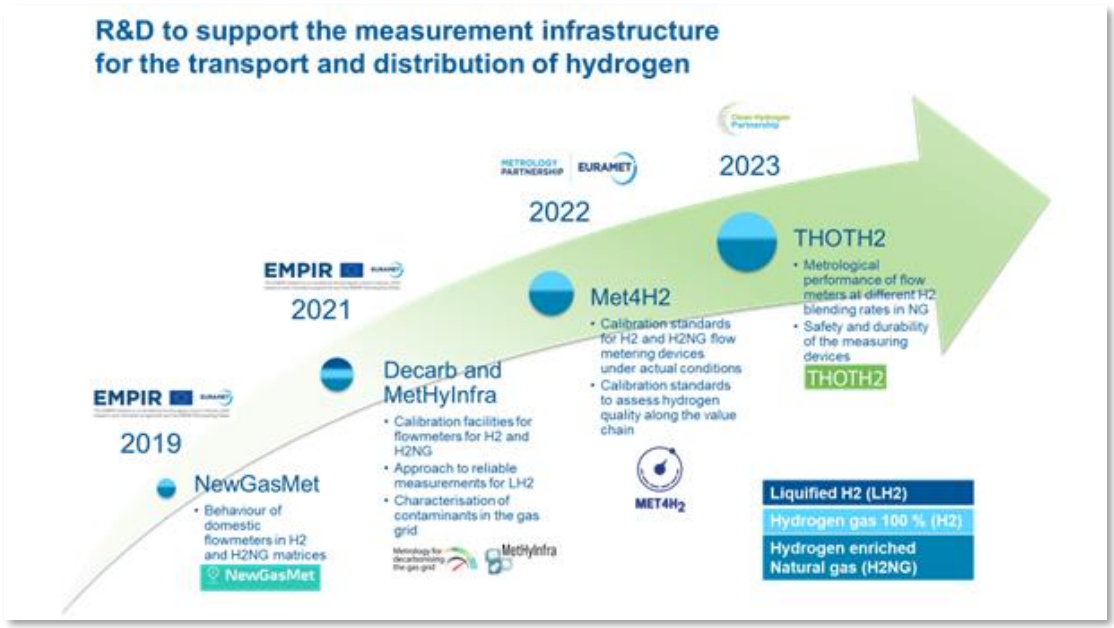

Figure 2: R&D to support the measurement infrastructure for the transport and distribution of hydrogen

2.1.1.4 EMN AdvManu: Metrology for semiconductor technologies

EURAMET and the EMN on Advanced Manufacturing organised an Open Consultation on Metrology for Semiconductor Technologies aimed at gathering metrological needs and challenges identified by major players in the chip ecosystem. The event, held online on 8 July 2022, was attended by over a hundred participants from the semiconductor industry, universities, research centres, the political sphere and calibration laboratories together with numerous EURAMET members and associates. The guest speakers represented R&D institutes and manufacturing companies - ASML, IMEC, ZEISS, STMicroelectronics - alongside the Key Digital Technologies Joint Undertaking, a Public-Private European Partnership for research, development & innovation which funds projects to foster world-class expertise in key enabling technologies that are essential for Europe's competitive leadership. Participants listed multiple examples of where state-of-the-art metrology must be developed and integrated into the production chain, both at the research and development laboratories and within the manufacturing stream:

- optical and e-beam patterning, characterisation and control of lithographic scanner to enable optimal system settings and patterning performance, feature placement metrology, after-etch profilometry
- 3D extension of the integrated circuit technology via wafer-to-wafer and chip-to-chip bonding
- accurate solutions for reflectivity metrology of high NA EUV mirrors coated with multilayers as well as micro-interferometry for roughness characterisation of mirrors over larger surfaces
- future CMOS and beyond CMOS: faster time to data on more complex structures, development of correlative approaches, integration of 2D materials into the process flow
- characterisation of advanced materials & system architectures: optical material parameters, mechanical and thermal properties of components; stress, adhesion and piezoelectrical behaviour
- mathematical tools and concepts that complement the more traditional metrological approaches: smart sampling methods, statistical algorithms and artificial intelligence

These findings informed the SRA of the EMN on Advanced Manufacturing and potential research topics for the Metrology Partnership and the Key Digital Technologies Joint Undertaking.

2.1.1.5 EMN Mathmet: Machine learning and artificial intelligence

On 3 December 2022, EMN Mathmet held a brainstorming workshop for the 2022 Metrology Partnership Health and IEM Call; with an emphasis on projects regarding digital health and artificial intelligence application in medicine that generated 4 PRTs. For the same Health call several brainstorming workshops were organised by the EMN TraceLabMed resulting in nine PRTs being proposed. Additionally, the EMN could introduce new stakeholders to project consortia. The following topics have been selected as joint research projects under the health call 2022:

- Uncertainty quantification for machine learning models applied to photoplethysmography signals; to improve European low-cost diagnostic and disease monitoring methodologies
- Developing a metrological framework for assessment of image-based Artificial Intelligence systems for disease detection ; Using imaged-based AI software for improved cancer diagnostics.

2.1.1.6 EMN Climate and Ocean Observation: EMNs support H2020 Project MINKE

EMN members are establishing a collaborative strategy through the H2020 project MINKE with the ocean observation community. MINKE brings together 16 key European marine metrology research infrastructures to create an innovative 'quality of oceanographic data' framework, with identifying the Essential Ocean Variables (EOV) as the key parameters to monitor, and adopting a multidimensional framework of data quality: accuracy and completeness. This project has in its objectives to involve the EMN for Climate and Ocean Observation to have a sustainable link to the metrology community coming from national metrology institutes and designated institutes, aiming to create a long- term framework. This puts the EMN COO in a favourable position to interact with stakeholders coming from the MINKE project e.g. GOOS. It is planned that the MINKE consortium creates joint position papers with EMN members to strengthen this relationship and form a robust observational infrastructure with high quality observations.

2.1.2 EMNs co-creating research agendas with externals

The creation of impact goes beyond what the EMNs do under their own research agendas. By shaping external research agendas with the metrology community's needs and partnering with external strategies, the EMNs open doors for funding and innovation. This collaboration not only empowers metrology researchers but also ensures Europe's unique metrology priorities make a lasting impact on the larger scientific landscape. EMNs deliver the needed infrastructure through interaction with stakeholders and the internal metrology community to inform external strategies.
It should be also mentioned that having strategic research agendas as an organization plays a pivotal role in fostering collaboration and engagement with EURAMET's stakeholders. These roadmaps not only guide our internal efforts and are an instrument to influence other strategies but also offer a unique opportunity for our valued stakeholders to exert their influence on our work. By openly sharing our strategic research priorities, we invite input, feedback, and insights from those who interact with our products and services most directly (how this is done can be seen in chapter 2.4). This collaborative approach not only ensures that our research aligns with the real-world needs and expectations of our customers and stakeholders but also establishes a sense of transparency and inclusivity in our decision-making processes. In essence, strategic research agendas empower us to co-create solutions that resonate more effectively with our audience, driving innovation, and strengthening our relationships within the wider community.

2.1.2.1 EMN Quantum: Metrology for Quantum technologies

The 'Framework Partnership Agreements' (FPA) by the European Commission created the opportunity to obtain funding for research projects under Horizon Europe. FPAs are EU funded initiatives to establish well-networked lab facilities that interact and support each other as well as European quantum technologies innovation actors (start-ups and small and medium-sized enterprises). The FPA for open testing and experimentation for quantum technologies aims to improve the quantum technological infrastructure within Europe. Qu-Test is a project under the FPA umbrella that focuses on the following three testbeds: quantum computing, quantum communication and quantum sensing. Industry requests will be handled by a "Single Entry Point" (SEP) and directed to the appropriate facilities. Additionally, Qu-Test also offers business and management support and coaching. The aim is to provide a 'one-stop-shop' to unique facilities, competences and know-how, for which European NMIs have much to contribute.

EURAMET's EMN for Quantum Technologies (EMN Quantum), established for the coordination of the metrology effort supporting the development of quantum technologies, realised the potential for future collaborations. Therefore, the EMN invited Dr Gabriele Bulgarini (TNO), coordinator of the project 'Qu-Test' to the network's general meeting at the end of 2021.
EMN Quantum supported the formation of the consortium as it will positively impact the European quantum metrology community overall. In the first 18 months the initial group of the FPA members comprising some of the EMN Quantum NMIs will start creating testing and experimentation facilities. In the first round (2023-2026), calls for new facilities will be launched, and all EMN Quantum NMIs will be in the optimal position to participate. Subsequently, another round of calls will be launched (2026-2029), and all NMIs and DIs are able to apply for and receive funding. This is a notable example of how an EMN opened accessibility to funding opportunities for research by linking NMIs with funding bodies. This will help to develop Europe's metrological capabilities, and ultimately ensure that Europe's achievements in science and technology remain competitive, including developments within quantum technologies.
During the lifetime of the FPA Qu-Test the EMN Quantum will act as an advocate for metrology, where latest information and needs from the FPA can be shared with other EMN members not involved. Based on that, all EMN members will be well informed on what is needed for future projects starting in 2026 under the FPA. The FPA is still ongoing and facilitating long-term funding and research opportunities for European industries and academia. EMN Quantum continues to support European NMIs and DIs in coordinating research approaches to aid the expansion of the quantum technological infrastructure in Europe.
These advances will help in the development of new products and their successive commercialisation. Promotion of quantum technology research is essential to ensure the competitiveness of the European market. EMN Quantum will continue to promote collaboration between research institutes and industries, and work towards including metrology in quantum research activities.

2.1.2.2 EMN Radiation Protection: Process to inform the EURATOM research programme

Through the EMN interaction with EURATOM in 2022, metrology needs are now better addressed in the work programme 2023 – 2025. The approach was indirect, through European governments and ministries who were asked to inform the work programme. The advantages of EMN radiation protection was and is to influence many European ministries with a unite message, which led to a work programme including metrology challenges. Through the EMN there is now a better understanding and collaboration between EURAMET and EURATOM (including the Partnership PIANOFORTE), leading to joint efforts in the field of ionising radiation through coordinated calls.
Currently the EMN works to include the metrological needs from JRC in its SRA, because originally JRC was established under the Euratom Treaty, therefore a proportion of the work of JRC is in the nuclear field.
A good example for knowledge transfer and implementation of metrology work is that the innovations achieved in EMPIR 19ENV01 TraceRadon lead to a successful application in HORIZON-EURATOM-2023-NRT-01 (Nuclear observations to improve Climate research and GHG emission estimates).

2.1.2.3 EMN Radiation Protection: Process to feedback on regulation

Legislation on ionizing radiation is based in Europe (and worldwide) on IAEA and ICRP recommendations, resulting to European Directives which have to be implemented by the member states. The process has with the EMN a more direct link to metrology as IAEA and ICRP are represented in the Stakeholder Council of the EMN, while members of the EMN support the work of ICRP (revision of ICRP 103: The current internationally practised system of radiological protection is based on the recommendations of Publication 103 of the International Commission on Radiological Protection, published in 2007) and IAEA (for example IAEA-TECDOC on the implementation on new operational quantities according to ICRU 95). The members of EMN work to improve standardization of radiation protection measurements and, subsequently, provide input for the future update of radiation protection Directives and international recommendations.

2.1.2.4 EMN Climate and Ocean Observation: Metrology identified as a valuable contribution to climate observation

For the first time the Global Climate Observing System programme (GCOS) implementation plan includes a strong role for metrology, influencing terminology and methodology committees in CEOS, ISO, WMO, and linking those through the EMN for Climate and Ocean Observation. It mentions uncertainties according to the GUM, the concept of traceability and the Fiducial Reference Measurement programs.

The GCOS Implementation Plan is a response to the findings of the 2021 GCOS Status Report, implications arising from the IPCC 6th assessment report and recent scientific studies on the climate cycles. The publication provides recommendations for a sustained and fit for purpose Global Climate Observing System. Global climate monitoring needs to cover the entire Earth system from the atmosphere to the oceans, from the cryosphere to the biosphere, and encompassing the water, energy and carbon cycles. It identifies six themes, each of them including several actions that if undertaken in the next 5-10 years, will lead to an improved Global Climate Observing System. The GCOS Implementation Plan supports and serves WMO Member States in addressing the challenges of climate change and the implementation of the Paris Agreement.

Another example is that Copernicus, EUMETSAT and ESA now require NMI participation in many projects. The project TRUSTED approached the EMN directly for support resulting in several NMIs directly contributing to the project goals.

2.1.2.5 EMN Energy Gases: co-creation of EU Clean Hydrogen Alliance Roadmap for standardisation

The Roadmap on hydrogen standardization, developed by the European Clean Hydrogen Alliance, has been published in March 2023. The EMN for Energy Gases' inputs have been taken up, metrology has been included as a horizontal priority and the Metrology Partnership research program is considered as a major funding mechanism for pre-normative research.

2.1.3 EMNs for regulation and standardisation

In many cases regulation, accreditation and standardisation requires metrology. For example, consumers rely on correct measurements of what they pay for, and patients must be sure that radiation does not exceed specified limits and that a diagnosis is the correct one. Highest precisionmeasurements are essential for high-quality industrial production (e.g. in reducing waste) and enable technological innovation. Thus, virtually everybody relies on metrology as a most fundamental part of the so-called quality infrastructure – from legal metrology to industrial innovation and quality assurance of production. The common factor is the metrological methodology, measurements and technologies.

Several EMNs are constructed with a scope aligned to major European regulation (See 1.2.5 for Pollution Monitoring, 1.2.8 Safe and Sustainable Food, 1.2.7 Radiation Protection and 1.2.11 Traceability in Laboratory Medicine). EMNs aligned with major European regulation seek strong communication with the Commission units that are responsible for the specific regulation. Furthermore, the metrologists contributing to the EMNs will strengthen communication with the associated national ministries.

EURAMET intends that the European Partnership on Metrology supports and enables effective design and implementation of regulation and standards that underpin public policies to address societal challenges and to foster the integration of innovative products and technologies in the market. This aim sets the context for the annual normative calls. Below are several projects which were motivated by EMNs.

Table 1: Normative projects under the Metrology Partnership motivated by EMNs

Project id	Short name	Full name	EMN
20NRM05	iMET-MRI	Improved metrology for quantitative MRI	Mathmet
21NRM02	Digital-It	Metrology for digital substation instrumentation	Smart Electricity Grids
21NRM04	BiometCAP	Protocol for SI-traceable validation of methods for biomethane conformity assessment	Energy Gases
21NRM05	STASIS	Standardisation for safe implant scanning in MRI	Mathmet
21NRM06	EMC-STD	Metrology for emerging electromagnetic compatibility standards	Smart Electricity Grids
22NRM01	TraMeXI	Traceability in medical X-ray imaging dosimetry	Radiation Protection
22NRM02	STANBC	Standardisation of Black Carbon aerosol metrics for air quality and climate modelling	Climate and Ocean Observation
22NRM03	MetHyTrucks	Metrology to support standardisation of hydrogen fuel sampling for heavy duty hydrogen transport	Energy Gases
22NRM04	e-TRENY	Metrology support for enhanced energy efficiency in DC transportation systems	Smart Electricity Grids
22NRM06	ADMIT	Characterisation of AC and DC MV instrument transformers in extended frequency range up to 150 kHz	Smart Electricity Grids
22NRM07	GuideRadPROS	Harmonisation, update and implementation of standards related to radiation protection dosimeters for photon radiation	Radiation Protection

2.1.4 EMNs and standardisation

Metrologists contribute to many standardisation committees at a national, European and international level. This provides strong links to industrial partners. Standardisation is recognised by the EC as a great driver for research development and a key channel for dissemination of innovations. EURAMET considers it important to get some potential needs from industries and society via the standardisation organisations.

Several EMNs consider standardisation development organisations as their key stakeholders. To foster this and enable discussion, a common platform between EURAMET and CEN-CENELEC was created, the platform STAIR-EMPIR (STAndards Innovation & Research). CEN-CENELEC has consulted EURAMET's Technical Committees using the STAIR platform since 2014, and since 2019 the EMNs have been included in this process to increase the collection and dissemination of standardisation needs.

Below are some highlighted engagements which contribute to this:

2.1.4.1 EMN for Quantum Technologies

Quantum technologies allow us to engineer novel devices with the promise of many new applications that can help solve some of today's most pressing global challenges. Examples include novel methods for earth surveys in times of climate change, exploration of natural resources and information transmission and processing. These and other applications of quantum technologies are approaching the market and will be a pivotal factor for success in a wide and diverse range of industries and businesses.

Between 2020 and 2023, CEN-CENELEC invited members of EMN Quantum Technologies to participate as experts in a focus group (FGQT) which was initiated to develop a standardisation roadmap for quantum technologies (published in March 2023). More than one hundred experts joined at the start of FGQT and during the course of 30 meetings about 200 different experts were involved. These experts are active in different domains of quantum technologies and mapped most of the ongoing standardization activities, defined needs and opportunities and put forward recommendations for further action to ensure that standards support

the future deployment of quantum technologies in European industry. EMN members in particular informed section 9 “Quantum metrology, quantum sensing and quantum imaging”, where novel applications are enabled through precise QT measurement. The chapter concludes which standard-documents (normative Technical Specifications) will be needed moving forward. Among other things, their purpose would be to support purchasing processes for constructing quantum computers and other normative documents could relate to characterization, calibration and testing of quantum-computing components and (sub)systems.

Having identified needs for Technical Reports and Technical Specifications on quantum technologies above, subsequent work will need to be undertaken to determine how to assure that those are created. The work should be organized such that on the one hand European interests are guarded, and the EC and European Quantum Flagships have hooks of control. On the other hand fragmentation should be avoided, and the focus should be on Europe’s position in a global market. This requires discussion and proposals at the European level, as well as global coordination with ISO, ITU, ETSI and other relevant standards-developing initiatives. On EURAMETs side, the EMN for Quantum Technologies delivers the needed infrastructure for coordination to support this endeavour of CEN-CENELEC.

EMN Quantum’s involvement with international standards developing organisations can be seen below:

- **ETSI:** ‘Industry Specification Group on Quantum Key Distribution’
- **CEN-CENELEC:** Focus Group on Quantum Technologies (FGQT), initiated by Flagship / JRC
- **CEN-CENELEC:** JTC22 standardisation of quantum technologies
- **ISO/IEC:** JTC1 ‘Information Technology’: WG14 ‘Quantum Computing’, SC 27/WG2 ‘Cryptography and security mechanisms’, SC 27/WG3 ‘Security evaluation, testing and specification’, SC 7‘Software and systems engineering’/ Study Group ‘Investigation of standards of quantum computing’, TC 90 ‘Superconductivity’: WG14 ‘Superconductor electronic devices’
- **IEEE:** Several standard-developing WGs
- **IMEKO:** TC25 ‘Quantum measurement and information’
- **QuIC:** ‘Working Group on Standardisation’ (WG4)

2.1.5 EMNs and Regulation

EMNs are developed to be a permanent structure in EURAMET to support the proper uptake of metrology research in the development and review of regulations. Often research projects aim to support the co-creation of regulations or directives and inform those based on metrological principles, but due to a project limited lifetime these processes often cannot be finalised. Below is one example of how the EMN on pollution monitoring positions itself to serve this need to implement more metrological capabilities in existing regulations:
The aim of the EMN on pollution monitoring is to be the metrological reference for a sustainable infrastructure dedicated to support European and international regulation and directives targeting pollution monitoring. This unique focal point in the pollution monitoring landscape aims to establish a regular and sustainable dialogue between NMIs/DIs and stakeholders. This EMN aims to be a reference for advanced metrology capabilities in pollution monitoring for end-users. Therefore, the EMN ambitions are to define the place and role of metrology in the monitoring measurement chain and to demonstrate its added value and benefits, notably to the European Commission.
As a further example, recently EMN Mathmet is putting efforts in sustaining ISO TC 69“Application of statistical methods SC 5 “Acceptance sampling” and legal metrology bodies in developing new statistical methods for acceptance sampling for conformity assessment.

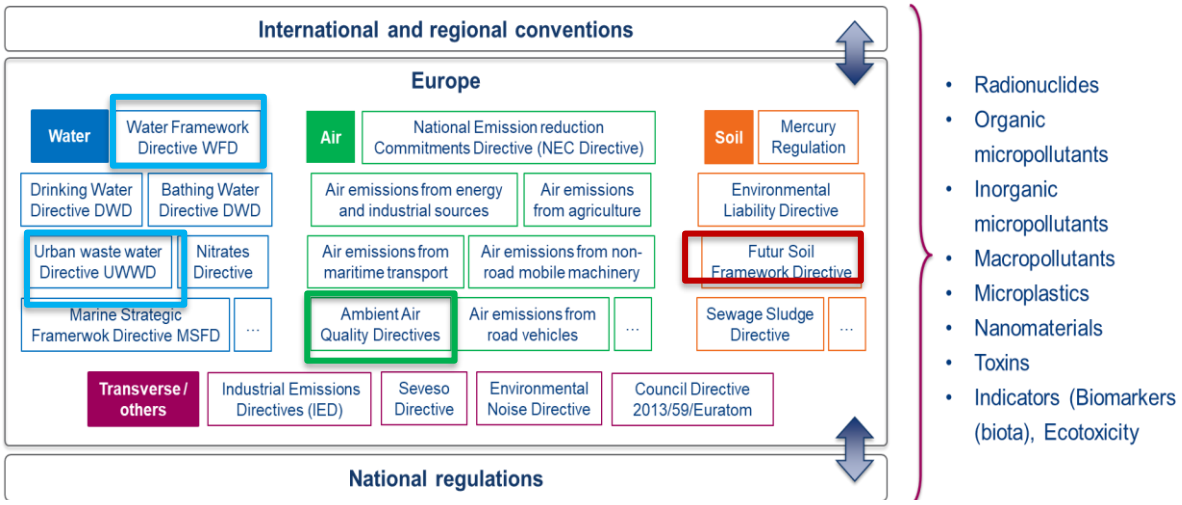

Figure 3: Review of relevant regulations and legislations

Europe has set up an ambitious environmental program through a wide set of restrictive regulations and strategic plans covering the different environmental compartments (air, soil, water) and sources of pollution (emissions, waste) of the environment. More than 20 European directives and regulations have been identified as constituting the core scope of Pollution Monitoring, not even considering international conventions (e.g. Convention on Long-Range Transboundary Air Pollutants (CLRTAP)) nor national ones, covering hundreds of parameters (see. Figure 3). Its ambitions to tackle pollution, requires harmonisation and implementation beyond the national boundaries to bridge the gap between science and policy. The need of enforceable data is strengthened by the Polluter Pays Principle (PPP) underlying the EU's environmental policy and requires that polluters should bear the costs of their pollution including the cost of measures taken to prevent, control and remedy pollution and the costs it will lead on society. Currently, the EMN Pollution Monitoring concentrates on the implementation of metrology capabilities in key directives which are under revision or under construction, e.g. the drinking water directive, water framework directive or the urban waste water directive, the ambient air quality directive or the soil framework directive. Here new metrological challenges have to be identified. EMN members participate in the revision of the directives at a member state level.

2.2 Stakeholder involvement by 2024

EMNs aim for continuous stakeholder engagement. While most interactions are informal, some stakeholders are connected to the EMNs formally via memoranda of understanding (MoU), letters of intent and appointments to the EMNs' stakeholder advisory boards. The key intentions behind those engagements are:

- provision of guidance about state-of-the-art metrological needs from the stakeholder communities, either limiting the progress of R&D or newly observed gaps due to new technological developments,
- the exchange of knowledge about capabilities and needs in the field of metrology and sharing of information on research performed under the European Metrology programmes (EMPIR and the European Partnership on Metrology) to participate jointly in funded research projects.

2.2.1 Understanding stakeholder needs

Metrology is a horizontal and multidisciplinary field. Metrology institutes operate a metrology infrastructure that is needed wherever stakeholders rely on accurate, reliable and correct measurements. They serve a broad stakeholder community from industry, society and academia, and do research and development responding to specific needs.
The stakeholders of EMNs are those who make or use metrological concepts within their respective field. Most of these stakeholder communities are organised through international organisations and EMNs seek to interface directly with those existing organisations to have a greater range of influence.

Since 2019, the EMNs have collated needs from stakeholder communities using a range of tools, such as online surveys, scanning of relevant stakeholder strategies, participating in open stakeholder consultations, conducting online workshops, participating at conferences and by participating in stakeholder committees. The EMNs also reviewed summaries of historical workshops, scientific literature, and stakeholder community strategies and implementation plans to identify and prioritise the areas where metrology can most meaningfully contribute.

EMNs were not only initiated to gather stakeholder needs but also to increase the involvement of stakeholders, which requires a better understanding of their needs and translate those into requirements or challenges for metrology. For example: The EMN for Climate and Ocean Observation defines their SRA as the metrological response to the defined stakeholder needs, which are defined in a dedicated Stakeholder Needs Report.

2.2.2 Formal liaisons with EMNs

EMNs are open clubs and aim for successful engagement with stakeholders. One instrument to foster this goal is to agree on formal liaisons between the EMN, EURAMET and the stakeholders. Often EURAMET has to act as the legal entity to sign off liaison documents, because the EMNs are no legal entities as such.

- **EMN partner status** requires signing the EMN MoU and is recommended when the stakeholder is a legal entity and fulfils minimum requirements defined in the EMN Rules of Procedure, e.g. to have relevant measurement capabilities relevant to the EMN scope of interest.
- **Direct liaison with EURAMET e.V.** requires signing an individual MoU-type of document, e.g. Letter of Intent, which defines contact persons, fields of engagements, etc. This is recommended when stakeholders wish for a higher-level liaison with EURAMET or do not want to sign the fixed EMN MoU.
- **Participation in the EMN's stakeholder council** which gives advice to the EMN, particularly in relation to stakeholder needs for the EMNs SRA.
- **Individual decisions by the EMN General Meeting** could include the appointment of contact persons, (standing) invitees and joint communication activities and events.

In the following, some highlights of successful formal liaisons are described:

2.2.2.1 MoUs and Letters of Intent

On 17 March 2023, a Memorandum of Understanding was signed by EURAMET, Hydrogen Europe and Hydrogen Europe Research. Implementing the use of renewable energy gases is essential in moving towards sustainable energy sources in the future. Therefore, the three organisations aim to jointly support hydrogen research and technology requiring metrological knowledge and information.
Hydrogen Europe is a European organisation representing stakeholders and companies that share the joint goal of moving towards a carbon neutral economy. Hydrogen Europe Research has similar aims and focuses on representing the research community that develops novel hydrogen-based technologies such as hydrogen fuel cells. Both organisations participate in the Clean Hydrogen Joint Undertaking, a research partnership funded by the European Union that aims to develop and implement hydrogen applications.
EURAMET brings together Europe's measurement science community and stakeholders to deliver on global challenges. Especially the Metrology Partnership helps to tackle these challenges, supports the European Green Deal, and underpins innovation in industry through collaborative research. In addition to the Metrology Partnership and EURAMET's Technical Committees it is the EMN for Energy Gases that focusses on hydrogen-related metrology.
Annarita Baldan, Chair of the EMN Energy Gases, comments:
"The Memorandum of Understanding will aid in the development of future collaborations between the partners and help European research in the field of energy innovations. The aims of the memorandum include:

- Exchanging of knowledge concerning state of the art measurement techniques, standards and calibration guidelines that form the metrological basis needed to implement hydrogen as an energy gas

- Sharing current results from research projects conducted as part of the European Partnership on Metrology and the Clean Hydrogen Joint Undertaking, as well as align their research goals to ensure the programmes are efficient and impactful
- Discussing future funding options for research programmes concerning renewable energy
- Sharing information about future events that are held regarding the use of hydrogen as an alternative fuel, and invite partners to attend and/or contribute if suitable"

Additionally, Hydrogen Europe and Hydrogen Europe Research will become official members of the EMN Energy Gases stakeholder council. Ultimately, the collaboration between EURAMET, Hydrogen Europe and Hydrogen Europe Research will open up new research possibilities in the field of energy gases and support the move towards a zero-emission society.

2.2.2.2 Stakeholder Councils

Most EMNs founded a Stakeholder Council. Each is composed of high-level experts from industry, research and academia and from international stakeholder organisations, such as the BIPM, the European Commission (DGs), AIEA, ICRP, European Joint Research Centre, EUROLAB and WELMEC. It provides independent strategic advice on the EMN's SRA, particularly in relation to stakeholder needs. Regular meetings of the Stakeholder Councils are organised which enables a close and direct interaction between the high-level Stakeholders and the EMN and EURAMET.

2.2.3 Interaction with other Partnerships under Horizon Europe

EMNs provide many cooperation models for formal and informal liaisons (see 2.3.1). Figure 4 shows how EMNs are connected to various European Partnerships and further external organisations.

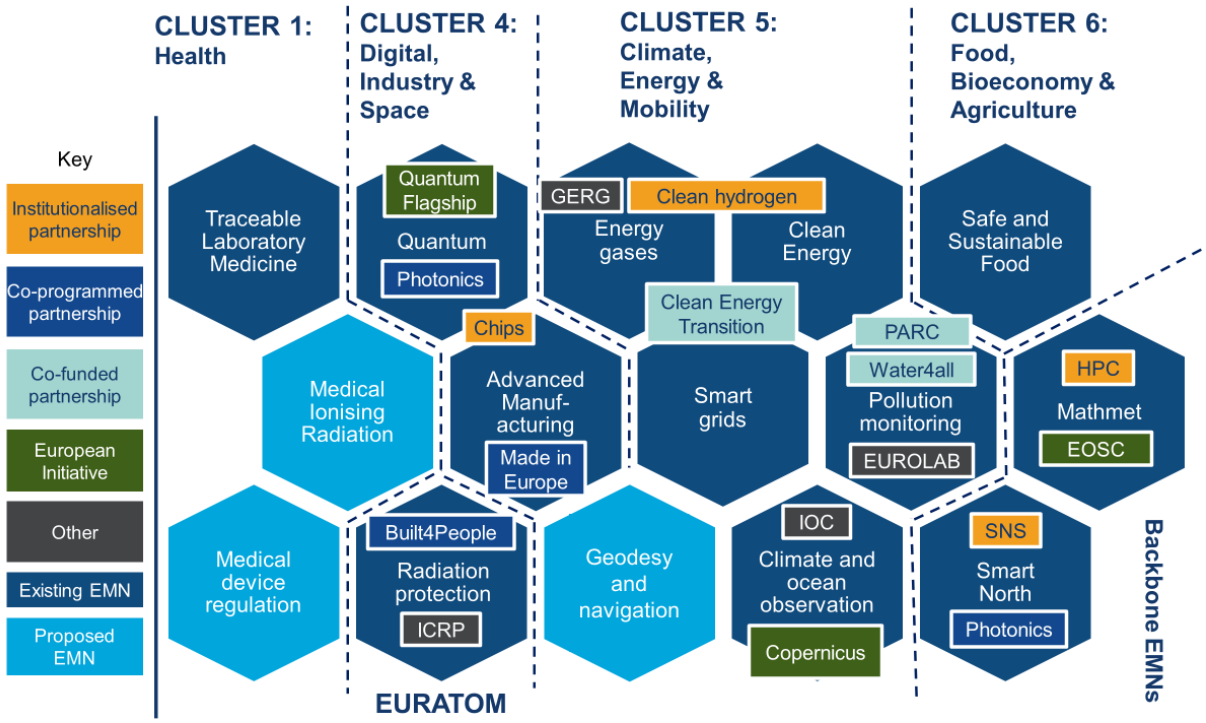

Figure 4: EMNs vs. Horizon Europe Clusters and liaisons with Partnerships & Initiatives

Table 2: Existing EURAMET contacts to Partnerships

Partnership	EMN or TC	Type of cooperation
Risk Assessment of Chemicals (Cluster 1)	EMN Pollution Monitoring, TC-MC	Informal liaison
Water4all (Cluster 1)	EMN Pollution Monitoring	Informal liaison
Key Digital Technologies (Cluster 4)	Advanced Manufacturing, Smart North	Invitee to EURAMETs open consultation

Partnership	EMN or TC	Type of cooperation
Smart Networks and Services (Cluster 4)	Smart North	Informal liaison
High Performance Computing (Cluster 4)	Quantum Technologies (through the Quantum Flagship)	Informal liaison
Photonics (Cluster 4)	Quantum Technologies, Smart North	Informal liaison
Made in Europe (Cluster 4)	Advanced Manufacturing	Stakeholder council
Clean Hydrogen (Cluster 5)	Energy Gases, Smart Grids, Potential EMN Clean Energy	Stakeholder council & MoU with EURAMET
Clean Energy Transition (Cluster 5)	Potential EMN Clean Energy, Energy Gases, Smart Grids, Smart North	Informal liaison
Build4People (Cluster 5)	Radiation Protection	Informal liaison
EOSC	Mathmet and EURAMET	Informal liaison
Sustainable Blue Economy Partnership	Pollution Monitoring, Safe and Sustainable Food and Climate and Ocean Observation	Informal liaison, but participating in Blue Economy's SRIA workshop

Table 3: Existing EMN contacts with European funding infrastructures beyond the Partnerships under Horizon Europe

European initiative	EMN	Type of cooperation
GERG (European Gas Research Group)	Energy Gases	MoU
Framework Partnership Agreements for open testing and experimentation and for pilot production capabilities for quantum technologies (FPA)	Quantum Technologies	Participation in the FPA consortium
Quantum Flagship	Quantum Technologies	Participation in the SRA developing group
Quantum Flagship	Quantum Technologies	Member of the Quantum Coordination Board (Core Group, and thematic group on Metrology and Sensing)
IOC Ocean Best Practices Programme	Climate and Ocean Observation (Ocean Section)	Informal liaison
MINKE (Metrology for Integrated Marine Management and Knowledge-Transfer Network)	Climate and Ocean Observation (Ocean Section)	Liaison through project deliverables of Minke
PIANOFORTE (EURATOM Work programme)	Radiation Protection	Invitee to GM and co-creation of workprogramme

European initiative	EMN	Type of cooperation
ICRP (International Commission on Radiological Protection)	Radiation Protection	MoU
IAEA	Radiation Protection	Invitation to GM

2.2.4 Communication activities

2.2.4.1 Campaigns

EURAMETs overall communication campaign title for 2022 was “Metrology: Measures for a sustainable future”. This overall campaign included several strategic topics, events and fields represented by the Metrology Partnership, EMNs, TCs and Working Group Capacity Building between February and December. All NMIs/DIs were invited to join this campaign. The campaign covered communication activities around events mentioned below, the Climate Change Conference (COP27), the EU Green Deal and the UN Sustainable Development Goals. EMNs play an important part in these communication activities and directly benefit by raising awareness in their fields, especially for high level stakeholders.

2.2.4.2 Events

In Annex B a full list of communication activities and events related to EMNs will be included soon. In the following some selected events which took place from 2019 – 2024 are highlighted:

2019:

- EMN Climate and Ocean Observation presented at several events including CIM2019, the ACTRIS annual meeting, Ocean 2019, CEOS-WGCV-IVOS and the virtual EGU
- EMN Quantum presented at the "International conference on quantum Metrology and Sensing" IQuMS 2019, and the connected stakeholder events; at the ETSI ISG-QKD meeting in Vienna (2-3 Dec 2019); at Basel QM&S Conference (February 2020); and at SPW 2019 in Milan (Oct 2019).
- TraceLabMed presented at several conferences and events: 19th International Metrology Congress2019 (Paris), Balkan Clinical Laboratory Federation Meeting 2019 (Antalya), 17th National Congress for Clinical Chemistry (Athens), JCTLM Member's and Stakeholder's Meeting 2019 (Paris), EURAMET TCMC Meeting 2018 (Brno) and 2020 (Bern), EQALM / Greek Society of Clinical Chemistry workshop 2020 (Athens).

2020:

- Within the Knowledge for Innovation framework, EURAMET organised two debates in the European Parliament where the EMNs Climate and Ocean Observation, Smart Electricity Grids and Energy Gases outstandingly demonstrated the impact and importance of their work to key stakeholders (see news about COO, and a tweet about SEG & EG).

2021:

- On 5th May 2021 a policy debate with an associated scientific debate was organised by EURAMET co-hosted by the IPQ about how the proposed European Partnership on Metrology would support the digital and green transitions. Energy Gases, Smart Grids and COO gave presentations here in front of members of the European Parliament and high-level stakeholders from industry, academic sector, and industry.

2022:

- Gas Analysis 2022 on 17 – 20 May, Paris. The biennial GAS Analysis event is the leading global symposium for gas analysis, and the best forum for the latest developments and applications in industry and society. EURAMET was an official partner and organised a key

note session with the EMN for Energy Gases, COO and the proposed EMN for Pollution Monitoring.

- Measurements and Metrology for Smart Electricity Grids - Excellence Training 9 to 25 May 2022; The event was jointly organised by Politecnico di Torino and INRiM with the support of the EMN for Smart Electricity Grids.
- Quantum Lectures 2022 on 24 to 26 May 2022 https://www.euramet.org/?event=67:1035; The event was organised by INRIM and the universities of Turin and Bari with the support of the EMN for Quantum Technologies.
- Cutting-edge measurement science for the future; The Joint IMEKO TC1-TC7-TC13-TC18 Symposium 2022 took place from 31 August to 1 September 2022, followed by a one-day EMN Mathmet satellite workshop on 2 September, on mathematical and statistical applications related to the activity of the Technical Committees involved.
- IMEKO TC6: First International Conference on Metrology and Digital Transformation on 19 to 20 September in Porto with a satellite workshop organised by Mathmet
- 5th Mathmet International Conference on 02 to 04 October 2022 in Paris
- European Radiation Protection Week (9-14 October 2022) with ICRP Contact person meeting on 08 October

2023:

- 10 May 2023: EMN Radiation Protection: PIANOFORTE Needs and Information Sharing
- 23 October 2023: EURAMET Open Consultation Event on Regulation with participation from EMN Radiation Protection and EMN Pollution Monitoring.
- 04 December 2023: 1st Multi-EMN Brainstorming Meeting in preparation of the Green Deal Call 2024

2024:

- SLOs position on the Vancouver call for action (publication drafted with contribution from EMN RP by Lorenzo Mazzoni for Physica Medica: European Journal of Medical Physics)
- EMR PR at the IMEKO World Congress: European Metrology Network for Radiation Protection: Quality infrastructure for a stronger Europe, 26 – 29 August 2024, Hamburg, Germany
- EMN RP at ICRP SLO Meeting, Munich, Germany on 10 September 2024

2.3 Coordination activities

National resources are limited and are currently insufficient to create a greater economic and social impact by metrology, when each state tries to do everything by itself. Moving from the present system of inefficient coordination of European resources in metrology, to a fit-for-purpose and truly coordinated metrology infrastructure with appropriate use of joint infrastructures and coordinated services will allow Europe to make a contribution to the international effort that matches its share of the world economy and trade. The following shows, in addition to what was mentioned in 2.1, examples of how EMNs create a truly coordinated infrastructure in their own field, including the development of strategic research agendas and the coordination of metrology services.

2.3.1 Strategic Research Agendas

Strategic Research Agendas outline a technical view of the future – documenting emerging drivers from the outside world and giving an analysis of how metrology research should develop in response to those drivers. They are the pre-cursors to the individual orientation papers that both EMNs and TCs may provide before Stage 1 of a call of the Metrology Partnership. SRAs are revised regularly in accordance with priority changes from the respective stakeholder community.

SRAs have also been used as a means to inform external strategies with metrology needs increasing the overall impact of metrology in Horizon Europe work programmes, other European research programmes and national research programmes (see 2.1.1 and 2.1.2).

Published EMN SRAs can be found in the following links:

- Advanced Manufacturing (draft published, for further stakeholder inputs)
- Climate and Ocean Observation
- Energy Gases
- Mathmet (soon to be published)
- Quantum Technologies (draft published, for further stakeholder inputs)
- Smart Electricity Grids

SRAs from Pollution Monitoring, Radiation Protection, Safe and Sustainable Food are under development and are expected to be published by mid-2024 at the latest. Traceability in Laboratory Medicine does not plan to develop an SRA but similar documents will be published:

- A strategy for a joint European response to the IVDR, and
- A joint strategy for the prioritisation of clinical measurands and R&D needs

2.3.2 Coordination of services

2.3.2.1 Energy Gases Service Platform

While this has never been a major objective of EMNs the closer collaborations between EMN members can eventually lead to a coordination of services. One example is Energy Gases' Service Database. The service platform allows stakeholders to easily find information about energy gas-related services provided by the members of the EMN for Energy Gases. The services are listed for six distinct gas types: natural gas, biogas/biomethane, hydrogen, carbon dioxide, liquified natural gas (LNG)/liquified biogas (LBG), and hydrogen/natural gas blends. For each type of gas, services are divided into the following main categories: gas analysis, certified reference materials, flow, material testing, density, humidity and temperature, material data, training courses, interlaboratory comparison, and sampling. Through the interactive map, stakeholders are quickly able to find where a given service is provided. Alternatively, search filters can be used to find a required service.

2.3.2.2 Smart Specialisation in Northern Europe

The countries in the Nordic-Baltic region are sparsely populated and located near the arctic region. These set specific challenges related to metrology for e.g. energy production and distribution, traffic and logistics, manufacturing and forest industry. To achieve carbon neutrality and sustainability in the region, industry needs efficient and resilient NMI-level metrology services that are developed for the future needs. The European Metrology Network "Smart North" drives at a sustainable development of high-level metrology services for industry in Nordic and Baltic countries. Addressing the prioritized targets of the 1st Strategic Agenda version, coordination activities are ongoing to initiate preparations for project calls outside the Metrology Partnership. Also, a common approach for directing customer enquiries to another NMI that can provide the requested service has been agreed and will be implemented in 2024. To enhance the efficiency of temperature calibration services, the NMI level radiation thermometry calibration service in Finland and Sweden was decided to centralize to RISE in Sweden.

2.4 Training and Knowledge Transfer

In addition to the previously mentioned types of stakeholder engagement, capacity building and training activities are key for most existing EMNs. For example, the Chair of the EMN for Radiation Protection represents EURAMET at the International Committee on Radiological Protection (ICRP). This liaison is based on an individual letter of intent and aims for cooperation, for their mutual benefit, in support of radiation protection research and technology requiring metrological knowledge and information, exchanging knowledge about capabilities, needs & capacity building actions in the field of metrology for radiation protection.

2.4.1 Events

In Annex B, a full list of communications, events and training activities related to EMNs is included. In the following some trainings which took place from 2020 – 2023 are highlighted:

2020

- **European energy gases workshop** – on 22 January 2020, hosted by the National Physical Laboratory, UK on behalf of the EMN for Energy Gases. 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, renewable energy gas sources are gradually entering the market.
- **Workshop EMUE (Examples of Measurement Uncertainty Evaluation)** - 21 to 22 January 2020, a joint workshop organised by LNE, France and the EMN for Mathematics and Statistics presenting concrete examples of how the evaluation principles of measurement uncertainty can support and add value to normative and related practices.

2021

- **Open Workshop on Measurement Challenges – SARS-CoV-2 and Future Pandemics,** 4 November 2021 Online workshop; The workshop focussed on (bio)chemical measurement challenges related to diagnostic measurements, therapeutics, and emerging techniques, and was jointly organised by EURAMET's EMN on Traceability in Laboratory Medicine (EMN TraceLabMed) and the Technical Committee for Metrology in Chemistry (TC-MC).
- **Open Workshop on Measurement Challenges – laboratory medicine,** 10 November 2021; Joint online workshop organised by EMN TraceLabMed & TC-MC on (bio)chemistry related health topics.

2022

- **Measurements and Metrology for Smart Electricity Grids** - Excellence Training, 9 to 25 May 2022; The event was jointly organised by Politecnico di Torino and INRiM, Italy with the support of the EMN for Smart Electricity Grids.
- **Quantum Lectures 2022** on 24 to 26 May 2022; The event was organised by INRIM, Italy and the universities of Turin and Bari with the support of the EMN for Quantum Technologies.
- **3D Metrology Conference 2022**; 16 November 2022 in Aachen, Germany; EURAMET's EMN for Advanced Manufacturing hosted the session 'The Future of 3D Metrology for Advanced Manufacturing'.
- **The BIPM-WMO Metrology for Climate Action Workshop 2022** was a global virtual workshop running from 26 – 30 September 2022, supported by EURAMET and the EMN for Climate and Ocean Observation.
- **Measurement Uncertainty Training Workshop** - the online workshop on 17 -18 May 2022 was organised by the EMN for Mathematics and Statistics. It aimed to strengthen training capabilities and improve existing courses on measurement uncertainty by facilitating the exchange of expertise, good practice as well as of experiences in developing and running training courses.
- **EURADOS Training Course on Radiation Protection Dosimetry and Accreditation of IMS Accreditation** The course was organised by the EURADOS WG02 on 'Harmonisation of Individual Monitoring' in Europe, a partner of EURAMET's EMN for Radiation Protection and was held at IST in Bobadela on 3 - 7 October 2022.

- **Training Course On The Measurement Reliability In Mycotoxin Analysis** - the training course on 22-23 November 2022 was jointly organised by EURAMET members UME, Türkiye, INRiM, Italy and the EMN for Safe and Sustainable Food.

2023

- **EMN Advanced Manufacturing Capacity Building Workshop** – was organised in Belgrade, 16-17 May 2023. Discussions with industry and NMIs/DIs representatives about the specific challenges, existing approaches, and further options for support of the manufacturing industry in the EU-13 and EU candidate countries from the metrology community and the EMN.
- **Workshop: The Future of Metrology for Advanced Manufacturing** – organised by The EMN for Advanced Manufacturing on 12 June 2023 at the euspen 23rd International Conference & Exhibition in Copenhagen, Denmark.
- **Measurement solutions for Energy Gases** - was organised on 21 to 22 March 2023 in Lisbon at IPQ in joint support with EMN for Energy Gases. In the workshop, policy makers discussed the latest EU policy and legislation designed to address the challenges related to decarbonisation.
- **Mathmet training course on Quality Assurance Tools** – on 22 to 23 March 2023 EMN Mathmet organised an online training course to introduce its Quality Assurance Tools (QAT) to a broad audience. These tools can be used in the framework of a quality management system addressing the quality of software, data and guidelines.

All EMNs have a long-term plan of trainings and workshops. As an example of such planning, we report the EMN for Radiation protection´s plan of trainings and workshops, which is part of its Knowledge Sharing and Capacity Building Programme. The trainings and workshops will be planned as follows:

- develop the concept and content for new and tailor-made training courses in the field of radiation protection on a regular basis. These trainings are planned by NMIs/DIs or EMN partners/members. All EMN stakeholders included in the database are invited to the training. In this frame: the training course “Dosimetry and Emergency Preparedness” is organized by EURADOS WG02 Harmonization of Individual Surveillance in Europe together with the Hellenic Atomic Energy Commission (EEAE) in Athens. The aim of this course is to convey the theoretical basics for dealing with emergencies and to expand them through practical measurement exercises. This training consists of 3 days of lectures and discussions combined with 1 day of practical exercises in small groups of 5 people. Lecturers from various European institutes will present different topics from different perspectives.
- EMN Radiation Protection regularly organizes one-day training workshops on the subject of radiation protection metrology. The target group are all stakeholders in the field of radiation protection. The training includes, for example, traceability, calibration and reading calibration certificates.

2.4.2 Training material

EURAMET’s EMNs contribute by preparing training materials which are available to a wider metrology audience including stakeholders and the interested public. EMNs have already published the following e-learning courses:

- Good practice in evaluating measurement uncertainty prepared by EMN Mathmet
- Quality Assurance Tools for Software, Data and Guidelines prepared by EMN Mathmet

Both courses are available at the BIPM e-learning platform https://e-learning.bipm.org/.

3 EURAMET governance for EMNs

EMNs are fully integrated in EURAMET and organised under its roof. The establishment of an EMN has to be approved by the EURAMET General Assembly. Membership of an EMN is open to EURAMET members and associates; associate membership or a liaison status is open to stakeholder organisations. These and other general principles are fixed in the EURAMET Rules of Procedures (https://www.euramet.org/publications-media-centre/documents).
In addition, the members of an EMN sign a Memorandum of Understanding (MoU) that includes:

- Scope of the network
- The strategic objectives
- Rules regarding data (elaboration, share and dissemination) and intellectual property
- The commitment of the partners and participants to contribute to the realisation of the strategic agenda and the work-plan which is mutually agreed among the partners
- Relationship between the participants of the EMN
- Coordination and cooperation within the EMN.

A template for the Memorandum of Understanding is provided by EURAMET – and available in Annex C. Further details are laid down in the corresponding Rules of Procedure, a template provided by EURAMET is in Annex C as well.

It should be noted that EMNs are not separate legal entities but an integral part of EURAMET.

Contracts concerning the activities of the EMN (employment, research projects, cooperation with externals, service delivery) are concluded by the individual members of the EMN or, in exceptional circumstances, by EURAMET eV. This avoids formal barriers to membership, strengthens the role of EURAMET, avoids the formation of a parallel structure to the NMIs and DIs and guarantees the national sovereignty of the EURAMET members.

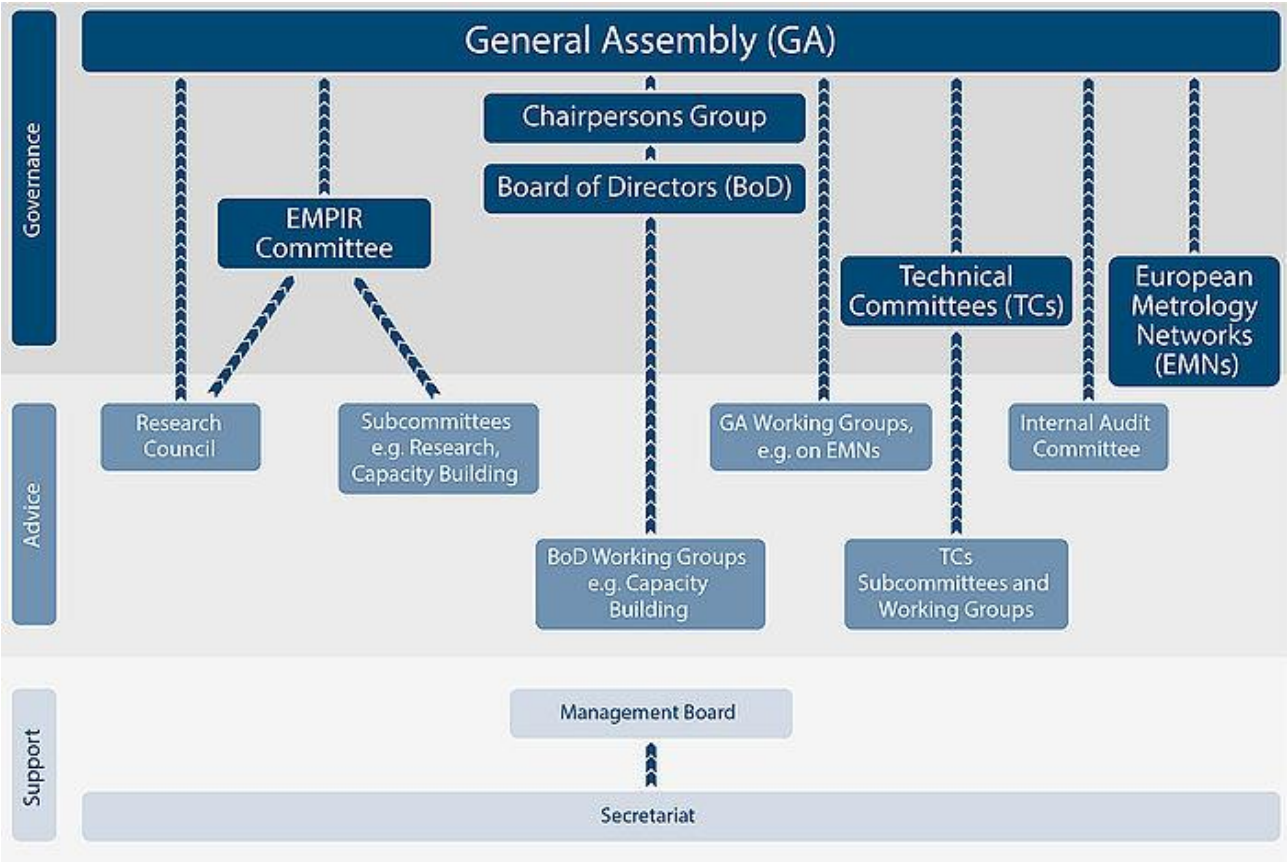

Figure 5: Organisational chart of EURAMET; EMNs are included as parallel structures to the TCs and directly responsible to the General Assembly.

3.1 Link between EMNs and EURAMET GA

A General Assembly working group (EMN GA-wg) evaluates proposals for EMNs and prepares the related decisions of the General Assembly. The EMN GA-wg consists of an appropriate number of elected members drawn from the group of delegates (no alternates). The EURAMET Chairperson and the General Secretary are members of the EMN GA-wg. The EMN GA-wg monitors the activities of all EMNs on a regular basis. The EMN GA-wg convenor is the link between the EMNs and the General Assembly.

3.2 Process to approve EMNs

Euramet has strategically analysed the landscape of potential EMNs and steered their establishment with a focus on the EU priority areas and objectives as expressed in the clusters of Horizon Europe and in EU regulation. The EMN GA-wg is responsible for reviewing the proposals and gives recommendations to the EURAMET BoD before a formal voting of the General Assembly is initiated. If a proposal passes the GA-wg and BoD discussions without any significant suggestion for amendments a formal GA e-mail voting will be initiated, or it will be voted on during the Annual General Assembly. If the feedback of the EMN GA-wg suggests significant modifications a re-submission by a subsequent deadline will be recommended.

Following the successful process to establish 11 EMNs between 2018 and 2022, with a total of 10 gaining funding from the EMPIR programme through support of Joint Network Projects (see sections 1.2 and 3.3.1), EURAMET plans to consider further proposals in 2023/24. In 2023 there will be several opportunities for submitting an EMN proposal together with a draft MoU to the General Assembly.

3.3 Supporting instruments for EMNs

3.3.1 Calls 2018 – 2020 – Joint Network Projects (JNPs) under EMPIR

The EU intended that EMPIR would make a significant contribution to economic growth in Europe and set targets both in terms of increased turnover in European companies and the interaction between the metrology and standardisation communities.

Following the Potential Network Topic (PNT) phase, the Support for Networks Call was implemented as follows:

Joint Network Projects (JNPs) are coordination and support actions. Under this instrument, research and development activities were not eligible. The clear focus was on networking activities and capacity building, with a view to catalysing the development of EMNs through communication with stakeholders and the clarification of needs and infrastructure requirements.
While the Joint Network Projects supported this contribution during their lifetime, there was and is a need for a long-term ongoing dialogue between the metrology community and relevant stakeholders. This dialogue should support the take-up of research outputs from the metrology community and the collection of needs from industry to inform future research. JNPs enabled this by funding activities such as:

- Foresighting and common vision
- Developing a Strategic Research Agenda
- Knowledge sharing amongst researchers
- Mobility and training of researchers
- Planning the development of shared Research Infrastructures
- Stakeholder involvement
- Dissemination of research results
- Widening Participation (activities related to extending cooperation with low performing RDI Member States and regions)
- Internationalisation (activities related to extending cooperation to third countries)

It was expected that these challenges would be successfully addressed within a typical timeframe of up to 5 years and with a budget in the region of 400 k€. JNPs were based on an existing organisation with the long-term aim of promoting the dialogue or plan to establish such an organisation. Within the EMPIR Research Programme, 3 Calls for JNPs were realised in 2018, 2019 and 2020.

3.3.2 EURAMET Secretariat support

All EMNs, whether supported through JNPs or not, receive central support from EURAMET's Secretariat (e.g. web-space, communications support, support for organising meetings etc.), as for all EURAMET bodies. For the duration of EMPIR this has been financed from the EMPIR discretionary funds.

3.4 Building sustainable and coordinated metrology networks

3.4.1 Strategic Agendas

The Strategic Agenda (SA) required from the EMNs is different compared to the SRA. It does not attempt to define the detailed research work expected from the EMNs. It should set out the vision, mission and medium-term objectives for the EMNs on their route to self-sustainability. This should be in a form suitable for publication on the EMN website. One of the leading questions which the SA has to answer is: What must the EMN do so that, in 2028, its routine operation for coordinating the delivery of services and expertise to European customers has become indispensable and that routine operation will be fully supported by joint national funding? EMPIR and The Partnership will

provide a decade of support to the EMNs, but there must be a route to self-sustainability after that time. The Strategic Agenda documents that route. So far, few EMNs have published a Strategic Agenda, which can be seen in the following:

- Energy Gases;
- Quantum Technologies;

3.4.2 Post JNP life

EMNs are run by their members and are supported by JNPs and through a central support of the EURAMET Secretariat. The following example explains how the EMN for Smart Electricity Grids is restructuring itself to be sustainable after JNP funding ceased. This example should illustrate how EMNs produce a joint staff effort and pool national resources towards their objectives. The example represents an extract of a document summarising a discussion at the 5th General meeting of the EMN (19/20 April 2023) to define the activities which would be maintained based on national resources from that point on.

The EMN for Smart Electricity Grids was officially formed in 2018 and received a coordination support project (JNP) under EMPIR in 2019 aimed at leading the EMN to a sustainable structure. The JNP ends by 30 April 2023 having supported the EMN in its initial resource intensive actions before and during its formation, including developing a website, creating strategic liaisons, publishing regular newsletters, engaging in various events, creating a Strategic Research Agenda and performing coordination activities for research projects.

3.4.2.1 Example: Priorities of a focused EMN

The EMN provides added value to all participating members that goes beyond simple collaboration and therefore justifies the need of maintaining it. **The highest priority for the future EMN activities is to increase the impact of metrology, while also providing a coordinated engagement with high level stakeholders towards the development of existing and new funding streams**. This particular activity was not mentioned in the JNP as such; however, it prepared the needed infrastructure for this. Activities which fall under this priority objective involve:

- Compiling and maintaining a relevant funding landscape for NMIs in the field of measurements for smart electric grids.
- Scouting for relevant contacts within high level stakeholders (e.g. reps of existing consortia, or groups defining strategies and call texts) to advocate for metrology.
- Engagement and building strategic stakeholder liaisons
- Improving the facilitation of JRPs with the help of documented stakeholder needs

The following points demonstrate further activities which are complete on their own but are all serving the overall objective to enhance access to funding opportunities:

- PR activities (including website maintenance, publishment of electrical newsletters)
- Maintaining the SRA (performing stakeholder workshops, establishing a stakeholder advisory board, etc.)
- Events (include smart grids metrology related sessions at existing events)

3.4.2.2 Example: New task groups:

In order to spread the workload on more shoulders it was agreed to create the following task groups:

1. Identifying new funding resources and providing coordinated approach (EPM, Horizon programmes) (TG), common preparation of projects, promote metrology in Call texts (Prio 1)
2. Stakeholder engagement

   2A) Building strategic stakeholder contacts, concentrate on few high-level organisations to begin with (ENTSOE, etc.)

   2B) Stakeholder Advisory board
3. Communication, PR, website (including knowledge transfer, training)

4. SRA (Maintenance team)
5. Events, conferences, stakeholder workshops
6. Synergies (national projects, building smaller cooperations between members) making it visible

To maintain progress of these task groups one representative of each is invited to participate in periodic steering group meetings.

3.5 Overall statistics

27 Nationalities participate in EMNs, including NMIs & DIs and stakeholders who signed the EMN Memorandum of Understanding)

Country	**EMNs**
Belgium	7
Bosnia and Herzegovina	7
Croatia	2
Czechia	6
Denmark	7
Estonia	3
Finland	7
France	8
Germany	8
Greece	4
Hungary	1
Italy	9
Lithuania	1
Netherlands	7
Norway	5
Poland	8
Portugal	7
Romania	2
Serbia	1
Slovakia	1
Slovenia	5
Spain	7
Sweden	6
Switzerland	8
Türkiye	8
United Kingdom	9

Annex A : Stories and events related to EMNs

Advanced Manufacturing

Stories:

16-05-2024 World Metrology Day spotlight: the European Metrology Network for Advanced Manufacturing
12-09-2022 Save the date: EMN Advanced Manufacturing Annual General Meeting 2022
17-08-2022 EURAMET consults stakeholders from the semiconductor sector
03-02-2022 New Advanced Manufacturing network votes in its first Chairpersons
16-12-2021 EURAMET's stakeholders share metrology for digital transformation needs
02-11-2021 Making way for the future of European manufacturing and circular economy
28-06-2021 New network for Advanced Manufacturing held introductory meeting

Events:

2024-05-22 to 2024-05-22 JNP 19NET01 Support for a European Metrology Network on advanced manufacturing: Final meeting
2023-06-12 to 2023-06-12 Workshop: The Future of Metrology for Advanced Manufacturing
2023-05-16 to 2023-05-17 EMN Advanced Manufacturing Capacity Building Workshop
2022-11-15 to 2022-11-17 3DMC 2022 - The future of 3D metrology for advanced manufacturing

2022-10-10 to 2022-10-11 EMN Advanced Manufacturing Annual General Meeting 2022 Hybrid meeting
2022-07-08 to 2022-07-08 Open consultation on Metrology for Semiconductor Technologies
2021-11-09 to 2021-11-09 Open Consultation on Metrology for Digital Transformation
2021-10-12 to 2021-10-12 EMN Advanced Manufacturing Annual General Meeting 2021
2021-10-11 to 2021-10-11 EMN Advanced Manufacturing Stakeholder Meeting 2021
2021-09-23 to 2021-09-30 Metrology for Digital Transformation
2021-06-23 to 2021-06-23 Introductory Meeting of EMN Advanced Manufacturing

Climate and Ocean Observation

Stories:

14-10-2022 Successful EURAMET poster session at Metrology for Climate Action Workshop
13-09-2022 Final chance to register for BIPM-WMO Metrology for Climate Action Workshop
20-07-2022 Network chair and vice-chairs re-elected for second three-year term
09-06-2022 New deadline for abstract submission for BIPM and WMO Climate Action Workshop
11-05-2022 Submissions of abstracts welcome for the Metrology for Climate Action Workshop
15-03-2022 EURAMET first partner for Metrology for Climate Action Workshop
04-06-2020 World Environment Day: EURAMET research supports our understanding of the oceans
09-12-2019 EMN for Climate and Ocean Observation attends European Parliament event
06-12-2019 UN Climate Change Conference
03-12-2019 EURAMET's Climate and Ocean European Metrology Network launches a new survey
30-07-2019 The EMN for Climate and Ocean Observation has its first general meeting
17-07-2019 New EURAMET Climate and Ocean Observation EMN to give keynote talk at CIM 2019
06-06-2019 World Oceans Day 2019
05-06-2019 A firm foundation to tackle climate change
17-05-2019 Launch meeting of the Climate and Earth Observation European Metrology Network
28-02-2019 Poster about new Climate and Ocean Observation Network wins best poster award

Events:

2023-06-14 to 2023-06-15 EMN Climate and Ocean Observation Annual General Meeting 2023
2022-09-26 to 2022-09-30 BIPM-WMO Metrology for Climate Action Workshop
2022-06-21 to 2022-06-22 EMN Climate and Ocean Observation Annual General Meeting 2022
2022-05-17 to 2022-05-22 GAS Analysis 2022 Conference
2021-06-17 to 2021-06-17 EMN Climate and Ocean Observation Annual General Meeting 2021

2021-05-05 to 2021-05-05 Climate neutral by 2050: the role of measurement science networks in delivering the EU's Green Deal
2021-04-30 to 2021-04-30 EMN Climate and Ocean Observation - Section Atmosphere Observation: Workshop on SRA
2021-04-30 to 2021-04-30 EMN Climate and Ocean Observation - Cross-sectional Workshop on SRA
2021-04-26 to 2021-04-26 EMN Climate and Ocean Observation - Section Land & Earth Observation: Workshop on SRA
2021-04-22 to 2021-04-22 EMN Climate and Ocean Observation - Section Ocean Observation: Workshop on SRA
2021-01-15 to 2021-01-15 Green Deal Call 2021: Brainstorming Meeting for EMNs Climate and Ocean Observation and Mathematics and Statistics
2020-12-09 to 2020-12-09 Green Deal Call 2021: Brainstorming Meeting for TC Metrology in Chemistry
2020-06-10 to 2020-06-11 EMN Climate and Ocean Observation Annual General Meeting 2020
2020-02-12 to 2020-02-13 International Webinar on Metrology Needs for Climate and Ocean Observation
2019-06-20 to 2019-06-21 Kick-off meeting of the EMN Climate and Ocean Observation

Energy Gases

Stories:

31-07-2023 Successful stakeholder workshop discussing renewable energy gases
24-05-2023 EURAMET, Hydrogen Europe and Hydrogen Europe Research strengthened collaboration
17-02-2023 EMN for Energy Gases holds formal liaison with European Gas Research Group
14-09-2022 Energy Gases EMN launches new services platform
13-05-2022 This Year's Gas Analysis Conference: What to Expect
15-03-2022 Annarita Baldan re-elected as EMN Energy Gases Chair
20/01/2021 Energy Gases EMN publishes its Strategic Research Agenda
17-08-2020 EMN Energy Gases welcomes Justervesenet as its 17th member
03-03-2020 International survey for Energy Gases industry
05-08-2020 Survey for the biofuel industry
14-04-2020 NPL hosts European energy gas workshop for key stakeholders
18-11-2019 EMPIR project work underpinning hydrogen as a clean fuel
15-11-2019 European Metrology Network to present workshop on energy gases
12-08-2019 The EMN for Energy Gases has its first meeting with participating stakeholders
05-06-2019 How to prepare our energy gas infrastructure for renewable gases
08-05-2019 EMN for Energy Gases launches

Events:

2024-04-22 to 2024-04-22 Validation of Methods for Biomethane Conformity Assessment Workshop
2024-03-19 to 2024-03-20 EMN Energy Gases Annual General Meeting 2024
2024-01-30 to 2024-02-01 EMPIR PROMETH2O project to run Trace Water Measurements Workshop at Gas Analysis 2024 symposium
2023-07-03 to 2023-07-05 Conference: Metrology for advanced hydrogen storage solutions

2023-06-15 to 2023-06-15 Computational Fluid Dynamics (CFD) workshop
2023-06-14 to 2023-06-14 'MetHyInfra' very high-pressure and liquefied hydrogen gas flows stakeholder workshop
2023-03-22 to 2023-03-23 EMN Energy Gases Annual General Meeting 2023
2023-03-21 to 2023-03-22 Measurement solutions for Energy Gases
2023-03-07 to 2023-03-10 2023 International Metrology Congress
2022-09-26 to 2022-09-30 BIPM-WMO Metrology for Climate Action Workshop
2022-08-29 to 2022-09-29 Training session of the NEWGASMET project
2022-05-17 to 2022-05-22 GAS Analysis 2022 Conference
2022-04-08 to 2022-04-08 EMN Energy Gases Annual General Meeting 2022
2021-05-05 to 2021-05-05 Climate neutral by 2050: the role of measurement science networks in delivering the EU's Green Deal
2021-04-23 to 2021-04-23 EMN Energy Gases Annual General Meeting 2021
2020-12-14 to 2020-12-14 Green Deal Call 2021: Brainstorming Meeting for EMN Energy Gases

2020-01-22 to 2020-01-22 European energy gases workshop
2020-01-21 to 2020-01-21 EMN Energy Gases Annual General Meeting 2020
2019-06-17 to 2019-06-17 Launch of the EMN for Energy Gases

Mathematics and Statistics

Stories:

12-02-2024 European Network for Mathematics and Statistics in Metrology publishes its Strategic Research Agenda
12-07-2023 EMN Mathmet develops Quality Assurance Tools for software, data and guidelines
17-05-2022 Metrology Networks bring in stakeholder needs related to digital transformation
02-02-2022 EMN Mathmet starts initiative on measurement uncertainty training
16-12-2021 EURAMET's stakeholders share metrology for digital transformation needs
12-11-2019 EMPIR project to present conformance-testing software tool at MATHMET Workshop
02-09-2019 Markus Bär (PTB) elected as first Chair of EMN for Mathematics and Statistics
05-06-2019 When modelling and data analysis becomes part of the measuring

Events:

2024-03-14 to 2024-03-14 Measurement Uncertainty Training Activity - Impact Workshop
2023-06-08 to 2023-06-09 EMN Mathematics and Statistics Annual Meeting 2023
2023-05-30 to 2023-05-31 Mathematical and statistical methods for metrology workshop (MSMM 2023)
2023-03-22 to 2023-03-23 Mathmet training course on Quality Assurance Tools
2022-11-02 to 2022-11-04 5th Mathmet International Conference
2022-09-26 to 2022-09-30 BIPM-WMO Metrology for Climate Action Workshop
2022-08-31 to 2022-09-02 Cutting-edge measurement science for the future
2022-05-23 to 2022-05-23 EMN Mathmet Annual General Meeting 2022
2022-05-17 to 2022-05-18 Measurement Uncertainty Training Workshop
2021-11-09 to 2021-11-09 Open Consultation on Metrology for Digital Transformation
2021-09-23 to 2021-09-30 Metrology for Digital Transformation
2021-09-21 to 2021-09-22 VirtMet 2021: Workshop on digital twins and virtual measurement devices
2021-05-31 to 2021-06-01 Joint Workshop of ENBIS and MATHMET on Mathematical and Statistical Methods for Metrology
2021-05-18 to 2021-05-19 EMN Mathmet Annual General Meeting & JNP Meeting 2021
2021-01-15 to 2021-01-15 Green Deal Call 2021: Brainstorming Meeting for EMNs Climate and Ocean Observation and Mathematics and Statistics
2020-06-04 to 2020-06-04 EMN MATHMET Annual General Meeting & JNP Meeting 2020

2020-01-21 to 2020-01-22 Workshop EMUE (Examples of Measurement Uncertainty Evaluation)

2019-11-22 to 2019-11-22 EMN MATHMET Annual General Meeting 2019
2019-11-20 to 2019-11-22 MathMet 2019
2019-06-19 to 2019-06-20 EMN MATHMET Annual General Meeting & Kick-off meeting 2019

Pollution Monitoring

Stories:

15-05-2023 Measurements supporting the global food system

Events:

2024-05-21 to 2024-05-22 EMN Pollution Monitoring Annual General Meeting 2024 and related events
2023-04-03 to 2023-04-03 EMN Pollution Monitoring Annual General Meeting 2023
2022-09-26 to 2022-09-30 BIPM-WMO Metrology for Climate Action Workshop

Quantum Technologies

Stories:

21-02-2023 European Metrology Network for Quantum Technologies supports stakeholders
29-04-2021 EMPIR project contributes to European Metrology Network for Quantum Technologies
09-08-2019 The EMN for Quantum Technologies has its Kickoff Meeting
05-06-2019 Metrology makes the second quantum revolution more reliable

Events:

2024-03-21 to 2024-03-22 BIPM Workshop on 'Accelerating the adoption of Quantum Technologies through Measurements and Standards'
2023-10-16 to 2023-10-20 EMN-Quantum participated with a Booth at EQTC 2023 and joined the round Table: Deployment of QT: Pilot lines, Test & Measurements and Standardization
2023-09-10 to 2023-09-15 EMN-Quantum contributed to the organisation of Quantum 2023 and co-organised the Round Table on "Single Photon Dictionary"
2023-07-03 to 2023-07-07 EMN-Quantum Session on "Metrology for Quantum Technologies" at CEWQO 2023
2022-11-30 to 2022-12-02 EMN Quantum Technologies Annual General Meeting 2022
2022-11-21 to 2022-11-21 Quantum Metrology: the present and the future
2022-05-24 to 2022-05-26 Quantum Lectures 2022
2021-11-29 to 2021-12-02 EURAMET EMN to run workshop at European Quantum Technologies Conference
2021-11-09 to 2021-11-09 Open Consultation on Metrology for Digital Transformation
2021-11-08 to 2021-11-09 EMN Quantum Technologies Annual General Meeting 2021
2021-10-11 to 2021-10-12 Single-Electron Quantum Optics for Metrology Workshop
2020-11-04 to 2020-11-04 EMN Quantum Technologies Annual General Meeting 2020
2020-06-25 to 2020-06-25 19NET02 Quantum Kick-off Meeting
2019-10-15 to 2019-10-16 EMN Quantum Technologies Annual General Meeting 2019 & Workshop on Stakeholder Engagement
2019-07-01 to 2019-07-01 Kick-off meeting of the EMN Quantum Technology

Radiation Protection

Stories:

18-05-2028 World Metrology Day spotlight: Radiation protection makes a difference in sustainability
10-07-2023 European Metrology Network for Radiation Protection engages with stakeholders
10-07-2023 Highlights from the European Metrology Network for Radiation Protection 2021 – 2023

30-03-2022 The ICRP and EMN for Radiation Protection prepare for close collaboration
08-02-2022 New network for Radiation Protection votes in its first Chairpersons
12-11-2021 Protecting European citizens from the risks of ionising radiation

Events:
2024-04-11 to 2024-04-11 EMN Radiation Protection Annual General Meeting 2024
2023-06-15 to 2023-06-15 EMN Radiation Protection Annual General Meeting 2023
2023-05-10 to 2023-05-10 EMN for Radiation Protection: PIANOFORTE Needs and Information Sharing
2022-10-05 to 2022-10-06 Metrology for Industry (Call 2023): Open consultation on Metrology for Radiation Protection
2022-10-03 to 2022-10-07 EURADOS Training Course on Radiation Protection Dosimetry and Accreditation of IMS
2022-04-13 to 2022-04-13 EMN Radiation Protection Annual General Meeting 2022
2021-09-29 to 2021-09-29 Kick-off Meeting of the EMN Radiation Protection

Safe and Sustainable Food
Stories:
20-05-2023 EMN for Safe and Sustainable Food webinar for World Metrology Day 2023
19-05-2023 Metrology Partnership project is addressing the issue of microplastics in food and the environment
15-05-2023 Measurements supporting the global food system

Events:
2024-05-16 to 2024-05-16 EMN Food - Stakeholder Meeting 2024
2024-05-14 to 2024-05-16 EMN Food Safety Annual General Meeting 2024 and related events
2023-05-15 to 2023-05-15 Measurements supporting the global food system
2022-11-22 to 2022-11-23 Training Course On The Measurement Reliability In Mycotoxin Analysis

Smart Electricity Grids
Stories:
08-03-2024 EMN for Smart Electricity Grids successfully interacts with stakeholders
13-07-2023 European Metrology Network for Smart Electricity Grids publishes Strategic Research Agenda
22-05-2023 New chair elected to the European Metrology Network (EMN) for Smart Electricity Grids
03-02-2023 EMN for Smart Electricity Grids launched its website
08-07-2022 The EMN for Smart Electricity Grids jointly runs successful excellence training

09-03-2022 European project helps tackling the need for improved smart meter test methods
01-03-2022 EMN for Smart Electricity Grids holds successful stakeholder workshops
05-03-2021 Smart Electricity Grids European Metrology Network launches stakeholder survey
01-07-2020 EMPIR projects on efficient and digital power grids draw stakeholder interest
28-08-2019 EMPIR webinar on smart grids is generating discussion amongst experts
06-06-2019 Smart Electricity Grids network successfully launched
05-06-2019 No smart grid without metrology support
28-04-2019 Kick-off meeting of the EMN Smart Electricity Grids

Events:
2024-05-15 to 2024-05-16 Measurements for smart electricity grids: workshop and open consultation

2024-05-13 to 2024-05-17 EMN Smart Electricity Grids Annual General Meeting 2024 and related meetings
2024-01-08 to 2024-01-09 Brainstorming Meeting for EMN Smart Electricity Grids and TC Electricity and Magnetism for EPM Calls 2024
2023-04-25 to 2023-04-27 High Voltage Workshop
2023-04-19 to 2023-04-20 EMN Smart Electricity Grids Annual General Meeting 2023
2023-03-07 to 2023-03-10 2023 International Metrology Congress
2022-11-24 to 2022-11-24 Call 2023: SEG Brainstorming event
2022-05-19 to 2022-05-24 EMN Smart Electricity Grids Annual General Meeting 2022
2022-05-09 to 2022-05-25 Measurements and Metrology for Smart Electricity Grids - Excellence Training
2022-04-06 to 2022-04-06 Measuring and assessing interference levels for the frequency range (2 to150) kHz
2021-11-16 to 2021-12-01 Open consultation on Metrology for Smart Electricity Grids
2021-06-16 to 2021-06-17 Two workshops on grid metrology for efficient electricity grids
2021-05-31 to 2021-06-03 EMN Smart Electricity Grids Annual General Meeting 2021
2021-05-05 to 2021-05-05 Climate neutral by 2050: the role of measurement science networks in delivering the EU's Green Deal
2021-01-12 to 2021-01-13 Green Deal Call 2021: Brainstorming Meeting for EMN Smart Electricity Grids and TC Electricity and Magnetism Part 3 & 4
2020-11-27 to 2020-11-27 Green Deal Call 2021: Brainstorming Meeting for EMN Smart Electricity Grids and TC Electricity and Magnetism Part 1 & 2
2020-06-03 to 2020-06-04 EMN Smart Electricity Grids Annual General Meeting 2020
2019-05-13 to 2019-05-13 Kick-off meeting of the EMN Smart Electricity Grids

Smart Specialisation in Northern Europe
Stories:
N/A

Events:
2021-06-16 to 2021-06-16 EMN Smart Specialisation in Northern Europe Workshop

Traceability in Laboratory Medicine
Stories:
22-09-2022 Laboratory Medicine Network candidates elected for next term
10-06-2022 Don't miss EMN TraceLabMed's workshop on the future of nucleic acid metrology!
26-04-2022 Calibration laboratories partner with EMN TraceLabMed
24-06-2020 Laboratory Medicine EMN strengthens relationships with key medical organisations
03-08-2020 TraceLabMed and EMPIR projects make vital contributions to COVID-19 testing
04-08-2020 The NIBSC, a member of TraceLabMed, supports vital COVID-19 research
31-08-2020 Members of Traceability in Laboratory Medicine network support COVID-19 response
19-07-2019 EMN for Traceability in Laboratory Medicine has 1st meeting with Stakeholders
15-07-2019 New EURAMET Traceability in Laboratory Medicine EMN to give talk at CIM 2019
05-06-2019 Building up a metrology-based infrastructure for clinical measurands
13-05-2019 Kick-off meeting for the EMN Traceability in Laboratory Medicine

Events:
2024-05-22 to 2024-05-22 Workshop on standardisation of test methods in microfluidics
2024-02-05 to 2024-02-05 EMN TraceLabMed Workshop
2024-01-18 to 2024-01-18 EMN TraceLabMed Annual General Meeting 2024
2022-10-24 to 2022-10-24 EMN TraceLabMed Annual General Meeting 2022 and JNP18NET02 Meeting

2022-06-23 to 2022-06-23 Workshop on the future of nucleic acid metrology
2021-11-10 to 2021-11-10 Open Workshop on Measurement Challenges – laboratory medicine
2021-11-04 to 2021-11-04 Open Workshop on Measurement Challenges – SARS-CoV-2 and Future Pandemics
2021-07-07 to 2021-07-07 EMN TraceLabMed Annual General Meeting 2021
2020-10-16 to 2020-10-16 Online Symposium on Standardisation and Harmonisation in Clinical Chemistry
2020-07-09 to 2020-07-09 EMN TraceLabMed Annual General Meeting & JNP Meeting 2020
2019-06-19 to 2019-06-21 Kick-off meeting EMN and JNP Traceability in Laboratory Medicine

Clean Energy

Stories:

05-02-2024 New European Metrology Network for Clean Energy established

Events:

2024-04-19 to 2024-04-19 EMN Clean Energy Annual General Meeting 2024
2024-02-27 to 2024-02-27 Kick-off meeting of the EMN for Clean Energy

Misc. Stories

28-02-2023 First EURAMET Networks booth at International Metrology Conference 2023
27-02-2023 26 EURAMET projects to present at CIM 2023
17-05-2022 Metrology Networks bring in stakeholder needs related to digital transformation
22-11-2021 European Partnership on Metrology successfully passed Parliament and Council
19/05/2021 It's World Metrology Day 2021
25-02-2021 EMNs and TCs help identify research needs related to the European Green Deal
09-05-2019 Happy Europe Day
04-03-2019 EURAMET implements European Metrology Networks

Annex B: EMN governance documents

Memorandum of Understanding on participation in the European Metrology Network for (EMN-title)

Rationale

Considering that the National Metrology Institutes (NMIs) and Designated Institutes (DIs) which have established the European Association of National Metrology Institutes (EURAMET e. V.) form the fundamental metrology infrastructure in Europe,
Considering the European initiative …,
Considering the provisions of regulation…,
Considering that EURAMET successfully coordinated …,

Considering that metrology underpins industrial competitiveness…,

Considering the successful cooperation of European NMIs and DIs in the EMRP/EMPIR projects…,

Considering that greater integration of basic research development and application in the field of … could open promising scientific and business opportunities,

Considering the need for a truly shared and coordinated metrology structure which goes beyond research activities,

Considering …,

Considering that the inclusion of (EMN-title) as an integral part of EURAMET could lead to a sustainable European metrology network in future,

Considering that EURAMET approved the European Metrology Network and its scope by decision of …
the organisations on behalf of which this Memorandum of Understanding is signed agree on the following:

Section 1
Scope of Network

1.1 (*EMN-Title*) is a European Metrology Network (EMN) with the objective of creating a sustainable structure in …, an area of strategic importance for the future of European metrology by:

- Creating and disseminating knowledge,
- Gaining international leadership and recognition,
- Building coordinated infrastructure,
- Establishing stakeholder relations,
- Fostering uptake and dissemination of research results,
- Providing simple access to an enlarged portfolio of capabilities and technologies,
- Facilitating technology transfer to European companies,
- Fostering collaborative research within the European metrology community,
- Increasing co-operation with European industry.

1.2 The organisations, on behalf of which this Memorandum of Understanding is signed, declare their common intention to take part in the EMN and commit themselves to contribute to the network within the agreed framework, subject to and dependent upon the funds and personnel available.

1.3 The most important elements in the establishment of the EMN will be described in a strategic agenda and a work plan. The strategic agenda and the work plan will be set up and regularly updated to specify the commitments of the individual Members and Partners.

1.4 Nothing in this Memorandum of Understanding shall conflict with the applicable policies and rules of EURAMET.

(Optional for EMNs with Sections) 1.5 The EMN has (number) Sections: …, …, ….

(Optional for EMNs with Sections) 1.6 The strategic agenda and the implementation plan will be segmented in themes that relate to these Sections and will also include overviews to bring the parts together in a form suitable for stakeholders who have cross-cutting interest in the EMN.

Section 2
Strategies and Aims

2.1 The EMN shall work with other national, European and international organisations dedicated to … and shall build on the links that exist between NMIs/DIs, academia and industries.

2.2 The EMN will actively promote knowledge transfer between its Members and Partners and third parties through dedicated workshop series, open access publications, and secondments.

2.3 In particular, the EMN will …(e. g.[2])

- *make use of the synergies between the Members and Partners involved,*
- *increase the visibility and acceptance in the research community active in the field,*
- *support scientific collaboration between Members and Partners of the EMN and third parties,*
- *provide a single point of reference for information, collaboration and participation to related organisations and policy makers,*
- *raise the overall level of metrology capability and quality of services,*
- *improve the effectiveness of policy advice,*
- *underpin regulation and standardisation through research, knowledge transfer and services,*
- *establish a comprehensive, longer-term infrastructure to respond to the needs,*
- *actively promote best practice in… by developing new guidance documents,*
- *stimulate exchange between academia and NMIs/DIs.*
- *support knowledge-transfer, uptake, and industrial exploitation,*
- *share information on funding opportunities,*
- *support planning of research projects towards competitive research funding.*

[2]Any services in the scope of the network shall only be provided by the Members or Partners of the EMN and not EURAMET e.V. itself. The EURAMET Board of Directors has to approve in advance all planned activities of the EMN which may have an effect on the non-profit status of the association.

2.4 Details of EMN activities will be described in the work plan. If the implementation of the work plan involves Members and/or Partners working together on specific joint research projects, these Members and Partners will set out the necessary specific provisions such as activities, publications, dispute resolution and intellectual property in separate written agreements as well as non-disclosure agreements for the exchange of confidential information.

2.5 Prior to the commencement of any activities contemplated under this Memorandum of Understanding, the Members and Partners will consider the need to enter into separate written agreements or subsidiary agreements to detail the respective commitments of each participant.

Section 3
Membership and Partnership

3.1 Membership in the EMN is open to EURAMET Members and Associates who have an active research programme and/or provide metrological services in topics covered by the EMN and can commit to supporting the aims of the EMN's strategic research agenda and to attending EMN General Meetings. Details will be described in the EMN Rules of Procedure.

3.2 Partnership in the EMN is open to stakeholder organisations and academic institutions with expertise in the said field. Candidates applying for Partnership should fulfil minimum criteria established by the EMN General Meeting and described in the EMN Rules of Procedure.
3.3 *(for EMNs without Sections)* Each Member and Partner may nominate up to three experts to form the Member or Partner delegation to serve on the EMN General Meeting, to act as the EMN contact persons for the Member or Partner and to participate in the activities. Additional experts may attend and participate in the EMN General Meeting at the discretion of the EMN Chair.
3.3 (for EMNs with Sections) Each Member and Partner may nominate one expert per Section where they participate, and an additional expert able to work across all Sections and contribute to the cross-cutting overviews, to form the Member or Partner delegation to serve on the EMN General Meeting, to act as the EMN contact persons for the Member or Partner and to participate in the activities. *Additional experts may attend and participate in the EMN General Meeting at the discretion of the EMN Chair.*
3.4 Each Member is entitled to one vote. Each Member shall nominate one primary contact out of the delegation who shall represent the organisation and shall be entitled to vote. Partner delegations do not have a vote. Details are described in the EMN Rules of Procedure. *(Addition for EMNs with Sections) Where a vote is needed within a Section only those Members who participate in that Section are entitled to vote, in that case the experts for that Section represent the organisation and shall cast the single vote on behalf of the member.*

Section 4
Governance

4.1 The affairs of the EMN shall be directed by the General Meeting. The General Meeting consists of the Member and Partner Delegations. One officially appointed EURAMET representative shall be invited to the General Meeting to represent the association and secure the link between EURAMET and the EMN. The General Meeting will particularly decide on the strategic agenda and the work plan.

4.2 The EMN General Meeting shall establish Rules of Procedure of the EMN in accordance with the EURAMET template. The Rules of Procedure shall be approved by EURAMET e. V.

4.3 The EMN General Meeting shall attempt to reach decisions by consensus whenever possible.

4.4 A decision requires a quorum of 50 % of the Members of the EMN. Decisions should be taken during the General Meeting meetings (including virtual meetings) or by written voting (e-mail) by a simple majority of the votes cast unless specified otherwise. Elections of the Chair and Vice-Chair(*s*) must be carried out freely and by secret ballot. Details are described in the EMN Rules of Procedure. *(Addition for EMNs with Sections) Any specific or technical discussions in the EMN will first be conducted in the individual Sections before being passed to the General Meeting for any necessary approval.*

4.5 The EMN General Meeting shall meet at least annually to review and discuss specific tasks. Extraordinary EMN General Meetings may be called by agreement of 50 % or more of the Members of the EMN. The General Meeting shall be chaired by the EMN Chair or in case of their absence by (*one of*) the Vice-Chair(*s*).

4.6 The EMN General Meeting shall elect a Chair, (*number*) Vice-Chair(*s*) and a Secretary out of the delegation of its Members for a three-year term of office. Re-elections are possible. The Chair and Vice-Chair(*s*) shall not serve more than six consecutive years in the same office. The Chair and the Vice-Chair(*s*) should represent different Member organisations and those different organisations should be from different countries.
(Addition for EMNs with Sections) The Chair should be able to represent all Sections equally to the stakeholders. Each Section shall elect one Vice-Chair out of the delegation of its members participating in that Section, to manage the discussions within that Section and represent the theme to stakeholders as appropriate. Each Vice-Chair should be recognised as an international expert in the theme of that Section.

4.7 Minutes of the agreed actions and decisions of the meetings shall be sent to the Members and Partners and all participants of the EMN General Meeting within (*number*) months.

4.8 The Chair represents the EMN in all dealings with external parties, and actively promotes collaboration and communication within the EMN and with external partners. The Chair may delegate individual tasks to the Vice-Chair(*s*). The Chair and the Vice-Chair(*s*) shall not be entitled to act or to make legally binding declarations on behalf of any other Member or Partner of the EMN, EURAMET e. V. or the EMN itself.

4.9 The EMN shall form a Steering Committee for matters with which the EMN is concerned unless the responsibility for such matters has been entrusted to another EMN body. The Steering committee shall consist of the Chair, the Vice-Chair(*s*) and one officially appointed EURAMET representative to represent the association and secure the link between EURAMET and the EMN. Additional experts may attend and participate in the EMN Steering Committee as required.

4.10 An EMN Secretariat may be established to provide the necessary administrative support. The work of the Secretariat is overseen by the EMN Secretary. The EMN will be supported by the EURAMET Secretariat to the extent possible.

4.11 The EMN may establish an external Stakeholder Council consisting of other European and international organisations and industrial stakeholders. At least once per year the Stakeholder Council will meet with the EMN Chair and appointed Members and Partners of the EMN General Meeting. By invitation, Stakeholder Council members may be represented in the General Meeting in an observer capacity. The Stakeholder Council will give strategic advice, particularly in relation to research activities and services. The members of the Stakeholder Council shall be appointed by the EMN General Meeting for a period of five years. Reappointments are possible.

Section 5
Finances

The General Meeting may decide on the amount and due date of membership fees, and on other means of financial income. These decisions must be made unanimously. The EMN Members or Partners may grant a voluntary financial contribution to EURAMET e. V. to fulfil the intended purpose of the EMN. EURAMET has the right to reject the financial contribution if it is not in line with the interests of the association.

Section 6
Members' and Partners' Rights and Responsibilities

6.1 Members and Partners commit themselves to the pursuance of the strategies, aims and objectives of the EMN.

6.2 All Members and Partners have the right to propose that specific tasks be carried out. Members and Partners shall carry out tasks on terms agreed by them.

6.3 All Members and Partners may seek information and assistance from the EMN and/or its individual Members or Partners on terms to be decided between the parties concerned.

6.4 For the attainment of the aims and objectives of the EMN Members and Partners are encouraged to make available information on current and planned work in areas of interest to the EMN and to participate in the work to the extent commensurate with resources and expertise at their disposal.

6.5 Members and Partners are encouraged to ensure that necessary resources are made available under their internal procedures.

6.6 Any publication or recommendation made directly pursuant to this Memorandum of Understanding and in the scope of the EMN is to be coordinated between the Members and Partners concerned and is to be pre-approved by the Steering Committee before passing it to EURAMET for approval. The EMN is to be clearly referred to.

6.7. Members and Partners shall, as far as applicable, comply with all policies, procedures, instructions, guides and other quality management system documents adopted by EURAMET with regard to the activities, tasks and objectives of the EMN.

Section 7
Data Protection and Joint Controllership

As the Members and Partners of the EMN and EURAMET may have a joint interest in processing personal data gathered in the scope of the activities of the EMN, they may be, to the extent they jointly determine the purposes and means of processing personal data, joint controllers in accordance with Art. 26 of the Regulation (EU) 2016/679 (General Data Protection Regulation), or Art. 28 of the Regulation (EU) 2018/1725[3], respectively. Details on the procedure steps, responsibilities, liability and documentation shall be laid out in the EMN Rules of Procedure or individual contracts on joint controllership between the affected parties.

[3] Regulation (EU) 2018/1725 of the European Parliament and of the Council of 23 October 2018 on the protection of natural persons with regard to the processing of personal data by the Union institutions, bodies, offices and agencies and on the free movement of such data, and repealing Regulation (EC) No 45/2001 and Decision No 1247/2002/EC

Section 8
Duration, Amendments and Termination

8.1 This Memorandum of Understanding is concluded for an initial term of five years. It will continue for additional five years' periods if at least 50 % of the Members and Partners support its continuation. It shall remain open for further participation from within the defined membership categories.

8.2 This Memorandum of Understanding may be amended subject to three months' notice of amendments being given to all Members and by agreement of a simple majority of 50 % of the Members.

8.3 Termination of participation of a Member or Partner in this Memorandum of Understanding shall be notified to the EMN Chair in written form not later than three months before it takes effect.

8.4 This Memorandum of Understanding may be terminated prematurely by a decision of at least 50 % of the Members and Partners.

8.5 Termination of this Memorandum of Understanding including any termination of a participating Member or Partner will not terminate activities entered into by the Members and Partners under separate written agreements or subsidiary agreements.

Section 9
Miscellaneous

9.1 This Memorandum of Understanding shall come into operation after signature of at least three Members on (date).

9.2 This Memorandum of Understanding does not prevent EMN Members and Partners developing own ideas and undertaking jointly further activities between themselves or also with third parties, concerning work in areas of interest to the EMN.

9.3 The parties must not enter into any Agreements, contracts or otherwise legally binding arrangements which would contradict the stipulations of this Memorandum of Understanding, the EMN's Rules of Procedure and/or impede the accomplishment of the EMN's purpose.

9.4 If EURAMET dissolves the status of the EMN as a EURAMET EMN, this Memorandum of Understanding and the organisational rules will be adapted accordingly without delay.

9.5 All unsettled disputes arising in the context of the EMN shall be brought to the EURAMET Board of Directors via the officially appointed EURAMET representative for the EMN.

9.6 Nothing in this Memorandum of Understanding shall be deemed to constitute a joint venture, agency, partnership, interest grouping or any other kind of formal business grouping or entity between the Members and Partners.

9.7 No Member or Partner shall be entitled to act or to make legally binding declarations on behalf of any other Member or Partner of the EMN, EURAMET or of the EMN itself.

9.8 None of the Parties shall assign its rights and obligations under this Agreement unless EURAMET explicitly agrees in writing.

Declaration of Accession
to the
Memorandum of Understanding
on participation in the European Metrology Network for
(EMN-title ….)

… (name of Member or Partner),

represented for the purpose hereof by …,

hereby consent to become a Member/Partner Organisation

to the Memorandum of Understanding on participation in the European Metrology Network for (*EMN-title*)

and accept all the rights and obligations of a Member/Partner Organisation as described in the Memorandum.

Done in two copies.

Date, signature

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Document Control Page

Document Title:	EMN Memorandum of Understanding Template	
Document Code:	G-OPS-TMP-005	Version 2.0
Document Control:	Approved: MSM	2022-01-03

TEMPLATE

European Metrology Network for (name)
Rules of Procedure

Version v1.1
As of (date of BoD approval)

Section 1
Status

1.1 The EMN is an integral part of EURAMET e. V. without own legal capacity. A EURAMET EMN may not act in conflict with the overall policy of EURAMET or with any relevant provisions concerning the non-profit character of the association.

Option:
The EMN has … sections: …. The strategic agenda and the work plan will be segmented by these sections but include overviews to bring the different parts together in a form suitable for high-level stakeholders.

1.2 In accordance with Section 4 of the EMNs Memorandum of Understanding (MoU) the EMN Members (NMIs/DIs) agree on the following Rules of Procedure.

Section 2
Strategies and Aims

2.1 The objectives are stated in the Memorandum of Understanding (see Section 2). To support their implementation, the EMN will develop and maintain a Strategic Agenda (SA) and a work plan.

2.2 The most important elements in the establishment of the EMN is described in the Strategic Agenda (SA). Its purpose is to set out the vision, mission and objectives for the EMN on its route to self-sustainability. The SA is revised on a regular basis. A summary of the SA will be published as content on a web page. Additionally, a downloadable version of the SA may be published at the website as well.

2.3 An important output of the EMN should be to develop and maintain a Strategic Research Agenda (SRA). An SRA identifies the research priorities which will lead to more successful research as it is outlining a clear framework for making decisions about future research activities. These activities will be a basis for successful stakeholder interactions for NMIs and DIs and will therefore lead to a sustainable research infrastructure which will demonstrate measurement capabilities at the top international level.

2.4 The EMN will have a work plan which defines their activities on an annual basis. The objectives in the EMN work plan will be derived from the EMN Strategic Agenda and are expected to contribute benefits to the EMN members and partners and to the implementation of the SRA. These activities include, *inter alia*

- The establishment and maintenance of the EMN website and the development of communications material (e.g. presentations, posters, leaflets) to promote metrology to the stakeholder community.
- Carrying out a regular (at least every two years) update to the stakeholder analysis, where key stakeholders are identified and their needs for metrology are described.
- Preparing regular (at least every two years) updates to the strategic research agenda that describes a roadmap for European metrological research to support stakeholder needs in the area of the EMN.
- Creating the EMN communications concept in line with EURAMET's 2030 strategy and communications strategy and in collaboration with the EURAMET Secretariat.
- Presenting the EMN at stakeholder conferences and in stakeholder meetings.
- …

2.5 The SA and SRA need to be approved by the EMN General Meeting (see Section 8) and the EURAMET Board of Directors (BoD). The BoD approves the first versions of EMNs SRAs and SAs to ensure that the EMNs follow a harmonised approach.

2.6 For further amendments, the EMN General Meetings take over the responsibility to classify changes into non-substantial or substantial amendments. Substantial changes can have a significant impact on the EMN or EURAMET and should be carefully considered. A substantial amendment is defined as a change affecting the purpose or orientation of the EMN, e.g. larger changes of the EMN scope, changes which would affect the EURAMET policy, the EMN MoU or RoP. A non-substantial amendment has no significant implications for the EMN purpose or orientation, e. g. editorial or linguistic changes, corrections of errors, minor clarifications, updates of references. Following that, the EMN General Meeting may approve non-substantial amendments. Substantial amendments have to be approved by the BoD.

2.7 The General Meeting shall inform the EURAMET Networks Officer about all amendments in the SRA, SA and the work plan with the appropriate classification. Further, these changes should be summarised for the benefit of the reader in the Authorship and Imprint site of the respective document.

2.8 At a five-year interval the BoD makes a systematic review of all existing EMN SRAs and SAs. The SRA and SA will each be published on a dedicated web page within the EMN´s website area.

Section 3
Membership and partnership

3.1 Membership in the EMN is open to EURAMET NMIs and DIs (in the following referred to as Members).

3.2 Partnership in the EMN is open to EURAMET's external stakeholders (Governmental, regulators, industry, academic, agencies, associations, organisations), in the following referred to as Partners. EMN Partnership is open to stakeholders outside Europe, but the focus of the network shall remain on European stakeholders with expertise in the field of the EMN which fulfil the following criteria:

- …

The criteria for partnership shall be revised on a regular basis.

3.3 The application for membership and partnership follows this process:

1. The application must be submitted in written form to the EMN Chair or Vice Chair.
2. The EMN Chair or Vice Chair informs the Networks Officer about the application.
3. Either the EMN Chair/Vice Chair or the Networks Officer/EURAMET Secretariat request a clarification from applicants about their ability to contribute to the EMN and to submit this in written form to the Networks Officer.
4. The Networks Officer informs the GA-wg on EMNs and the BoD about the application for membership and partnership. In case of an application for partnership, the EMN shall seek the advice of the GA-wg on EMNs before accepting the applicant and continuing with the voting. The EURAMET BoD retains a veto right in this context.
5. The EURAMET Secretariat informs all EMN primary contacts and conducts an e-mail voting among them on the admission of the new Member or Partner.
6. The EURAMET Secretariat informs the primary contacts about the voting results.
7. If the result of voting is positive, the EURAMET Secretariat sends the EMN MoU, RoP and nomination form to the applicant with the request to sign the necessary documents and send them back to the EURAMET Secretariat, where the documents will be stored centrally.
8. As soon as the documents arrive, the Networks Officer/EURAMET Secretariat informs all EMN Members and Partners about the results. The Secretariat updates the EMN contacts in EURAMETs databases and the EMN website.
9. If the potential Member or Partner cannot be included into the EMN as such (e.g. negative EMN voting result, advise from the GA-wg, BoD veto), the EMN Chair conveys this EMN decision to the potential Member or Partner.

Section 4
EMN Governance

4.1 Decisions and voting

4.1.1 Decisions on matters of the EMN shall be reached by consensus whenever possible. Decisions should be taken by the General Meeting that can also meet virtually or take decisions by written voting (e-mail). Decision is made by a simple majority of the votes cast unless specified otherwise. In the absence of consensus, decisions are to be taken by voting by the respective EMN body (General Meeting, Steering Committee, etc.) and following due procedure (details explained in section below). All voting will be conducted in a fair and transparent manner.

4.1.2 Decisions must be documented and made available to all Members and Partners of the EMN and the EURAMET Secretariat.

4.2 General Meeting

4.2.1 The General Meeting shall meet annually for all Member and Partner delegations to decide and be informed on all matters of importance to the EMN, including:

- Electing the chair of the EMN and the vice-chairs responsible for each EMN Section and the secretary.
- Removal of the EMN Chair, Vice-Chairs, Members of the Steering Committee.
- Proposing termination of memberships and partnerships with the EMN to the EURAMET BoD.
- Agreeing on the Strategic Agenda, the Strategic Research Agenda, the work plan and the communication concept of the EMN.
- Reviewing stakeholder needs and stakeholder engagement.
- Voting on the proposed resolutions/decisions.
- Appointment of the Members of the Stakeholder Council; The Chair, Vice-Chairs and Secretary, the EMN Mentor and EURAMETs Networks Officer are per default part of the Steering Committee.
- …

4.2.2 After his/her term of office the EMN Chair moves automatically into the Past-Chair position for one year, unless the EMN Chair will be re-elected. The Past-Chair is automatically a member of the EMN Steering Committee and has a participation right for all EMN Meetings, including the EMN General Meeting, Stakeholder Advisory Meetings, etc.

4.2.3 All EMN Members and Partners have the right to propose items to the General Meeting.

4.2.4 Each Member delegation is entitled to vote in the General Meeting and has one vote. The voting shall be done by the nominated primary contact. Partner delegations do not have a voting right. If there is more than one Member delegation per country, all Member delegations will be entitled to vote.

4.2.5 The General Meeting may entrust certain responsibilities and decisions to the Steering Committee, the EMN Chair, the EMN Vice-Chair and/or the EMN Secretary. Guests may be invited to the General Meeting on the discretion of the EMN Chair.

Option:
4.2.6 Any specific or technical discussions in the EMN must first be conducted in the individual sections before being passed to the General Meeting for any necessary approval.

4.3 Elections

4.3.1 The EMN General Meeting will elect a chair of the EMN and a/*n* Vice-Chair*(s) to lead each section of the EMN* for a three-year term. The chair and *the* Vice-Chair*(s)* should come from different countries. The election process and the counting of votes is organised and carried out by the EURAMET Secretariat.

The election for the Chair and Vice-Chair(s) follow this process:

1. An open call for candidates will be issued by the EURAMET Secretariat to all Members with a four-week deadline.
2. All candidates should provide a CV to the EURAMET Secretariat. The candidates may add further information like a mission statement.
3. The EURAMET Secretariat will check the eligibility of the candidates and advise on the necessary order of the elections to ensure that the MoU and RoP requirements are met.
4. The information on candidates will be shared to all voting Members by the EURAMET Secretariat.
5. In case of written voting by e-mail, each Member should return their preferred candidate and/or an abstention to EURAMET by e-mail by the specified deadline.
6. The EURAMET Secretariat informs all Members and Partners about the results and updates the EURAMET contacts database.

4.3.2 Specific rules for the election of the EMN Chair involve that successor candidates for an upcoming vacant EMN Chair position are proposed first by the EMN itself (e.g. the Steering Committee). One or

several candidates may be proposed. If necessary, the EURAMET Delegates are informed and asked for further candidates.

4.3.3 The election of a new EMN Chair will usually be done ahead of the EMN General Meeting. Timing should be such that the incoming EMN Chair can join the EMN General Meeting as observer. If an EMN Chair can be re-elected and stands for a re-election and the EMN is supporting the re-election, the election process is done during the General Meeting (and not ahead, as described above).

4.4 Steering Committee

4.4.1 The Steering Committee consists of the EMN Chair, the EMN Vice-Chair(*s*) and …. (*number*) representatives out of the Member and Partner delegations elected in the General Meeting for a three-year term of office. Re-elections are possible. Each member of the Steering Committee is entitled to vote in the Steering Committee.

4.4.2 A Steering Committee will operate to prepare proposals and implement decisions of the General Meeting. The Steering Committee will meet at least… *(number)* per year.

4.4.3 All EMN Members and Partners have the right to propose items to the Steering Committee

4.4.4 The Steering Committee may allow permanent participation in which case the participant will get the status “Standing Invitee” without voting right. Guests may join the meetings of the Steering Committee on invitation by the EMN Chair.

4.4.5 The GA-wg appoints one official EURAMET representative, who has a seat and voting right in the Steering Committee to represent EURAMET and safeguard the interests of the association. The EURAMET representative will report to EURAMET on a regular basis. The members of the Steering Committee will contribute to the reporting if requested. The EURAMET Networks Officer has automatically the status of standing invitee.

4.4.6 The Steering Committee will attempt to reach conclusions by consensus whenever possible. The Steering Committee forms a quorum if at least …. Members are present. Decisions may also be taken by e-mail. Decisions and conclusions must be documented and send to all members of the Steering Committee.

4.4.7 The Steering Committee is particularly responsible for:

- Preparing proposals requiring voting in the General Meeting
- Implementation of decisions of the General Meeting
- Preparing regular reports on the progress towards the work plan and send them to the General Meeting.
- Drafting the Strategic Agenda, Strategic Research Agenda and work plan
- Preparing decisions for the General Meeting.
- Appointing a responsible person to prepare the minutes of the General Meeting
- Pre-approving any publication or recommendation made under the name of the EMN or using the EMN branding. The final approval is done by the EURAMET Secretariat.
- Monitoring if EMN activities are progressing according to plan.
- Holding meetings with the Stakeholder Council, if appointed, and providing their comments to the General Meeting.
- Maintaining relations with liaison organisations.
- Contribute to public consultations in accordance with EURAMET general operational procedure for public consultations and lobbying (G-OPS-PRC-203).
- …

4.4.8 If the EMN has no Steering Committee these tasks are on the responsibility of the EMN Chair, Vice-Chair(s) and Secretary.

4.4.9 Where the Steering Committee does not have the technical expertise to review a publication, or to carry out other duties, the Steering Committee shall ask the EMN Members for advice. If appropriate, the Steering Committee can ask other experts for support with a particular activity.

4.5 EMN experts and primary contacts

4.5.1 Each Member and Partner may nominate up to three experts who form the Member or Partner delegation to attend the EMN General Meeting and to participate in the activities of the EMN. The EMN contacts are registered by the EURAMET Secretariat and published on the EURAMET website. Each Member shall nominate one **primary contact** out of the delegation who shall represent the organisation and hold the voting right.

Option:

*4.5.1 Members and Partners specify which of the … (number) sections of the EMN they intend to participate in. Each Member and Partner may nominate one expert per section where they participate in, and an additional expert able to work across all EMN sections (cross-sectional expert). The nominated experts form the Member or Partner delegation, attend the General Meeting and participate in the activities. Each Member shall nominate one **primary contact** out of the delegation who shall represent the organisation and hold the voting right. The EMN contacts are registered by the EURAMET Secretariat and published on the EURAMET website. The EMN cross-sectional experts engage with high level stakeholders (e.g. policy makers, industry, European associations, etc.) at the general level without preferring one specific section. Cross-sectional experts may participate in each of the EMNs sections.*

4.5.2 In case the primary contact cannot attend a particular meeting and/or make a decision concerning EMN matters they may nominate one of the experts of the same institute as their proxy. The EMN Chair must be informed prior to the meeting about this decision in written form.

4.6 The EMN Secretary

The EMN Secretary is the operational manager of the EMN. The EMN Secretary shall exercise the overall management of the EMN and EMN Secretariat on behalf of the Steering Committee and the General Meeting.

4.7 The EMN Secretariat

An EMN Secretariat may be established to provide the necessary administrative support. The work of the Secretariat is overseen by the EMN Secretary. The EMN Secretariat will maintain close contact to the EURAMET Secretariat and will be supported by the EURAMET Secretariat to the extent possible.

4.10 The Stakeholder Council

4.10.1 The EMN may establish an external Stakeholder Council consisting of other European and international organisations and industrial stakeholders. At least once per year the Stakeholder Council will meet with the EMN Chair and appointed Members and Partners of the EMN General Meeting. By invitation, Stakeholder Council members may be represented in the General Meeting in an observer capacity. The members of the Stakeholder Council shall be appointed by the EMN General Meeting for a period of five years. Reappointments are possible.

4.10.2 The Stakeholder Council will give strategic advice to the EMN, particularly in relation to stakeholder needs in the field of the EMN. Members of the Stakeholder Council act independently in their role and do not represent the interests of their organisation or their country.

4.10.3 The EMN Chair or the Vice-Chair/*s* are responsible to invite the stakeholder into the Stakeholder Council in written form or verbally.

Section 5
Conduct of Members and Partners

5.1 Members and Partners of the EMN are expected to abide by the rules of the EMN. They are expected to act in the best interests of the EMN and EURAMET and not bring the EMN or the association into disrepute. No Member or Partner of the EMN may use or pass on any benefits or services of membership to a non-member or non-partner.

5.2 In case of termination of membership or partnership of an institute the EMN shall seek the advice of the GA-wg on EMNs before proposing termination to the EURAMET BoD.

Section 6
Cooperative activities and relationship with liaison organisations

6.1 Cooperative activities between Members and Partners of the EMN may be arranged following the requirements for EURAMET projects or those of other funders.

6.2 If the EMN wishes to establish a formal relationship with another organisation, the related agreement must be endorsed and signed by EURAMET e. V. When there is already an existing agreement between EURAMET e. V. and a liaison organisation which is of interest to the EMN activities, the EMN will refer to this agreement and EURAMET will adjust the activities under that agreement to include the activities of the EMN.

6.3 The EMN may establish cooperation with other organisations and may enter into non-binding arrangements. It is generally recommended that the EURAMET Secretariat is informed in advance of these collaborations, especially about planned activities where the Secretariat is meant to assist with.

6.4 The EMN should aim for facilitating seminars and events to maintain stakeholder interactions as well as raising awareness of joint research topics with end-users, industrial stakeholders and early adopters of metrological technologies.

Section 7
Finance

7.1 All financial transactions and the accounting of the EMN shall be done via the EURAMET Secretariat.

7.2 EURAMET has the right to reject any financial contribution to be offered to or received by the EMN if it is not in line with the interests and rules of the association.

Section 8
Commitment and Resources

8.1 The Members and Partners will maintain and annually update their commitment on Full-Time Equivalents (FTEs) and resources on the EMN SharePoint site. Thereby enabling EURAMET to assess reliable and continuous operation of the EMN.

8.2 Representatives who are elected as Chairs, Vice-chairs, Secretary’s or elected to the Steering Committee, shall be supported by their employing organisation during their full term of office in order to fulfil their responsibilities properly.

Section 9
Link to EURAMET and EURAMET rules

The EMN shall keep the EURAMET´s Networks Officer informed on all matters relevant to the EMN's operation and strategy. EURAMET will keep the EMN informed of any changes in its Quality Management System relevant to the EMN.

Section 10
Communications, website and icon

10.1 EMN communication (e.g. material, activities, campaigns) is developed in cooperation with EURAMET Communications and follows the EURAMET Brand Guidelines and process for approval.

10.2 The EMN is required to inform EURAMET Communications about communication activities in the name of the EMN and seek guidance on approval, implementation and support before the activity is started.

10.3 The EMN will suggest and/or draft news stories and web content about activities, achievements, and impact of the EMN, relevant scientific activities of EMN Members and Partners etc. and develop those in collaboration with EURAMET Communications.

10.4 The EMN Members and Partners may use the EMN icon in combination with the EURAMET logo on their letterhead and advertising as long as they remain Members or Partners of the EMN.

10.5 The EMN website is hosted by EURAMET e.V. and maintained and further developed by EURAMET e.V. and the EMN. The aim of the website is to provide information for internal and external stakeholders interested in the EMN.

Section 11
Data Protection

11.1 To ensure lawfulness, transparency and accountability when processing personal data, the Members and Partners of the EMN will comply with any applicable data protection legislation.

11.2 The Members and Partners processing data for the purposes of the EMN shall determine and document, with regard to each processing activity, the roles and responsibilities of each participating Member or Partner in fulfilling such obligations, in particular and if applicable by:

- Providing data subjects with statutory information on data processing (Art. 11, 13, 14 GDPR)
- Enabling data subjects to exercise their statutory rights against each of the Parties as data controllers (Art. 15 – 21, 26 GDPR)
- Concluding agreements on joint controllership and/or data processing between the Members/Partners and/or third parties processing data (Art. 26, 28 GDPR)
- Conducting data processing impact assessments (Art. 35 GDPR)
- Keeping records on data processing (Art. 5 (2), 24 (1), 30 GDPR)
- Involving their data protection officer (Art. 38 (1) GDPR)

Section 12
Changes to the Rules of Procedure

12.1 Any changes to the Rules of Procedure should be suggested in writing to the EMN Chair one month before the decision of the General Meeting. Such changes would have to be recommended by formal voting by the EMN General Meeting and then sent to the EURAMET Secretariat for approval by the EURAMET Board of Directors.

Section 13
Primacy of Memorandum of Understanding

13.1 Nothing in these Rules of Procedures shall be deemed to constitute an alteration to the Memorandum of Understanding and in the event of any inconsistency the Memorandum of Understanding shall prevail.

Annex C: List of JRPs (under the Metrology Partnership) with relation to EMNs (by 2022)

Title	Related EMN
Metrology for Earth Biosphere: Cosmic rays, ultraviolet radiation and fragility of ozone shield	Radiation Protection
Metrological framework for passive radiative cooling technologies	Please select
Metrology for European emissions verification on methane isotopes	Climate and Ocean Observation
Metrology for the hydrogen supply chain	Energy Gases
Metrology Support for Carbon Capture Utilisation and Storage	Energy Gases
Metrological traceability of measurement data from nano- to small-microplastics for a greener environment and food safety	Safe and Sustainable Food
Metrology for multi-scale monitoring of soil moisture	Climate and Ocean Observation
Metrology for the harmonisation of measurements of environmental pollutants in Europe	Please select
On farm quantification of ammonia and greenhouse gas emissions from livestock production	Pollution Monitoring
Metrology for digital substation instrumentation	Smart Electricity Grids
Protocol for SI-traceable validation of methods for biomethane conformity assessment	Energy Gases
Standardisation for safe implant scanning in MRI	Mathmet
Metrology for emerging electromagnetic compatibility standards	Smart Electricity Grids
Supporting the implementation of Digital Calibration Certificates in the European metrology community	Mathmet
Trustworthy virtual experiments and digital twins	Advanced Manufacturing
Fundamental principles of sensor network metrology	Mathmet
Uncertainty quantification for machine learning models applied to photoplethysmography signals	Mathmet and TraceLabMed
Developing a metrological framework for assessment of image-based Artificial Intelligence systems for disease detection	Mathmet
Metrology for genomic profiling to support early cancer detection and precision medicine	Traceability for Laboratory Medicine
Primary spectrometric thermometry for gases	Climate and Ocean Observation
Metrology for quantum-based traceability of the pascal	Quantum Technologies
New calibration standards and methods for radiometry and photometry after phaseout of incandescent lamps	Climate and Ocean Observation
Self-calibrating photodiodes for UV and exploitation of induced junction technology	Please select

Integrated European research, calibration and testing infrastructure for fibre-optic thermometry	Climate and Ocean Observation
Traceability in medical X-ray imaging dosimetry	Radiation Protection
Standardisation of Black Carbon aerosol metrics for air quality and climate modelling	Climate and Ocean Observation
Metrology to support standardisation of hydrogen fuel sampling for heavy duty hydrogen transport	Energy Gases
Metrology support for enhanced energy efficiency in DC transportation systems	Smart Electricity Grids
Characterisation of AC and DC MV instrument transformers in extended frequency range up to 150 kHz	Smart Electricity Grids
Harmonisation, update and implementation of standards related to radiation protection dosimeters for photon radiation	Radiation Protection
Towards a true 8-digit digitiser	Smart Electricity Grids

Project	Short name	Title	Related etablished EMN	Related established EMN	Related established EMN
21GRD01	OpMetBat	Operando metrology for energy storage materials	Please select	Please select	Please select
21GRD02	BIOSPHERE	Metrology for Earth Biosphere: Cosmic rays, ultraviolet radiation and fragility of ozone shield	Radiation Protection	N/A	N/A
21GRD03	PaRaMetriC	Metrological framework for passive radiative cooling technologies	Please select	Please select	Please select
21GRD04	isoMET	Metrology for European emissions verification on methane isotopes	Climate and Ocean Observation	Pollution Monitoring	N/A
21GRD05	Met4H2	Metrology for the hydrogen supply chain	Energy Gases	Please select	Please select
21GRD06	MetCCUS	Metrology Support for Carbon Capture Utilisation and Storage	Energy Gases	N/A	N/A
21GRD07	PlasticTrace	Metrological traceability of measurement data from nano- to small-microplastics for a greener environment and food safety	Safe and Sustainable Food	Pollution Monitoring	Please select
21GRD08	SoMMet	Metrology for multi-scale monitoring of soil moisture	Climate and Ocean Observation	N/A	N/A
21GRD09	MetroPOEM	Metrology for the harmonisation of measurements of environmental pollutants in Europe	Please select	Please select	Please select
21GRD10	quantiAGREMI	On farm quantification of ammonia and greenhouse gas emissions from livestock production	Pollution Monitoring	Climate and Ocean Observation	Please select
21NRM01	HiDyn	Support for the standardisation of luminance distribution measurements for assessing glare and obtrusive light using high-dynamic-range imaging systems	N/A	Please select	Please select
21NRM02	Digital-It	Metrology for digital substation instrumentation	Smart Electricity Grids	N/A	N/A
21NRM03	MEWS	Metrology for emerging wireless standards	N/A	N/A	N/A
21NRM04	BiometCAP	Protocol for SI-traceable validation of methods for biomethane conformity assessment	Energy Gases	N/A	N/A
21NRM05	STASIS	Standardisation for safe implant scanning in MRI	Mathmet	Please select	Please select
21NRM06	EMC-STD	Metrology for emerging electromagnetic compatibility standards	Smart Electricity Grids	N/A	N/A
21SCP01	DCC2GO	Supporting the implementation of Digital Calibration Certificates in the European metrology community	Please select	Please select	Please select
21SCP02	TRaMM	Traceability Routes for Magnetic Measurements	N/A	N/A	N/A
22DIT01	ViDiT	Trustworthy virtual experiments and digital twins	Advanced Manufacturing	Mathmet	N/A
22DIT02	FunSNM	Fundamental principles of sensor network metrology	Mathmet	Advanced Manufacturing	Climate and Ocean Observation
22HLT01	QUMPHY	Uncertainty quantification for machine learning models applied to photoplethysmography signals	Please select	Please select	Please select
22HLT02	A4IM	Affordable low-field MRI reference system	N/A	N/A	N/A
22HLT03	AlphaMet	Metrology for emerging targeted alpha therapies	Please select	Please select	Please select
22HLT04	MetrINo	Metrology for innovative nanotherapeutics	N/A	Please select	Please select
22HLT05	MAIBAI	Developing a metrological framework for assessment of image-based Artificial Intelligence systems for disease detection	Please select	Please select	Please select
22HLT06	GenomeMET	Metrology for genomic profiling to support early cancer detection and precision medicine	Traceability for Laboratory	Please select	Please select
22HLT07	NEuroBioStand	Standardisation of measurements of neurodegenerative disease biomarkers	Please select	Please select	Please select
22IEM01	TOCK	Transportable optical clocks for key comparisons	Please select	Please select	Please select
22IEM02	DireK-T	Dissemination of the redefined kelvin	Please select	Please select	Please select
22IEM03	PriSpecTemp	Primary spectrometric thermometry for gases	Climate and Ocean Observation	Energy Gases	Pollution Monitoring
22IEM04	MQB-Pascal	Metrology for quantum-based traceability of the pascal	Quantum Technologies	Please select	Please select
22IEM05	NEWSTAND	New calibration standards and methods for radiometry and photometry after phaseout of incandescent lamps	Climate and Ocean Observation	N/A	N/A
22IEM06	S-CALe Up	Self-calibrating photodiodes for UV and exploitation of induced junction technology	Please select	Please select	Please select
22IEM07	INFOTherm	Integrated European research, calibration and testing infrastructure for fibre-optic thermometry	Climate and Ocean Observation	Energy Gases	Smart Electricity Grids
22NRM01	TraMeXI	Traceability in medical X-ray imaging dosimetry	Radiation Protection	N/A	N/A
22NRM02	STANBC	Standardisation of Black Carbon aerosol metrics for air quality and climate modelling	Climate and Ocean Observation	Pollution Monitoring	N/A
22NRM03	MetHyTrucks	Metrology to support standardisation of hydrogen fuel sampling for heavy duty hydrogen transport	Energy Gases	N/A	N/A
22NRM04	e-TRENY	Metrology support for enhanced energy efficiency in DC transportation systems	Smart Electricity Grids	N/A	N/A
22NRM05	MeLiDos	Metrology for wearable light loggers and optical radiation dosimeters	Please select	Please select	Please select
22NRM06	ADMIT	Characterisation of AC and DC MV instrument transformers in extended frequency range up to 150 kHz	Smart Electricity Grids	N/A	N/A
22NRM07	GuideRadPROS	Harmonisation, update and implementation of standards related to radiation protection dosimeters for photon radiation	Please select	Please select	Please select
22RPT01	TracInd BVK-H	Traceability for indentation measurements in Brinell-Vickers-Knoop hardness	Please select	Please select	Please select
22RPT02	True8DIGIT	Towards a true 8-digit digitiser	Please select	Please select	Please select
22RPT03	MultiFixRad	Improving the realisation of the kelvin by multiple fixed-point radiation thermometry	Please select	Please select	Please select
22RPT04	RFMicrowave2	Development of RF and microwave metrology capability II	Please select	Please select	Please select