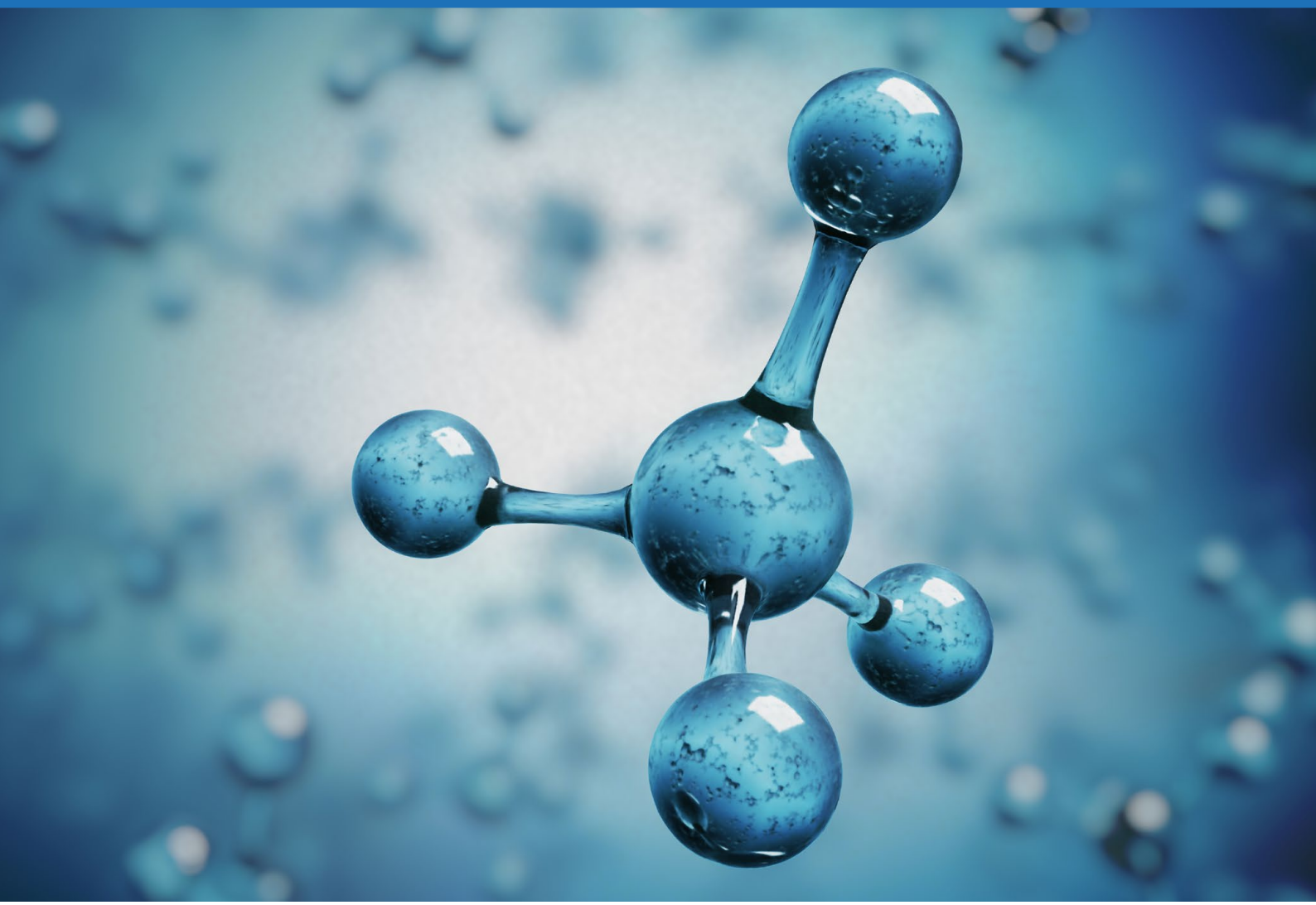
Research Roadmap 2021 Summary

METHANE EMISSIONS MANAGEMENT

European Gas Research Group



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INTRODUCTION

The use of natural gas to replace oil and coal is one of the most feasible options for reducing carbon dioxide (CO_2) emissions. However, **methane** (CH_4) is the main component of natural gas and the second most important **greenhouse gas** emitted after CO_2. Rapidly reducing methane emissions is regarded as the **single most effective strategy to reduce global warming in the near term**.

Methane emissions are in the spotlight of decision makers: this year, the European Commission will propose legislation to **measure, report and verify** methane emissions, put limits on **venting and flaring**, and impose requirements to **detect leaks and repair them**. The European Union and the United States announced in September 2021 the Global Methane Pledge, the International Methane Emissions Observatory (IMEO) was launched at the G20 Summit, and methane diplomacy took centre stage at the COP26 in Glasgow.

The **European Gas Research Group (GERG**) has long been involved in methane emissions reduction from the mid- and downstream gas sector, with a European perspective. Over the past decades, the mid- and downstream gas industry has consistently worked on development & testing of **new technologies** and methodologies, first for leak detection and LDAR, then also explicitly for methane emissions reporting and reduction.

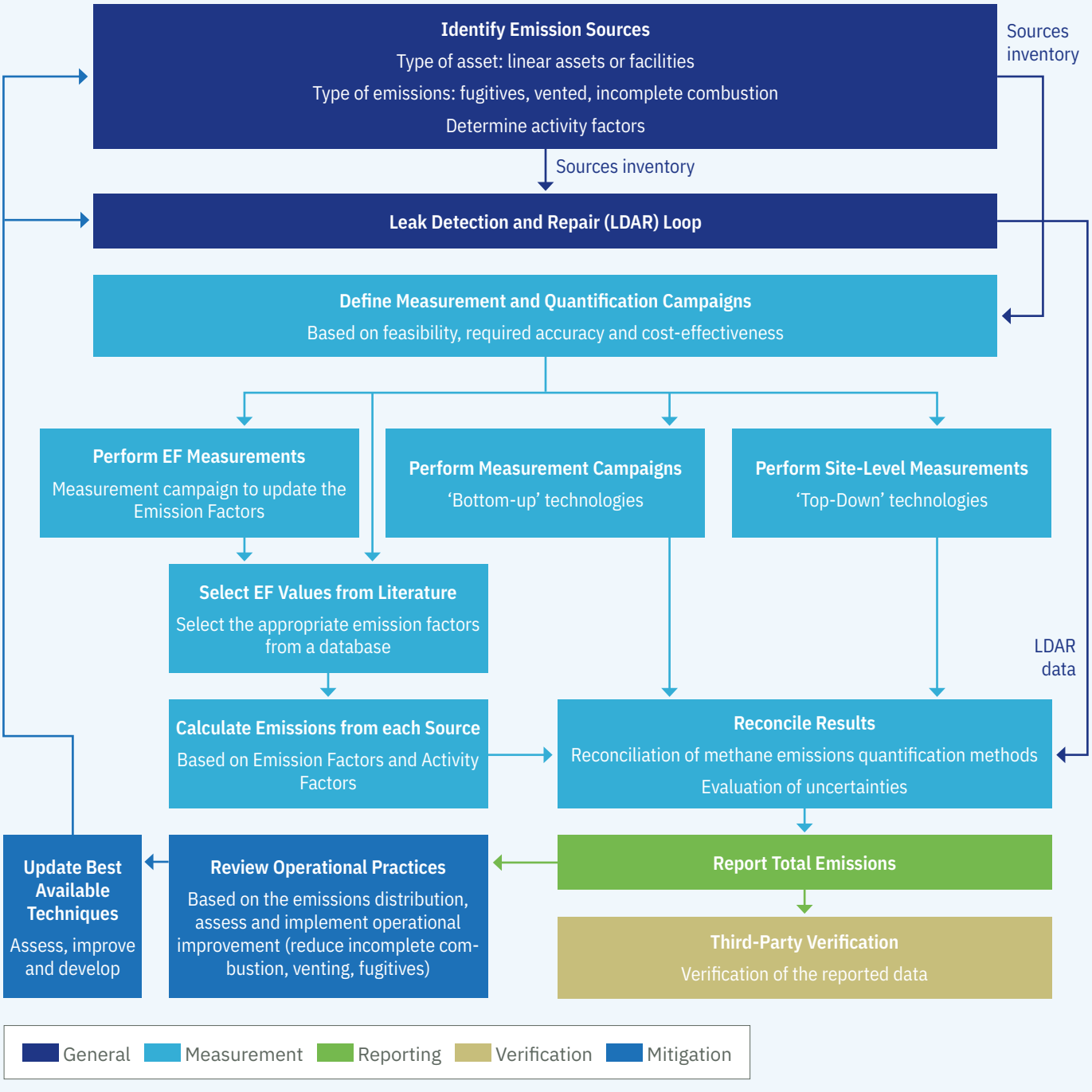
The transition from **leak detection** to **emissions quantification** faces the new challenge of high measurement uncertainties, reconciling methods and finding innovative technological solutions (new or existing) to quantify emissions in the best possible conditions and reach a reliable enough level of reporting.

Innovation is central to successfully tackling these emissions.

HOW SHOULD METHANE EMISSIONS BE MANAGED

Methane emissions **management** and **mitigation** is a process where information circulates in a loop, in order to enable **continuous improvement**. Each sector of the energy value chain faces specific technological and operational challenges, however common high-level steps can be summarised in Figure 1.

Figure 1: Methane Emissions Management



GERG'S RESEARCH ROADMAP PROCESS

The process is a **collaborative effort** by industry experts that **defines research and development gaps** and integrates the results of other ongoing initiatives in Europe and internationally. It will be used as a tool to inform the larger R&D community, as well as policy makers, facilitating the creation of targeted research projects.

Brainstorming phase

Gathering of insights from GERG industry professionals and experts.

Definition of research topics

Scoping of research knowledge gaps and evaluation of criticality.

Production of the roadmap

Summary of results and recommendations for the most prominent research topics.

Project creation in the GERG Programme Committees

Distribution and Utilisation

Transmission and Storage

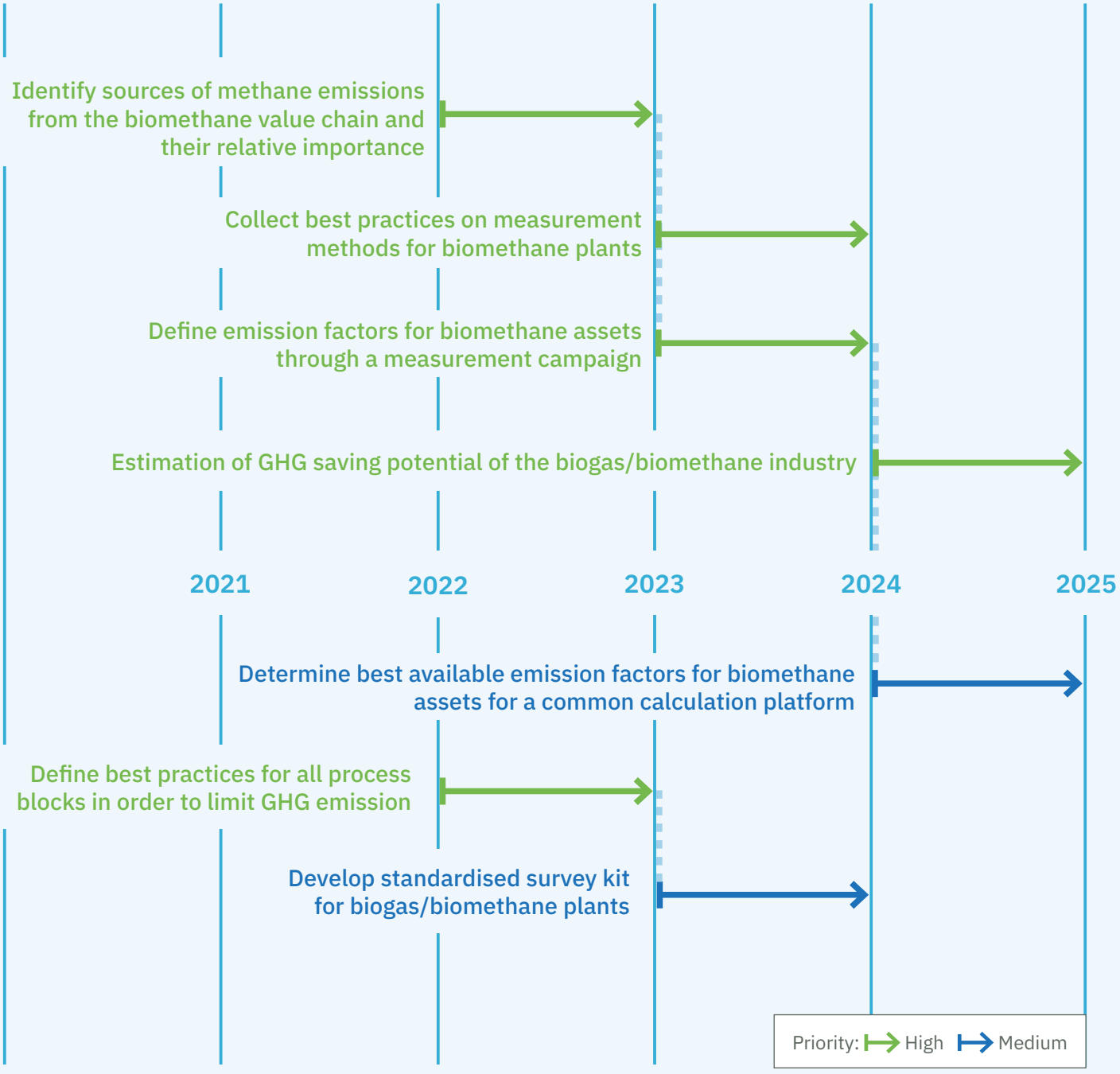
LNG

THE GERG ROADMAP

The GERG Methane Emissions Working Group tackled several sectors (transmission, distribution, end-use, biomethane, LNG) and different parts of the methane emissions management system, **from detection and quantification of emissions to mitigation solutions**.

For each value chain segment and each methane emissions management topic, the roadmap defines precise **research actions** and prioritises them. Tentative timelines were created, representing the criticality of the different R&D topics. An example is presented in Figure 2.

Figure 2: R&D Topics Methane Emissions Biomethane Value Chain



KEY FINDINGS

Transmission and distribution

Studying **different detection and quantification techniques** is critical to develop methods **reconciling data** from different sources. This includes improving on existing technology to expand its scope (quantification uncertainty, detection thresholds), being able to compare data from different methods such as **top-down** and **bottom-up** measures, and developing protocols to v**alidate the equivalence** between various emerging quantification technologies.

Correlation factors are a high priority for both the transmission and the utilisation sectors. They allow the industry to demonstrate how close estimated methane emissions are to the reality on the ground.

In order to give us good quality reliable data, we need to improve on the **emission factors** used across the value chain: the future methane emissions management system will require a European database of emission factors, collected from EU operators and improved through large-scale measurement campaigns.

In addition to emission factors, better knowledge on **activity factors** – leak size distribution – will allow to **target more efficiently the emission reduction measures**.

For distribution, the difficulty of this task is increased due to the very large number of operators and low leakage rates, as important reductions were achieved in the past with campaigns originally built around compliance with safety regulations.

Mitigating the identified sources (from fugitives, venting and flaring) can be achieved through defining and implementing **best-practices** (LDAR campaigns and other operational practices), and investing in **more efficient and cost-effective technologies**. Some high priority areas are: high bleed continuous pneumatics mitigation, electrical or pneumatic air starters, recovery and recompression of emissions in the process gas, installation of excess flow valves in new service lines, best practices for flaring.

LNG

For liquefied natural gas, **LDAR campaigns** also play an important role, as does the definition of **emission factors** (including also the emerging small-scale LNG sites). **Mitigation actions** include limitation of emissions from transfer and regasification, use of nitrogen to purge LNG pipes, optimised LNG truck loading, and flaring best practices.

Utilisation

Methane emissions from utilisation (industrial, commercial, and domestic appliances) are challenging because they are distributed on a much larger number of sources in the field. The current knowledge about those emissions is incomplete, and research efforts are required to **investigate the existing emissions, develop test protocols**, and **mitigate the emissions by improving the technologies** (one important example is the incomplete combustion from engines).

Biomethane

The biogas and biomethane sector have a **high potential** as a solution in the decarbonisation toolkit: circular, local energy production, potential for negative emissions depending on the inputs and outputs. This makes assessing and managing methane emissions from biomethane sites even more important, to make sure the benefits of this technology are not compromised. The actions for biomethane sites are defining measurement factors, implementing quantification campaigns, developing survey kits for operators, collecting and sharing best practices.

Finally, an overarching recommendation is that we must strive to develop precise **cost abatement curves** per value chain segment to give visibility of the needed resources per achieved reductions.

CONCLUSION

Building on long-standing efforts to limit and reduce methane emissions from the European gas sector, the gas industry can play a major role in this effort.

Collaborative R&D and knowledge sharing is key to make this happen. While lack of data should not hold back efforts to target methane emissions by implementing quick-win actions, **further research remains paramount to improve methane leaks detection, quantification and mitigation**.

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