

25th anniversary and new Key Comparison ahead.

During 2024, a EuReGa Harmonisation intercomparison was successfully completed. The comparison has expanded the range of the harmonised cubic meter up to 25000 m³/h.

EU's natural gas harmonization group celebrates its 25th anniversary

The European reference for gas metering can now celebrate its 25th anniversary started in 1999 by NMI (now VSL) and PTB by signing a MoU. A kind of metrological marriage where independent traceability chains are harmonized towards one reference value: the harmonized reference value. From that moment, the comparison results from the institutes showed that there was virtually no difference, which was seen as a major advancement. LNE (France) was interested in joining the group and their membership was effectuated in 2004.

With more candidates at the horizon and to link the HRV to the metrological world, it was necessary to legally formalize the collaborations. Therefore, in 2012, a consortium was established under the name EuReGa (European Reference for gas metering), in which many matters were formalized. Soon after that, in 2013, Force Technology (Denmark) also joined to strengthen the HRV with their primary standard and calibration facility [1].

EuReGa harmonisation intercomparison

In 2023, a new combined EuReGa harmonisation intercomparison and EURAMET key comparison commenced. This iteration has been expanded to incorporate a DN600 meter package, which includes both a turbine meter and an ultrasonic meter, to facilitate harmonisation up to 25000 m³/h at pressures ranging from 8 bar to 60 bar. The testing phase for this comparison began in July 2023 and was scheduled to conclude in the spring of 2024. Due to unforeseen circumstances, it was not completed before the end of 2024. Upon completion, the harmonised Reference Value (HRV) will be calculated, and a comprehensive report will be prepared.

EURAMET key comparison

The Technical Protocol for the EURAMET key comparison will be made available and published on the BIPM website when the protocol of key comparison CCM.FF-K5.2021 is published at BIPM KCDB.

EuReGa primary intercomparison

In 2024, a primary comparison started between PTB/Pigsar, VSL, and FORCE Technology, all of which use piston provers for their measurements. LNE/Cesame will join through a separate comparison with PTB using sonic nozzles. As the sonic nozzles will be calibrated using PTB's piston prover all labs can be compared. All tests have been completed, and the results are currently being analyzed. A detailed report will be prepared once the analysis is finished.

Meetings

The harmonization group gathered together in two meetings in 2024, one online meeting in May and one "in person" meeting in December at the location of GRTgaz, now NaTran, in Alfortville, Paris.

EuReGa governance

The Assembly of Representatives consists of Erik Smits (VSL), Julia Hornig (PTB), Henri Foulon (LNE-LADG), Bo Holm Andersen (FORCE Technology).

The Team of Experts consists of Bodo Mickan, Thomas Lorenz, (PTB), Detlef Vieth (pigsar), Christophe Windenberger, Abderrahim Ouerdani (LNE-LADG), Fares Ben Rayana, (RICE/GRTgaz), Jesper Busk, Kurt Rasmussen (Secretary) (FORCE Technology), Menne Schakel, Marcel Workamp (VSL), Roy van Hartingsveldt, Mijndert van der Beek (Euroloop).

Outlook

For the coming year the following activities have been planned,.

- Finalizing the analysis of the results from the harmonisation.
- Finalizing the analysis on the results from the primary intercomparison.

Conclusion

With a successful completion of the harmonisation exercise in 2024 including the EURAMET key comparison and the settlement of the EuReGa governance, EuReGa looks

back at a successful period and is celebrating its 25th anniversary. In addition, EuReGa has many plans for the years to come.

References

[1] newsletter EuReGa 25th anniversary

EU's Natural Gas Harmonization Group Celebrates Its 25th Anniversary

Twenty-five years ago, National Metrology Institutes (NMIs) began collaborating on harmonization to establish a higher level of trust in the trading of large volumes of natural gas. This initiative has proven to be a great success, enhancing confidence in natural gas trading to the benefit of society.

Are you interested in understanding what harmonization entails? Do you wish to learn about the reasons and incentives for harmonization?

Read the historical context below, which led to the founding of the EuReGa group and its subsequent success.

Before 1993, there were only a few calibration facilities for natural gas volume meters in Europe, located in the Netherlands (Groningen, Bergum, Westerbork, and Utrecht). Gas metrology gained momentum due to the need for accurate measurement of natural gas quantities, driven by the discovery of large natural gas reserves in northern Netherlands in 1959. The development of large, stable gas turbine meters also progressed during this period.

Creating a reference value for high-pressure natural gas in the Netherlands involved displacing natural gas with a known, easily measurable amount of oil at atmospheric pressure. The known quantity of gas was derived from a Bell prover, which could then be calibrated by knowing the amount of displaced gas. Scaling up to higher pressures and volumes was achieved through pressure and volume bootstrapping. Three gas volume meters were calibrated at atmospheric pressure and placed in parallel to calibrate one gas meter at 9 bar, which was expanded to atmospheric conditions in the three meters using mass balance (kg in = kg out). Subsequent steps were taken to serve common network pressures (21 bar, 36 bar, 51 bar, and 61 bar). This process was labor-intensive, taking about a year and 2500 man-hours, with an uncertainty of approximately 0.3% at the

highest flows and pressures. The stability of the reference value was also no better than a few tenths of a percent.

In 1993, a new laboratory, pigsarTM, was established in Dorsten, Germany. At pigsarTM, an independent realization of the cubic meter was achieved using a passive piston prover, where a piston moved by the gas flow through a precisely measured cylinder. This allowed gas distributors and manufacturers to have their gas meters calibrated at different facilities in two countries.

However, creating two reference values led to differences, which could amount to 0.2 % at certain pressures and flows. Metrologists from NMI (Netherlands) and PTB (Germany) could explain these differences based on the uncertainty claims of the facilities and did not consider them significant. However, for gas distribution companies, a 0.1 % difference could cause a financial imbalance of about 15 million euros in the Netherlands alone.

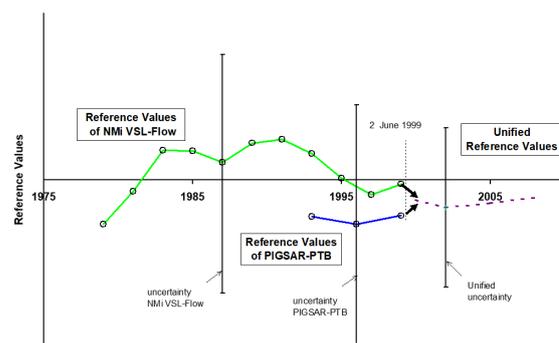


Figure 1 two independent traceability chains

Complaints were lodged at the national metrology institutes of the Netherlands and Germany, prompting metrological experts to brainstorm solutions. The solution was found by merging the two independent traceability chains, resulting in a single cubic meter of natural gas. This method, extensively described in various publications, is based on the determination of the Harmonized Reference Value (HRV). The HRV is the weighted average of measurement results from the involved calibration facilities, with the weighting factor inversely proportional to the square of the uncertainty with which a laboratory can determine the gas volume. The HRV serves as the new reference value for all participating laboratories, with national reference values adjusted accordingly.

In June 1999, a Memorandum of Understanding (MoU) was signed between Nmi VSL (now VSL National Metrology Institute) and PTB, pledging to use only the harmonized value for all derived installations. This "metrological marriage" resulted in virtually no differences in comparison results, seen as a major advancement. Harmonization also brought additional benefits.



Figure 2 festivities in Dordrecht, experts from pigsar, PTB and NMI VSL on 2nd June 1999, Harmonization was a fact

Since the reference values are based on results from multiple participants, variations in the realization of each pure cubic meter are dampened by averaging. This is evident in the behavior of 10 identical master meters from the former calibration facility "Westerbork" around the first harmonization round.

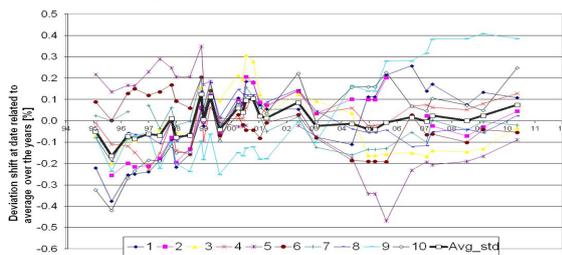


Figure 3 Average deviation shifts of 10 working standards from 1995 to 2011: harmonization seems helpful!

Statistically, the uncertainty of a harmonized reference value improves with more information, theoretically reaching 0.0% with an infinite number of participants and traveling standards. However, a compromise was necessary.

Certificates issued by participating laboratories now feature a statement regarding the use of the harmonized reference value. Although successful in Europe, the methodology was initially not accepted worldwide. Some metrologists felt that active fine-tuning

was unscientific. Over time, the method was better understood and embraced. The downside is the need for many stable traveling standards to cover the entire flow range (40 m³/h – 25000 m³/h volume flow at 8 bar(a), 20 bar(a), and 60 bar(a)). The fleet of traveling standards has grown to 10, divided over 5 twin packages, with tightly organized coordination.

LNE (France) expressed interest in joining the group from the start in 1999, becoming a member in 2004. With more candidates on the horizon, it was necessary to legally formalize collaborations. In 2012, a consortium named EuReGa (European Reference for Gasmetering) was established, formalizing many aspects. Soon after, in 2013, Force Technology (Denmark) joined to strengthen the HRV with their primary standard and calibration facility.

The 25 years since the start of this metrological approach, harmonization, have flown by. Some original metrologists have become grandfathers, and sadly, some are no longer with us. We remember them with great respect and reverence: Hans Juergen Hotze (pigsar), Jean-Pierre Vallet (Cesame), and Johannes Elskamp (NMI VSL), who greatly contributed to the success of the harmonization process.

We trust that with the current team of experts and the influx of new generations of metrologists, we will continue to serve the gas flow world for many years to come with this ultimate form of collaboration. Developments will be communicated on the EURAMET website in the coming years, as you are accustomed to.



Figure 4 Old and new generation EuReGa Metrologists 'at your service'