



20IND06 PROMETH2O

Metrology for trace water in ultra-pure process gases

Steering Board Meeting

Online, hosted by INRIM

27 October 2022 – h14:00-16:00



The EMPIR initiative is co-funded by the European Union's Horizon 2020 research and innovation programme and the EMPIR Participating States

1. Review the status of the stakeholder survey
2. Review the project activity in line with stakeholder needs
3. Review any relevant aspects of project impact and engagement

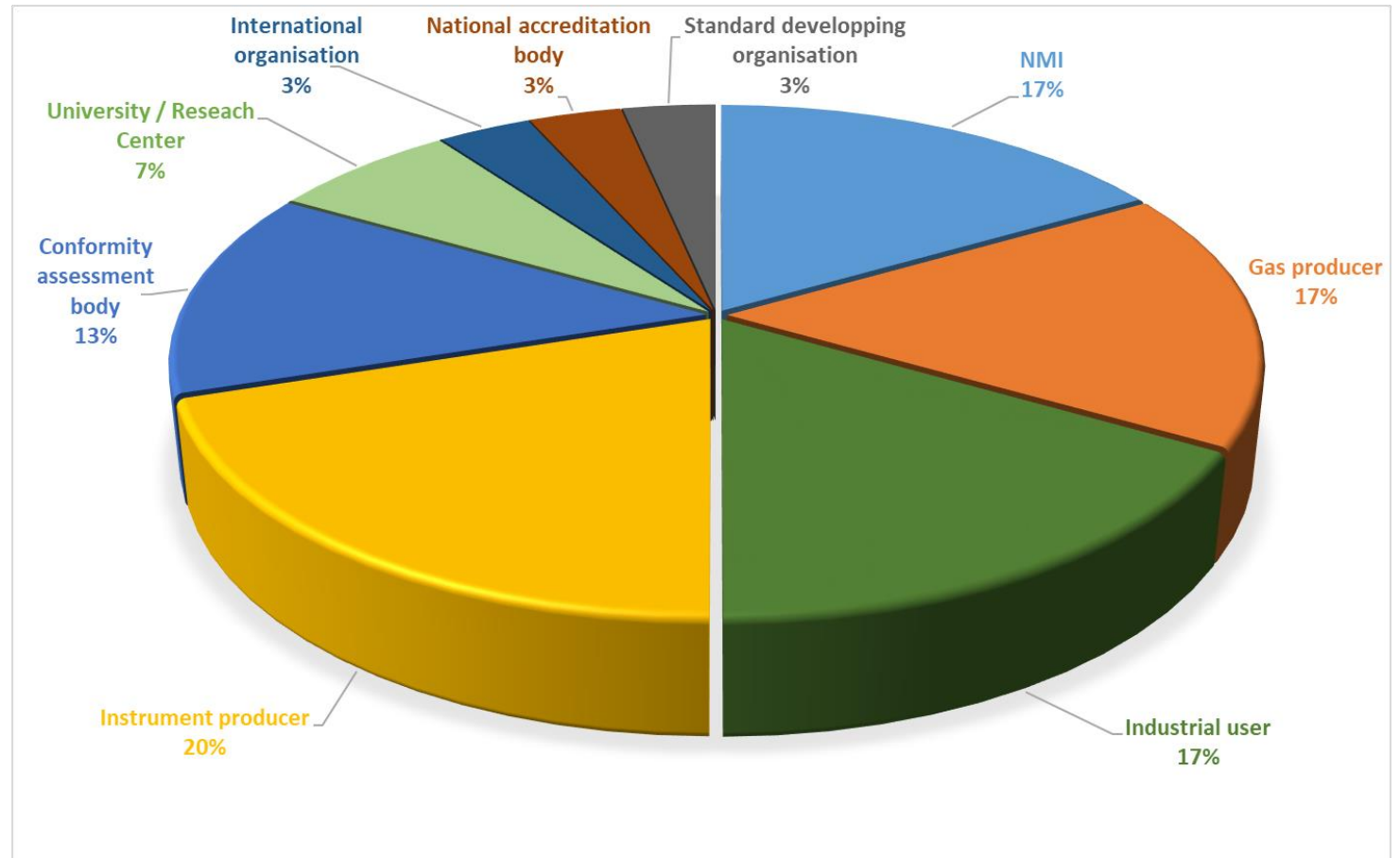
Online meeting on GMeet platform at: <https://meet.google.com/yiy-djdq-owd>

1. Status of the stakeholder survey

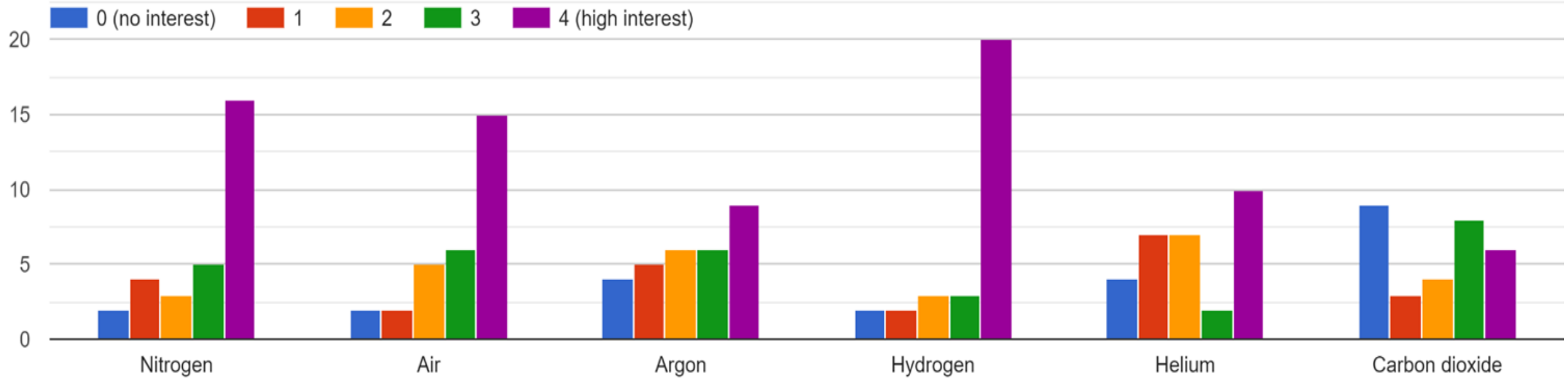
- As part of the stakeholders engagement, a questionnaire-based survey was prepared on Google Forms and shared among 50 selected people representing their respective organizations.
- The aim of the questionnaire was to collect information about needs and priorities of the stakeholders' community concerning **the water contamination of ultra-pure process gases** in order to keep PROMETH2O better aligned with the stakeholders' demands.
- The collected data were processed and only its statistics is made available to the public (this meeting, the project web site and/or project meetings).
- *The questionnaire consisted of 8 questions (... and its filling took no more than 10 minutes).*

Stakeholders profile

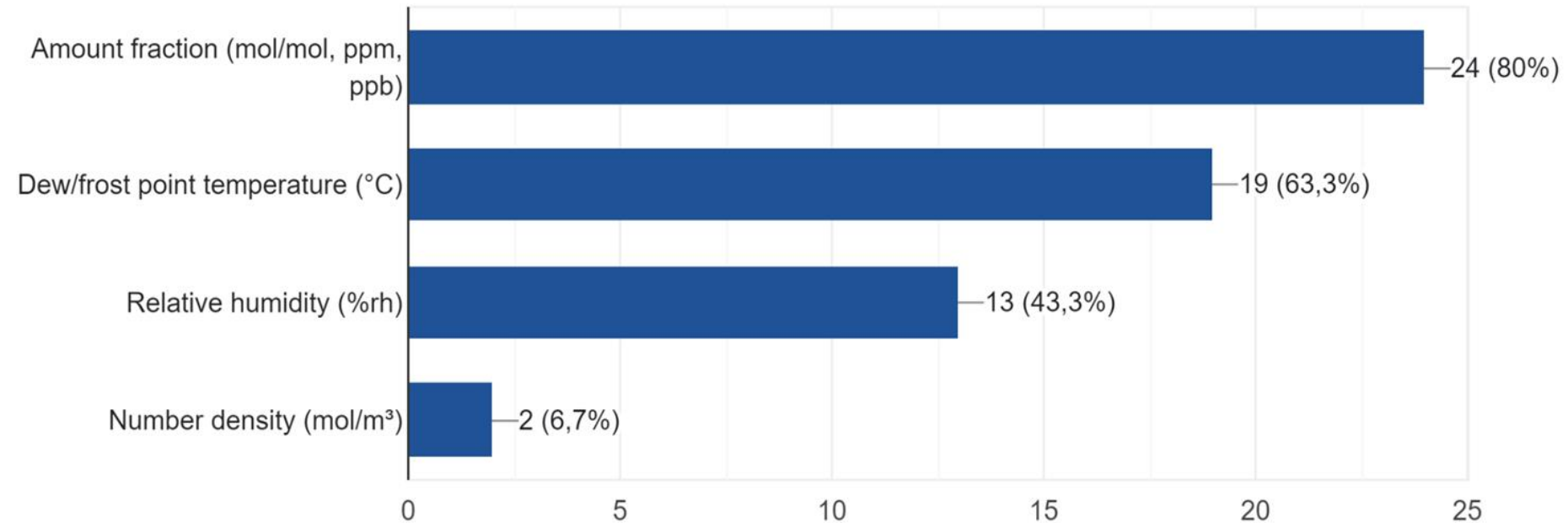
- ✓ The survey covered a broad stakeholders' community
- ✓ 30 replies received against 50 enquiries
- ✓ a remarkable success rate of 60 %.



Question 1: Which of the following carrier gases are you interested in?

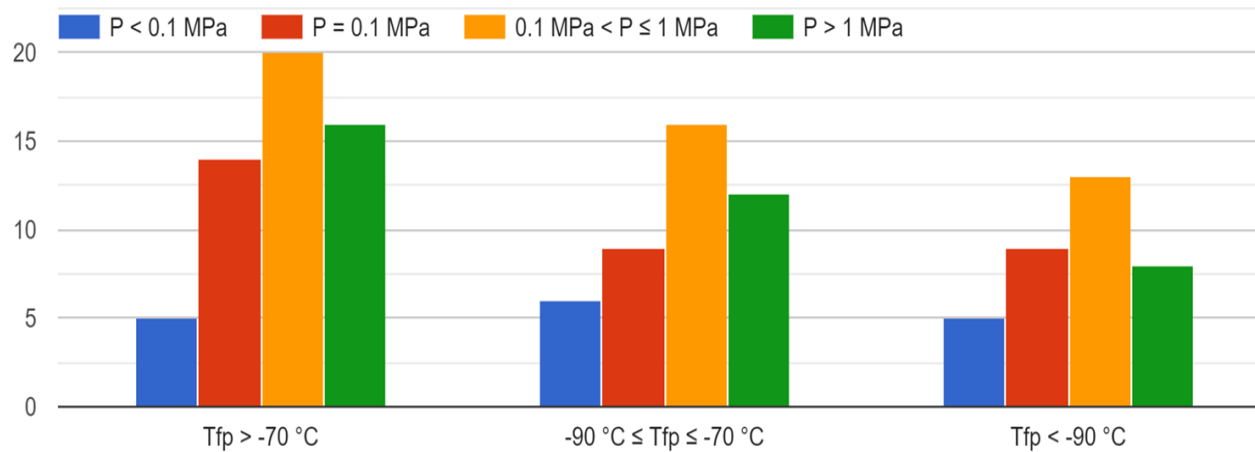


Question 2: Which of the following measurands are of your interest?

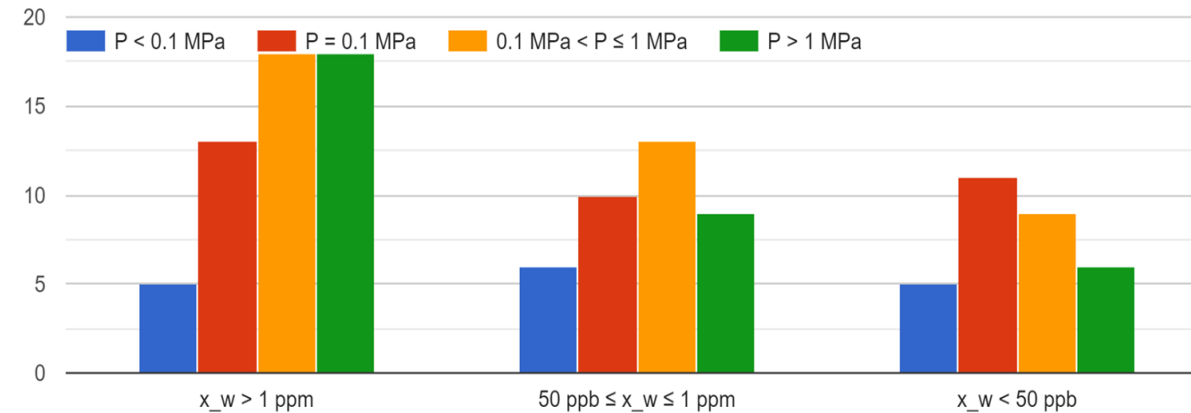


Question 3: Which is the humidity range of your interest and the pressure regime?

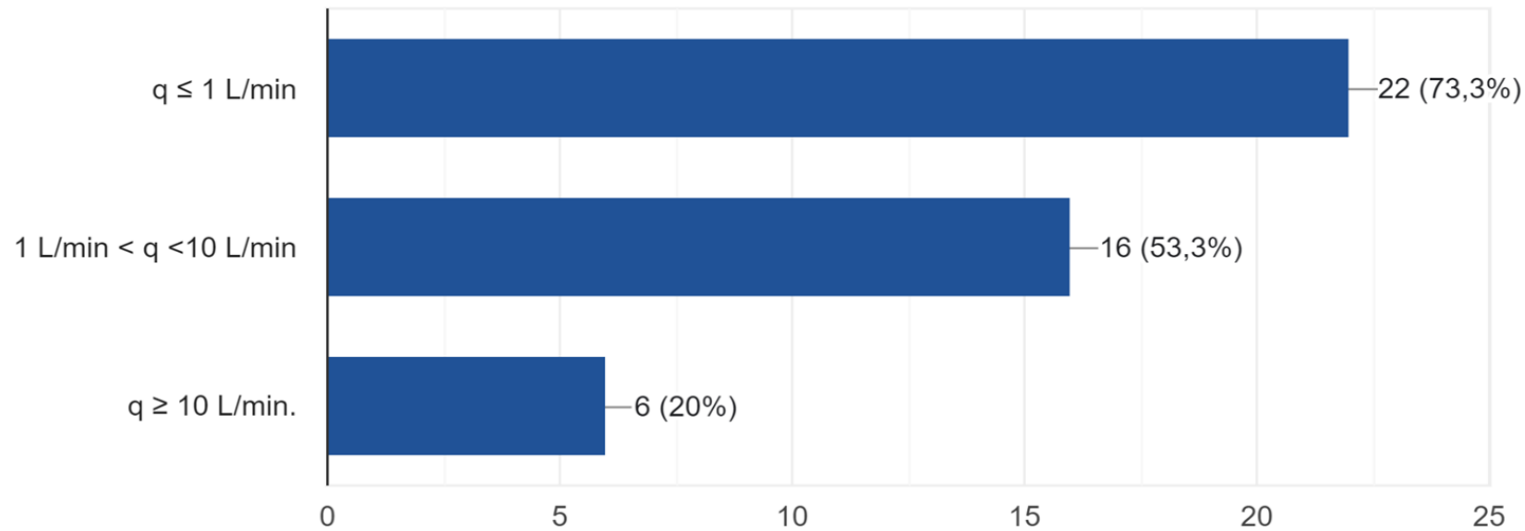
a) Frost point temperature



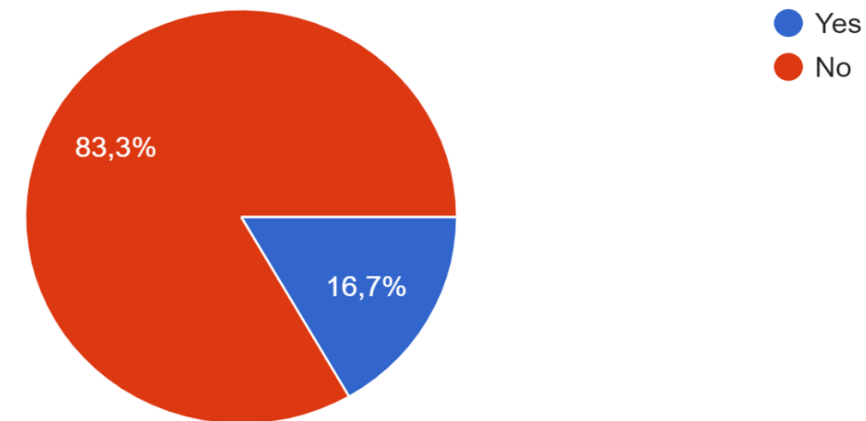
b) Water vapour amount fraction



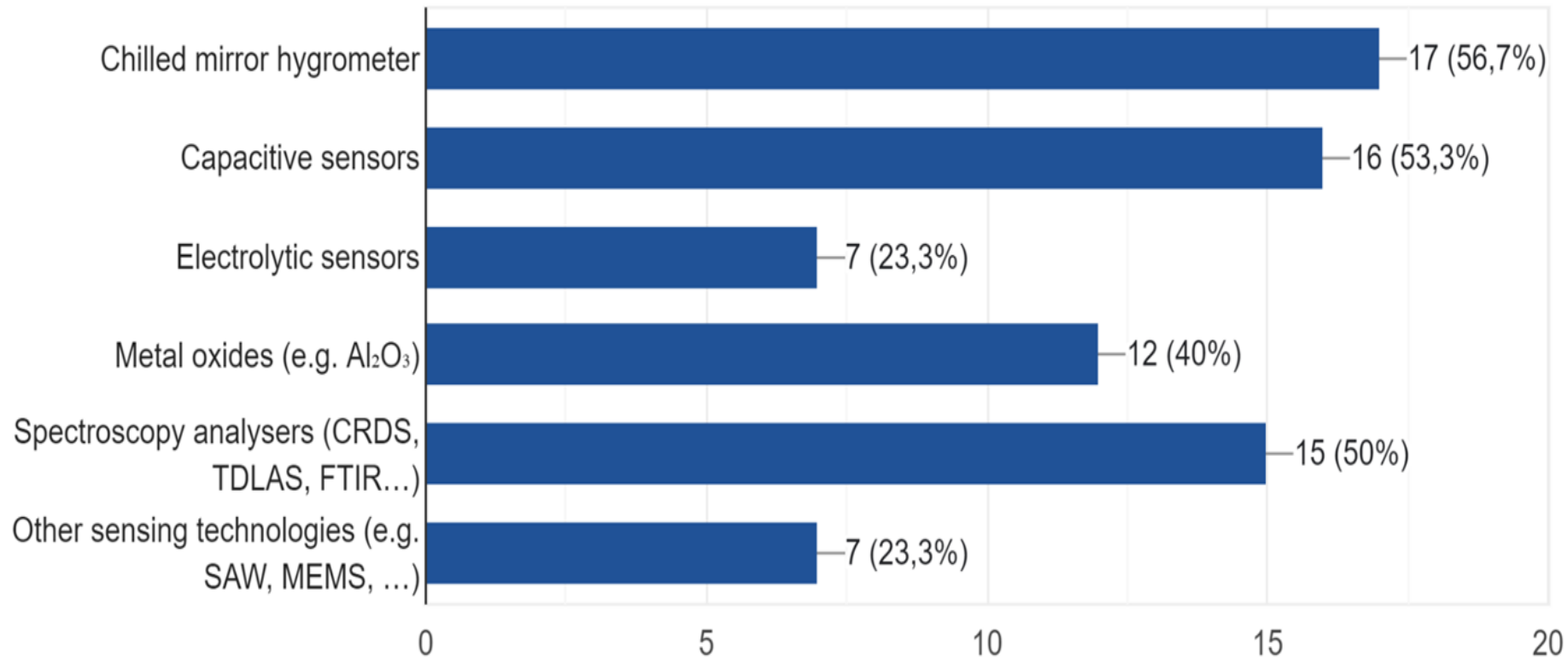
Question 4: The gas flow rate q in the sampling line



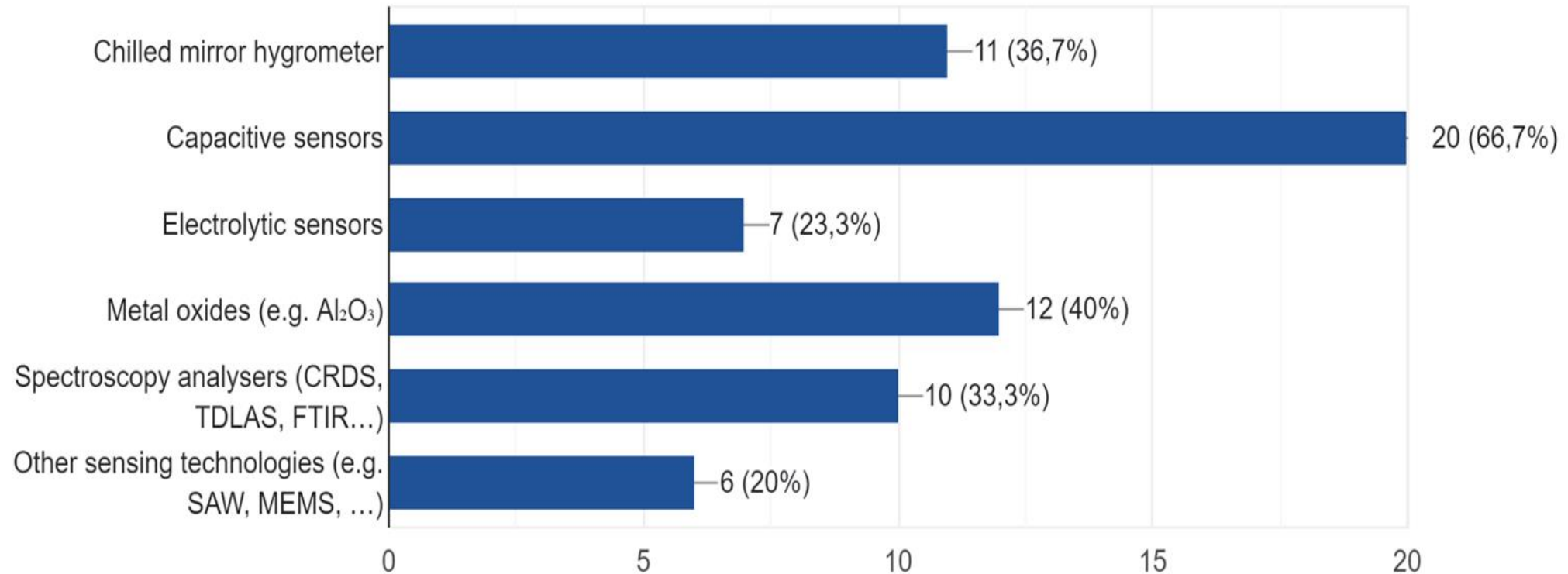
The sampling line is connected via a heated hose?



Question 5a: Which kind of sensors do you use in **laboratory** analyses/calibrations?



Question 5b: Which kind of sensors do you use or are required in **field measurements**?



Question 6: Why do you need to measure the trace water content in pure gases and which is the required measurement uncertainty?

Development of trace-moisture standards. Production of gas reference standards. Certification of gas standards for customers

“I need to measure the trace water content in pure process gases as part of the quality assurance process to guarantee product gas quality.”

Control impurities to support process gas industry, hydrogen economy, CCUS, medical gases and to avoid reaction with trace molecules

“We supply our moisture measurement solutions to a cross section of customers, from gas producers to high end users like semiconductor plants. Moisture is a contaminant for both of these customer segments.”

Hydrogen purity grade definition and gas networks acceptancy limit

“H₂ production by water electrolysis and Fuel Cell applications.”

EU and National standards to support EU directives, e.g. the quality of natural gas (EN 16726), biomethane (EN 16723-1, EN 16723-2), and HENG

“Measurement of water dew point of natural gas and biomethane to be injected into the network and to be used in engines.”

Required uncertainty

≤ 10 %

≤ 1 °C

1 % to 10 %

H₂ purity (>99.999%)

Depending on stds
(≤ 5 ppm)

Question 7: What problems/needs do you consider to have in your application?

Metrological traceability, instrument drift, changing response. Sensitivity to pressure, gas species and quality of the purge gas. Limited data in specialty gases

“Few suppliers of suitable instrumentation. Cross-sensitivity of instrumentation. Some instruments only work at pressure well above atmospheric.”

Having a portable, easy to use calibrator that can be ready for use within the working day is considered a useful asset

“Our customers have experienced problems relating to instrument drift, poor response times and hysteresis issues which they have to assess on site before deciding whether or not to send an instrument away for adjustment.”

Accurate measurement of water concentration for correction purposes for primary analytes

“We need an international traceable system for calibration at under 0.1 ppmv.”

2. Project results to match stakeholder needs

- Project achievements so far
 - Optical analysers (far-UV and CRDS) demonstrated to 200 ppb
 - CMH characterised down to -100 °C fp
 - Microwave hygrometer demonstrated to 0.5 ppm
 - Trace water generator in N₂ operated down to -105 °C (5 ppb) at 0.65 MPa
 - Primary humidity generators upgraded to 1 MPa
 - Initial measurements of $f(T, P)$ in N₂ and Ar down to -70 °C
 - Commercial portable FPG working down to -90 °C available

Are stakeholder needs matched?

3. Relevant aspects of project impact and engagement

- Open discussion with the Steering Board members
 - Suggestions, remarks, ...
- Further steps
 - A short report in view of the mid-term project review made by an independent committee at 02/2023
 - Some form of “demonstrable” liaison and impact with
 - Int’l organisations: CCT WG-Hu, CCQM GAWG, IAPWS WG TPWS, JCS,, EURAMET TC-T, TC-MC
 - Standard devel. organisations: ISO/TC 158/WG3, DIN NA 062-05-73 AA, SEMI Gases TC
 - Please consider becoming a project collaborator (signing LoA)



PROMETH₂O

Thank you for your attention

EMPIR



EURAMET

The EMPIR initiative is co-funded by the European Union's Horizon 2020 research and innovation programme and the EMPIR Participating States