

The background image for the technical highlights document shows a close-up of a metallic surface with a liquid being poured onto it, creating ripples and splashes. The lighting is bright, highlighting the metallic texture and the fluid motion of the liquid.

Technical Highlights Future Challenges from TC Flow

TC- Chair Petra Milota

Madrid and Tres Cantos, Spain
15 – 18 May 2017



Flow

Challenges



Challenges

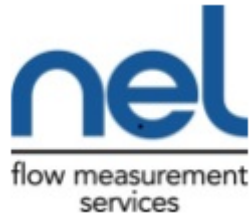


- Securing matching funding for successful EMPIR proposals
- Funding mechanisms for smaller collaborative research projects that do not fit the EMPIR funding model
- NMI/DI involvement in standards bodies such as ISO etc.
- Reducing national metrology budget with increasingly diverse client requirements
- Get funding for new facilities to build up a metrological infrastructure (LNG, high pressure, high temperature, high viscosity, complex fluids, ...)
- Build up metrology awareness in the medical field

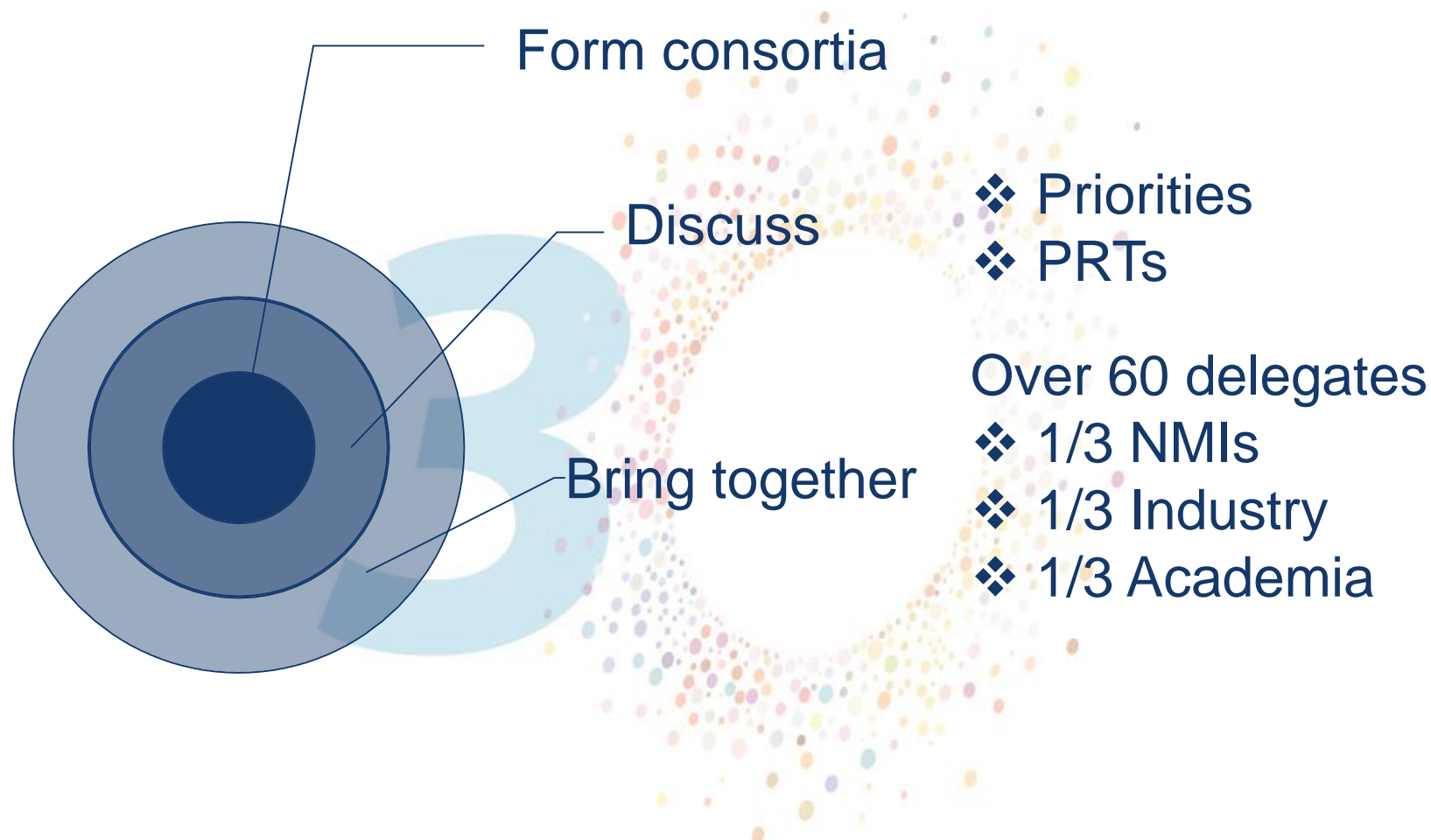
EMPIR Industry Workshop



EMPIR Industry Workshop



Goal of the workshop

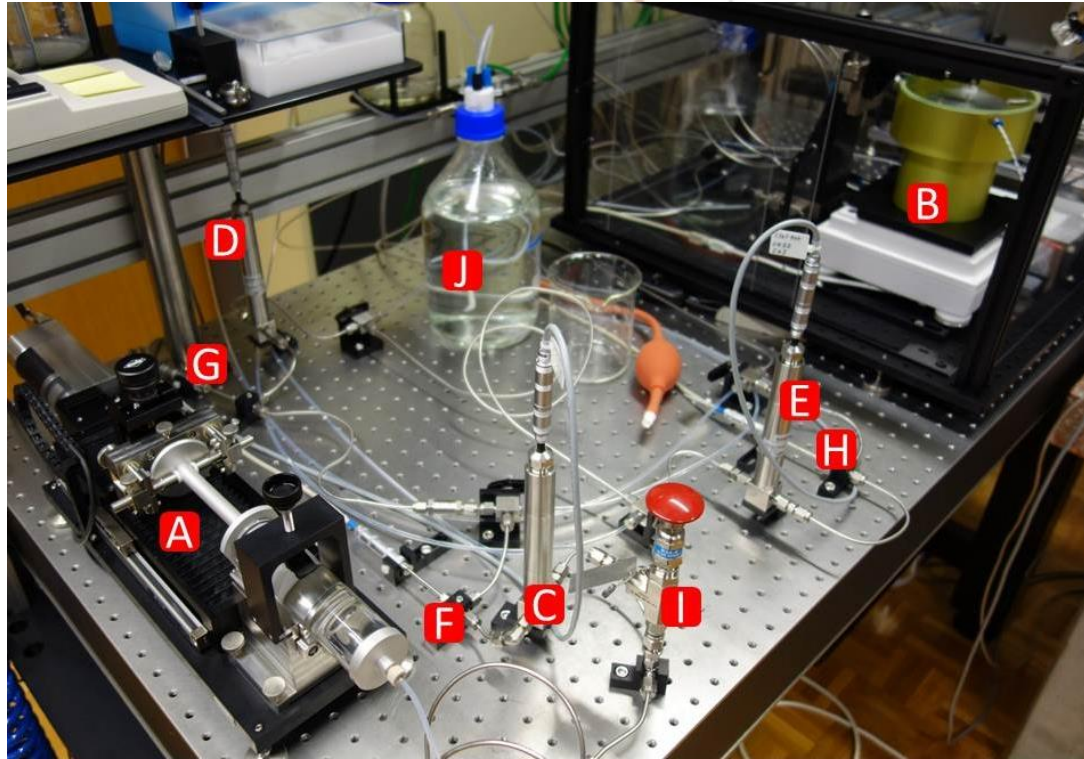


Results

- Five different themes were covered
 - Flow Meter Diagnostics
 - Multiphase, wet gas and steam
 - High pressure and/or high temperature flows
 - Sensor networks and big data
 - Waste Water and Large Diameter Pipes

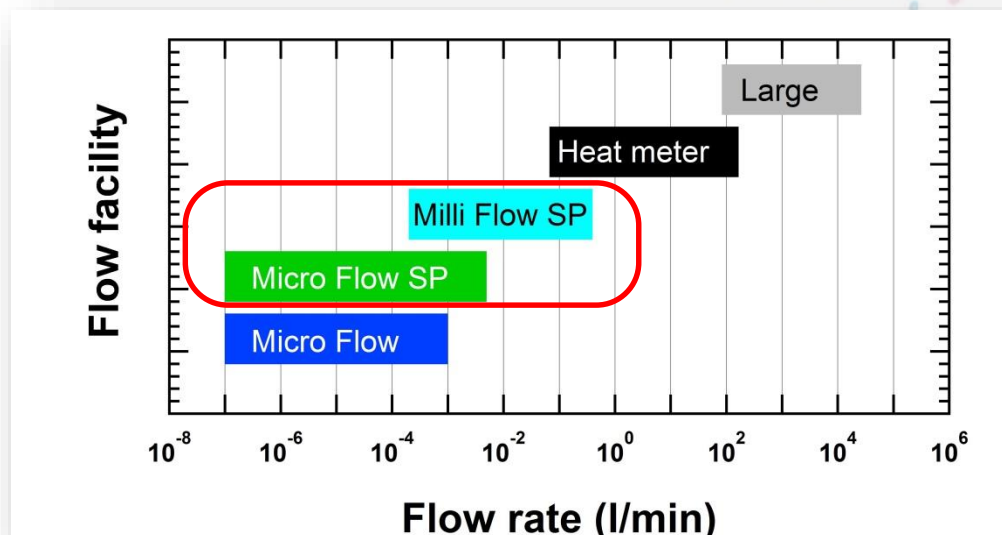


Liquid Milli-Flow Facility, various liquids

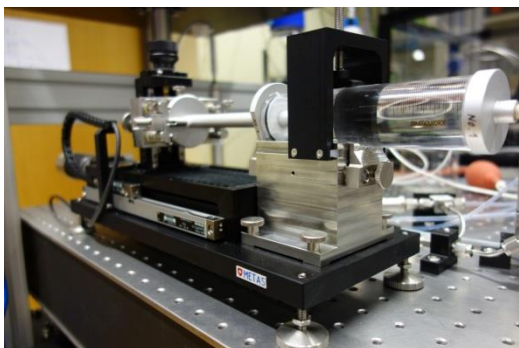


(A) syringe pump, (B) beaker on balance,
(C, D, E) pressure sensors, (F, G, H) temperature sensors,
(I) pressure security valve, (J) water reservoir

Micro-Flow and Milli-Flow Facilities



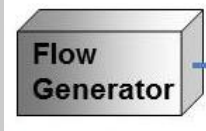
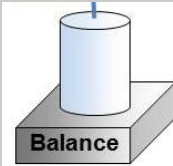
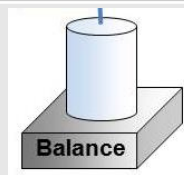
Accurate and fast calibration method
for flow rates from 100 nl/min to 400 ml/min !



✓ portable flow generator

✓ any liquid



Capability to calibrate	Method
Flow sensors	 or 
Flow generators	

Syringe Pump	Micro-Flow	Milli-Flow
Flow rates:	100 nl/min – 5 ml/min	0.2 ml/min – 400 ml/min
Pressure range (upstream DUT):	0 – 8 bar (2.5 bar)	0 – 8 bar
Temperature:	22 ° C (ambient)	22 ° C (ambient)
Uncertainty (k=2):	0.70 % – 0.15 %	0.07 %

Planned developments

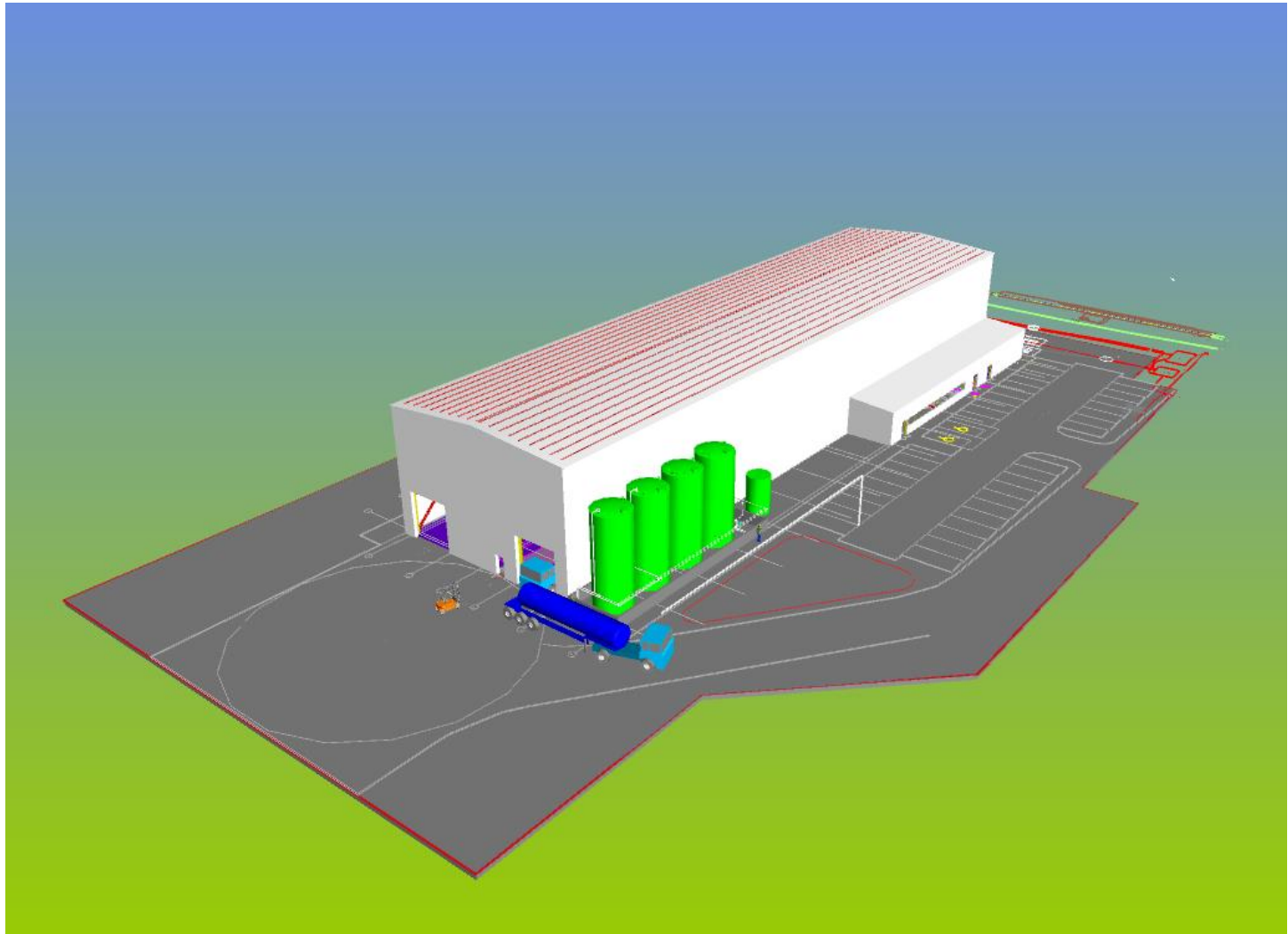


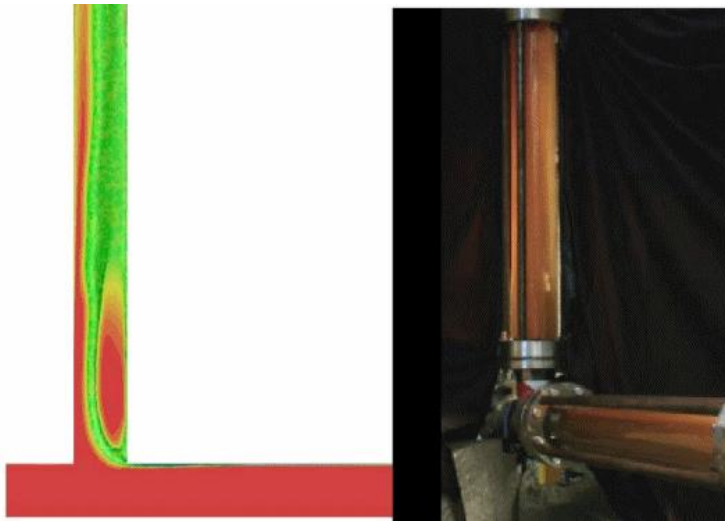
Planned developments



- Extension of European metrology reference network for multiphase flows through new multiphase EMPIR project and develop a Centre of Excellence
- Produce new TC-Flow roadmap for European flow metrology to cover the changing metrology landscape and align with industry needs.
- However, we all are also continuously trying to improve our existing facilities to meet customer demands (lower uncertainty, range expansion, higher level of automatization, etc.)

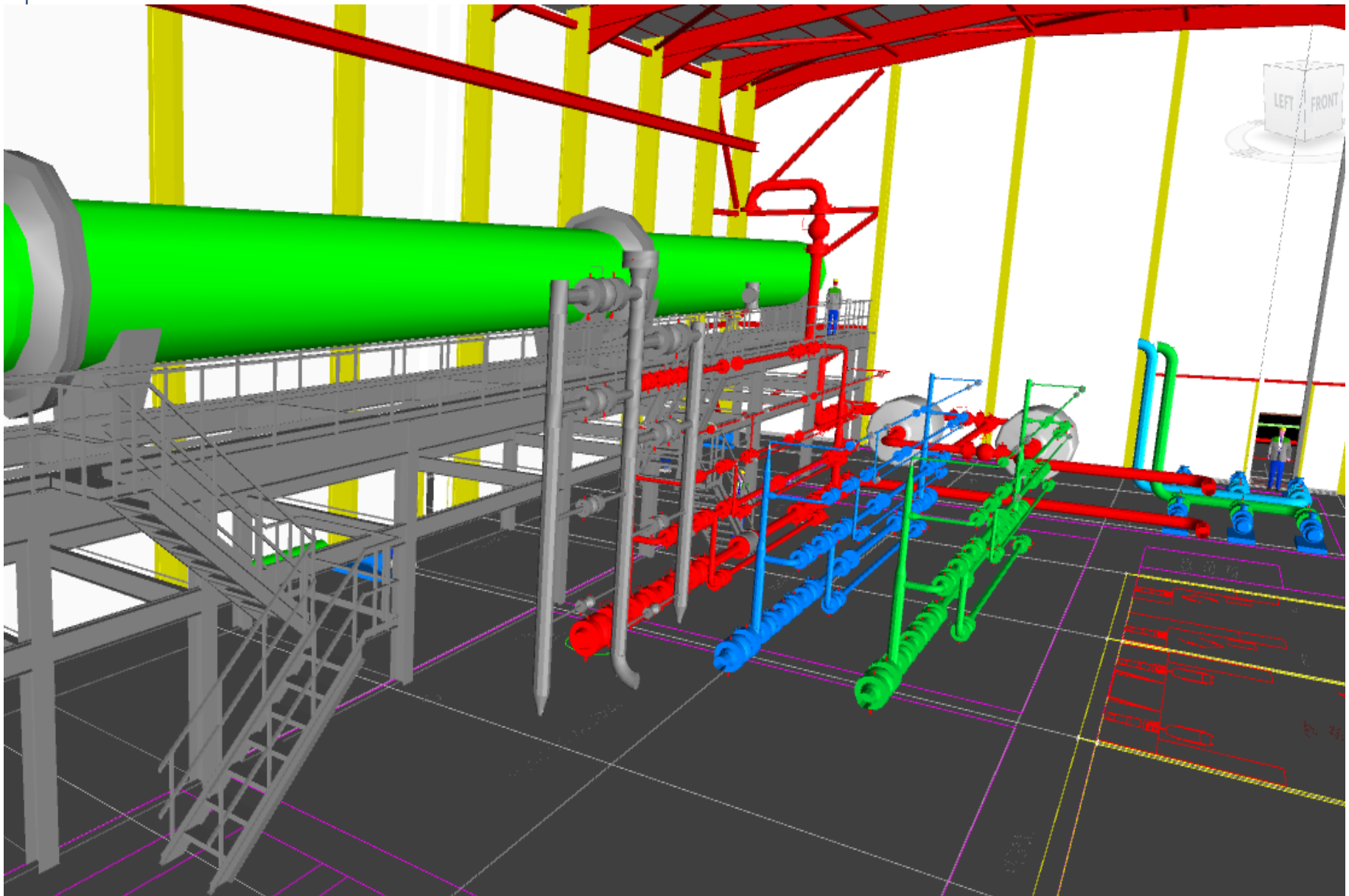
New Multiphase Facility





Parameter	Operation range
Pressure	15 – 150 bar(g)
Temperature	20 – 50 Deg C
Gas flowrate	500 – 3000 m ³ /hr
Oil flowrate	125 – 550 m ³ /hr
Water flowrate	125 – 550 m ³ /hr
Combined liquid flowrate	1100 m ³ /hr

The facility should also provide means to visualise and control flow patterns upstream of the test flow meter.

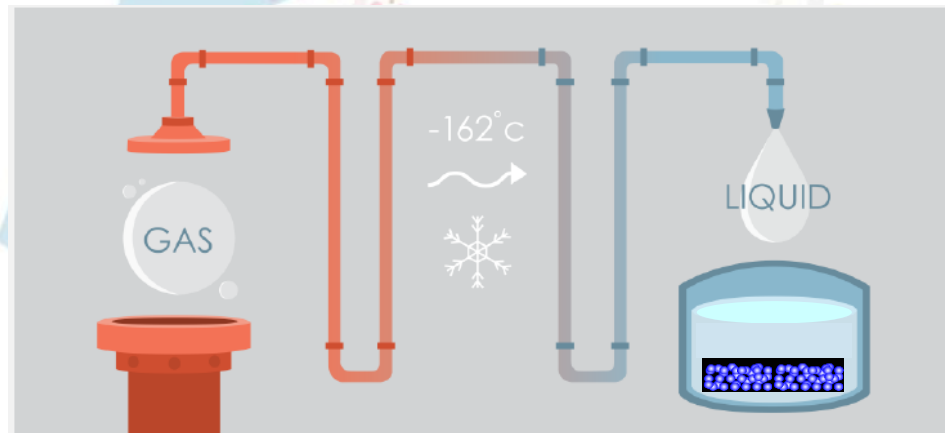


Metrology for LNG



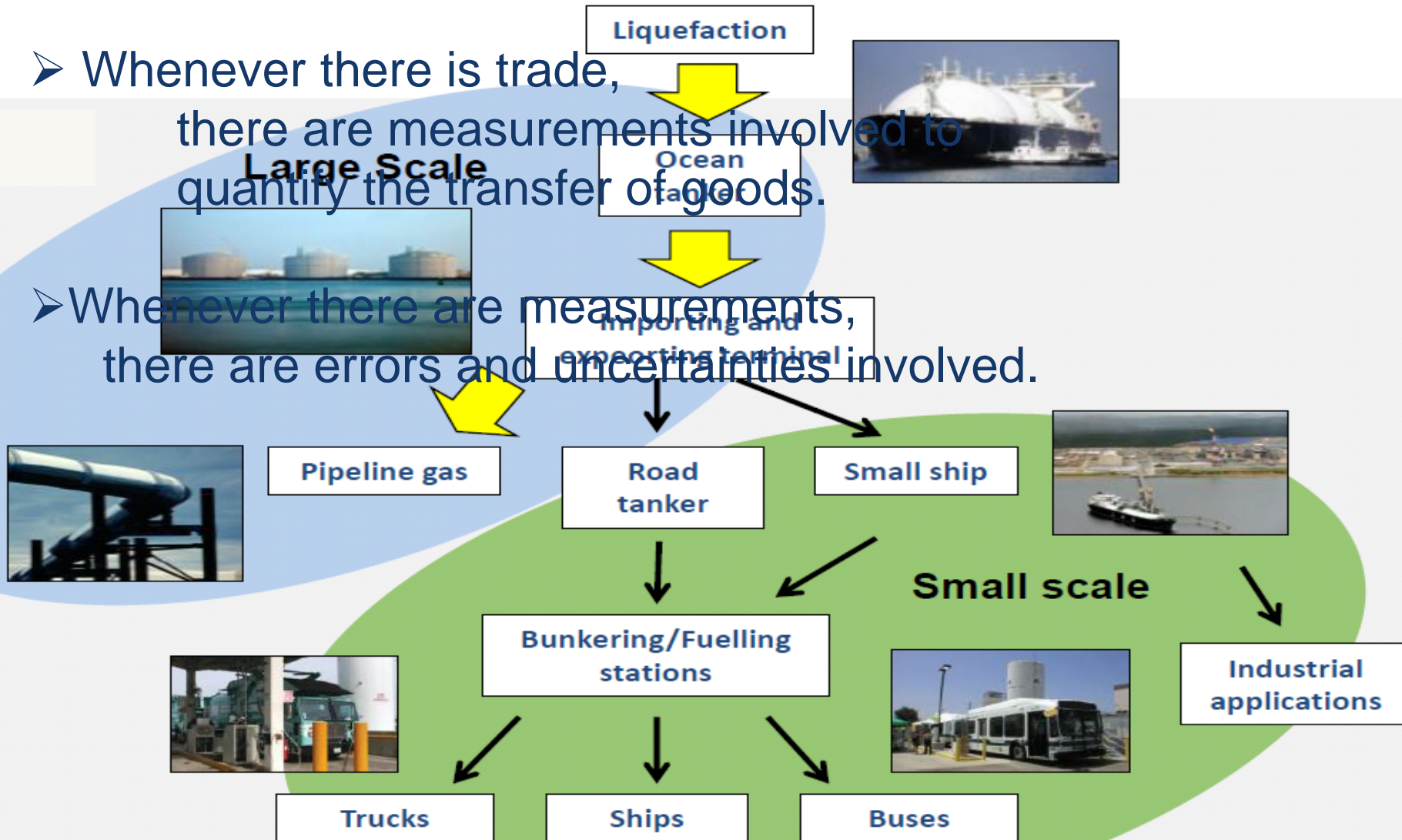
What is LNG

- LNG is natural gas temporarily converted to liquid form
- LNG takes up about 1/600 the volume of natural gas
- Easier to store or transport
- Predominantly methane

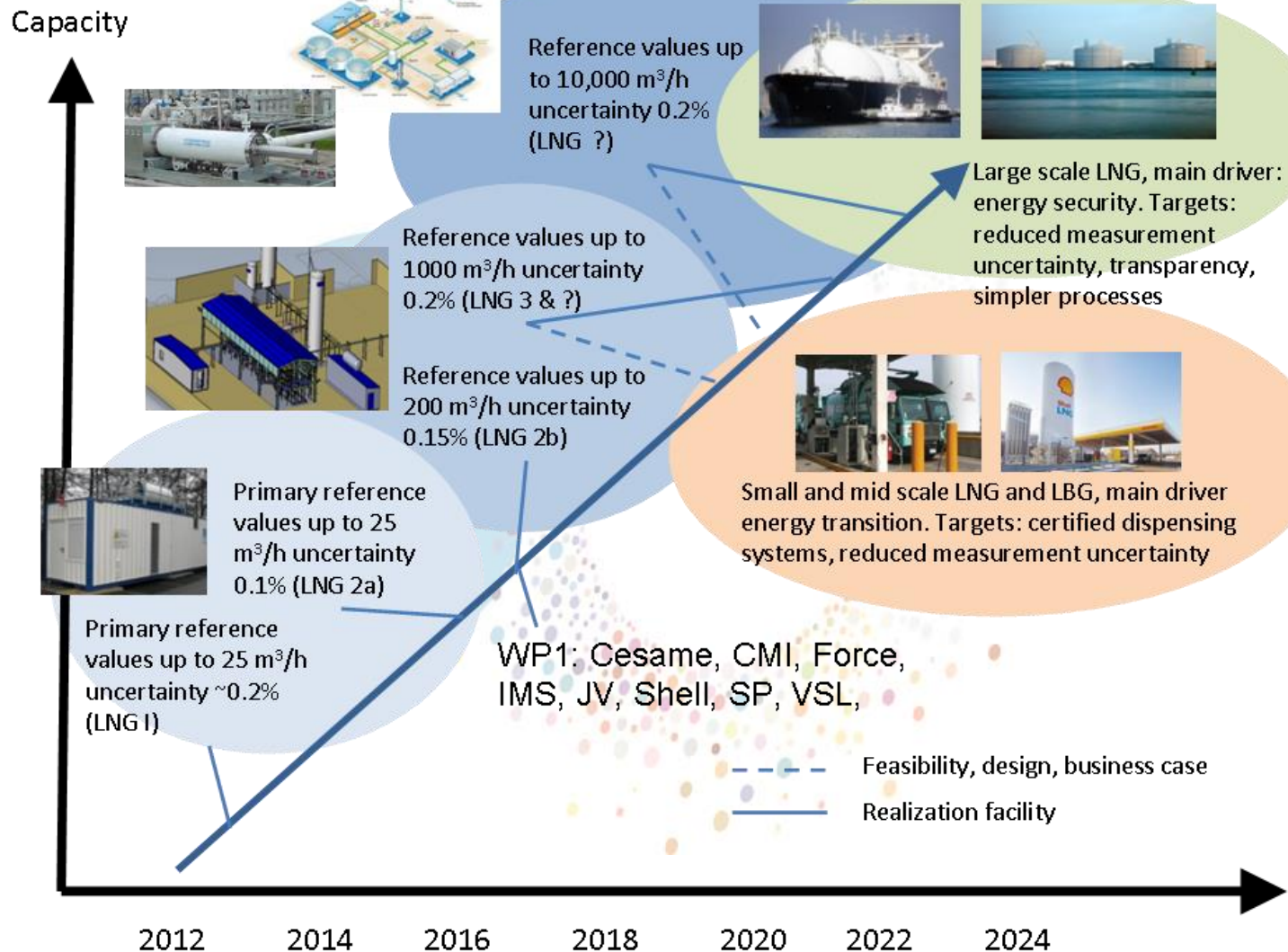


Distribution chain

- Whenever there is trade, there are measurements involved to quantify the transfer of goods.
- Whenever there are measurements, there are errors and uncertainties involved.



LNG research and calibration facility



EMPIR 2016 Energy call



- Development of a hydrogen infrastructure for hydrogen vehicles
- Hydrogen fueling is critical to the success of a hydrogen economy
- Goal of hydrogen fueling is to achieve a high range in a short filling time

- No metrological infrastructure for

- Flow metering



- Hydrogen quality assurance



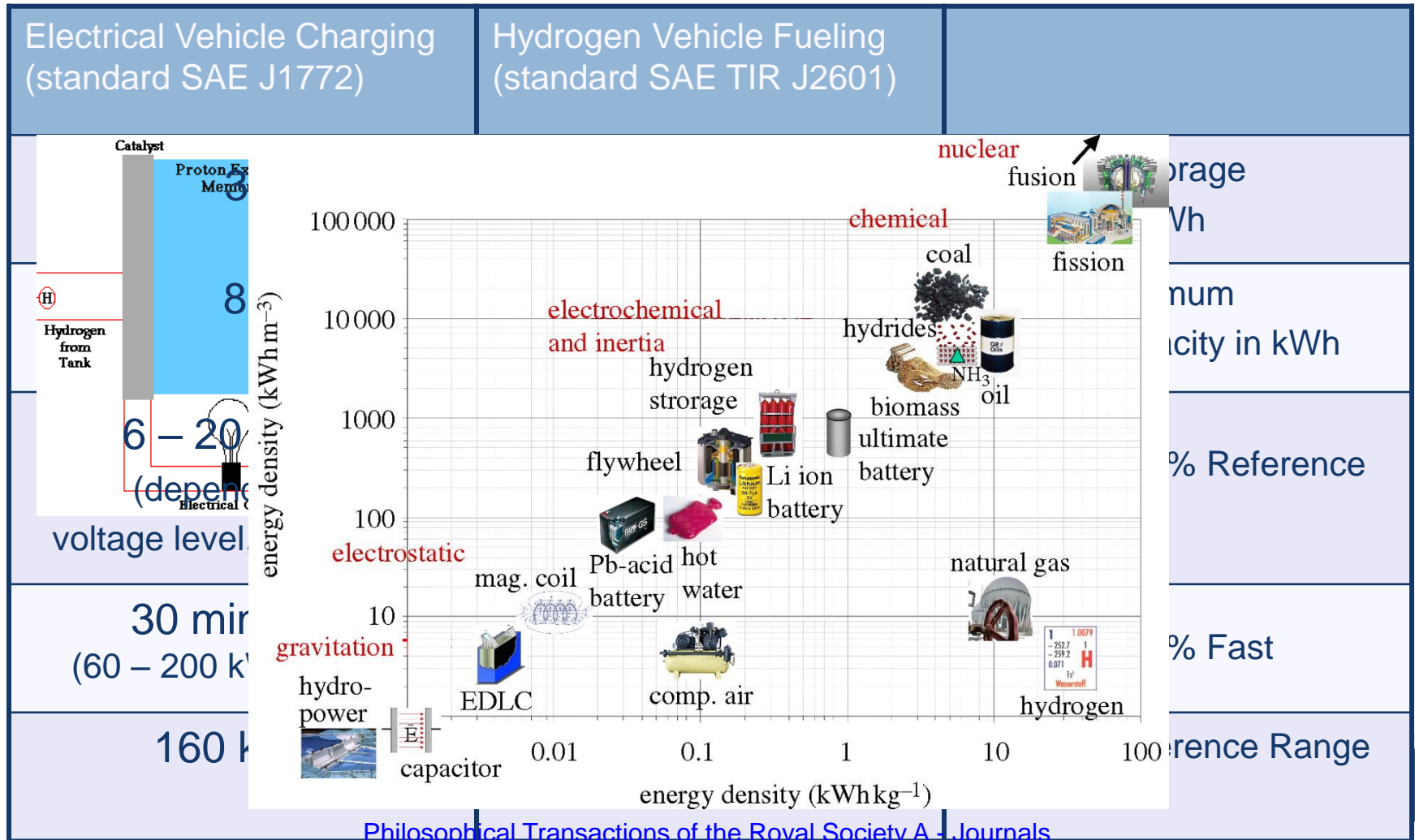
- Hydrogen quality control



- Sampling



Flow



Compress hydrogen to 70 MPa to get the needed amount

Flow

• Challenges

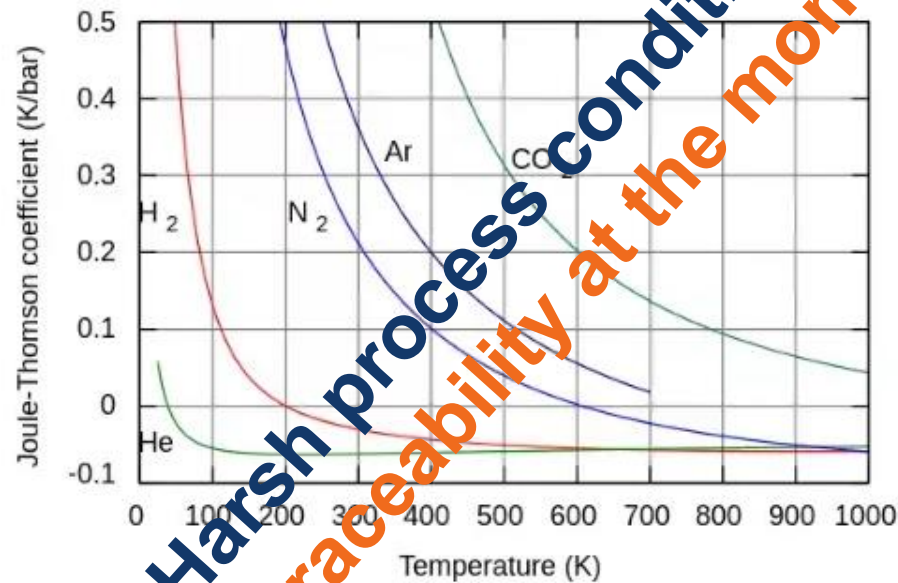
- High pressure
- Manage heat of compression, storage tanks have a maximum temperature rating of 85 ° C.
- Compressed hydrogen heats up when expanding at ambient temperature

• Fueling performed in accordance to standard SAE J2601

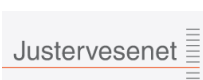
- Provides guidance for hydrogen fueling
- Maximum Gas Temperature: 85 ° C
- Maximum Pressure: 87.5 MPa (70 MPa NWP)
- Hydrogen Delivery Rate
- Cooling of hydrogen before delivery down to -40 ° C



Flow



Partners



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