VSL

National Metrology Institute

EMPIR EURAMET

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

DC Grids

Standardization of Measurements in Low-Voltage DC Grids

Helko van den Brom

VSL B.V.

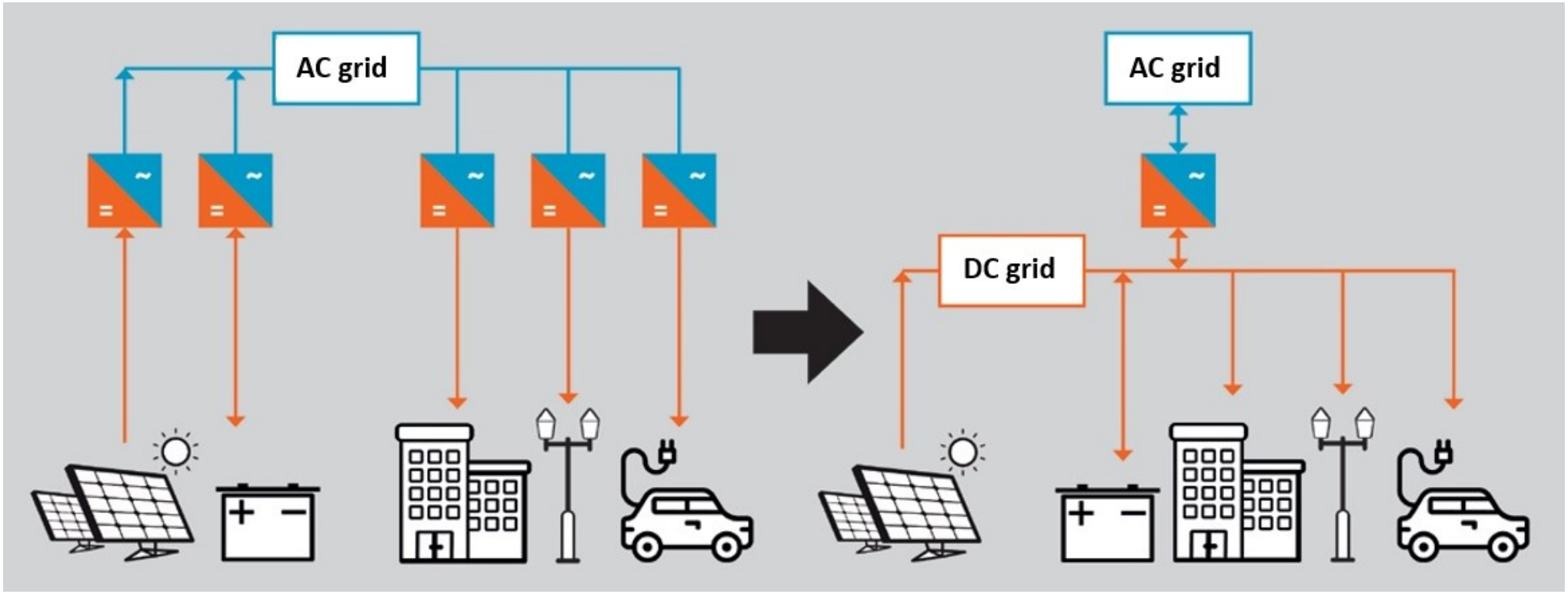
20NRM03 DC grids final workshop

16 May 2024, VSL, Delft, NL

AC or DC?


AC/DC

From AC to DC



Unaddressed needs

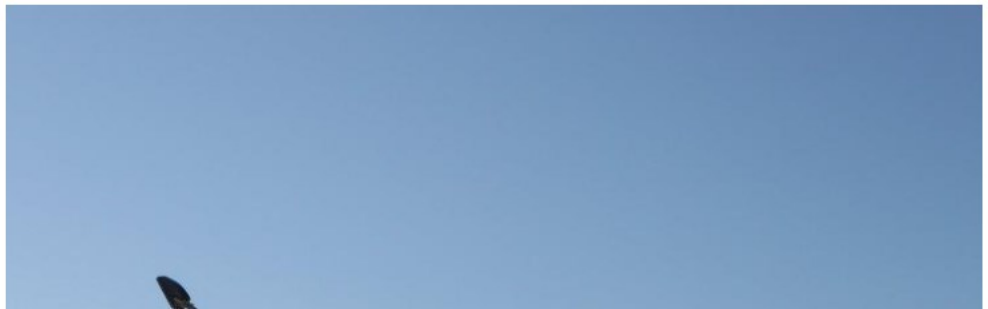
- CLC TC8X WG01 – “Physical characteristics of electrical energy”
  - EN 50160 “Voltage characteristics of electricity supplied by public distribution systems”
  - DCPQ defined as new work item
- Metrology support is necessary:
  - proper power quality definitions for DC
  - a practical measurement guide
  - determine realistic DCPQ limits

- IEC TC13 WG11 – “Electricity metering equipment”
  - IEC 62053-41:2021 “Electricity metering equipment - Particular requirements - Part 41 - Static meters for d.c. energy (class 0.5 and 1)”
  - Similar to AC equivalent 62053-21
- Need to investigate additional specific metrological aspects of DC meters
  - ripple in EV charging stations
  - immunity of DC energy meters

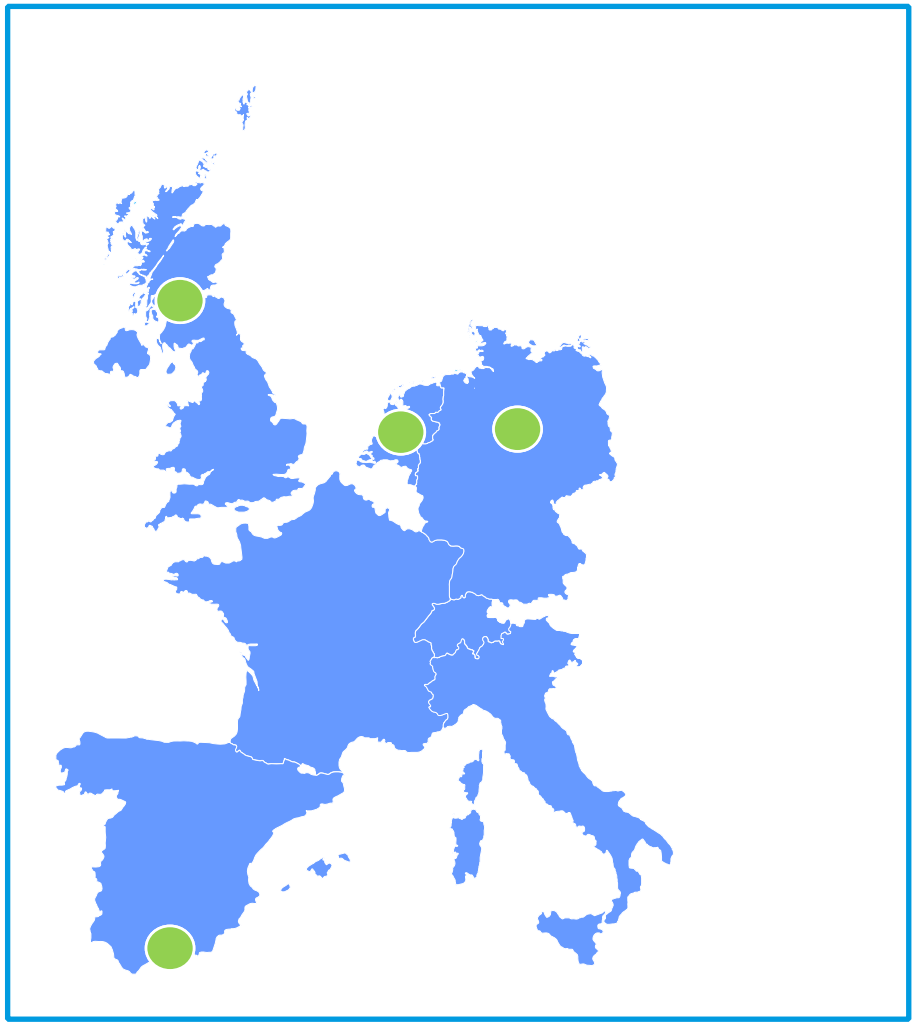
DC Grids

20NRM03 DC Grids

The increasing use of distributed energy generation and storage has led to local DC trial grids becoming an extension to traditional AC distribution networks. Like AC grids, DC grids must fulfil power quality (PQ) limits to guarantee reliable operation. However, knowledge about PQ in public DC systems and its impact on DC electricity metering is currently lacking,



20NRM03 DC grids – consortium



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RESEARCH CENTRE FOR ENERGY RESOURCES AND CONSUMPTION

TU/e

Università degli Studi della Campania *Luigi Vanvitelli*

University of Strathclyde Glasgow

eDF

20NRM03 DC grids – technical objectives

Aim: traceable measurement and characterization of PQ parameters to support standardization in further development and deployment of DC grids.

- New **on-site instrumentation** for DC distortions
- Onsite **measurement campaigns** in LVDC grids

- New **definitions of DCPQ** phenomena
- New **analysis algorithms** to categorize DCPQ

- **Traceability** for DC power and DCPQ parameters
- **New reference systems** for DC PQ and DC metering

- New **PQ severity indices** for DC grids
- New **methodologies for PQ level surveys** in DC grids

16 May: Agenda (morning)

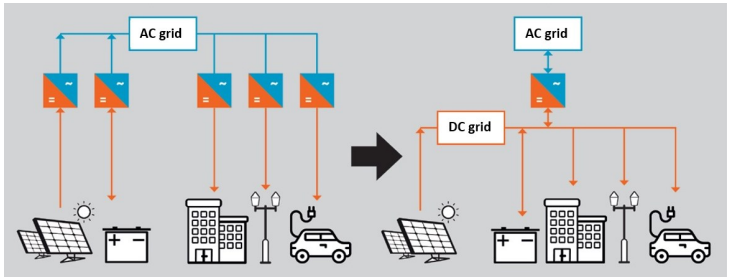
Time CEST, UTC+2	Item
08h30	Arrival and registration
09:00	**Reliable Measurements for LVDC grids and DC metering**
09:00	Welcome – Helko van den Brom
09:10	Introduction • The European Research Project DC Grids: Overview – Helko van den Brom, VSL, Netherlands • The role of DC for modern utilities – Jorge Sánchez, ENDESA, Spain
09:50	Project outcomes I • Trigger mechanisms to detect DCPQ events and distortions – CIRCE, Universidad Zaragoza, Spain • On-site measurements in LVDC grids – VSL, Netherlands
10:30	Coffee break
11:00	Project outcomes II • Test waveforms for DC PQ analysis tools – University of Strathclyde, Glasgow, UK • Measurement of DC voltage ripple in laboratory environment – LNE, France • AC ripple over DC: new solutions for measurements and calibration – INRIM, Italy
12:00	**Lunch**

16 May: Agenda (afternoon)

12:00	**Lunch**
13:00	<u>Project outcomes III</u> • DC power and energy and DCPQ reference systems with distorted signals – METAS, Switzerland • Superposing DC and AC signals for testing DC meters – PTB, Germany • Power Quality Compatibility Levels in DC power networks – University of Campania, Italy • JRP DC grids input to standardization activities on DC metering and DC grids – EDF, France
14:20	Coffee break
14:40	<u>External presentations</u> • Advanced DC Electricity Meter Testing and Standards – Henri Schouten, NMi Certin, Netherlands • DC/DC Converters for MVDC grids – Bruno Lefebvre, SuperGrid Institute, France • Shift to Direct Current: overview of a HORIZON 2023 project – Hugo Morais, University of Lisbon, Portugal • Transducers and energy meters in DC grid applications – Yihui Zuo, LEM, Switzerland*
16:00	**VSL lab tour**
17:00	**End of day and drinks**

Standardization of measurements in DC grids

- Aim: traceable measurement of PQ to support standardization of DC grids
- Key results:
  - Initial DC PQ definitions and considerations
  - Onsite measurement equipment
  - Onsite PQ measurement results
  - Reference systems for DC metering and PQ
- Future:
  - Improved standardization of DC metering and PQ
  - New customer calibration and test services for DC electricity and DC PQ measurement devices
  - A source of knowledge and capabilities for DC grid measurements



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