Advanced DC Electricity Meters Testing and Standards

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- Developments in standards for DC meters
- Challenges in legal metrology
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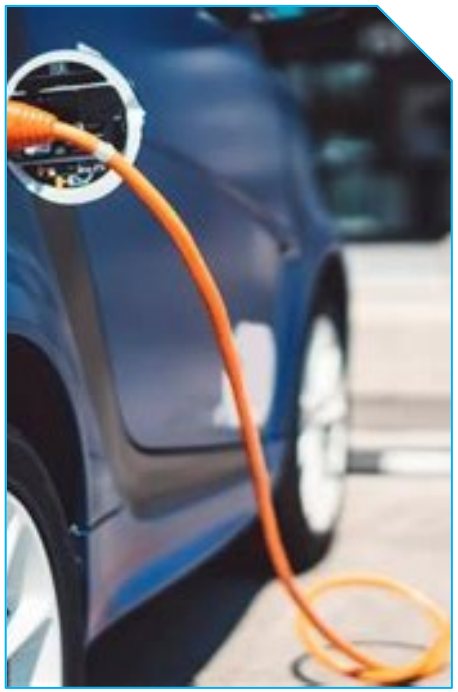
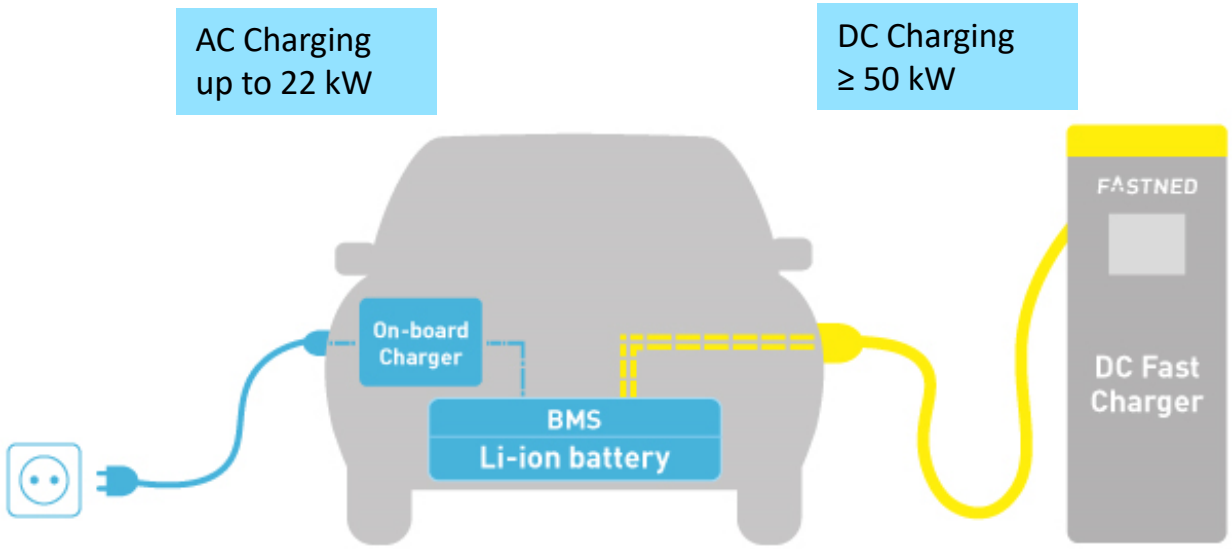
Drive to develop DC meters for billing purposes

- For a long time: the world is AC!
- Electric vehicles become popular!
- A new charging infrastructure is needed, at home, at public places, along the motorway, at parking places



Aspects of charging stations

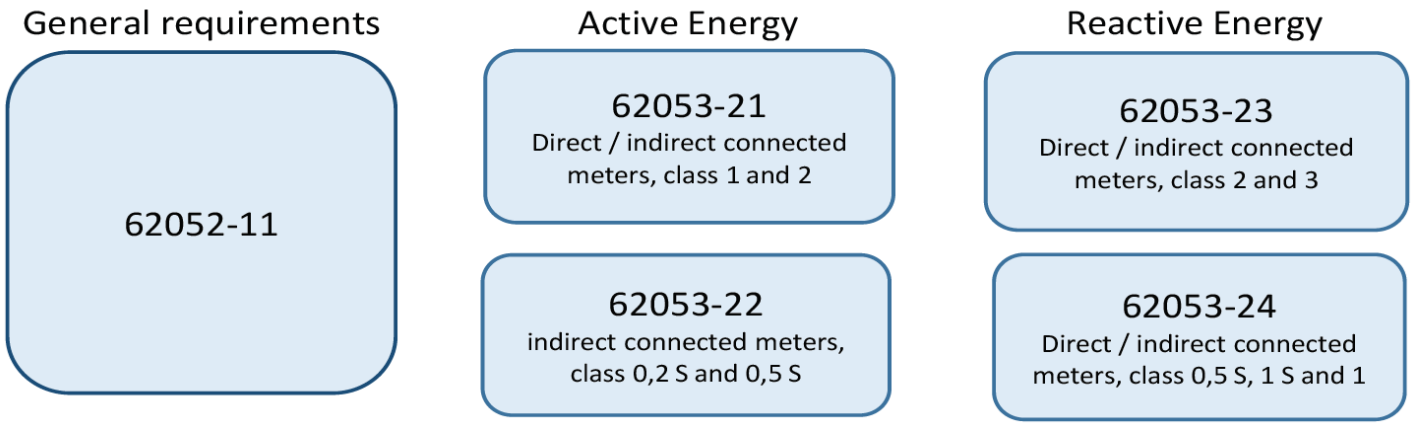
- Various chargers: slow (6 kW), medium (22 kW), fast (50 up to 350 kW)…
- AC and DC chargers



- Various metrological aspects: cables and energy loss, AC to DC conversion
- DC chargers: measure after the AC/DC conversion
- Certified DC meters are needed!

Developments in standards for DC Meters

Traditional IEC family of standards for AC meters:



Developments in standards for DC Meters

	General requirements	Particular requirements	
IEC	62052-11 Edition 2	62053-41 DC meters, class 0,5 and 1	
CENELEC	EN 62052-11 Edition 2	50470-4 DC meters	

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Can we use these standards to certify DC meters and use them for billing purposes?

Challenges in legal metrology

Electricity meters are covered by Annex V of the MID (2014/32/EU)

Problems:

- Originally the MID was not intended to cover DC meters
- Most countries require a certified MID meter inside an AC EVSE
- No certification regime for fast chargers

Approve DC Meters under the MID?

Traditional view: the MID doesn't cover DC electricity meters

Challenges to traditional view:

The MID describes meters for 'active electrical energy'. Both AC and DC meters are within the scope.

The requirements can be fulfilled for both type of meters.

Mandate M/541 requests for DC meter standards for the implementation of the present MID.

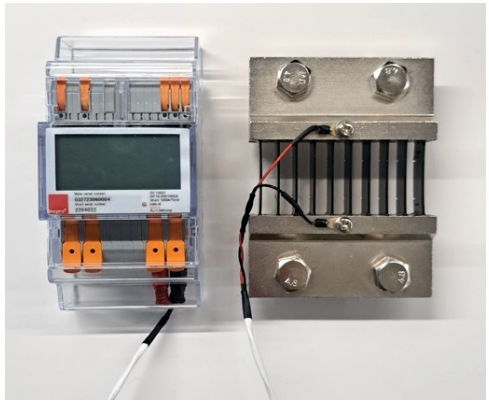

EC-type examination certificate

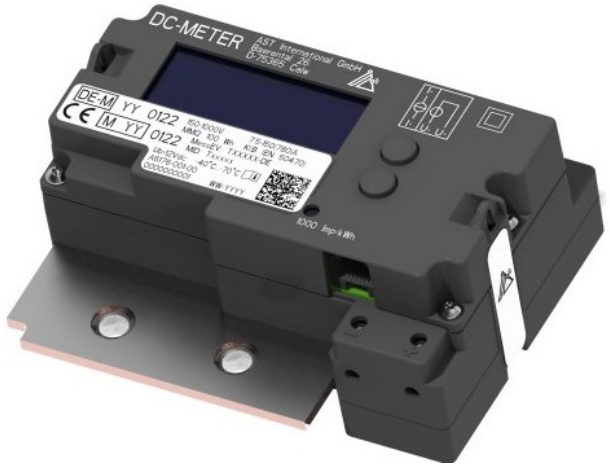
The NMi Certification Board decided to apply the MID for DC meters.

See https://nmi.nl/nmi-decides-to-apply-mid-for-dc-meters/

Design aspects

- Separate or integrated sensor part
- Analog or digital sensor output
- Housing, sealing
- Heat





For EVSE:

- creation of dedicated charging session data string (OCMF)
- cable compensation

Experiences with DC metering aspects

- Dedicated equipment has to be developed….

- Common measuring ranges 150 – 1.000 V, up to 1.000 A
- Equipment needs to be flexible (cable connections)

Experiences with DC metering aspects

- In general, the optical pulses via the LED are less stable compared with AC meters
- Dedicated connectors and busbars are important (e.g. for durability testing)
- Mechanical stress on conductors might have a relatively big impact
- Durability test according to 62059-32-1
  - standard to be adapted for DC – working project in IEC TC13
  - intermittent durability test?
- Differential mode current disturbance test with frequencies ≥ 10 Hz: difficult setup
- Short-time overcurrent testing required at very high values ($30 \cdot I_{max}$)

Future developments within NMi

- Actual situation:
  - power supplies up to 1.500 V and 1.800 A
  - traceable measurements up to 1.000 V and 1.500 A
  - dedicated portable setup to measure DC chargers on site up to 500 A
- 17025 accreditation for IEC 62053-41, planned scope extension for EN 50470-4
- ANSI C12.32 for North America
- Interlaboratory comparison with a DC charger running in Q1/Q2 2024
- Expand testing capabilities to 3 test benches with phantom load
- Various running and upcoming type testing assessments for DC meters from various manufacturers
- Contribution to CurrentOS Foundation: an organisation for DC microgrids

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