

From standards to the power outlet: X.509 certificates and Smart Meter rollout in Germany

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Definition „Smart Meter“

- A Smart Meter is an **intelligent**, digital meter that **records energy consumption** (e.g., electricity, gas, or water) at short intervals and automatically transmits the data to the energy supplier or grid operator.
- It eliminates the need for **manual meter reading** and enables detailed consumption analysis.

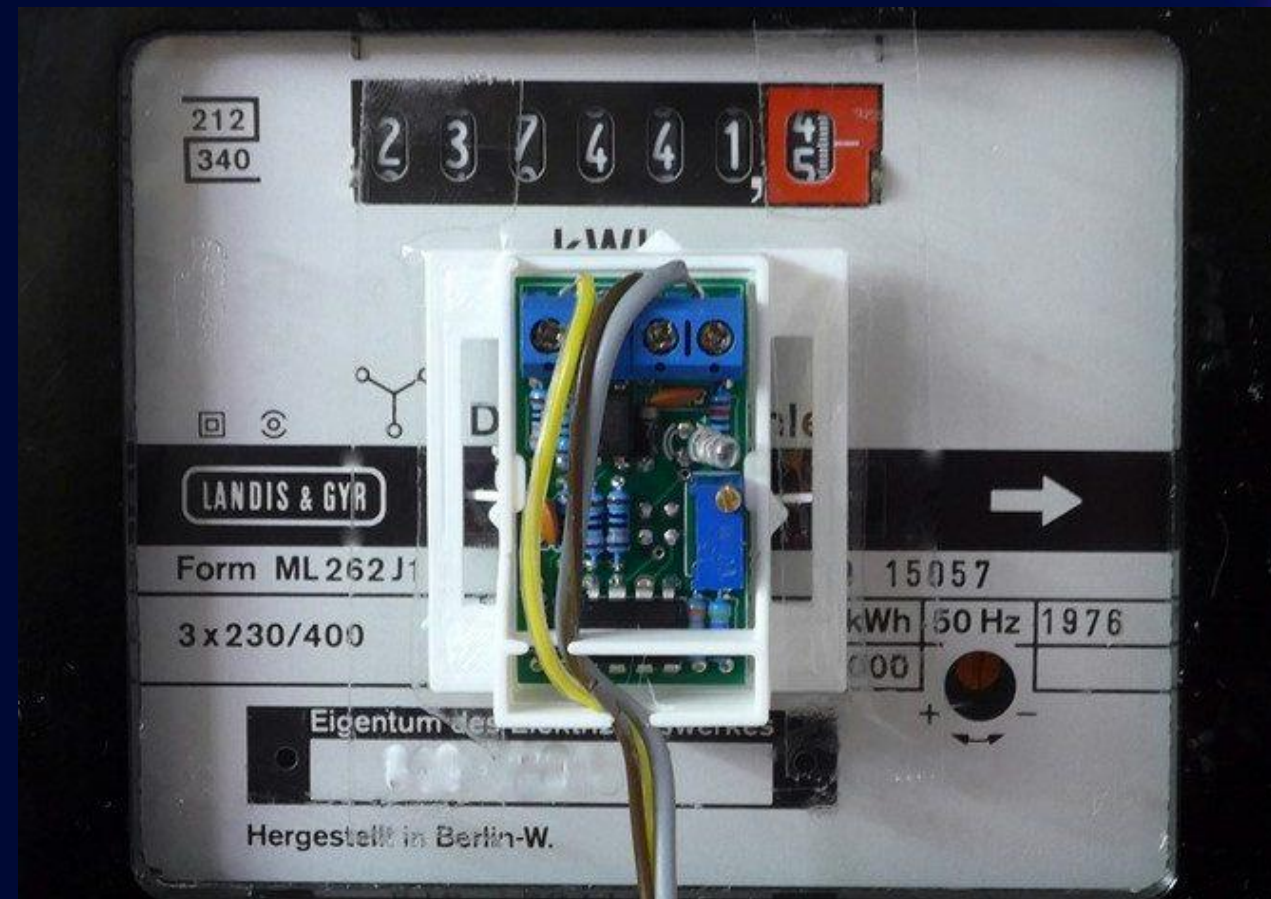
Ferraris Meter

- The traditional way
- Counts the number of rotations of the aluminum disc
- Was this smart?



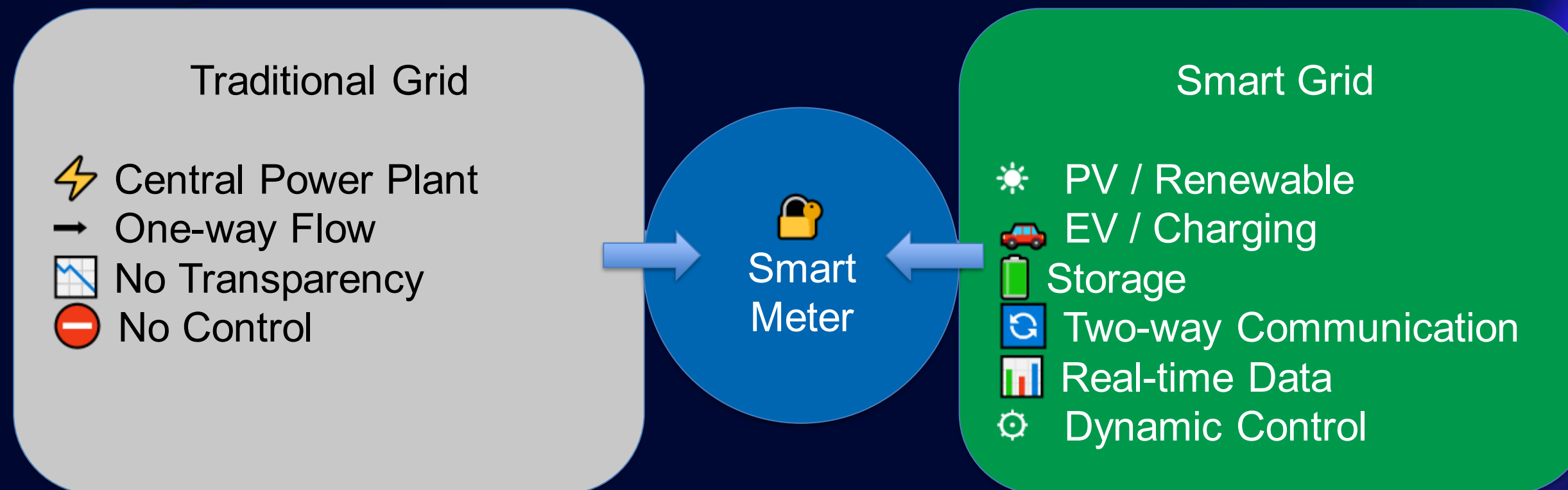
Ferraris Meter

- The revolutionary way
- Counts the number of rotations of the aluminum disc with an electronic sensor
- A smart approach



Motivation

- The Smart Meter rollout is not about replacing meters — it is about transforming the energy system into a digital, controllable and secure infrastructure.



Smart Meter deployment in the EU

- 2009 Member states were requested to proceed with the roll-out for a minimum of 80% of the electricity end-users by the year 2020 Source [European Commission](#)
- Publication of the directive 2019/944 pushed the rollout in the EU (Clean Energy for all Europeans)

• Source: [ACER 2025 Monitoring Report](#)

Smart meter roll-out across the EU-27 and Norway in 2024



Source: ACER, based on data provided by national regulatory authorities (NRAs), 2025.

Smart Meter Rollout in Germany

- The Rollout is regulated by Law; Metering Point Operation Act ([MsbG](#), Messstellenbetriebsgesetz;)
- Mandatory installation applies to consumer sites with an annual consumption of 6 MWh or more
- Households with smaller consumption can enforce the installation by request

Timeline Smart Meter Standardization and Rollout

2000–2010	EU Smart Grid Initiatives Initial Concepts
2010–2016	BSI Standards Development (TR-03109, BSI TR-03145, Common Criteria Protection Profiles)
2016	Metering Point Operation Act (Messstellenbetriebsgesetz, MsbG) Legal Framework
2020	BSI Market Declaration – Three independent manufacturers Rollout Start
2022	Regulatory failure due to missing certification of fulfilment of interoperability requirements. Rollout stopped by court decision
2023	Reform (Act on Restarting the Digitalization of the Energy Transition, GNDEW); Acceleration of Rollout

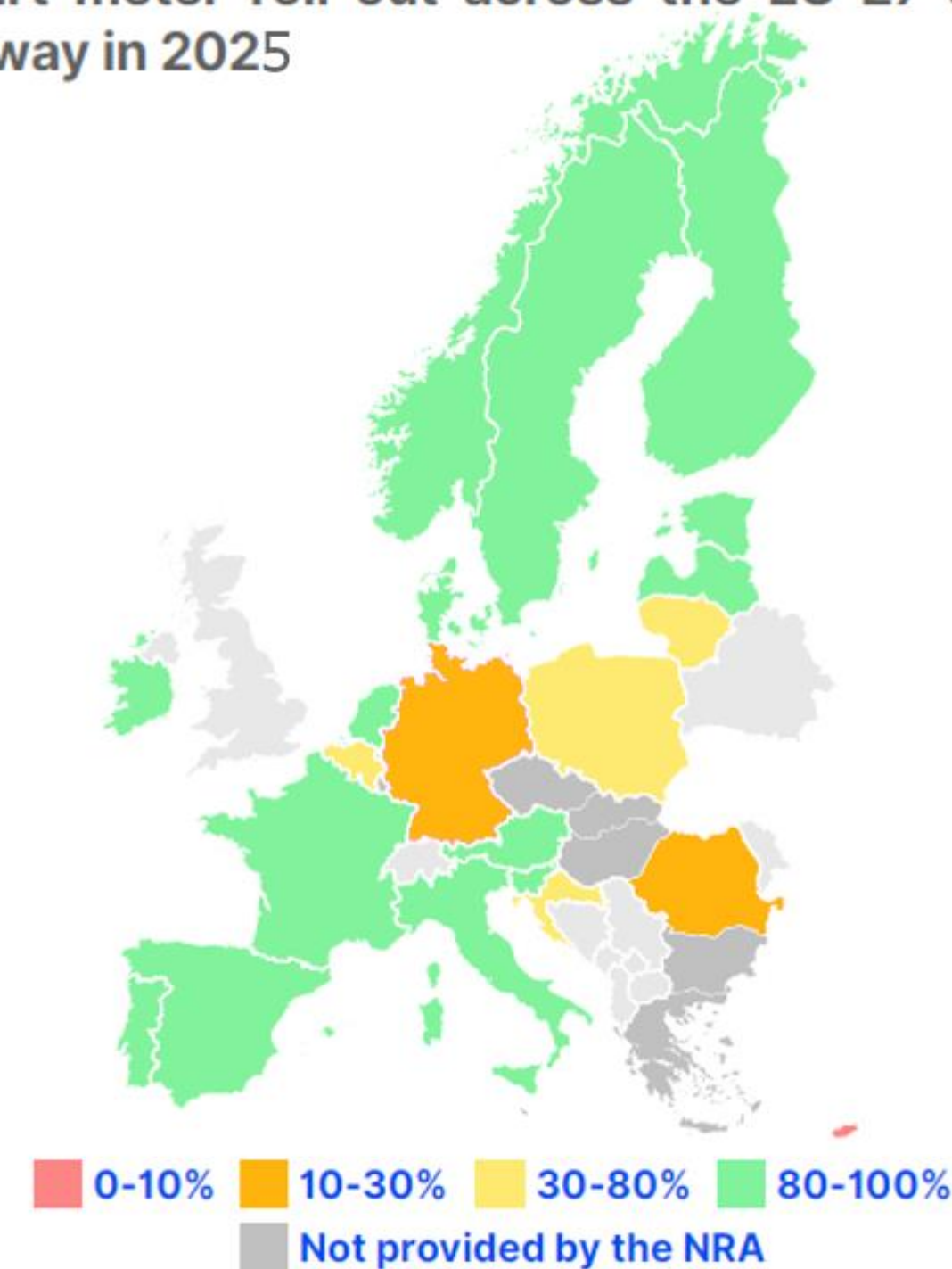
Smart Meter Rollout in Germany

- Staggered rollout with clear target quotas
 - 20 % (2025)
 - 50 % (2028)
 - 90% (2032) for all metering points
- Quotas defined in [MsbG](#)

Smart Meter Rollout in Germany by End of 2025

- Mandatory Installation Cases for iMSys in Germany / Cut-off Date: December 31, 2025
 - Acc. to BNetzA 23,3% Source: [BNetzA](#)
- Quota destination reached!

Smart meter roll-out across the EU-27 and Norway in 2025



Source: ACER, Modified by Atos

Question

- What makes the smart meter rollout in Germany so unique?
- The regulation?
- The technical implementation?
- The special requirements for certification?

Core Components Smart Meter in Germany

- A complete Smart Meter (referred to in Germany as an "Intelligent Metering System" or iMSys) typically consists of two parts.
 - **Modern Metering Device:** The digital meter that records energy flow.
 - **Smart Meter Gateway:** Secure interface for communication between electricity consumers and producers and electricity grid operators and energy suppliers.

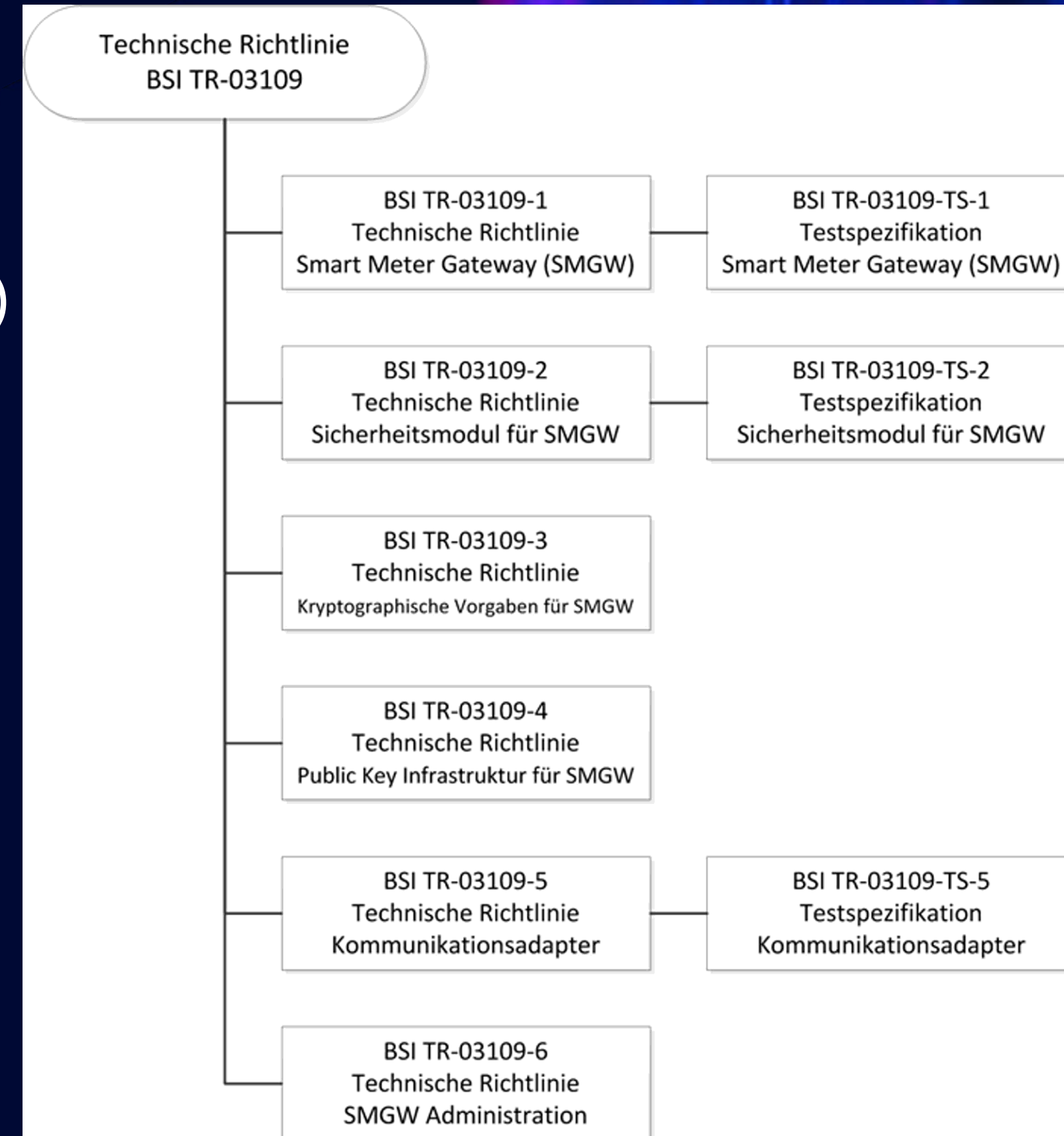


Smart Meter regulation in Germany

- Defined by the Federal Office for Information Security (BSI, Bundesamt für Sicherheit in der Informationstechnik)
- Specifications in form of
 - Technical Guidelines (TR-03109)
 - Protection Profiles (PP) for CC (Common Criteria) evaluation
- Containing the details for Approval and Certification

BSI TR-03109 Family Tree

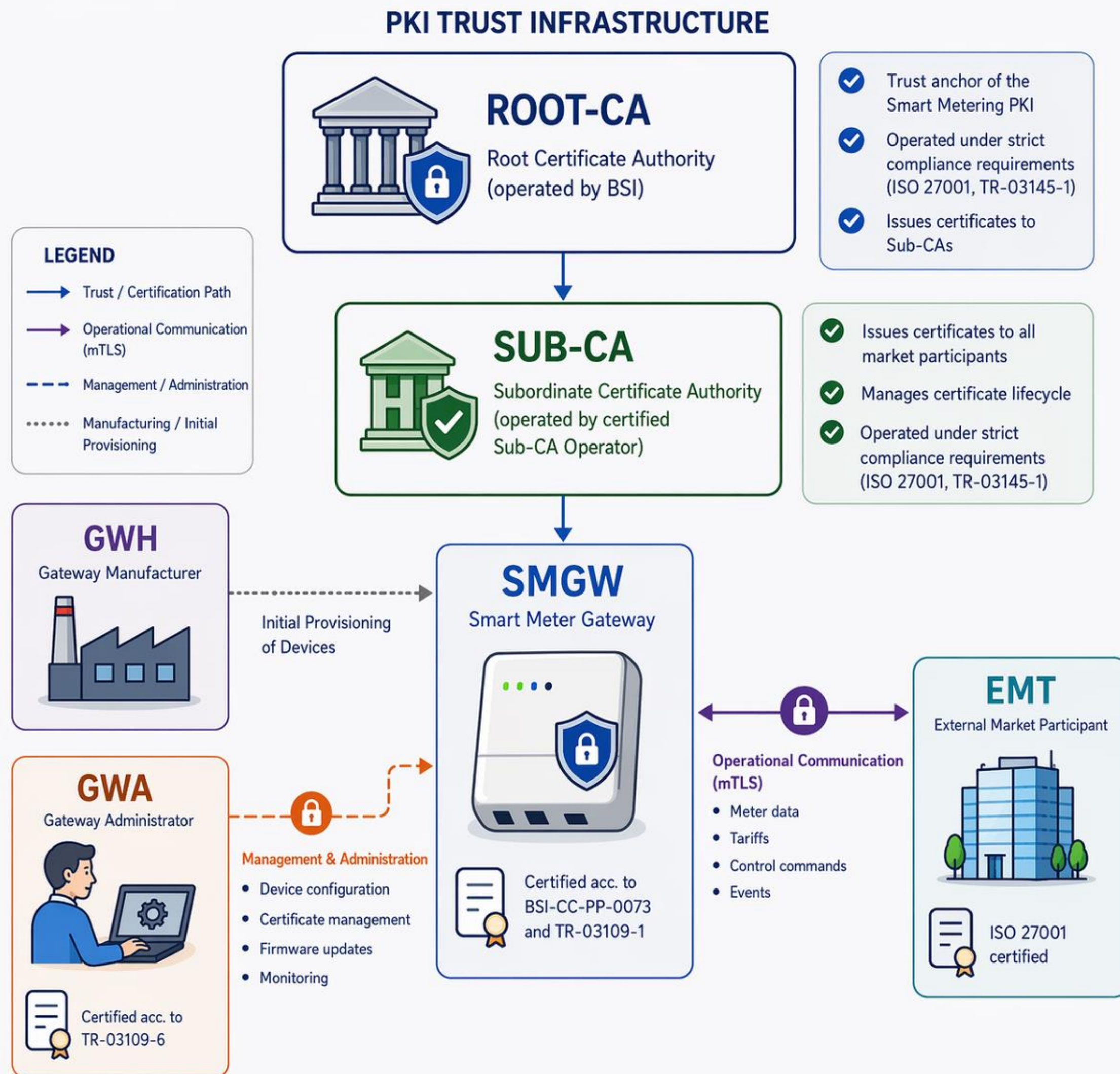
- Technical Guideline (Master Document)
 1. TG Smart-Meter-Gateway (SMGW)
 2. TG Security Module
 3. TG Cryptographic Specifications
 - (refers to BSI TR-03116-3)
 4. TG Public Key Infrastructure
 5. TG Communication Adapter
 6. TG SMGW-Administration



BSI TR-03109 Family Tree ...

- Additional requirements
 - BSI-CC-PP-0073: Protection Profile for a Smart Meter Gateway (SMGW-PP)
- Certificate Policy (CP) for the Smart Metering PKI

Certification requirements for participants in the smart meter system



Certificate types for end entities within Smart Meter

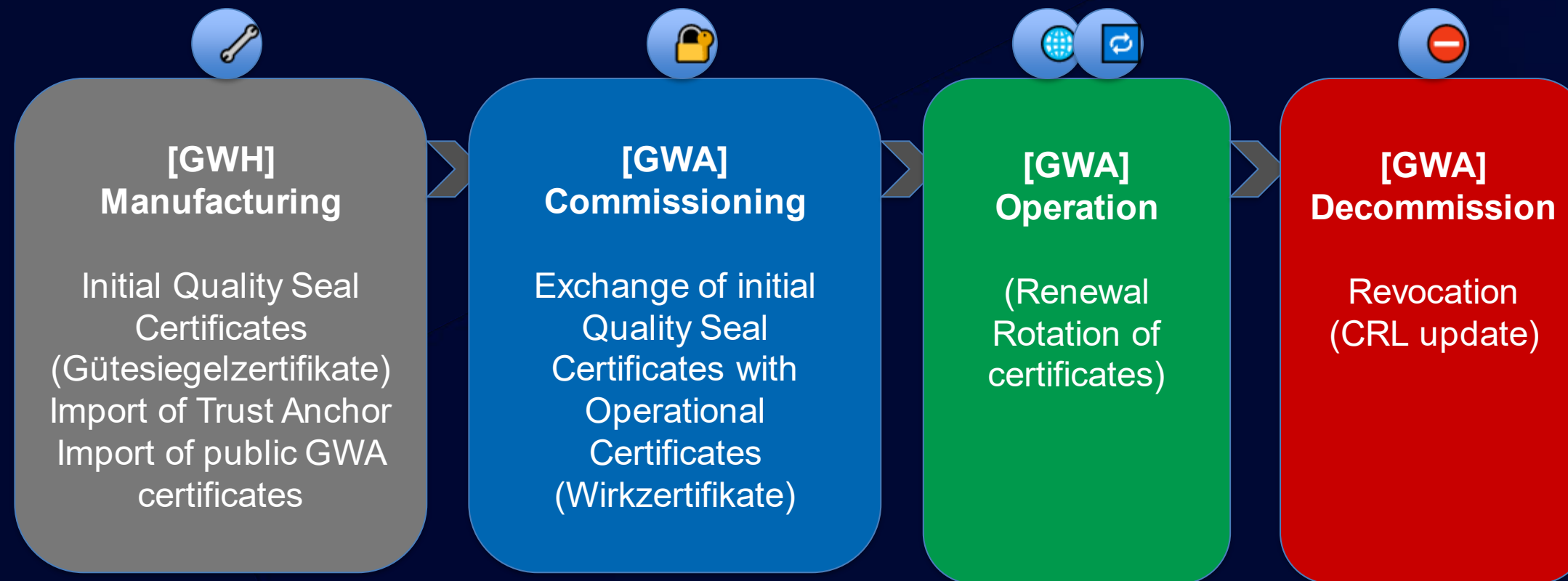
- Basically, the same certificates for the following participants (EMT, GWA, GWH, SMGW)

Type	Description
C _{TLS}	TLS-Certificate: Establishment of an encrypted, integrity-protected, and mutually authenticated channel between the participants of the SM-PKI (mTLS).
C _{Enc}	Encryption certificate: End-to-end data encryption for the end recipient (Data layer, independent of TLS connections)
C _{Sign}	Signature certificate: Verification of electronic signatures on data (data layer, independent of TLS connections). Not applicable to TLS authentication.

- EMT - External market participant
- GWA - Gateway-Administrator
- GWH - Gateway-Manufacturer
- SMGW - Smart Meter Gateway



SMGW – Certificate Lifecycle



- The Smart Meter Gateway is not just a device
 - It is a fully managed cryptographic identity within a regulated PKI lifecycle.

Finally - Security Characteristics What Makes It Special

- Government-controlled root of trust
- Mandatory certification (CC + TR-03109 + TR-03145)
- Full end-to-end security model
- No implicit trust (zero-trust-like model)
- Strict role separation (GWA, EMT, GWH)
- The SMGW is not just a meter – it acts as a cryptographic trust anchor within a nationally regulated PKI ecosystem.

Questions?

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