SMART AND SUSTAINABLE UTILITIES

Communication, Infrastructure Technology And Testing Solutions

Points Covered

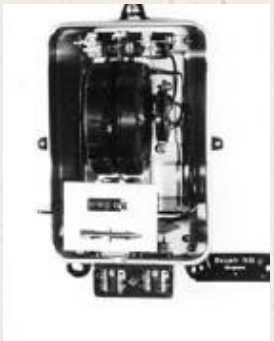
- Meter Over The Ages
- Testing Of Smart Meters In India
- ✓ Smart Meter Functional Zones
  - ✓ Metrology
  - ✓ Load Switch
  - ✓ Metering Protocol
  - ✓ Communication Module

Points Covered

- Case Study – The German Approach
- ✓ Intelligent Measuring System
- ✓ Objective Of iMSys
- ✓ Rollout Plan for iMSys
- ✓ Sample Project On iMSys
- ✓ Futuristic Requirements
- ✓ Conclusion

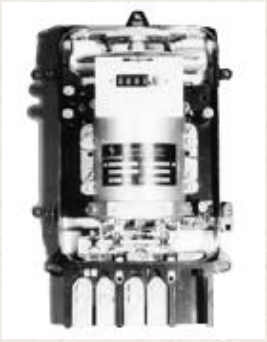
Meter Over The Ages

1925 Rotating Watt hour Meter



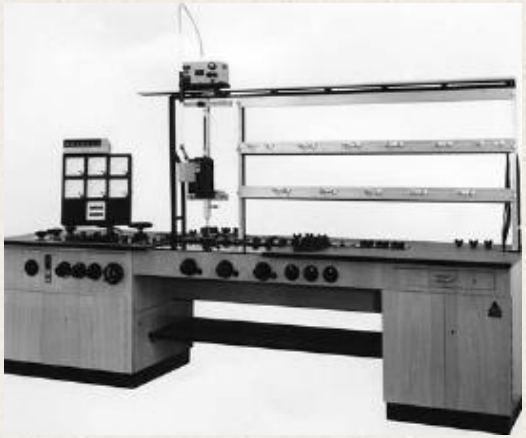
1930 Rotating Watt hour Meter

1942 Rotating Watt hour Meter



1959 Rotating Watt hour Meter

1969 Ferraris meter, dynamic Electormechanical Meter



Meter Over The Ages …

1979 Single Phase Meter, dynamic; Electormechanical meter and register(mechanical drum type register) Watt hour Meter

1991 Hybrid meter Electonic meter and electromechanical register (mechanical dru-type reigter)

1994 Current transformer meter, hybrid electromechanical meter, electronic data processing

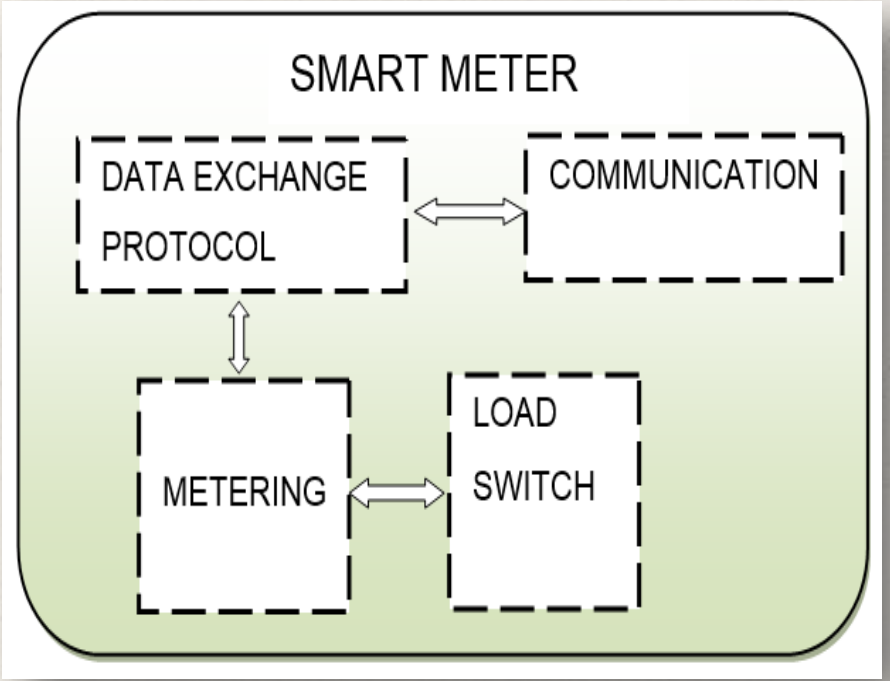
1996 Current transformer meter, fully electronic , with a complex tariff structure

2009 Smart Three-phase current meter, electronic; Electronic meter and register, simplified tariff structure, telecontrolled switch

Testing of Smart Meters In India

- Available Standards: IS 16444:2015

- Smart meters functional zones
  a) Metrology
  b) Load switch
  c) Metering protocol
  d) Communication module



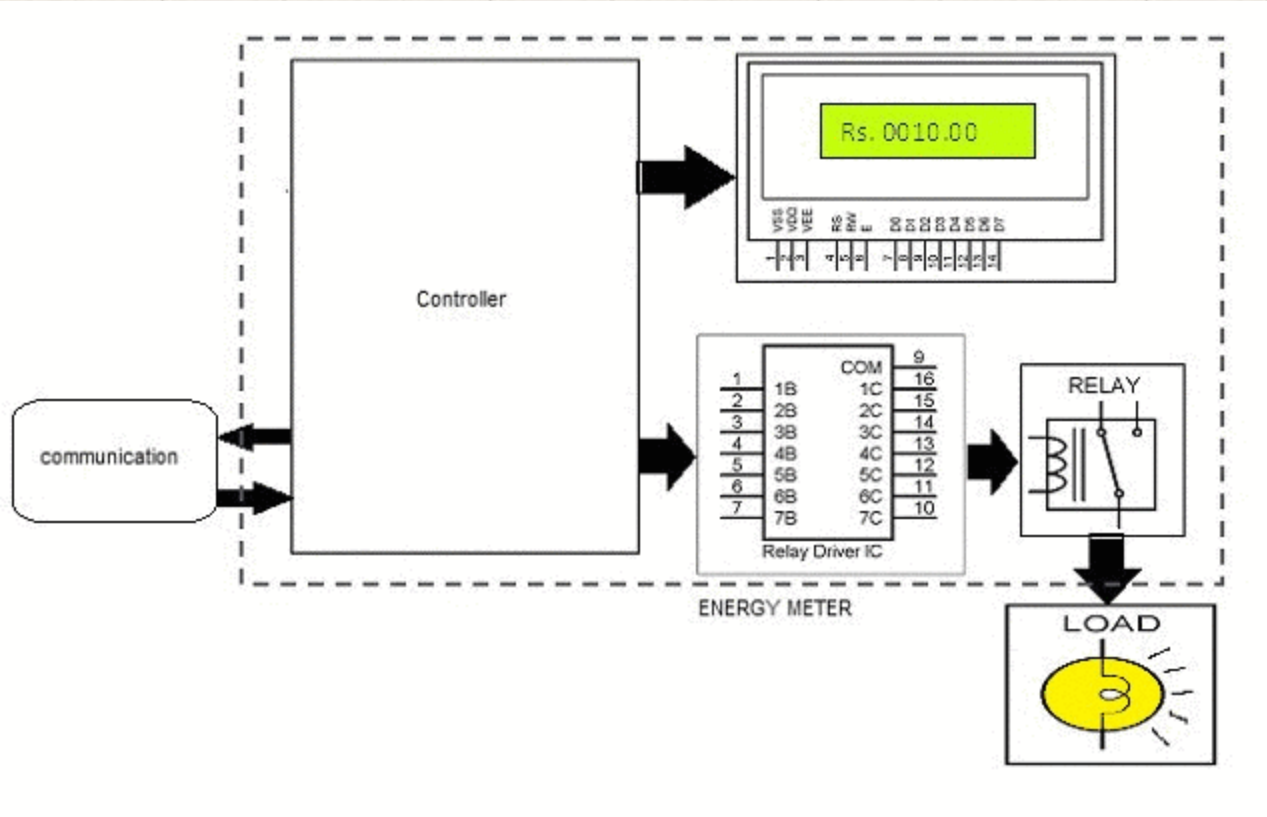
Metrology

- Metering and metrology requirement shall be according to IS 13779 and IS15884 (specific conditions).

- Following tests are included -
  - Insulation properties
  - Accuracy requirement
  - Electrical requirements
  - Electromagnetic compatibility
  - Climatic influence
  - Mechanical requirement

LOAD SWITCH

- Switching element to connect/disconnect the flow of electricity to the load.



Testing of Load Switch

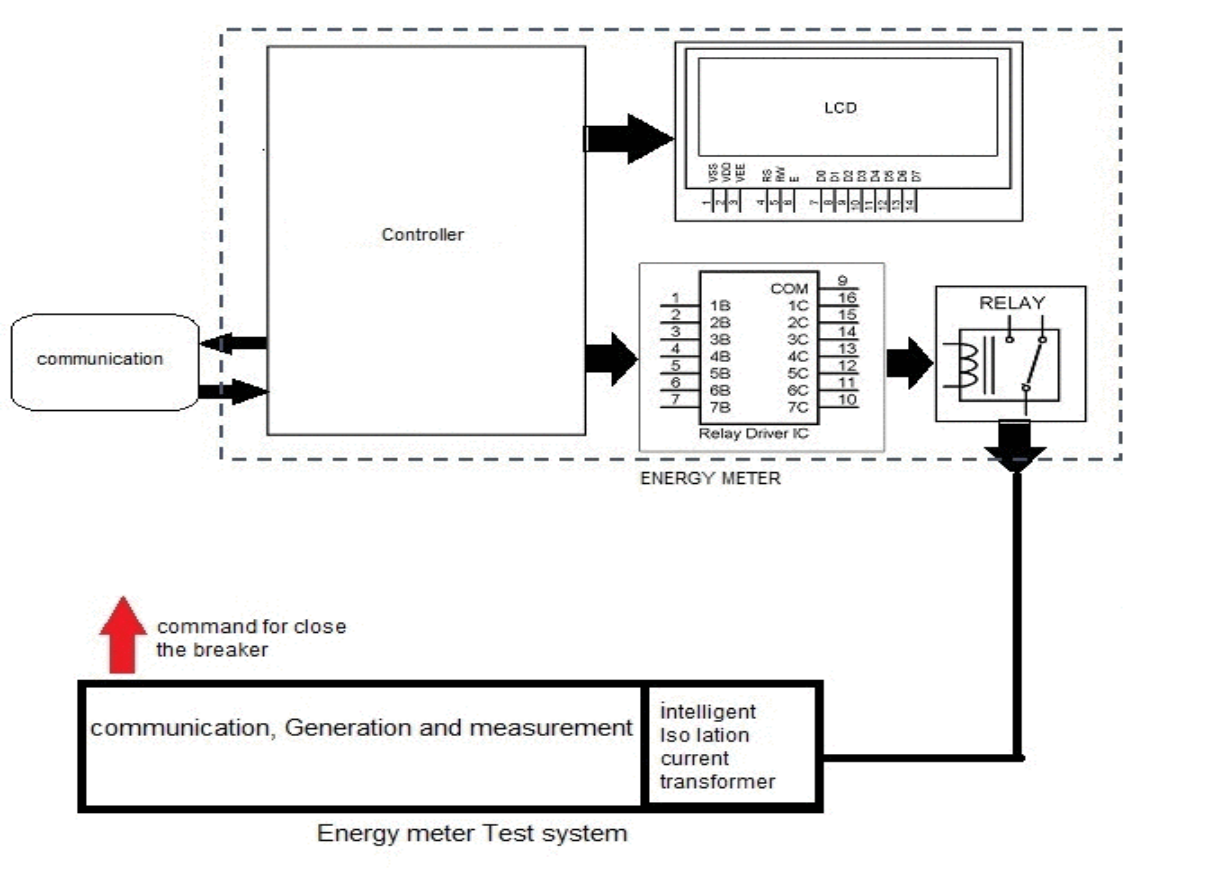
- Performance requirement for load switch is as per 4.6.6.2 of IS 15884.

"*The load switch shall be designed and rated to make and break at Vref, Imax with a linear resistive load and at Vref, Ib,0.4 inductive power factor for 3000 operations".*

Methodology for Testing of Load Switch

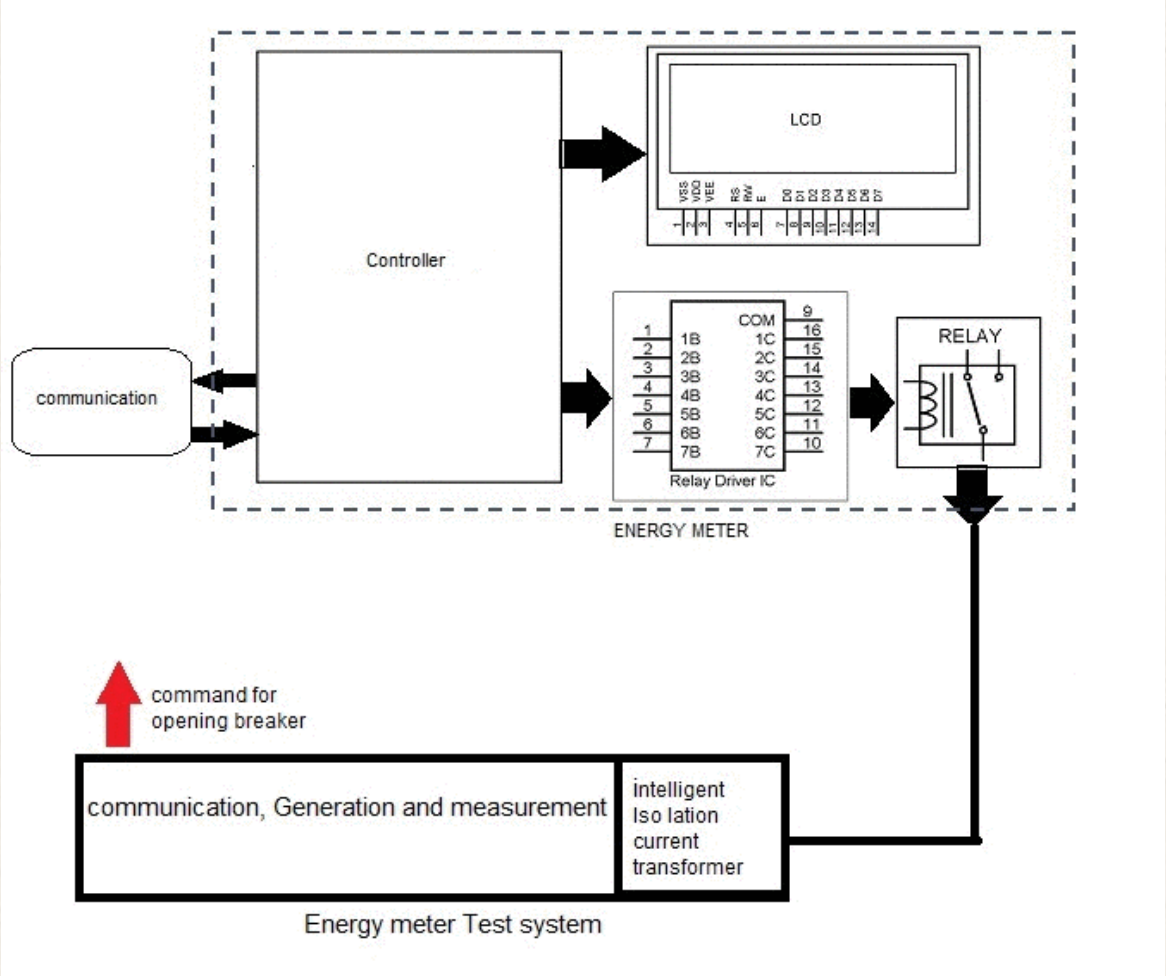
- Load switch capabilities can be tested by sending commands to the meter to make and break contact and measuring the resistance across the load switch contact.
- The methodology requires following capabilities in the test system
  a) Communication with meter - Catered by DLMS/ proprietary protocols
  b) Detecting the state and counting - Intelligent Isolation current transformer can detect on the basis of resistance at individual meter place

Methodology for Testing Load Switch ..



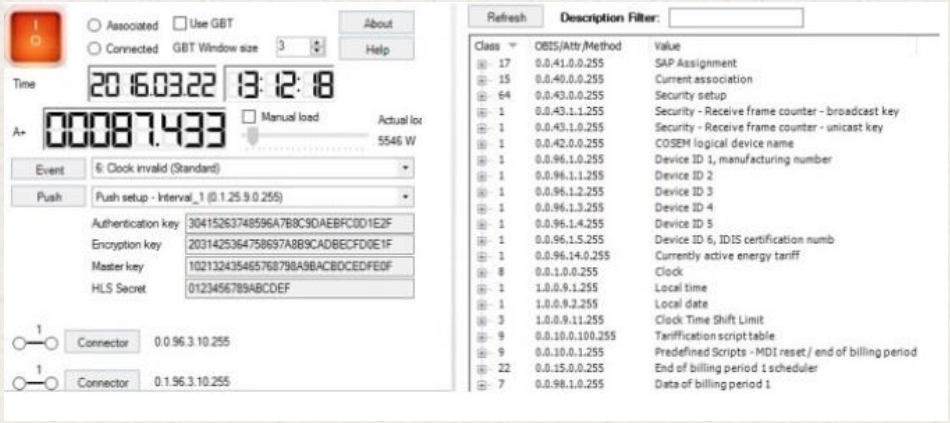
For ex. ***RCLOSED*** *Ohm defined for close contact and* ***ROPEN*** *ohm defined for open contact then the measured value of resistance across the load switch less than or equal to* ***RCLOSED*** *Ohm treated as close circuit and more than or equal to* ***ROPEN*** *Ohm treated as open circuit*

Methodology for Testing Load Switch ....



Data Exchange Protocol

- Testing requirement as per IS15959 (part 1,2 and 3)
- Application layer protocol primarily DLMS/COSEM shall work with other layers of communication.
- Conformance testing tool (CTT) is used and the testing shall be done by accredited laboratory and having membership with DLMS UA
- Conformance testing is defined vide Annex K of IS 15959.

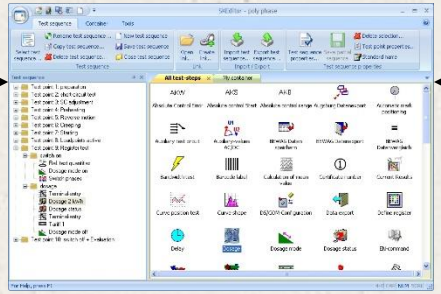


Test Equipment Requirement

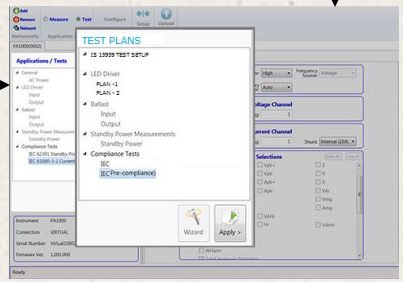
- Power up energy meter.
- Integrate external CTT and report can be generated → powerful application software of energy meter test system is required.

Test system generation and measurement

Smart Energy Meter



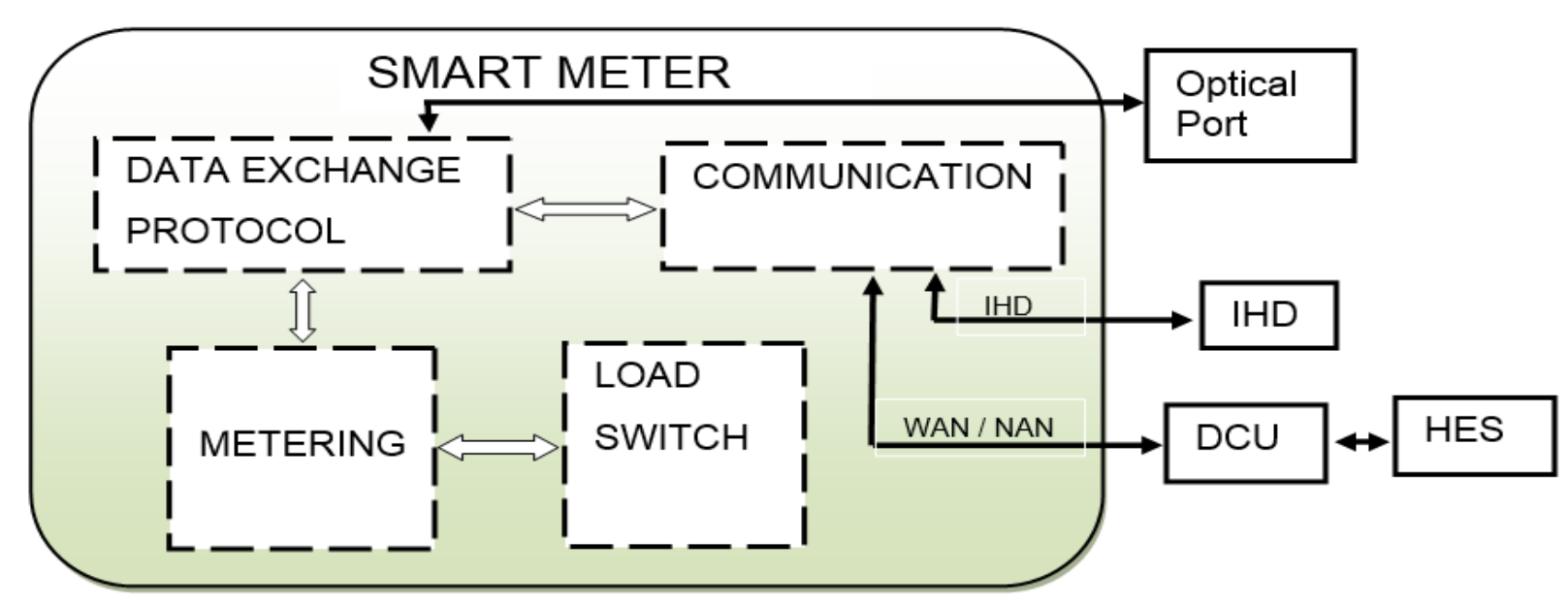
Test system Application software



Conformance Testing Tool

Communication Requirement

- The communications between a Smart meter and DUC (Data Concentrator Unit), HES (Head End System) and IHD (In Home Display) are established either by wired or wireless communication technology. Guidelines for PLC, WAN, RF Technology and communication layer protocol as per IS 15959.



Communication Requirement...

- Communication should achieve following points -

- A secure and reliable connection between the devices
- Reliable delivery of packages
- Repeatedly sending non-incoming packets
- Ensuring an error-free transmission
- To merge incoming data packages in the correct order
- The prevention of the reading by unauthorized third parties (by encryption)
- Preventing manipulation by unauthorized third parties (electronic signatures)

CASE STUDY
– The German Approach

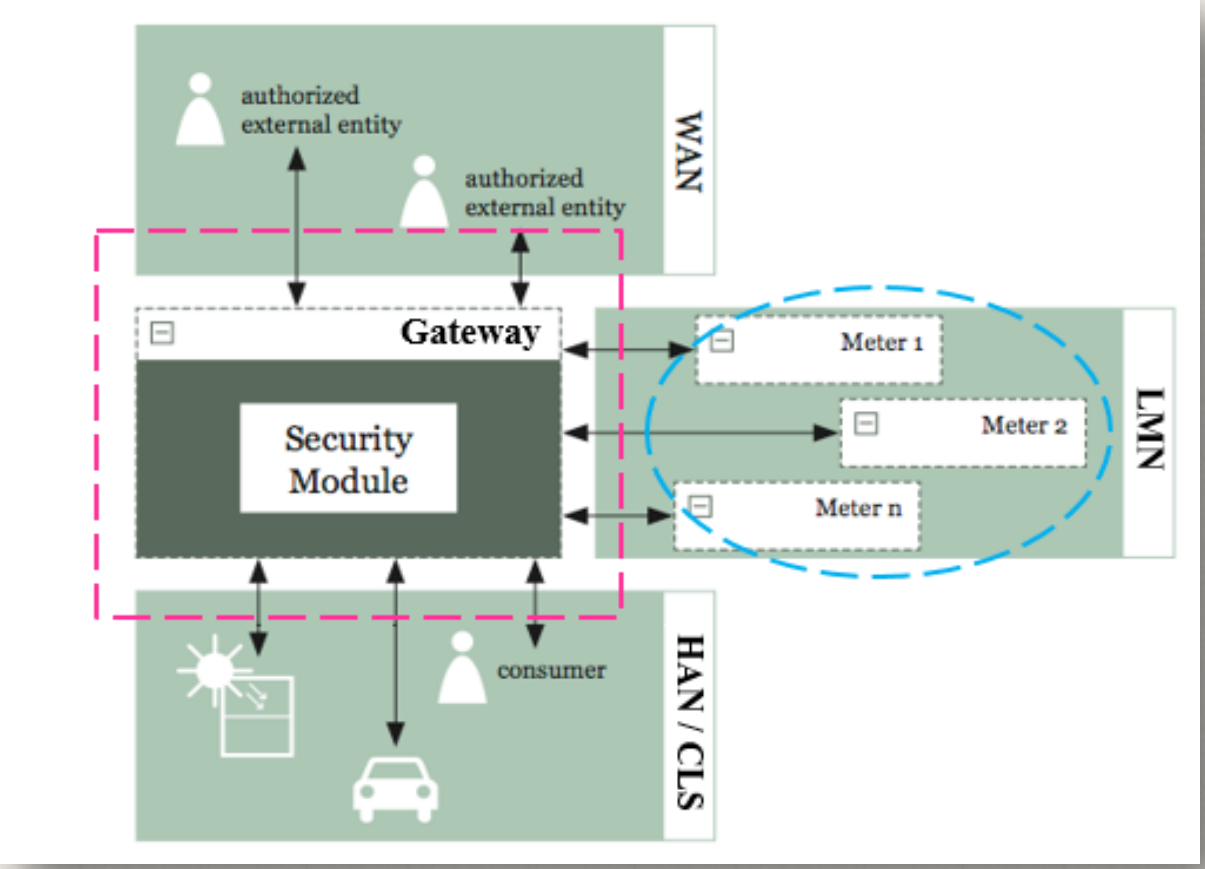
CASE STUDY – The German Approach

- The Energy Transition in Germany

Year	Electricity generation from renewable energies
2020	30 – 35 %
2025	40 – 45 %
2035	55 – 60 %
2050	80%

Intelligent Measuring System

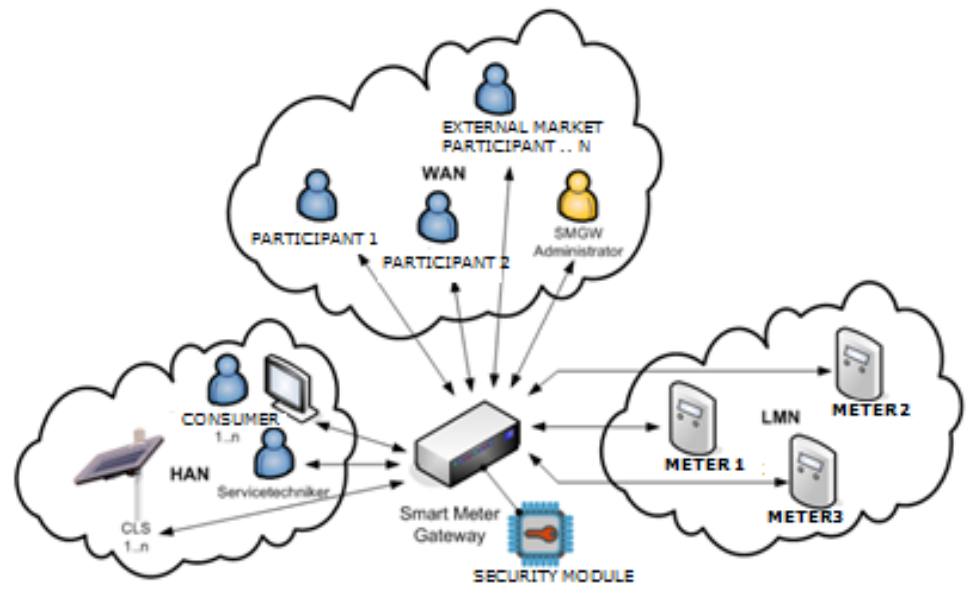
- Intelligent measuring systems(iMSys)



Intelligent Measuring System ..

- The intelligent measuring system consists of –

1) Basic meter – Digital and modern electricity.
2) Smart Meter Gateway (SMGw).
3) Controller box– For smart network control.

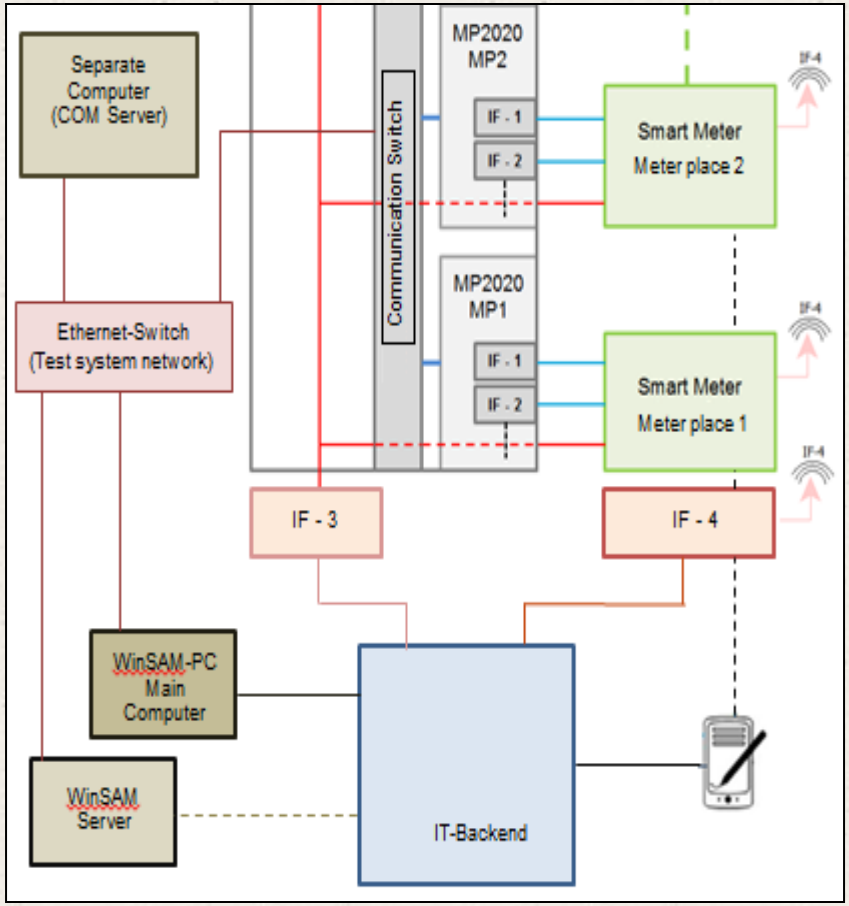


Rollout Plan For iMSys

- Federal office for Information security (BSI) – Developed Technical Guidelines – BSI TR-03109
- Physically-Technical Federal Agency (PTB) – Formulated Guideline for iMSys(PTB-A 50.8 and 50.7)

Year	Rollout plan for iMSys (MS2020)
2017 – 2024	All consumers > 20,000 kWh + producer > 7 kWh
2019 – 2026	All consumer > 10,000 – 20,000 kWh
2021 – 2028	All consumer > 6,000 – 10,000 kWh

Sample Project On iMSys



Smart Meter with 3 interfaces: • Multi Utility interface • Customer interface • WAN interface
Kind of interfaces: • Optical interface (IF - 1) • Wired interface → M-Bus or RS485 (IF - 2) → PLC G3 (IF - 3) • Wireless interface (IF - 4)
Data protocol: DLMS/COSEM
Encrypted data communication
Testing the whole communication line
Connection to the IT backend system
KoaLa GUI

Implementation Of Smart Meter Projects

1	Germany: iMsys (Basic Meter + SMGw + CB) • > 20 German power and utility companies • Meter manufacturer (devolo in Aachen)
2	Austria: iMg (Intelligent measuring instrument) • Smart Meter West (Salzburg, Innsbruck, Bregenz) • Energy Steiermark (Graz) • Utility Klagenfurt
3	Further projects will follow in Germany and Austria
4	Projects will also come up abroad (pilot projects are running almost in all countries)

Futuristic Requirements

- Detailed specification/standards shall be available for smart meter test system.
- Infrastructure /laboratories shall be developed to test the smart meters.
- Experience and methodology so far used in EU and world wide shall be studied and modified accordingly to suit the requirement of the India market.

Conclusion

If utilities want to ensure intelligent, efficient and sustainable supply, the use of renewable energies is a key step towards achieving the goal, coupled with the necessary measures to digitize all processes. We also require **suitable test systems** to test and verify each part of the intelligent measuring system.

For the introduction and implementation of Smart Meter projects

we are at your disposal at any time

Thank you!!