



Choose certainty.  
Add value.

# TÜV SÜD Product Service

## -- *Smart Grid Communication* --

**IEC 61850 Interoperability and Integration  
Integrity Testing as part of the FAT**

TÜV SÜD Product Service  
Smart Grid Services (PS-COP-MUC)

Amsterdam, 28 September 2017

- Head of Smart Grid Communication Laboratory
- Technical Product Specialist IEC 61850 and Communication Protocols
- More than 20 years of experience in test development (SW, HW and Test Systems) and product test & qualification.
- Responsible for the Test Bench development and maintenance
- Member of IEC TC57 WG10
- Member of USE61400-25
- Member of UCAIug Testing Subcommittee
- Member of DKE 952.0.10 and 952.0.17
- Based in Munich, Germany
- Contacts: [Peter.Pfisterer@tuev-sued.de](mailto:Peter.Pfisterer@tuev-sued.de)
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The TÜV SÜD

IEC 61850 IOP-II Testing during FAT



# Inspiring trust in a changing world

Solutions that ensure quality,  
safety and sustainability for future  
generations



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**Choose certainty.  
Add value.**

# Our heritage: 150+ years of business success



**1866**

On 6 January, 22 industrialists united to establish the Steam Boiler Inspection Association Baden in Mannheim.



**1906**

Our first vehicle periodic technical inspection was carried out.



**1938**

The launch of a standardised nationwide system created 14 regional inspection associations named TÜV.



**1964**

Expansion beyond Europe began with a cable car accident investigation in Cape Town, South Africa.



**1991**

Asian subsidiaries launched in Hong Kong then Japan, Taiwan and China, with North American subsidiaries set up around the same time.



**2006**

Singapore's PSB Group is acquired, with TÜVTÜRK launched the following year and our largest acquisition to date, ATISAE, in 2016.



**1881**

The first binding standards related to boiler safety were agreed, paving the way for uniform technical inspections.

**1921**

Environmental advocacy began with our publication of a report addressing dust pollution.

**1951**

TÜV organisations were tasked with performing regular inspections of all motorised vehicles.

**1989**

TÜV Product Service GmbH was launched, pioneering the concept of worldwide approvals.

**1996**

The TÜVs from Germany's southern states united to form TÜV SÜD.

**Today**

TÜV SÜD has been inspiring trust for more than 150 years and remains committed to shaping the future of commerce and society.



**150+**  
YEARS OF  
QUALITY, SAFETY  
& SUSTAINABILITY



**1,000**  
LOCATIONS  
WORLDWIDE



**€2.3**  
BILLION  
IN ANNUAL  
REVENUE



**24,000**  
EMPLOYEES



**43%**  
OF REVENUE  
OUTSIDE GERMANY



**574,000**  
CERTIFICATES



**100%**  
INDEPENDENT &  
IMPARTIAL



**1**-STOP  
SOLUTIONS  
PROVIDER

Note: Figures have been rounded off.



## Testing & product certification

Beyond testing for compliance with directives, we issue TÜV SÜD certifications based on standards set according to internationally recognised benchmarks.



## Inspection

We independently verify that at every stage your systems, processes and procedures comply with the relevant codes, requirements, regulations and standards.



## Auditing & system certification

We audit and certify management systems for virtually all industries, ensuring your value chain complies with requirements for quality, performance and IT security according to international, national and other relevant standards.



## Knowledge services

We provide knowledge services on diverse topics ranging from quality, safety and risk to environmental protection, regulatory requirements and process optimisation.

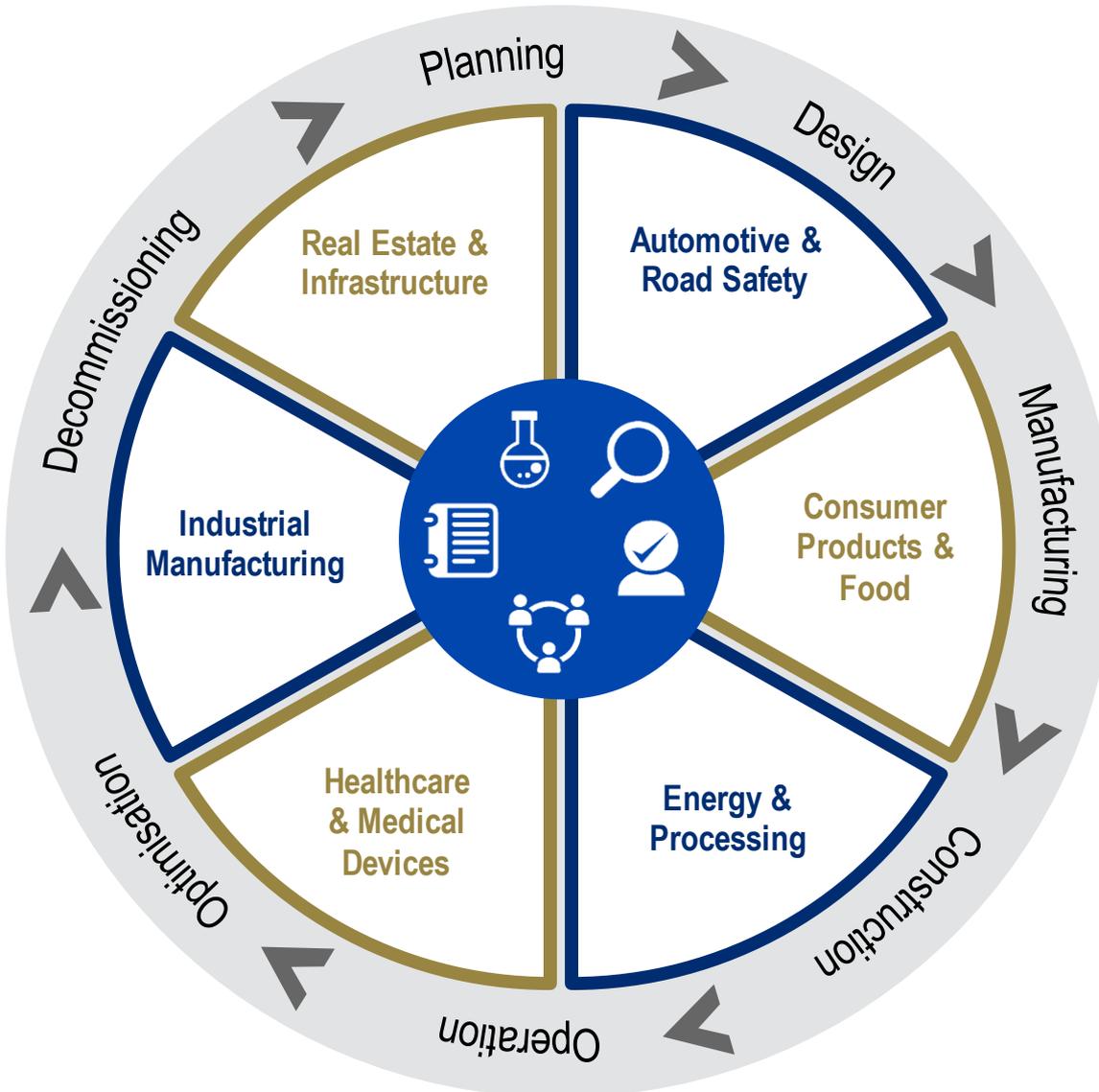


## Training

We support people and organisations to enhance performance through a wide range of work safety, technical, management systems, executive training programmes and certified qualifications.



# End-to-end solutions for the entire business lifecycle



## Watch video



- Testing & product certification
- Inspection
- Auditing & system certification
- Knowledge services
- Training



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**574,000**  
product certificates



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**54,000**  
system certificates



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**20,000**  
personnel certificates

## ENERGY AND PROCESSING SECTOR

- Engineering and knowledge services
- Life testing and maintenance services
- Product certification
- Project development and design review
- Risk-based inspection and maintenance



Make your devices and systems ready to communicate in the Smart Grid

## **IEC 61850 Conformance Testing and Certification**

- Testing and certification of
  - Server IEDs, Client IEDs
  - Merging Units
  - IED Configuration Tools
  - System Configuration Tools

## **IEC 61850 Interoperability Testing**

- Testing of devices for their interoperability with other components and ensuring an exchange of data between systems of different manufacturers
- UCA IOP Event in Munich 2013 hosted by TÜV SÜD

## **IEC 61850 Interoperability & Integration Integrity Testing**

- Testing the configuration and implementation of the IEC 61850 communication for a substation/power station within the FAT

## **Redundancy PRP/HSR Testing**

- IEC 62439-3 PRP/HSR Conformance Testing
- HSR & PRP Interoperability Testing
- PRP and HSR network performance



## Smart Grid: Power from an array of intelligently linked sources

### **IEC 61400-25 Conformance Testing**

- Testing according to selected parts of IEC 61400-25, the standard on Communications for monitoring and control of wind power plants

### **IEC 61850 & IEC 61400-25 Training**

- Standard Trainings: Basic / Utility / Developer
- Customized trainings according to the needs of the client

### **IEC 61850/IEC 61400-25 profiling for Utilities**

- Component analysis to guarantee the interoperability of all systems involved

### **Type Testing VDE-AR-N 4105, CEI 0-16, CEI 0-21**

- Testing of acceptable grid impact
- Testing of circuit breakers (grid protection device)

### **IEC 62351 & IEC 62443 Security Testing**

- IEC 62351 & 62443 consultancy and auditing with preparation of test report

### **IEC 61850-3 Testing**

- Electromagnetic Compatibility (EMC), shock and vibration testing (Environmental)





TÜV SÜD's unique Communication Protocols Test Laboratory





The TÜV SÜD

IEC 61850 IOP-II Testing during FAT



- The IOP-II Testing is an enhancement of the already known testings:
  - IEC 61850 Conformance Testing (with certificate)
  - IEC 61850 Interoperability Testing (White-List)
  - IEC 61850 Interoperability and Integration Integrity Testing (Project Specific) during the Factory Acceptance Test

Specification and Tender

Development with FAT/SAT

Ramping and Life Cycle

## IOP Tests



- Proof of basic communication

## FAT



- Proof of configuration, integration integrity, network stability,
- Check of simulated Functionality

## SAT



- Proof of the real Functionality

## Maintenance Tests



- System Checks, finding root cause of problems, stability checks

# IOP and Integration Integrity Testing during FAT



Areas of testing



## Missing Conformance Testing



### Missing Certificates

- Missing certificates results into missing or incorrect documentation, up to problems in the communication

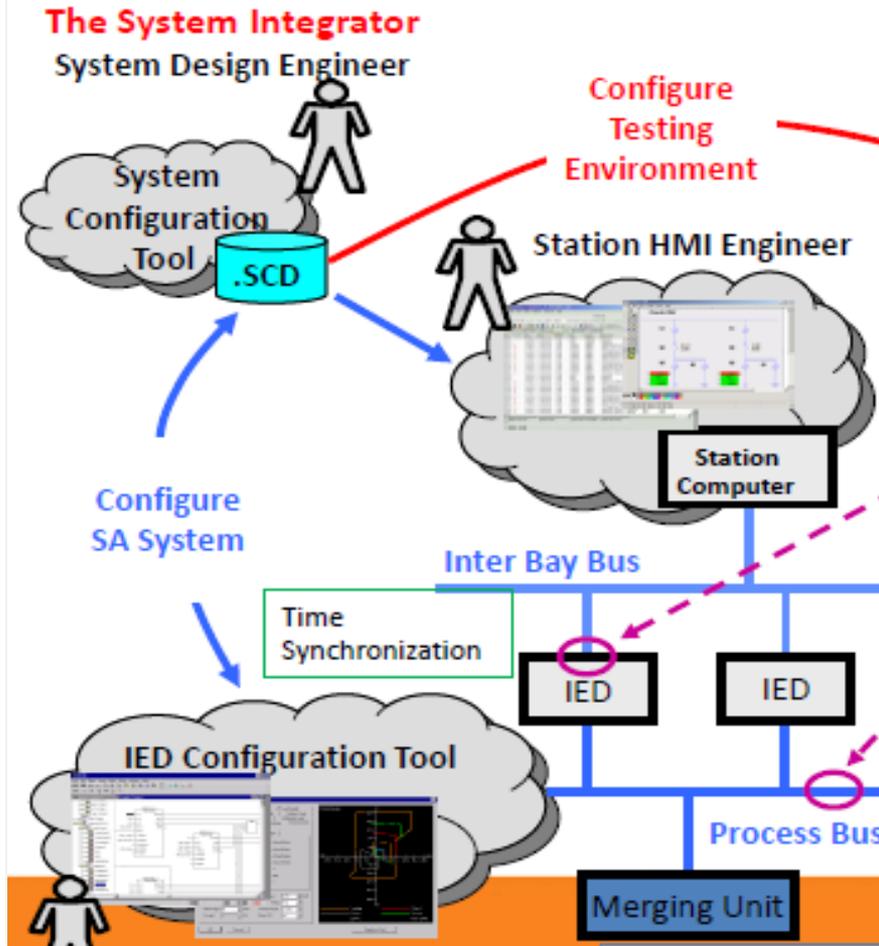
### Wrong or missing LN configuration

- Edition 2 devices with GGIO LN's instead of the standardized LN's

### Under-tested implementation

- IEDs tested and certified with less communication functionality but used with more features and services as certified

## Network and Configuration Tools Issues



### Network problems

- Network setup and architecture
- Network configuration
- Switches

### IED Configuration Tools

- ICT's often not conform to the IEC 61850 standard (e.g. limited in import/export)
- Bug generators

### System Configuration Tools

- SCT's often also introduces bugs (e.g. half Edition 1, half Edition 2)
- SCT's also often not conform to the IEC 61850 standard

# Recommendation on how to consider Testing for IEC 61850



- Establish trust for Data & Information exchange over a digital medium.  
⇒ **Check for actual, valid conformance certificates**
- Pay attention to your technical requirements.  
⇒ **Specify your communication requirements and proof correct implementation.**
- Avoid unexpected costs during development and life cycle.  
⇒ **Earlier you find problems and issues less expensive is the fix**
- The communication is the base of information exchange in the substation. ⇒ **Test it with a good strategy to get it save**



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