IEC61850 Maintenance approach

2017, September the 27th
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**Agenda**

- **REE`s overview**
- **Today’s objectives**
- **SAS (Substation Automation Systems) maintenance**
  - How IEC61850 may affect to current maintenance processes?
- **Maintenance view on IEC61850 proposed solutions**
  - IEC61850 SAS design aspects related to the O&M works
- **Conclusions and possible next steps**
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REE’s overview

Red Eléctrica is the owner of the entire Spanish high-voltage transmission grid and is a world reference in the integration of renewable energies.

MISSION
Red Eléctrica has the mission of ensuring the continuity and security of the electricity supply and the effective coordination of the electricity generation and transmission system. Additionally, it is responsible for the transmission of high voltage electricity and it builds, maintains and operates the facilities of the transmission grid.

VISION
The goal is to be one of the leading companies in the management of electricity systems, recognised for offering a quality service of the highest standards, implementing ethical management, maintaining a firm commitment towards sustainable development and generating value for all our stakeholders.

VALUES
- Responsibility
- Respect
- Reliability
- Environmental awareness
- Leadership and creativity
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REE’s overview

Key performance indicators 2015

**GOOD GOVERNANCE**
- Attendance to the Shareholders’ Meeting (+2.1%)
- Women on the Board (-8.4%)
- Reduced Board (+3.1%)
- Independent Directors (-3.4%)

**EMPLOYEES**
- Workforce (+0.9%)
- 1,697 people
- Women on the Workforce (+2.1%)
- 23.1%
- Women in Management Positions (+4.3%)
- 20.2%

**FINANCIAL DATA**
- Net Revenue (+5.0%)
- €1,938.9 M
- Net Profit (+8.3%)
- 606 M

**BUSINESS**
- KM of Lines (+3.0%)
- 42,986 km
- Substations (+2.0%)
- 5,428 substations
- Quality of Service of the Peninsular Grid (-0.2%)
- 97.93% grid availability

**INTEGRATION OF RENEWABLES**
- (-14%)
- 37% of demand

**INT. QUALITY**
- Shareholder Information Office (+10.2%)
- 1,284 visits attended to
- Local Suppliers (+5.0%)
- 98% of total purchases

**ENVIRONMENTAL**
- Fulfilment of Environmental Programme (+27.7%)
- 84%
- Restoration of Habitats (+15.0%)
- 1.4 M for the “REE Forest”
- Km of line marked with bird-saving devices (+15.3%)
- 2,950 km

**SOCIAL**
- Investment in the Community (+15.0%)
- €6.6 M
- Client Satisfaction (+1.2%)
- 8.3 out of 10

**TRAINING**
- 100 hours per employee

**WEBSITE**
- RED ELÉCTRICA DE ESPAÑA

IEC61850, Maintenance approaches in REE
2017, September the 27th
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REE’s overview

93% of net revenue

Electricity activity in Spain

7% of net revenue

Other activities

100% Electricity system operator and transmission agent activity

REE’s overview

33,000 km Dark optical fibre

And 800 points of presence and technical spaces

Investment in electricity transmission infrastructure abroad is channelled through different subsidiaries integrated in Red Eléctrica Internacional (REE): in Peru, REDESUR, in which REE controls 55% of the shareholding, and Red Eléctrica Andina (REA), a company wholly owned by REE. In turn, REDESUR controls Transmisión Eléctrica del Sur and Transmisión Eléctrica del Sur 2. In Chile, Red Eléctrica Chile, a company wholly owned by REE. This subsidiary, in turn, has acquired 50% of the share capital of Transmisión Eléctrica del Norte (TEN), owned by the Chilean company IC-L.
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- REE’s overview

**today's objective**

- SAS maintenance
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Today’s objectives

Design a reliable SAS

• Whole Life Cycle analysis

Are we prepared to handle these systems?

• Adapt SAS IEC61850 to make it ...
  o Efficient
  o Maintainable
  o Easy to use and standardize

• Adapt your ways of working

DRIVERS

• Simplicity
• Modularity
• Security & Safety
• Maintainability
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Maintenance feedback: Are we prepared?
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Maintenance feed back: Are we prepared?

Figure 4: Knowledge about IEC61850

Figure 6: Design criteria
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Maintenance feedback
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Maintenance ‘view’

Strengths
Staff expertise
Already Digital
Want to improve

Weaknesses
Different depts.
IEC61850 knowledge
Existing substations

Opportunities
Technology available
Network control
Moving to CBM
Testing standardization

Threats
Cyber security
Doc Management
New ways of working
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Optimizing SAS within REE

Drivers
• Reliability, availability, security and maintainability.
• TCO Minimization
• Simplify
• Towards CBM
• Vendor independency

Challenges
• Testing, isolation, security and maintainability
• Tools handling
• Process bus (SPV)
• TCO Minimization
• Interoperability
• Simplify
• Existing substations
• Towards CBM
• Vendor independency
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IEC61850 design concepts

- REE’s design criteria
  - Simple & reliable & efficient
  - Multi-vendor
  - Protection / Control (segregated)

- Architecture
  - 1st Station Bus
  - 2nd Process Bus (trips & commands)
  - 3rd Process Bus including SPV

Figure 1: Step by Step PACS Design Process
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IEC61850 design concepts
IEC61850, maintenance approach

Isolation

Tests / Isolation
- Testing isolating steps
- 52/89 status & alarms
- Execute control and protection commands
- Breaker failure protection transfer
- Trip circuit monitoring
- Interlocking logics (CILO)
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Isolation
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Conclusions

– IEC61850 technology is already available

– Working processes should be revised

– IEC61850 SAS can be considered as an optimization driver in terms of maintainability.
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Conclusions

— Considering **maintenance needs from design steps**
  - C&P functions segregated
  - **Isolation and testing**
  - Cybersecurity
  - Condition Based Maintenance.
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Conclusions

— Learning by **doing**

— **Existing** substations
  
  • Refurbishment and renewal
  
  • Bay extensions

— **Interoperability** in multivendor Station and ‘Process’ bus solutions
  
  • GOOSE - MMS
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