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Avoiding ENSTO-E Experiences in IEC 61850 deployment

Effective Implementation Processes

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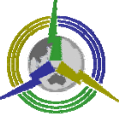
ENSTO-E European TSOs

- Europe - first deployments of IEC 61850
 - * 8 years experience
 - * Laufenburg
 - * ...
- ENSTO-E 41 Transmission utilities
- Largely vendor specific projects initially

A picture is worth a thousand words,
but sometimes you also need the right words




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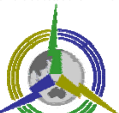
ENSTO-E Letter

<http://tinyurl.com/ENSTO-E-Statement>

- Instantaneous interoperability between suppliers
- Engineering efforts
 - ✳ mature standardized third-party tool
 - ✳ market to clearly move to a top-down approach
 - ✳ TSOs are unable to cope
 - ✳ technical knowledge and skills that are required
- Interoperability over the lifetime



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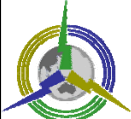


Punch List


<http://tinyurl.com/ENSTO-E-Report>

- Specific issues to be resolved
- Most categorized as :
 - ✳ part of the requirement spec of the utility
 - ✳ Vendor implementation issues – need to enhance the conformance testing
 - ✳ Clarifications in the standard required
 - ✳ Standard to limit options and / or to define profiles

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TF user feedback

 Note: “50%” of the issues are due to incomplete specifications of the users, incomplete implementations in products and lack of knowledge of the key issues of the standard with limited (no) investment in tools

 TC57 / WG10 Task Force created for user feedback to the Standard

- ★ Not TISSUE database
- ★ Includes ENTSO-E punch list



Deployment Strategies

 Specify what is required

- ★ Detail

 Engineering Process

- ★ 3rd Party Tools investment – they do exist
- ★ Integration
- ★ Management

 Training

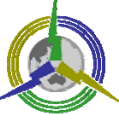
 Project planning

- ★ “3 days to write a specification” !!!!!







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Required Knowledge




-  Project Management
-  Function Modelling
-  The engineering process
 - ✦ Role of different tools
 - ✦ Scope and purpose of different files
 - ★ SEAPAC 2011 37D
-  The elements of the IEC 61850 data models
 - ✦ Specification of requirements
-  The principles of the information exchange – purpose of control blocks and data sets
-  What Conformance means/does not mean



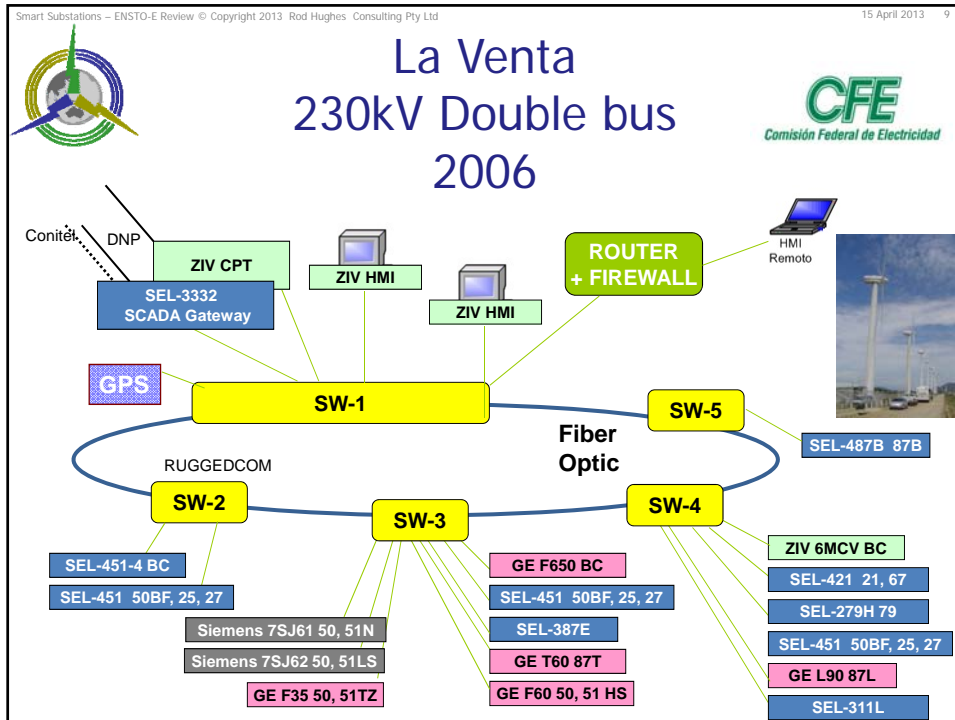
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Proper Specification

-  All IEDs shall be compliant ?
 - ✦ Which Parts?
 - ✦ Which Edition?
 - ✦ Which models?
 - ✦ Which options?
-  GOOSE shall be used
 - ✦ To do what with what other IEDs?
 - ✦ Avoiding GGIO routing?
 - ★ TISSUES 864, 880, 900
 - ✦ What about MMS?
 - ✦ LAN architecture?
-  **Don't expect to get what you don't specify!**

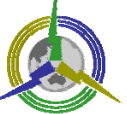
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Investment

Tools

- * Vendor Independent
- * Vendor specific

Process development

- * Multiple engineers in multiple departments in multiple organisations over multiple stages

Solution development

- * Proof of Concept
- * Proof of Interoperability
- * Usability
- * Standardisation

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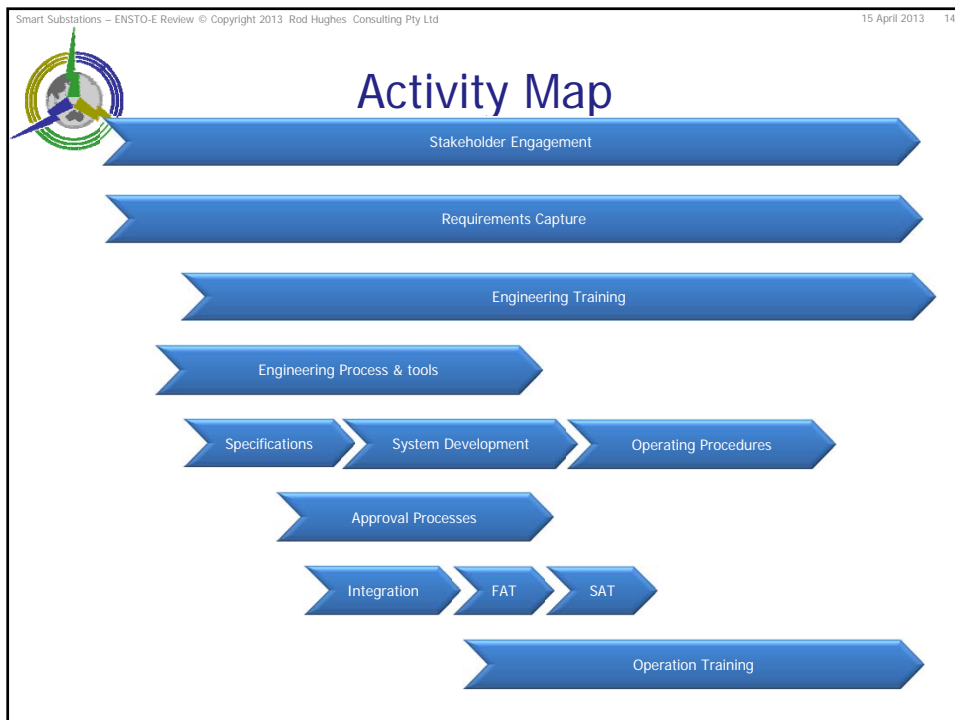
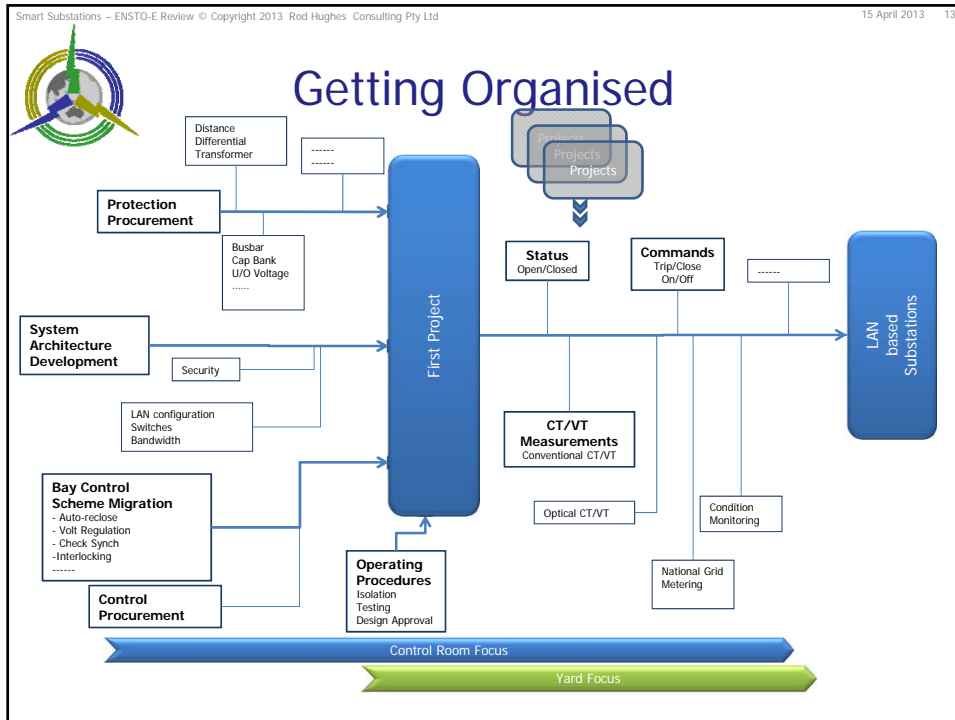


Organisation not Technology

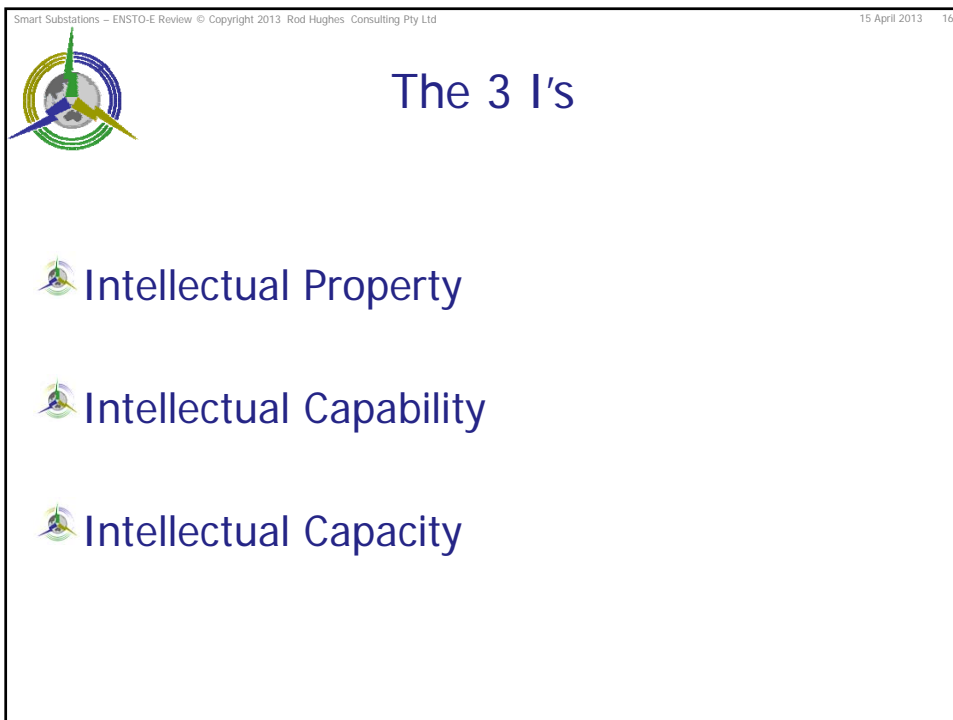
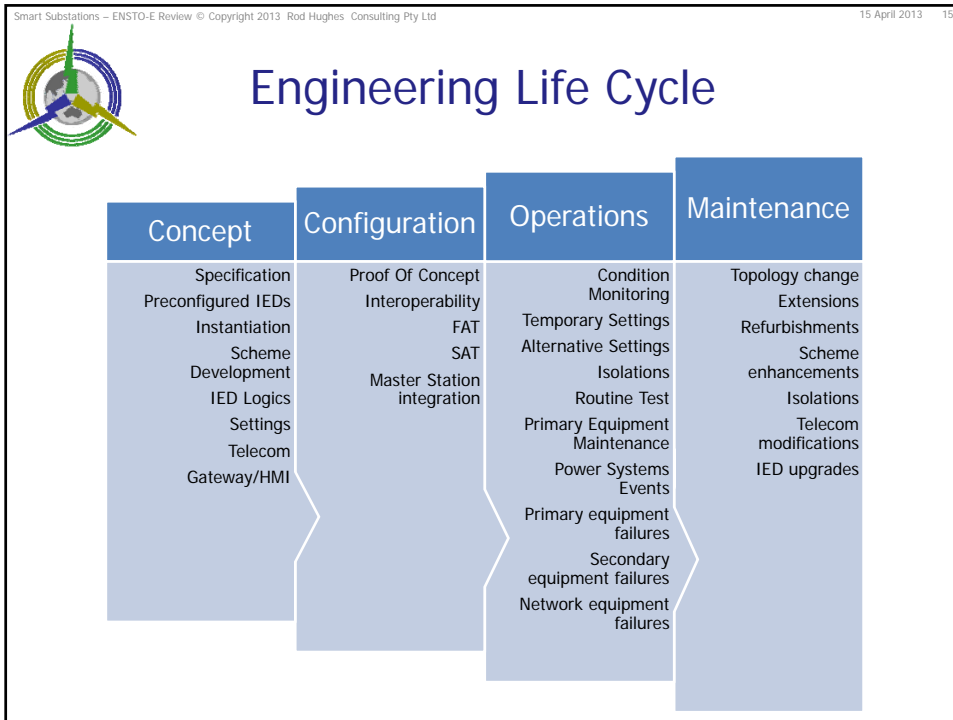
“Technology is not the barrier to adoption. The fundamental issue is organization and prioritization to focus on those first aspects that provide the greatest customer benefit toward the goal of achieving an interoperable and secure Smart Grid.”

- * IEC
- * http://www.iec.ch/smartgrid/downloads/sg3_roadmap.pdf

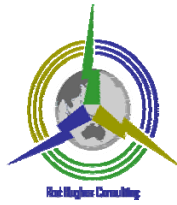
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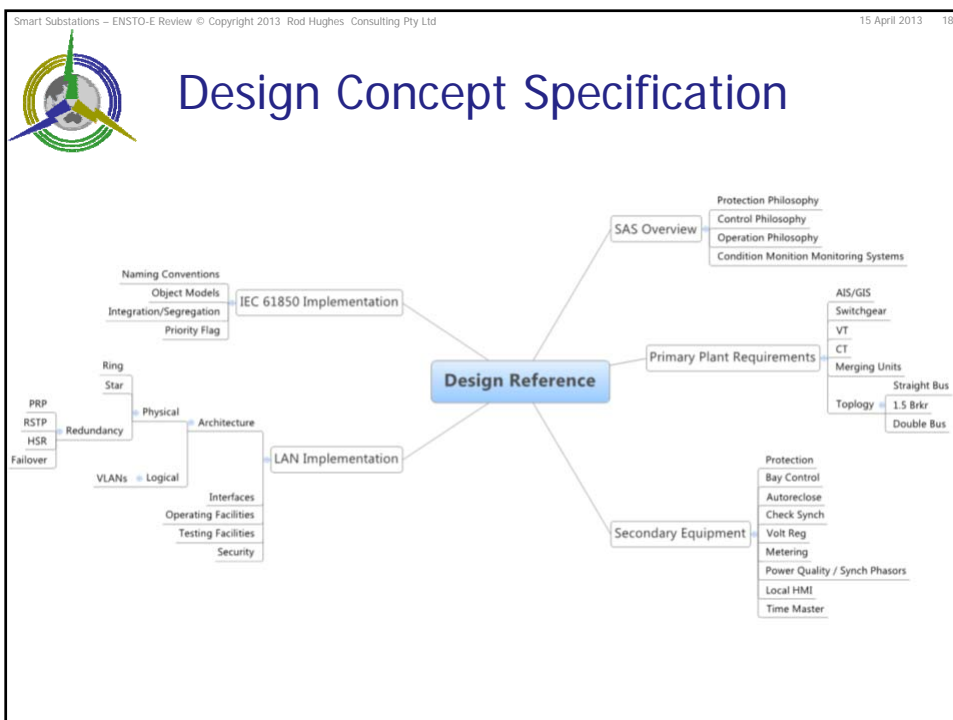
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The 6 Elements

- 🌐 Business Case and Implementation Strategies
- 🌐 SAS Definition – Design Concept Specification
- 🌐 IED & System Procurement
 - ✦ Relays, Controllers, Condition Monitoring, HMI, Network Switches ..
- 🌐 Engineering and Operational Tools
 - ✦ Top-down vendor independant
- 🌐 SAS Introduction and Implementation Standardisation
- 🌐 Staff development
 - ✦ Concepts to practitioner



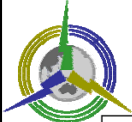
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DCS: Principles/Allocations

- ✳ Connections to primary plant,
- ✳ Plant status inputs and control outputs,
- ✳ Function definition:

- ✳ Protection
- ✳ SCADA and operator initiated Trip/Close,
- ✳ Automatic Voltage Regulation,
- ✳ Auto Reclose,
- ✳ Interlocking,
- ✳ Disturbance Recorder capture
- ✳ etc.



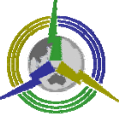
Design Concept Specification

TransGrid SAS Design Concept Report –	TransGrid SAS Design Concept Report – IEC 61850 Impl	TransGrid SAS Design Concept Report – IEC 61850 Implement
Contents	8.2.2. HMI	11.1.3. Implementation Tasks
1. Scope	8.2.3. Controllable objects and auto	11.1.4. Operation Tasks
2. Summary	8.2.4. Control of switching compone	11.1.5. Maintenance Tasks
3. References	8.2.5. Switchgear Position Indicato	11.2. IEC 61850 engineering process
4. Terms, Definitions and	8.2.6. Synchrocheck	11.2.1. Substation specification description
5. SAS Design Objectives	8.2.7. Voltage regulation	11.2.2. IED capability description
6. System Overview and A	8.2.8. Reactive plant control	11.2.3. Substation configuration description file
6.1. Primary plant requi	8.2.9. Auto reclose	11.2.4. Configured IED description file
6.2. Secondary equipme	8.2.10. Load shedding	11.2.5. Instantiated IED description file
6.3. Substation autom	8.2.11. GIS gas pressure supervi	11.3. IEC 61850 tool requirements
6.3.1. Redundancy re	8.2.12. Transformer cooling contro	11.3.2. IEC 61850 system configuration tool
6.3.2. Substation aut	8.2.13. Panel based indications &	11.3.2. IED configuration tool
6.3.3. Communicatio	8.3. Protection	
6.3.4. Network Equip	8.3.1. Protection design principles	12. Migration
6.3.5. Access to the d	8.3.2. Line protection	
6.3.6. Realisation of	8.3.3. Transformer protection	13. Physical and Ancillary Requirements
6.4. Connections to the	8.3.4. Busbar protection	13.1. Panels
7. Substation Automation C	8.3.5. Capacitor bank protection	13.2. IEC 60255 Compliance
7.1. External interfaces	8.3.6. Circuit breaker failure protect	13.2.1. IEC Type Test Requirements
7.1.1. SCADA Interfa	8.3.7. Fault location	13.2.2. IEC 61850 Compliance
7.1.2. Constatn man	8.4. Measurements	13.2.3. Electro-Magnetic Compatibility (EMC)
7.1.3. Disturbance an	8.5. Metering	13.2.4. No Maloperation
7.1.4. Protection con	8.6. Alarms & Event Recording	13.3. Environmental Operating Conditions
7.1.5. Synchrobas	8.7. Condition monitoring	13.4. IED Enclosure Degree of Protection
7.1.6. Third party acc	8.8. Disturbance and fault recording	13.5. Acoustic Noise
7.1.7. National grid m	9. IEC 61850 Implementation Constrants	13.6. IED Mounting Arrangement
7.1.8. Time synchron	9.1. Object model	13.7. Electrical Connection Terminals
7.1.9. Connection bet	9.2. Naming convention	13.8. Surge Protection
7.2. Internal interfaces	9.3. IEC 61850 component require	13.9. AC/DC Auxiliary Supplies
7.2.1. Control and pr	9.3.1. Station components	13.10. IED Auxiliary Supplies
7.2.2. Condition mon	9.3.2. Bay components	13.11. IED Communication Ports
7.2.3. Disturbance an	9.3.3. Network components	13.11.1. Front Port
7.2.4. Protection sign	9.4. IED Logic	13.11.2. Rear Port
7.2.5. Time synchron	9.5. Performance requirements	13.12. Primary Current and Voltage Sensing Inputs
7.3. Process interfaces	9.5.1. SAS message latency	13.12.1. Instrument Current Transformer with 1 Amp Output
7.3.1. Voltage Regul	9.5.2. Network Recovery Time	13.12.2. Instrument Voltage Transformers with 110V Output
7.3.2. Analogue Input	9.5.3. SCADA Data Availability & R	13.13. DC Analogue Inputs
7.3.3. Status inputs	9.6. Test & Maintenance Support	13.14. Binary Inputs
8. Substation Automation C	10. LAN & Information Security	13.15. Output Contacts
8.1. Degree of function	10.1. Information Security Controls	13.16. D.C. Circuits
8.1.1. Restrictions on	10.2. LAN Ownership	13.17. Time synchronization connection
8.1.2. Function alloca	10.3. SAS Network Information Secu	13.18. Operation Indicators (LEDs)
8.1.3. Server require	10.3.1. Malware protection	13.19. IED Controls and display
8.2. Control and autom	10.3.2. Network Access Control	13.20. IED Self Checking
8.2.1. Control locator	10.4. CNV Access from Substations	13.21. Only Pre-Qualified IEDs
	10.4.1. Business Requirement	13.22. Firmware Upgrades For IEDs
	10.4.2. Design Strategy	13.23. Software Upgrades For IEDs
	10.4.3. Design Principles	13.24. SAS HMI, Keyboard and Mouse
	11. Life cycle information management	Annex A CIGRE References
	11.1. The life cycle of a substation	
	11.1.1. Pre design library Tasks	
	11.1.2. Design Tasks	

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Systems Specification Tool

SSD File

- ✦ Primary Plant Allocation
- ✦ Virtual IED Assignment
- ✦ Logical Devices
- ✦ Key LN requirements


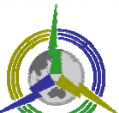


Figure 1: Primary Plant Allocation (SCL) File

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Selected References

<https://ideology.atlassian.net/wiki/x/HYBq>

- RH12: Experiences in organisational development and specifying IEC 61850 systems
- RH13: IEC 61850 Edition 2 – what does it mean for the end user?
- RH14: Experiences of IEC 61850 Engineering – Designing good systems the right way.
- RH15: Choosing and using IEC 61850 SCL files, process and tools correctly throughout the complete SAS lifecycle

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- 30 years in protection engineering
 - * GEC, ALSTOM: P&C Engineer, Engineering Manager, General Manager – Australia
 - * ALSTOM: P&C Product Director - France
 - * ElectraNet: Protection & Telecoms Manager, Plant Strategy & Technology Manager
 - * SKM: State Manager - South Australia
 - * AECOM: Technical Director - South Australia
 - * **Rod Hughes Consulting Pty Ltd: Managing Director & owner**
- CIGRE 
 - * AP B5 Protection & Automation 1985 - 1998, 2001- current
 - * (Convener since 2004)
 - * AP D2 2001 – 2004 Information & Telecommunications
 - * Technical Brochure 326 Implementation of IEC 61850
 - * WG B5-39 Documentation for Digital Substation Automation Systems – Convener
 - * South East Asia Protection & Automation Conference
- UCA® International Users Group
- IEEE Power Engineering Society
- Publications and Technical Papers
- Training courses – Protection & IEC 61850
- LinkedIn® forum
- Owner IEC 61850 Patent: Operator & Test Interface



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- * IEC 61850 and associated standards
- * Automation & Control
- * Protection design 11kV to 500kV
- * Training
- * Cyber Security
- * Smart Grid and Smart Metering
- * Telecommunications
- * Substation LAN



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