SYSTEMS ENGRAINING, IEC STANDARDISATION OF SUPPLY & DEMAND MANAGEMENT

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Show multidisciplinary and systems engineering nature of standardisation of Smart Grids in general and Supply and Demand Management in particular.
• Systems Engineering Approach For Systems
• Systems and Standards Life Cycle
• Power System and its Challenges
• Supply and Demand Management
• Standardisation challenge
• SDM Standardisation @ IEC
• Conclusions
SYSTEMS ENGINEERING APPROACH FOR SYSTEMS
"Systems engineering is an interdisciplinary approach and means to enable the realization of successful systems" INCOSE Systems Engineering Handbook

- Systems Engineering is all about creating and sustaining successful, purposeful systems
  - Need for Systems Thinking
  - Need for Strategic System Engineering approach
  - Need for capturing actual System Emergent Properties
  - Need for Transparency and Collaboration across the verticals
  - Need for common Model Based Systems Engineering Tool(s) to provide necessary holistic view of system
SYSTEMS AND STANDARDS LIFE CYCLE
SYSTEMS AND STANDARDS LIFE CYCLE

System Initiatives & Objectives

System Standards Needs / Requirements & Functional Analysis

Emergent Property Assessment

Deployment & Conformity of Standards

Design, Development, & Testing of Standards
POWER SYSTEM AND ITS CHALLENGES
DRIVERS FOR CHANGE

- Combat climate change
- Support growing populations
- Support electrification of energy use
- Improve cost efficiency
- Enhance security of supply

Causes for decision makers, engineers and researchers to rethink the power system
INTEGRATION OF NEW ‘GRID USERS’

- Intermittent energy sources
- Distributed generation
- New electrical loads
- ‘Smarter’ grid users
CONCEPT OF NEW FLEXIBILITY SOURCES

Main requirements

• Balance supply and demand
• Economic use of grid capacity

Solution direction

• Use of alternative sources of ‘flexibility’
• Scale management of flexible energy resources to more endpoints
SUPPLY AND DEMAND MANAGEMENT
SUPPLY AND DEMAND MANAGEMENT (SDM)

Integration of these new ‘users of the power system’ into:

• Power markets
• Scheme’s for balancing
• Scheme’s for protection
ENORMOUS SOLUTION SPACE

- Standardisation is seeking unanimity
- It starts with unanimity on what to standardise

For every ‘quadrant’, there are already more than one solutions … what to standardise?
STANDARDISATION CHALLENGE
STANDARDISATION CHALLENGE

- Embrace a multidisciplinary approach
- Cater for market and org. structure variations
- Standardise (quickly), but design for change
EMBRACE MULTIDISCIPLINARY

• Root challenges are electro-technical in nature
• Requires input also from other disciplines such as ‘Business’ and ‘ICT’
• SDM standardisation must cover:
  • Analysis and design from all viewpoints
  • Clear definition of their interrelationships to bridge the different ‘languages’
STANDARDISE, BUT DESIGN FOR CHANGE

- Need for SDM solutions is there, but area is not yet mature
- However, waiting for the best solutions to emerge simply does not suffice
- So start standardisation quickly but don’t hamper future innovations
STANDARDISE, BUT DESIGN FOR CHANGE

Examples

• Tight-coupling between communication (on the transport level) and SDM approach
• Integrating concepts specific to the SDM approach into energy resources

• Tight-coupling is an important anti-pattern
• Barrier for improvements in the field
• Even if internationally Standardised, because of the capital destruction required to change
SDM STANDARDISATION @ IEC
STANDARDISATION EFFORTS @ IEC RELATED TO SDM

• SG 3 on Smart Grids
• SEG 2 on Smart Grids
• TC 8 Systems aspects for electrical energy supply
• TC 57 Power systems management and associated information exchange
• PC 118 Smart grid user interface
## NIST Framework Standards

<table>
<thead>
<tr>
<th>Smart Grid Functionality &amp; Service</th>
<th>List of Standards</th>
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<tr>
<td><strong>Smart Network Management</strong></td>
<td>- Electromagnetic compatibility &amp; power quality</td>
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<td>- Advanced network operation and control (e.g., faster fault identification and self-healing capabilities, advanced network automation, volt var/watt control)</td>
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<td>- Smart metering and power line communication</td>
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<td>IEC 61000 series</td>
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<td>IEC 61968/61970/62325 (CIM)</td>
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<td>IEC 61850 series, IEC 60870 series</td>
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<td>IEC 62689 series</td>
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<td>IEC 62351 series</td>
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<td>IEC 60255 series</td>
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<tr>
<td><strong>Smart Integration of Distributed Generation and e-mobility</strong></td>
<td>- Integration of distributed generation</td>
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<td>- Integration of electric vehicles</td>
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<td>- Integration of new usages such as storage, heating &amp; cooling, etc.</td>
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<td>EN 50438</td>
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<td>IEC 61850 series</td>
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<td>TS 50549-1 &amp; 2</td>
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<td>ISO/IEC 15118</td>
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<td>IEC 62786</td>
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<td>IEC 61851</td>
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<td><strong>Smart Markets and Active Customers</strong></td>
<td>- Enable DSO to act as market facilitator and grid optimiser</td>
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<td>- Develop demand response and demand side management programmes</td>
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<td>- Aggregate distributed energy resources and e-mobility</td>
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<td>- Balance the power grid</td>
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<td>IEC 61968/61970/62325 (CIM)</td>
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<td>IEC 62056 (DLM/COSEM)</td>
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<td>IEC 61850 series</td>
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<td>SEP 2.0, Open ADR, ...</td>
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CONCLUSIONS

• Smart grid in general and SDM in particular is a very interesting field with potentially enormous impact

• But it is a complex and immature field requiring
  • Multidisciplinary teams
  • Capable of systems thinking