

NEXT GENERATION SUBSTATIONS

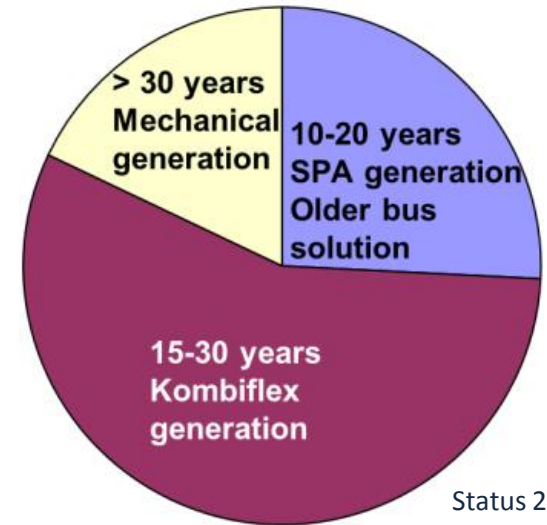
Developing a high functionality low cost smart substation concept to drive the next phase of the utility digital transformation

Anders Johnsson, Vattenfall Eldistribution AB, Sweden

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BACKGROUND

- Rapidly aging substation automation systems together with limited life time of modern DSAS devices.
- Big gap in reinvestments.
- Mix of old standardized/new non-standardized substations.
- Procurement strategy based on functional requirements could lead to unique solutions.
- Need a new standardized concept to efficiently replace SAS





DEPLOYMENT OF STANDARD SUBSTATION CONCEPT

Organisational

Processes

Roles

Competence

Tools

Procurement

Technical

Functions

Specifications

Interfaces

- Affects both organisational and technical issues.
- Development of tool based IEC 6850 process
- Update of technical specifications

SCOPE OF NEW IEC 61850 PROCESS

- Strategic direction to standardize Protection, Automation and Control Systems (PACS) by implementing IEC 61850.

Key issues:

- Overcoming the engineering challenges of multi-vendor systems through the lifecycle of the system.
- Defining and utilizing templates that ease the engineering process in new and refurbished substations.
- Leveraging the latest vendor-independent tools to improve speed and accuracy of engineering from a customer perspective.*

**A DSO perspective on IEC 61850 specification and engineering, presented at IEC 61850 Europe 2016*



NEW TECHNICAL SPECIFICATION

- Move to IEC 61850-8-1 station bus for all remote and local monitoring and control.
- Keep hard wired separate backup control at each bay unit or cabinet.
- Station-HMI part of RTU-solution
- Station specific signal list based on common template.
- Frame agreements on IEDs



DRIVERS, NEEDS AND EXPECTED BENEFITS

Vattenfall Eldistribution
Starting point

Ongoing R&D activities
Deliverables

Future Benefits

**Aging primary
substations**

IEC61850 Pilot

**Maintenance
calendar based**

**Next Generation
Protection and Control
concept**

**New primary
equipment**

**Reference architecture
to enable Condition-
Based Maintenance**

**Faster replacement
additional cost
reductions**

Ability to buy "batches"

**Implemented new
primary equipment**

**Reduced maintenance
costs**

DIGITAL SUBSTATION R&D ACTIVITIES

Main activities

For faster **substation PACS** replacement process & additional cost reductions

Main Deliverable: **Basic concept for next generation protection and control**

Implementation of new **primary equipment**, saving environment and costs

Main Deliverable: **Indoor Substation Concept**

Condition based maintenance to reduce maintenance costs, optimize use of substation equipment, optimize planning

Main Deliverable: **Pilot identification of reference architecture**

Short term **Implementation support**

Main Deliverable: **Routines to find faults in IEC 61850 systems**

Developing a high functionality low cost smart substation concept...

- Next step towards more standardized, cost effective and resource effective technical solutions for protection and control.
- Continuous technology development provides opportunities for improvements of the IEC 61850 PACS concept.
- Developing next generation P&C equipment as a successor and continuator of the deployment of IEC 61850 work processes.



EVALUATION OF NEXT GENERATION P&C CONCEPT

Evaluation parameters

- Standard HW for different P&C applications.
- P&C functions according to Vattenfall needs.
- Standardization for the system engineering, over the entire lifespan of equipment.
- Contribution to more efficient FAT/SAT.
- Shortening of installation time on site.
- Efficient procurement IEC 61850 work process
- Improved quality assurance of the P&C delivery



EVALUATION RESULTS

Highest scores

- Bay digitization marshalling kiosks
- Modularized protection & control unit



VS



Other companies may have other parameters and thus come to other conclusions.



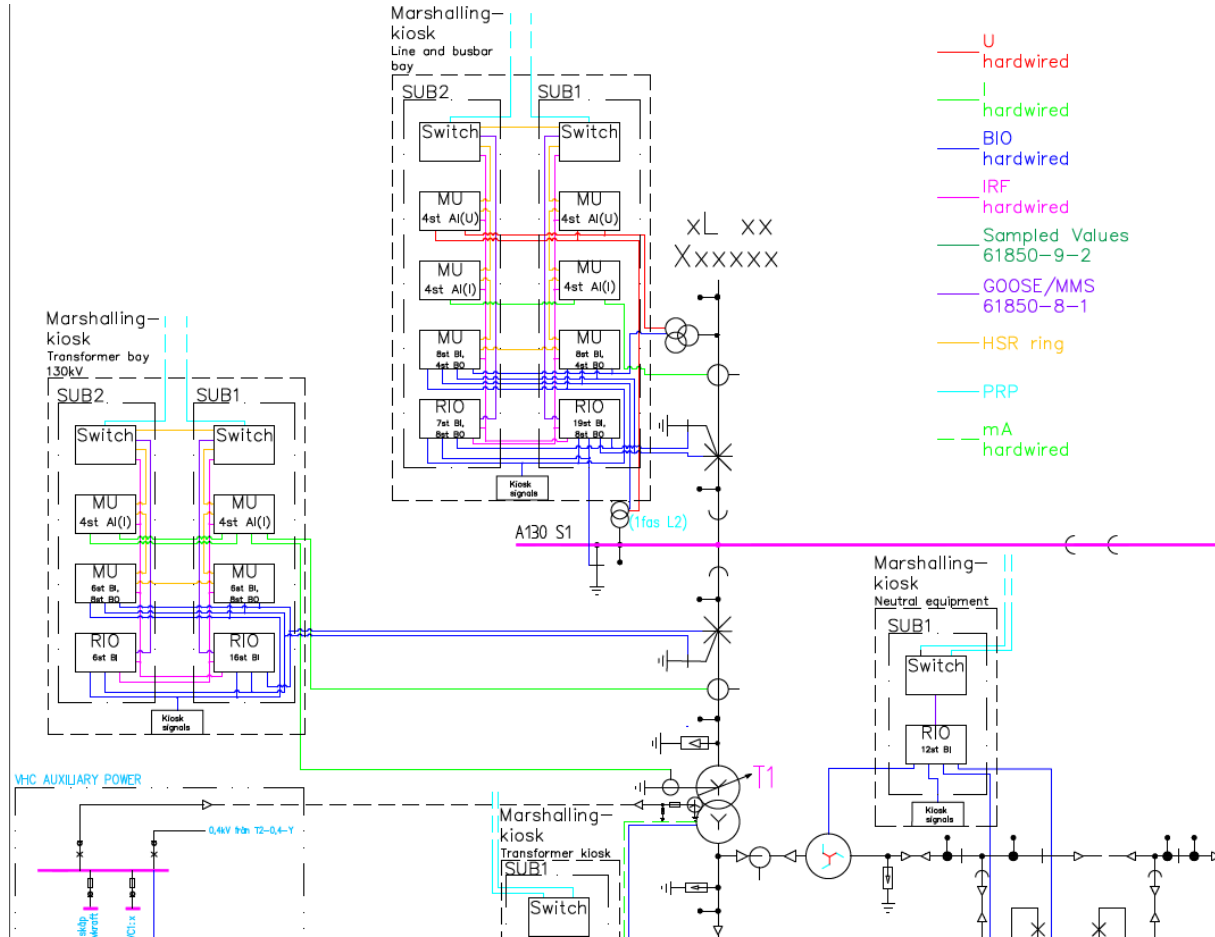
- Other concepts evaluated
- Centralised soft P&C and,
 - Integrated bay P&C into single IED.

DETAILED RESULTS

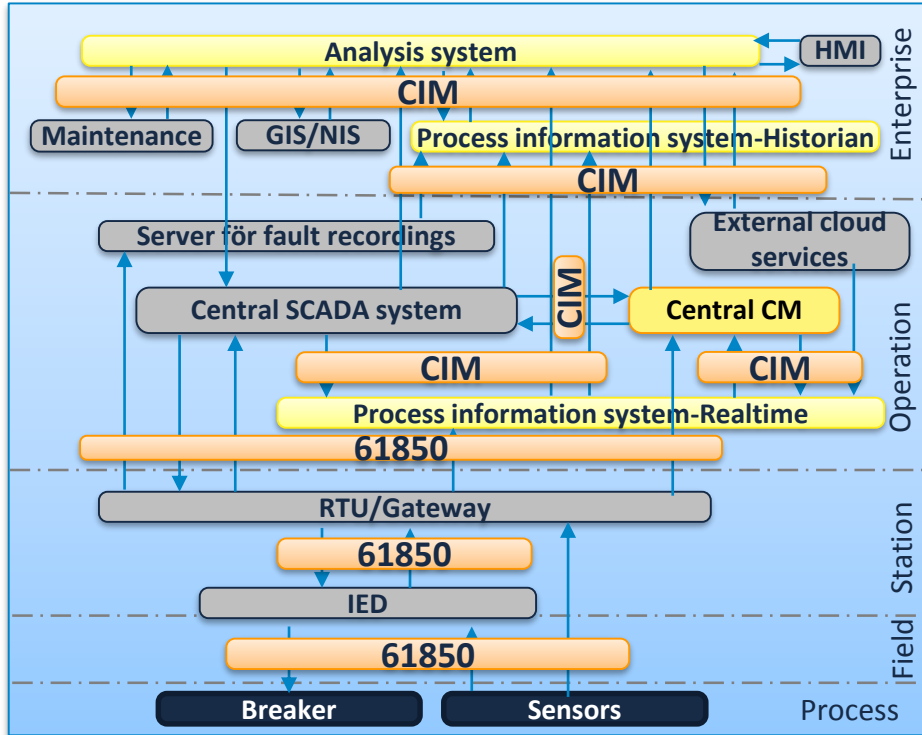
	Total sum	General issues	Procurement process	Project execution	Operation & maintenance
Bay digitization marshalling kiosks	55	15	8	9	23
Modularized P&C unit	52	13	7	10	22
Concept X	46	14	2	8	22
Concept Y	44	9	5	8	22
Concept Z	39	9	2	6	22

NEXT STEP

- Integration of newly identified concepts in a basic design
- Development of conceptual basic design – digitizing information & data
- Business case for pilot installation
- Broader set of functions has to be considered for the communication network architecture.



REFERENCE ARCHITECTURE TO SUPPORT INFORMATION EXCHANGE FROM PROCESS TO CENTRAL CONDITION MONITORING SYSTEM



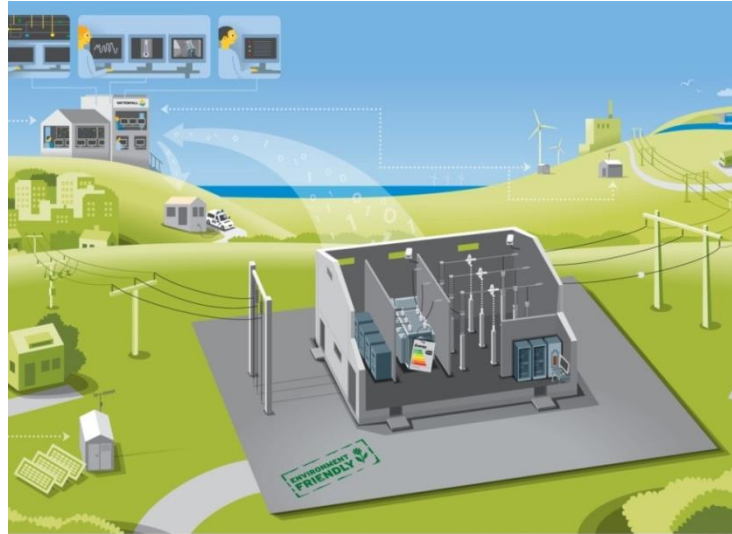
Example - Information exchange for calculation of Asset Health Index – **Breaker**

- Creation of realtime Process information
- Reporting of disturbance recording files
- Creation of historic process information
- Make process information and disturbance records available for analysis system
- Make asset information available for analysis system
- Provide calculated AHI for maintenance.

... to drive the next phase of the utility digital transformation.

Digital PACS

- Extended digitalisation
- CM data
- Process bus
- Software independent of hardware
- Distribution automation and FLISR



Primary equipment

- Indoor substation concept and compact design
- NCIT

Access to data

- Enterprise Service Bus
- Asset health index
- Close the loop NIS/PACS



QUESTIONS?

anders.johnsson@vattenfall.com