

ELFORSK, MAY 2017, MIKAEL DAHLGREN

Digitala lösningar... för ett mer effektivt framtida elsystem

Power industry environment

Common trends

Aging

Significant T & D infrastructure is at or near end of life.



Demands

25000

15000

5000

-OECD

-Non-OECD

Å

Increasing load and fault levels

Complex networks due to renewable

Erosion of skill engineering and operation staff retire

2013

-----World



Longer maintenance cycles, keeping same performance Limited outage time Less maintenance being performed

Regulations

Business performance demands higher return on investment Government regulations (e.g. quality of supply)





Electric power system of the future

Core themes defined by Cigré

Characteristics

- Bi-directional energy flow
- Application of "Smart Metering" and major need for information exchange.
- More power electronics for AC and DC.
- Storage for grid stability. .
- New market design and market rules & regulations.
- New grid protection concepts in order to cope with characteristics of renewable generation.
- New environmental and energy efficiency regulations.
- Increase capacity and efficiency of assets.
- Involvement of stakeholders in the development of adequate grid infrastructure to cope with future requirements.



Wind and solar growth in parity to Nuclear development in the 70-thies

Growth Comparison Nuclear Electricity and Solar+Wind

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California 2017

8 consecutive hours with negative prices

How much weather dependent production can we have?

The pioneering technology leader

Enabling a stronger, smarter and greener grid

Stronger

Ultra High Voltage DC and AC Resilient transformers Power quality solutions & FACTS¹ Interconnectors

Continuously breaking records: more power over longer distances (12 GW over 3,000 km)

Smarter

Digital substations Grid automation Sensor-based technologies Enterprise software solutions

Digital substation: smart configuration and interoperability, up to 80% less cabling, up to 50% less outages

Eco-efficient Gas Insulated Switchgear

Ultra low loss, amorphous core and biodegradable oil transformers

HVDC Light² and FACTS for renewable integration

Transformers: up to 70% less losses GIS³: up to ~100% less greenhouse gases FACTS: more capacity in existing lines

¹Flexible Alternating Current Transmission Systems ²Voltage Source Conversion ³Gas Insulated Switchgear

Digital technologies are driving new innovation in industrial markets

Media is focused on B2C but the "killer app" is in B2B

ABB is in the "eye of the storm" for massive value migration

A \$4 – 11 trillion digital opportunity by 2025

Range of sized potential	Low
economic impact	High

Disruptive technologies will have substantial impact by 2025 (economic impact of 12 most significant technologies, \$ trillions, annual)

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Industrial markets primed to adopt digital technologies

Computing + connectivity + cloud + analytics set to unlock value

What does it take to win in digital?

Mastering the control room

From physical to digital differentiation

ABB Ability[™]: industry-leading digital solutions

Utilities

Reduced installation time (<40%), maintenance costs (<50%) and outage time (<50%)

SELECTION

How ABB Ability[™] solutions deliver value

Digitally connected products and services providing expertise

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Digitally connected products and services providing expertise

Digital Substation

Enable higher reliability and productivity in fleet service

Asset management

Data analytics and condition monitoring features enable ABB's asset health center

Asset Health Center

Asset management solution

Situation and challenge:

- Critical assets to be analyzed: 3,500 substations, 8,667 transformers, 10,737 breakers, 274 batteries; 33% transformers over 50yrs old; 18% over 60yrs
- How can AEP prevent failures, optimize maintenance and prioritize renewals?

Solution:

- ABB Asset Health Center
- Consolidated SCADA, sensor & maintenance data analyzed via industry-leading asset performance models

Benefits:

- Target 15% savings on O&M
- Automatic alerts, action recommendations & priorities
 - Prevented at least three transformer failures
- Consistent prioritization of asset replacements

Digitalization opens up new, large opport unities

Increased productivity: uptime, speed, yield

Digitalization via intelligent products, communication and software

Digitalization is quickly entering into the power grid

What is the next (next) generation of the digital revolution

Power generation change characteristics

• Going from synchronous machines to power electronics controlled generation

Results From the World's Biggest Transactive Energy Test

A Pacific Northwest project shows promise—but there's much more work to do on automated price-balancing.

y Jeff St. John September 02, 2015

Completely new applications are emerging fast

- New service services, time based to condition/risk based philosophy
- Dynamic rating of cables, OH and transformers, dynamically 5-20% higher capacity
- Optimization of losses and voltage profiles especially in distribution grids with a lot of PV, EV and Storage
- Transactive trading, => Reduce peak demand with 8%.
- Block chain micro payments?

Post IEC 61850

 Self-configuring devices with data from the web, plug and play/forget

Energy Storage

- Grid Singularity in Austria
- Solarcoin MIT start-up
- Transactive grid in New York

Many trends in grid energy storage

OECD uses half of the worlds electric consumption

Slight decline in absolute terms. How will it develop? Impact on grid?

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Internet of Energy

The digital power grid

