Microgrids Digital Transformation

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SmartGrids and Microgrids: Real Time, Internet of Things, Big Data and Digital Transformation needed

Weather Prediction: Sunny, Windy, 23°C
- Wind leads to more electricity generation
- Sun leads to increased electricity generation
- Green Electricity available
- Energy production covers (estimated) needs
- Lower electricity production
- Heat generators are not needed
- Electricity Car can get cheaper recharge
- Service Ecosystem 2020+…
The Microgrids Equation

- Microgrid Modes of Operation into Active Networks
- Storage: Variable Load, Demand Side, Distributed Energy
- Economics: Smartgrids Business Models
- Internet of Things: Big Data, IT/OT, Real Time Predictions

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Big data brings new business opportunities, innovation, transformation and growth

More than 60% of CEOs expect **15%–50% of their earnings growth** in the next **5 years** to come from technology-enabled business innovations.

*McKinsey study, 2013*

- **30+ Billion Things by 2020**
  - Internet-of-Things
  - Home Devices
  - Personal Devices

- **44 trillion gigabytes (44ZB)** of data will be generated in 2020… data creation is more than doubling every two years

- **60%** increase in operating margin in retail companies using Big Data as a **new resource**


http://www.mckinsey.com/insights/business_technology/big_data_the_next_frontier_for_innovation
The Digital Strategy empowering the Business Strategy
Technology innovations Maturity Model for Utilities & Grids
IT/OT Integration: Situation awareness, integrating financial and operational data with predictive analytics to drive decision making.

- Asset Information
- System Integrity
- Predictive Analytics
- Asset Risk and Algorithms
- Future Simulation for Investment
- Load Profiles
- Duval Triangles
- Geo-Spatial Display of Analytics

Asset Classes:
- Substation Transformers
- Substation Breakers
- URD
- Others (TBD)

Analytics Architecture / HANA® Technology Platform

Outcomes:
- Reduced Asset Risk
- Increased Capital Effectiveness
- Improved System Reliability
- Improved Maintenance Strategies
- Increased Regulatory Transparency
- Increased Cust. & Worker Safety
- IT Benefits
Underground Residential Distribution (URD) : Role of IT/OT integration & Big Data in improving Outage Management

Analyze the test/inspection and historical outage data around Underground Residential Distribution assets (Primary cables, Pad Mount Transformers and Fuses)

View and Analyze a condition score for URD cables and transformers, Optimize inspection, Visualize the URD network on a geo-spatial user interface, Layer descriptive and predictive analytics
Digital Grid Applications & Analytics
combining Business Processes + Information + Technology

Information Intelligence:
e.g. Real Time Predictive Analytics (e.g. Predicting Customer’s Demand)

- Complex Event Processing
- Visual Enterprise
- Mobility User Experience

- In-Memory Technology
- Big Data (HANA)
- IT/OT Integration
- Active Networks
- Cloud Demand Management

- Cloud Metering-ISO
- Aggregation
- Electrical Vehicles
- Virtual Power Plants

- Smart Homes
- Smart Cities
- Customer Self Services
- Cloud On Premise

- SmartGrids & Microgrids Platforms (OnPrem or PaaS)

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Critical Transformer Load & Loss of Life using in-Memory Big Data Predictive Analytics

IEC 60076-7 VDE 0532-76-7
(Loading guide for oil-immersed transformers)
Example of Technology Innovations: Asset & Customers’ Big Data and Analytics

**Asset Lifecycle & Predictions In-Memory (HANA) & Analytics**

- **Asset Management: Main Market Trends**
  - SHOT analysis
  - Legacy asset management
  - Asset management
  - CMMS (Computerized Maintenance Management System)
  - Predictive maintenance
  - Performance optimization

- **In-Memory Computing and Analytics**
  - In-memory management
  - Data analysis and decision making
  - Predictive maintenance
  - Performance optimization

**Geo Analytics**

- **Geographical representation of Technical Objects**
  - Empower users with visual experience

**Smart Metering & Energy Efficiency**

- **Energy Efficiency Scorecard**
  - Energy usage breakdown
  - Energy efficiency
  - Cost savings

**3D Visual Enterprise**

- **3D Visual representation of Technical Objects**
  - Empower users with visual experience
  - 3D models of objects
  - Interactive visualization

**SmartGrids**

- **Images of electrical grids**
  - Color-coded for temperature and warning levels
  - Real-time grid monitoring

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Customer 13
The Unique Value Proposition Combining Business Processes, Information and Technology

BUSINESS PROCESS PLATFORM

INFOGRAPHIC:
Forecasting

Predictions

INFORMATION PLATFORM

Powered by in-Memory Technology (SAP HANA)
Smarter Decisions + Smarter Processes = Smarter Services
In any of the three Operating modes of Microgrids, Active Network Management requires:

- Management of power flow constraints
- Management of voltage constraints
- Management of distributed generation contributing to transmission system constraints
- Smart electric vehicle charging
- Demand Response (domestic / commercial)
- Day ahead scheduling of controllable demand to coincide with renewable energy production to support frequency stability
Incorporate Microgrids Controller enabled by Digital Intelligence for an improved Active Network Management

New layer of control: Microgrid Controller (Southern Company)
Layers of Microgrid Control (Southern Company Project) which could be empowered by Digital Intelligence (IT/OT, IoT, HANA, RT)
«Apple Store» like as a Public HANA Cloud Platform for Energy Services: H2020 project «FLEXICIENCY» could include Microgrid cases.

ENR HCP “FLEXICIENCY “ Electricity pan-European Marketplace for Distribution & Retail:

Kind of “Apple Store” for Energy Demand Services

target 10 000 Utilities on the same Public Marketplace
1. The Microgrids Equation
2. Digital Energy
3. Microgrids Digital Intelligence
4. Conclusion
## Microgrids: what will change?

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- **Energy**: Connect all assets and customers data in real time
- **Networks**: Integrate microgrids with a specific controller layer
- **Data**: Big data collected in real time
- **Customers**: Flexible demand
- **Microgrids**: Integrate with active networks, DER and active demand