EFFICIENCY

EcoStruxure™ for Utilities
FUTURE
Grid of Data
3D+E equation redefining the energy world...

**More ELECTRIC**

- 48% increase electricity demand in 2040 compared to 2020

  *Source: IEA WEO 2014*

**More DIGITIZED**

- 10X more increase connected devices than connected people by 2020

  *Source: Cisco, Internet World Statistics, McKinsey*

**More DECARBONIZED**

- 86% of investments in Power Generation till 2040 will be in zero-carbon fuels
  - Of which 71% in Wind, Solar and Hydro

  *Source: BNEF 2017*

**More DECENTRALIZED**

- 12% of generating capacity from DG in 2025
  - 65% of DG investments will be distributed Solar PV

  *Source: Frost & Sullivan*
Power industry is facing an unprecedented change
By 2025, the traditional centralized model will be complemented by a world of distributed energy

New revenue model:
• Decreasing revenue due to self-consumption
• High network reinforcement needs due to distributed generation and soon EV
• Investment shift towards TOTEX

New level of operational complexity:
• Need to collaborate with multiple stakeholders

Digitization:
• Data management
• Security threats

Distribution utilities are most impacted by business uncertainty
What are Utilities looking for?
Flexible and stepwise Digital Transformation to power the world’s economy

Grid efficiency
• Network reliability
• Network management optimization
• Asset life-cycle management
• DER integration

Demand management
• Demand response, flexibility services
• Energy communities and microgrids
• Customer Engagement

Digital transformation
Digitized infrastructure and workforce
more situational awareness through IoT

Cybersecurity
Open data management for seamless IT/OT convergence
Leveraging integrated solutions of our EcoStruxure architecture
Already service the electricity supply of 100+ million customers

Open IoT-enabled Architecture for IT/OT integration
Maximizing the value of data with apps, analytics & services

Actionable data for better decision-making

- Integrated ADMS applications
  - Common network model
  - Smart Meter data retrieval
  - Dynamic Protection Settings
  - Asset Investment Planning

- De-siloed meaningful analytics
  - Grid Operations
  - Asset Performance Management
  - Asset Investment Planning
  - Grid Model Optimization
  - Revenue Optimization

- Cloud Connected Digital Services
  - Customizable services
  - APM as a Service
  - LV network monitoring
  - Microgrid Management

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Integration is key to get most of the investment

GIS integration with DMS

- as the single source of network model and assets catalog
- From years of network modelization in DMS and OMS to days thanks to integration with GIS
- From discrepancies between different systems to a single version of the truth
- Allow dual view, topologic and geographic view of the network

Projects:
- SEC Makkah
- Dong Energy
- Peco, USA
Integration is key to get most of the investment

AMI integration with DMS

- Improving the accuracy of network state calculation by sharing the load profiles captured by the meters
- More precise determination of energy losses and revenue losses
- Energy consumption and available capacity calculation (precise calculation of losses and taken energy).
- Improving the accuracy of fault localization.
- Providing demand side management and direct load management.

Projects:
- Enel Italy
- Fortum Finlandia, Sweden
- Peco, USA
Integration of IT/OT Standalone Applications

Comprehensive Integration of IT/OT Applications is Mission Impossible
Cyber threat put grid resilience at stake

Unprecedented level of cyber risks on IT and OT systems

Number of Cyber attacks targeting Power Systems is growing exponentially

Cyber threats are becoming increasingly sophisticated with critical impact

Grid reliability and resilience are key drivers enforced by the Regulators

Regulatory compliance pick up steam in Electrical Grid Management Systems

Advanced Malware
Ransomware
Trojan
Supply Chain
Phishing
Third Parties
Application attacks
Employee negligence
Supply Chain
Third Parties
Customer case: Network Losses

Challenges:
• Reduce general costs by enabling peak sharing
• Analyze data for actionable results
• Ensure solution complements existing systems
• Significant cost and energy savings
• Complete visibility on distribution system
• Optimize voltage profile and enable peak sharing
• Established system able to predict impact of power outage, generation & voltage variation

Energy Savings of 4% representing 144GWh (5.7ME) energy saved yearly

“It is possible to integrate renewable resources and all the benefits of green energy, while increasing the quality of service and the power quality.”

Enel

ENEL
Italy’s No.1 power company, Europe’s 2nd largest in installed generation capacity serving over 61 million customers

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Customer case: Changing Revenue Model

Duke Energy

EcoStruxure™ ADMS and Demand Response solution have been deployed on the entire network, with controllable load of over 7,000 MW peak, 500,000 transformers, and approximately 1.5 million customers.

Challenges:

- Manage peak loads requiring engagement of expensive peak generators or energy purchases
- Improve customer satisfaction of largest customers who increasingly have energy supply options
- Peak load reduction by avoiding load shedding
- Optimization of network performance
- Planning applications for optimal investments (cap banks, voltage regulators, ..)

Over 300 MW demand reduction
Customer case: Self-immune Grid

SA Power Networks
Operating a distribution network that stretches across South Australia, comprising thousands of kilometers of powerline and hundreds of substations, the utility delivers electricity to 1.5 mln households.

Challenges:
• Outage frequency induced by severe weather
• Extended fault pinpointing time in rural areas due to lack of SCADA coverage and long distances over a huge network area
• Quick localization, disconnection and isolation of overhead power lines’ faults

Power is restored to the majority of customers on a feeder in < 1 min
• Fault location, isolation and service restoration
• Network monitoring
• Load flow analysis
• Real-time control and optimization
• Operational planning
• Training and simulation

“EcoStruxure™ ADMS is a very powerful tool. It’s a fantastic platform for us to develop in the future and be at the leading edge in the distribution sector.”

SA Power Networks
Customer case: Self-immune Grid

Tata Power
India-based Tata Power provides electricity to more than 350,000 households in the Mumbai area. Critical to the company’s strategy to boost operational and business excellence, the demand- and supply-side quality management solutions deployed led to both enhanced customer experience and improved profitability.

Challenges:
• No real-time data and therefore diminished ability to avoid technical losses
• Very distributed network area making pinpointing faults difficult
• Lacking operational flexibility
• Overutilization of the grid and increasing power demand with poor demand planning

With **self-healing grid** power is restored to customers in < 20 sec
• Rapid fault isolation and quick restoration of power
• Minimized errors and outage duration with an automated solution
• Improved customer satisfaction
• Increased revenue recognition (SAIDI/FI)
• Easy adaptation to the existing centralized solution
• Easy deployment

“We’ve taken an innovative step in implementing a decentralized control approach to handle power interruption – a self-healing grid by Schneider Electric.”
Tata Power
Digital Transformation success enablers

- Senior management buy-in and sponsorship of the program
- Get the engagement of the end-users, involve all stakeholders: PM, Engineering, Operations, GIS
- Have a strategic plan, not ad-hoc or islanded approach, insist on Integration
- Review the plan with the vendors, it will insure its feasibility
- Ask for advance functionalities beyond SCADA
- Start with a pilot or PoC before mass deployment
- Choose a reliable long-term partner, with proven experience, strong project delivery capability, strong local presence, training and transfer of knowhow
- Reliability and performance of the communication infrastructure
- Follow standards and industry practices, avoid proprietary technology or massive customization
- Learn from others success and failure
EcoStruxure Grid in MicroGrids
An integrated energy system consisting of interconnected loads and distributed energy resources, controlled as a single entity and operated in parallel with grid or in an intentional islanded mode.
The Microgrids Family

**Green, Saver, Active**
Hybrid system: Grid + local generation/storage + load management

**Green, Resilient, Autonomous**
Hybrid system: Grid + local generation/storage + load management

**Faster, Greener, Cheaper...**
Hybrid system: Diesel/Gas &/or renewable generation + storage + load management
Microgrid – new model between the utility and their customers (2/2)

Able to:
• Shift usage
• Store energy
• Schedule production

In order to:
> Optimize self production
> Optimize vs. tariffs
> Participate to DR request
> Run through blackouts
Value proposition for Microgrid… and its integration within the Grid

For End-users
- Energy cost
- Sustainability
- Reliability
- Efficiency and Optimization
- Access to Reliable energy
- Green Energy

For Electrical Companies
- Develop new services
- Customer intimacy
- Operational savings
- DER & Microgrid system and services...
- Long term partnerships
- Run Demand-side management
Case Study #1

SDEM / Morbihan Energies

Type: Office building, islandable
Location: Morbihan, France
Size: 100 kW
Completed: 2014

Solution
First smart grid-ready energy storage and management system for an office building in France with islanding capabilities, Management of DER including: EV, energy storage, PV, wind turbine, loads..

Mini Kergrid

Type: Multi site office building
Location: Morbihan, France
Size: 30 buildings of 100 kW or less
Completed: Under execution

Scope
- energy storage, PV, loads
- Demand Response
How Schneider Electric can help?
Microgrids

Energy Consulting:
- Microgrid sizing

Local generation:
- Diesel, CHP, Turbine OEM
  - From SE: LV components, Industrial control

Electrical Storage:
- From SE: Storage inverters, Storage systems

Power system engineering

Load management systems:
- From SE: Flexible BMS, Smart EV Charging

Microgrid optimization
- Load management systems:
  - Flexible BMS
  - Smart EV Charging

Energy Consulting:
- Microgrid sizing

Solar PV plant:
- From SE: String inverters, Utility scale inverters

Electrical Integration

Microgrid Automation

Microgrid Optimization
We Package our Technology for Your Application

Buildings

Large sites

Utilities & Districts

Access to Energy
Our Differentiation - Technologies

Integration

Architectures and systems that ease integration of new resources – downstream & upstream

Energy Control Center.
All your microgrid in one box (Buildings) – minimizing the impact on the rest of the installation.

Villaya Emergency. Mobile Microgrid solutions for Emergency actors..

Reliability

Edge automation that makes microgrids more reliable and resilient than the grid

Ecostruxure Microgrid Operation
Ensure system stability whatever the system configuration

Orchestration / Analytics

Best-in-class algorithms that make the best of local energy resources

Ecostruxure Microgrid Advisor
Optimize when and how to produce, consume and store energy
EcoStruxure™ Microgrid Advisor
Forecast and optimize when to consume, produce, store, or sell energy

EcoStruxure™ Microgrid Operation
Manage island mode and optimize DER in real time
**Example**

**Type:** Smart District  
**Location:** Grenoble, France  
**Size:** 7 buildings  
**Completed:** Under execution

**Customer pain point:**  
Better integrating local energy generation, managing all energy flow (thermal and electrical), training students about energy

**Solution:**  
EcoStruxure Microgrid Advisor levering DEMIS features for forecasting and optimizing when to produce consume store energy, regarding all energy flow in the whole campus

**Scope:**
- EcoStruxure Microgrid Advisor with DEMIS
- DER: PV, BMS (HVAC), EV, Energy storage, CHP
- Delivering of a learning platform dedicated to students
Case Study #2

IMT Campus Microgrid

**Type:** Smart District  
**Location:** Grenoble, France  
**Size:** 7 buildings  
**Completed:** Under execution

**Customer pain point**
Better integrating local energy generation, managing all energy flow (thermal and electrical), training students about energy

**Solution**
EcoStruxure Microgrid Advisor levering DEMIS features for forecasting and optimizing when to produce consume store energy, regarding all energy flow in the whole campus

**Scope**
- EcoStruxure Microgrid Advisor with DEMIS
- DER: PV, BMS (HVAC), EV, Energy storage, CHP
- Delivering of a learning platform dedicated to students
Microgrid services

**ENGINEERING STUDIES**

1. Validate the economical and technical choices
   - Microgrid technical & economic sizing
     - Local and flexible loads sizing power supplies
     - i.e. renewable sources and storage
     - Based on the Microgrid power requirements.

2. Build a strong and reliable design
   - Load flow and voltage plan analysis
     - **Checks:** Voltage plan, Equipment overload
     - **Recommends:** Transformer tap settings, Reactive power compensation
   - Short circuit studies & discrimination study
     - **Dynamic stability:** Motors start-up and reacceleration
     - **Thermal and dynamic current withstand**
     - **Protection and discrimination**
     - **Network and rotating machines stability**

**ENERGY AS A SERVICE**

3. Operate and maximize outcome from the microgrid
   - Financing (partners)
     - Move from CAPEX to OPEX
   - Managed services
     - Optimization of energy resources
     - Participation in demand-response
   - Asset Management
     - Sensing and measurement of Microgrid assets
     - Predictive on-line maintenance

**Life Is On**

[Schneider Electric Logo]
Case study #3
Island, Philippines

Type: Island, off grid microgrid
Location: Philippines
Size: 4 MW
Completed: Sizing study completed

Customer pain point
Island running on genset only. The aim is to reduce genset OPEX by integrating biomass, PV and energy storage

Solution
Delivering DER sizing study, taking into account economical and technical challenges, with the possibility to simulate scenarios for finding the best mix and type of DER

Scope
• DER sizing study
• DER: genset, biomass, PV, energy storage
Montgomery County Microgrid

Type: Public Safety HQ and Correction Facility, islandable
Location: Maryland, USA
Size: Completed: Under execution

Customer pain point
Aging infrastructure with power outages, budget challenges with no capability to perform upfront investment, aggressive sustainability goals

Solution
Microgrid as a service business model with Duke energy, delivering advance microgrid solutions with no upfront cost

Scope
- Installation of 2 microgrids
- EcoStruxure™ Microgrid Operation and EcoStruxure™ Microgrid Advisor provided by Schneider Electric
- DER: PV, Energy Storage, gas engine

Value Proposition
- Lower / No Upfront Capital
- Cost avoidance
- Less volatile energy costs
- Better resiliency
- Better sustainability
- Higher energy security
- Site upgrades
What is on the horizon for distribution companies in the transformation to Grid 2.0?
What is Grid 2.0?

The spirit of this new process will be a transition from central to local, from analog to digital and from big/heavy to small/light systems.

We need to talk about and discuss how we can enable and plan for this future…
Will the Distribution Grids be less important?

• Although distributed and flexible systems are marching their way in, we still need a physical infrastructure (which is the distribution grid) for distribution of the generated electrical energy.

• The main point will be that the limitations, inadequacies or flexibility of this distribution grid will dictate how flexible our end systems will be.
Would the Duck Curve be a problem for utilities?

The gap between generation and consumption leading to a change in the conventional load graph towards becoming what we call “duck curve”.

(https://www.caiso.com)
Technical problems in the horizon

Distribution grid systems that have been conventionally designed and operated for one way power flow are going to have bi-directional power and data flow.
What should we do?

• The systems to solve these problems will also have to be distributed in nature and will bring together a substantial resource requirement.

• We need to look into systems that utilize the existing assets more effectively by operating them with integrated information Technologies.

• It is very important that the distribution companies to have some control over and manage PV generation, battery, EV charging stations (which are quite ready for IT-OT integration) and also guide the end users.

• Distribution companies and prosumers are going to be stakeholders that will be in constant interaction and that they can start taking steps towards enabling this interaction straight away.