Smart Design for Smart Grids

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October 2018
Providing power management technologies that are more reliable, efficient and safe.
Power for Africa

Possible Game Changers for Africa

• Hydroelectric power

• Capacity potential of renewable energy such as solar, geothermal and wind

• Gas to power

• Political will and spend

• Growth in consumer demand as population increases

• Advances in technology
  Internet of Things supporting micro grids

Africa has opportunity to ‘leapfrog’ traditional developmental milestones
Key Challenges for Utilities

- Ever increasing public need for **reliable power**
- Aging **infrastructure** leading to high downtime, and/or need for high maintenance
- Distributed, varying renewable power increasing
- **Risk** of cyber (and other) attack / breakdowns
- Lack of skilled labor / aging **workforces**
- **Financial** - How to get paid for energy delivered
- **Financial** – How to fund required investments
What does a smart grid look like?
Utility Grid Construction - tomorrow
Smart grid characteristics

• Allows for economic growth

• Increase in quality of human life

• Access to real time power-grid information

• Real-time control of electricity spend

• High-load and peak time energy management

• Allows integration of all energy sources into grid, i.e. coal, solar, wind

• Accommodates connection of large numbers of micro grids, widely distributed

• Decentralised power supply

• Bi- and multi-directional directional power generation
Smart Grid Interoperability

**Smart Grid:** the integration of power, communications, and information technologies for an improved electric power infrastructure serving loads while providing for an ongoing evolution of end-use applications. (Std 2030)

**Interoperability:** the capability of two or more networks, systems, devices, applications, or components to externally exchange and readily use information securely & effectively. (Std 2030)
Customer challenge
Dutch regional network operator Stedin was faced with a 50-year old infrastructure:
• 2,200 bays of switchgear based on minimum-oil circuit breakers in its HV substations
• 3,200 similarly equipped bays in distribution cabinets.

Eaton solution
Stedin and Eaton devised a two-fold approach to minimize risk and impact on the company’s core business. The switchgear would all be replaced within 20 years. Throughout this period Eaton and Stedin would work together to conserve the old equipment prior to replacement.

Business outcome
Both Stedin and Eaton are confident that the safety and security of the substations and distribution cabinets that use obsolete breakers can be maintained until the replacement program is completed in 2032.
Typical RMU – Basic Design-for ring applications (LBS-CB-LBS)

1. Protection relay
2. Control panel
3. Mimic diagram
4. Voltage detection system
5. Inspection window
6. Cable cones
7. Cable clamps
8. Earth bar
9. Busbar
10. Change-over switch
11. Vacuum interrupter

LBS = Load-break switch
CB = Circuit-breaker
Typical application of RMU (LBS-CB-LBS) configuration in Distribution Ring
Typical application of RMU (LBS-CB-LBS) switching behavior – *Step 1: Cable fault*
Typical application of RMU (LBS-CB-LBS)

Switching behavior – Step 2: Tripping of Circuit-breaker

= Ring de-energized
Typical application of RMU (LBS-CB-LBS) 

Switching behavior – **Step 3: Opening of load-break switch**

= Ring de-energized
Typical application of RMU (LBS-CB-LBS)

Switching behavior – Step 4: Opening of load-break switch

= Ring de-energized
Typical application of RMU (LBS-CB-LBS)

Switching behavior – Step 5: Closing of load-break switch

= Ring de-energized
Typical application of RMU (LBS-CB-LBS)

Switching behavior – Step 6: Closing of circuit-breaker

= Ring de-energized
Modern block version – Smart Design

CB-CB-CB configuration

1. Protection relay
2. Control panel
3. Mimic diagram
4. Voltage detection system
5. Inspection window
6. Cable cones
7. Cable clamps
8. Earth bar
9. Busbar
10. Change-over switch
11. Vacuum interrupter
Modern application of RMU (CB-CB-CB)
Configuration in Distribution Ring

= Open point in ring
Modern application of RMU (CB-CB-CB) 

Switching behavior – Step 1: Cable fault

= Open point in ring
Modern application of RMU (CB-CB-CB)

Switching behavior – **Step 2: Opening of circuit-breaker**

= Ring de-energized
Modern application of RMU (CB-CB-CB)

Switching behavior – **Step 3: Opening of circuit-breaker**

= Ring de-energized
Modern application of RMU (CB-CB-CB) 
Switching behavior – Step 4: Closing of circuit-breaker

= Ring de-energized
Typical LBS-CB-LBS vs Modern CB-CB-CB

**LBS-CB-LBS**
- Low initial purchase cost
- Higher total cost of ownership
- Higher downtime
- Switching bigger part of the ring

**CB-CB-CB**
- Higher initial purchase cost
- Lower total cost of ownership
- Lower downtime
- Switching smaller part of the ring
Recognition as a leader among S&P 500 companies on the CDP’s Climate Disclosure Leadership Index

Named one of Corporate Responsibility magazine’s “100 Best Corporate Citizens”

Inclusion in the FTSE4Good Index Series, designed to measure the performance of companies demonstrating strong Environmental, Social and Governance (ESG) practices

For us it’s not just about doing well, it’s about doing good.