Power Distribution Automation Solution

Smart Grid Data Aggregation

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The energy dilemma is here to stay

The facts

× 2
Energy demand
By 2050
Electricity by 2030

The need

÷ 2
CO₂ emissions to avoid dramatic climate changes by 2050

Source: IEA 2007

Source: IPCC 2007, figure (vs. 1990 level)

Frequent power outages
Rising energy prices
Climate change
Conflicts for resource access & control
How does Smart Grids impact Distribution networks?
As we move from traditional grids ...

Centralized generation

Top-down energy flow

Transmission

Distribution

Commercial and industrial

Residential

Supply/demand balance done by integrated utilities

Central production adapting to demand variation

Rather passive users

Homes

Industry

Building

Datacenter

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Datacenter
...to Smart Grids

- **Transmission**
  - Centralized generation
  - Renewable energy plants > 1MW

- **Distribution**
  - Distributed and intermittent generation at all levels

- **Commercial and industrial**
  - Decentralized distributed generation <1MW

- **Residential**
  - Bi-directional flow of energy and...data!

- **Active users**
  - (willing to "visualize" and control their consumption, becoming producers, using EV...)

- **Bi-directional flow**
  - homes
  - industry
  - building
  - datacenter
The MV/LV Transformer Substation: A strategic point in distribution networks
Traditional grids have been focused on feeder automation ...

**RTU+FPI (Traditional grid)**

- Improving energy availability
  - MV fault location
  - Distribution network reconfiguration
  - MV distribution loop management

**Benefits**

- SAIDI/SAIFI optimization
... but as grids become smarter so must their feeder automation

**Growing Distributed generation integration**
- MV fault location with multi-direction Energy
- Energy Flow Monitoring
- Monitoring of the LV feeders

**Energy demand management**
- LV load management
- Transformer temperature overload

**Focus**
- Bi-directional energy flow
- Transformer monitoring
With AMM aggregation, MV/LV substations become communication hubs …

- AMM, Demand response
  - Meter Reading
  - Tariff management
  - Load management

Focus
- Demand Response
... capable of managing demand response and LV network distribution

**Smart Feeder Automation:** FPI & RTU + monitoring + Concentrator

- **SCADA/DMS**
- **SI AMM**
- **RTC**
- **GSM**
- **GPRS**
- **Internet**
- **WiMax**
- **COM (WAN)**

**A single unit for Feeder automation and AMM**

**MV/LV substation**

**Power Line Carrier**

**Smart Meters**

- **AMM**, Demand response
  - Meter Reading
  - Tariff management
  - Load management

**Focus**

- **LV Network distribution**
- **Demand Response**
Smart Meter data aggregation benefits
Out of the 10 applications, let’s take a look at some network operation benefits

1. New customer connection
2. Permanent fault
3. Transient default
4. Voltage management: over voltage
5. Voltage management: under voltage
6. Load management: unbalance currents
7. Non technical losses
8. Network disturbances: Harmonics, power factor …
9. Load shedding
10. Neutral cutout
New customer connection
New customer connection

- **Meter+Box deliverables:**
  - Customer identification
  - Contract
  - Loads & production
  - Outgoing & phase
  - Reflectometric data

- **KSFA deliverables:**
  - SLD updating
  - Data storage & transmission

- Meter connected?
  - On which feeder?
  - On which phase?
New customer connection

Benefits

- Real time update of network/customer topology

- Manage commercial data

- Manage drawings & technical data

Retailer

DNO
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Permanent fault

On which phase?
Where?
Permanent fault

- Meter + Box deliverables:
  - Answer to ping
  - Customer identifications
  - Contract
  - Loads & productions

- KSFA deliverables:
  - Scan the meters
  - Substation fault indication
  - Data storage
Permanent fault

- **Meter + Box deliverables:**
  - No answer to ping

- **KSFA deliverables:**
  - Scan the meters
  - Detects lack of communication
  - Substation fault indication
  - Data storage
  - Data transmission
Permanent fault

- Fault Localization
- Maintenance alarm
- Historic management

DNO
Permanent fault

Benefits
- Save time to repair (SAIDI improved)
- Real time update of data base

- Historic management
Retailer

- Historic management
DNO
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Voltage management
Over voltage

- Context
  - High local production
  - Low load level

Sunny & Windy spring afternoon

How to regulate the voltage?
Voltage management
Over voltage

• Meter + Box deliverables:
  • Detect over-voltage
  • Signal

• KSFA deliverables:
  • Receive & analyze
  • Load shedding decision
  • Production requirements:
    • kW vs. kVAR
    • disconnection
Voltage management
Over voltage

• Meter+ Box deliverables:
  • Manage load shaping

• KSFA deliverables:
  • Check results
  • Balance with next substations
Voltage management
Overflow voltage

Benefits
Improve quality index

- Historic management
- Retailer
- Historic management
- DNO
MV/LV substations are set to gain the most from data aggregation

**MV/LV substations: data hub for**
- MV Current, Voltage and FPI
- LV Current and voltage monitoring
- Smart meter data

**Gathering all functions in one unit**
- Optimise equipment and installation costs
- Guarantee a high industrial grade for concentrator functions
- Optimise the communication interface
- Naturally share the data

**LV Distribution becomes under control**
- Data base updating
- Voltage management
- Fault localisation
- . . .
Make the most of your energy™

Thank you for your attention!