KASM – Network Losses

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Agenda

• Kent Active System Management (KASM) - Overview
• Contingency Analysis Solution (CAS)
• CAS Use Cases
• Network Losses
Kent Active System Management (KASM) Project Overview

- **Objective:** Facilitate future connection of DG and manage curtailment of existing DG efficiently
- **Duration:** Jan 2015 – Dec 2017 (3 years)
- **Project Value:** £3.9M
- **Partners and Suppliers:**
Increasingly Dynamic DNO Network (East Kent Area)

- GSPs: Sellindge & Canterbury
- 800MW connected generation
- 50MW accepted generation
- Parallel running between transmission and distribution
- 2 interconnectors existing and more to come…

AN INCREASINGLY DYNAMIC DISTRIBUTION NETWORK
Summary of Issues:

- Increasing DER connection plus interconnectors (unpredictable power flows)
- Reverse Power Flow limits in parts of network (export to transmission network)
- East Kent requires 34 credible Contingency scenarios to be analyzed (manually)
- Need for worst case operational and planning practices (Min Demand, Max Generation)
- Long lead times and high cost for generation to connect

Improvements Needed:

- Operate system in a smarter way – maximize use of existing assets
- Move away from worst case planning methods
- Create accurate forecasting for planning in operational time frames
- More cost efficient & informative management of customer connections
- Provide improved visibility of transmission grid network for future system modeling

KASM Solutions:

- Contingency Analysis
  - Real Time
  - Look Ahead
  - Study Mode
- Forecasting packages and capabilities to support Look-Ahead Contingency Analysis and Study Mode planning analysis
- Improved data exchange with National Grid
KASM Project Overview:

Develop contingency analysis (CA) software and forecasting tools that can be used to run the distribution network closer to its limits, by moving away from conservative, ‘worst case’ assumptions.

Key tools:

1. ICCP (Inter Control Centre Protocol) link
2. Load and generation forecasting
3. CA tool

Benefits:

✓ Reduce constraints on renewable generators
✓ Release network capacity
The KASM solution – ICCP link

- ICCP – Inter Control Centre Protocol
- Enable real-time data exchange between control centres.

Increased visibility helps DNOs/TSOs manage and plan their networks.
Load and generation forecasting

Data Inputs:
- Weather data
- Wind generation forecast (MW)
- Historic load and generation profiles (MW/A)

Forecasting modules

Output: hourly forecasts (0 – 120 hrs)
The KASM solution – Contingency Analysis

Infeed

Line 1

Line 2

Line 3

Line 4

Line 5

Line rating 100MVA

A

B

C

D

A

B

C

D

G

Windfarm 100MVA

Line Demand 40MVA

Secure

Secure

Infeed

Line rating 100MVA

Line 1

Line 2

Line 3

Line 4

Line 5

Line Demand 40MVA

Line Demand 40MVA

Line Demand 40MVA

Windfarm 100MVA

Secure
The KASM solution – Contingency Analysis

The CA solution can analyse several contingency scenarios over a number of minutes on a periodic basis.
The KASM Solution

- Several internal and external data sources
- Interfacing with multiple UKPN Applications
- Contingency analysis:
  - Real-time mode
  - Look ahead mode
  - Study mode
- Forecasting modules
- Archive of studies
## The KASM Use Cases

<table>
<thead>
<tr>
<th>Function</th>
<th>KASM Desired Outcomes</th>
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<tbody>
<tr>
<td><strong>Reliability Management</strong></td>
<td>• Apply constraints in real-time rather than assuming worst case a week ahead</td>
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<tr>
<td>(Control Engineer)</td>
<td>• Mitigate adverse contingencies in real-time</td>
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<tr>
<td><strong>Outage Management</strong></td>
<td>• Model network to determine constraints in short-term with increased accuracy of forecasts – rather than assuming worst case.</td>
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<tr>
<td>(Outage Planner)</td>
<td>• Reduced outage constraints on generators</td>
</tr>
<tr>
<td><strong>Network Capacity Management</strong></td>
<td>• Planning based on dynamic network operations rather than static time based – defer costly network reinforcement.</td>
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<tr>
<td>(Infrastructure Planner)</td>
<td>• Potentially allow new generation to connect to the network</td>
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KASM Network Losses Project

Objective:

- At a holistic level, understand network losses on the 400kV – 11kV network across a number of scenarios for a variety of network assets
- Identify opportunities to minimise network losses based on additional understanding
- Identify synergies or overlap between EHV losses and LV/HV losses

Method:

- Develop losses algorithms which can utilise existing data within the KASM contingency analysis solution to help understand network losses
- Create four work packs to investigate system losses, component losses, sensitivity of load/generation and sensitivity of network topology
WP1 – Total System Losses

Total on-line system loss (P and Q) calculation on a periodic basis for the KASM catchment area
WP2 – Component level losses and generation sensitivity

Component level losses for transformers and lines

Loss sensitivity associated with distributed generation
WP3 – Impact of load and distributed generation on losses

Understand the impact of changing load and generation on the distribution network.

- Do we see clear trends in the impact of generation?
- Can these trends be applied to LV networks?
WP 4 – Optimum network topologies

Relate power losses with network topologies and identify optimum network topology to minimise losses

Number of network configurations analysed

Losses calculated (MW)
• Under most conditions losses don’t change significantly
• Maximum loss reduction is approx. 1% for this initial case
• Increasing the number of network re-configurations can further reduce losses by a small amount
Thank you