Active Network Management Workshop

David van Kesteren

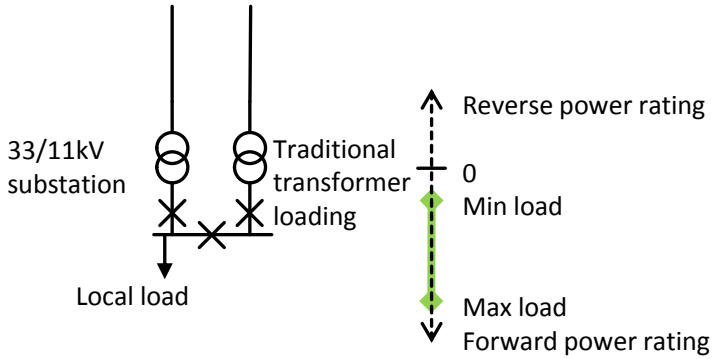
System Planning

Topics

- What is ANM
- Why do we need it at Driffield
- How will it work
- When will it be delivered
- How much will it cost
- When and how will it be rolled out elsewhere

Impact of connecting generation

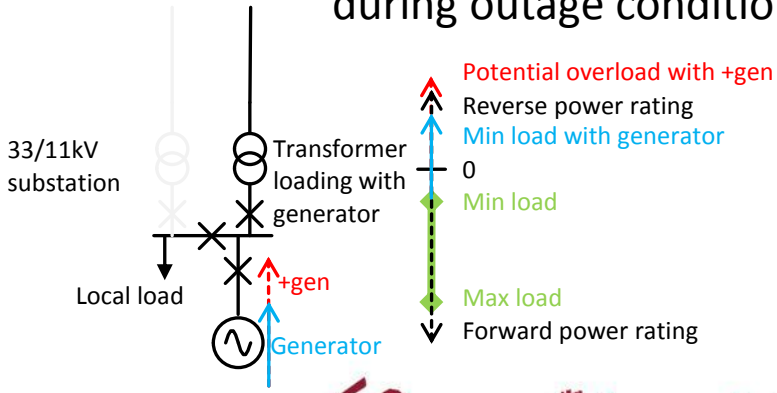
- Key network drivers
  - Develop an economic, efficient and coordinated network
  - Operate equipment within its design capability



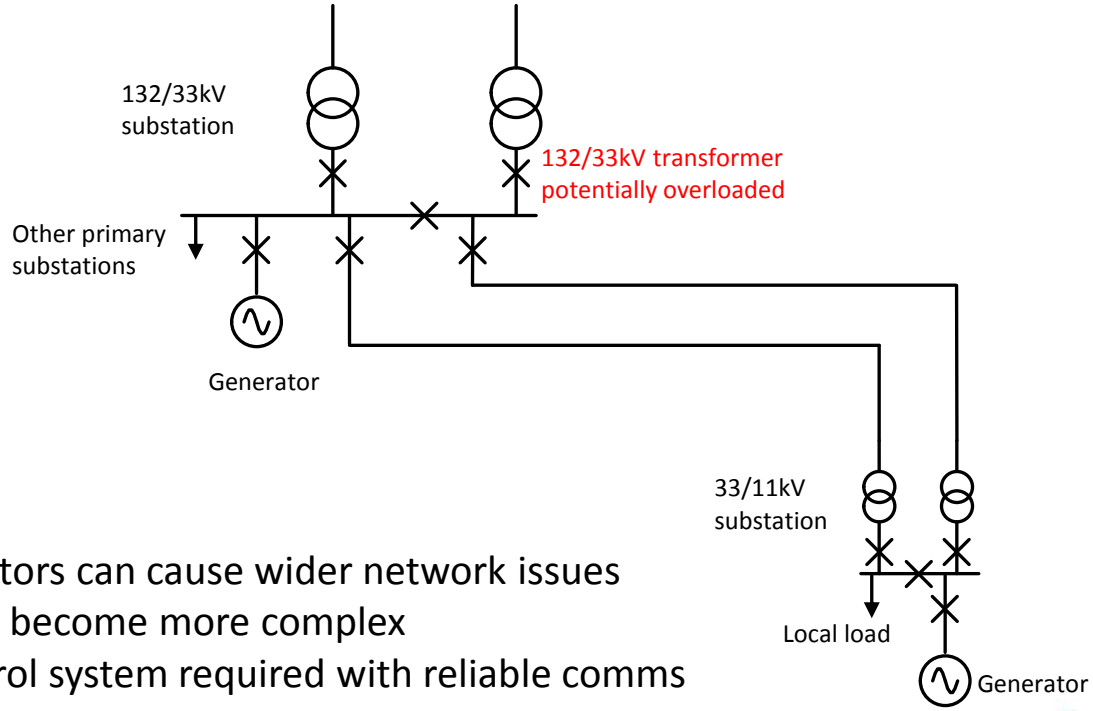
Impact of connecting generation

- Key network drivers
  - Develop an economic, efficient and coordinated network
  - Operate equipment within its design capability
- Potential frequency of overload driven by combination of demand and generation profiles
  - Many potential constraints occur infrequently
- Cost of reinforcing for infrequent constraints is uneconomic and inefficient for both the generator and the network operator
- A constrained connection, with lower capital cost, can be both economic and efficient

Simple local constraint signal can limit generator during outage conditions



Impact of connecting generation



Multiple generators can cause wider network issues
Control systems become more complex
Wide-area control system required with reliable comms

Active Network Management as a solution

What is ANM?
ANM constrains the generator at peak times to avoid overloading the network.

Pros

- ✓ Minimum demand only occurs for short periods in the year
- ✓ As network demand increases more generation can be turned on
- ✓ Unused contracted generation capacity can be utilised by other generators
- ✓ Lower cost of connection for generator and avoided reinforcement cost
- ✓ Potentially releases more capacity than can be economically achieved through conventional reinforcement

Cons

- ✗ No absolute guarantee of level of network availability
- ✗ Small-scale generation (LV) may erode available headroom over time
- ✗ Levels of curtailment will be higher for later entrants

Active Network Management at Driffield

Ian Fletcher

Smart Grid Implementation Unit

Driffield network issues

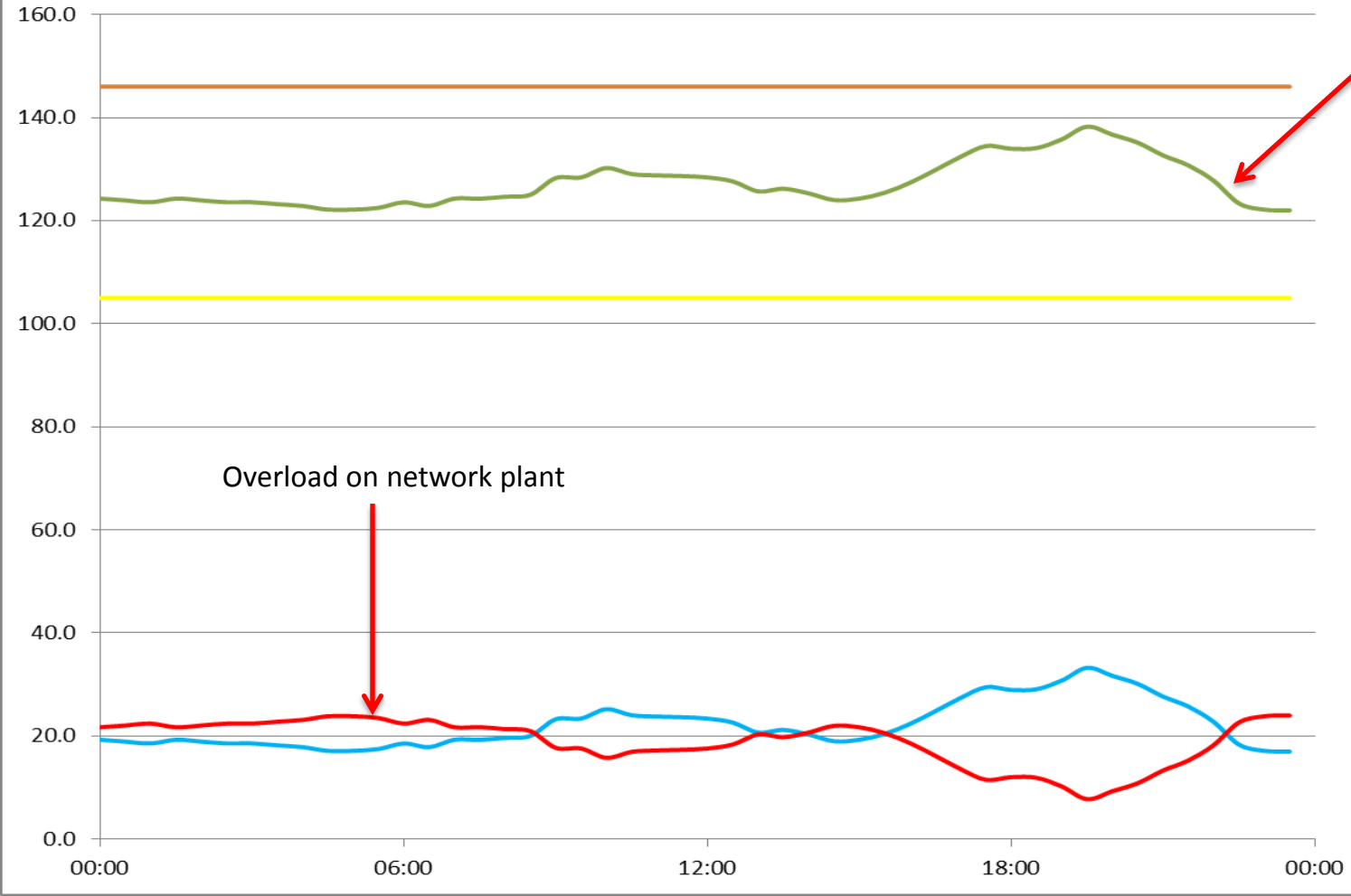
Current contracted HV/EHV generation capacity	146MW
Network export capacity	105MW
Network minimum demand	17MW
Overall generation capacity at minimum demand	122MW
Maximum demand	114MW
Theoretical generation capacity at maximum demand	219MW

Conventional limit for generation

Additional headroom can only be accessed by managing the output from generation

- Exceeding the conventional limit for connected generation may lead to network plant being overloaded
- Network minimum demand can reduce or increase over time

Plant overload example - existing & contracted generation



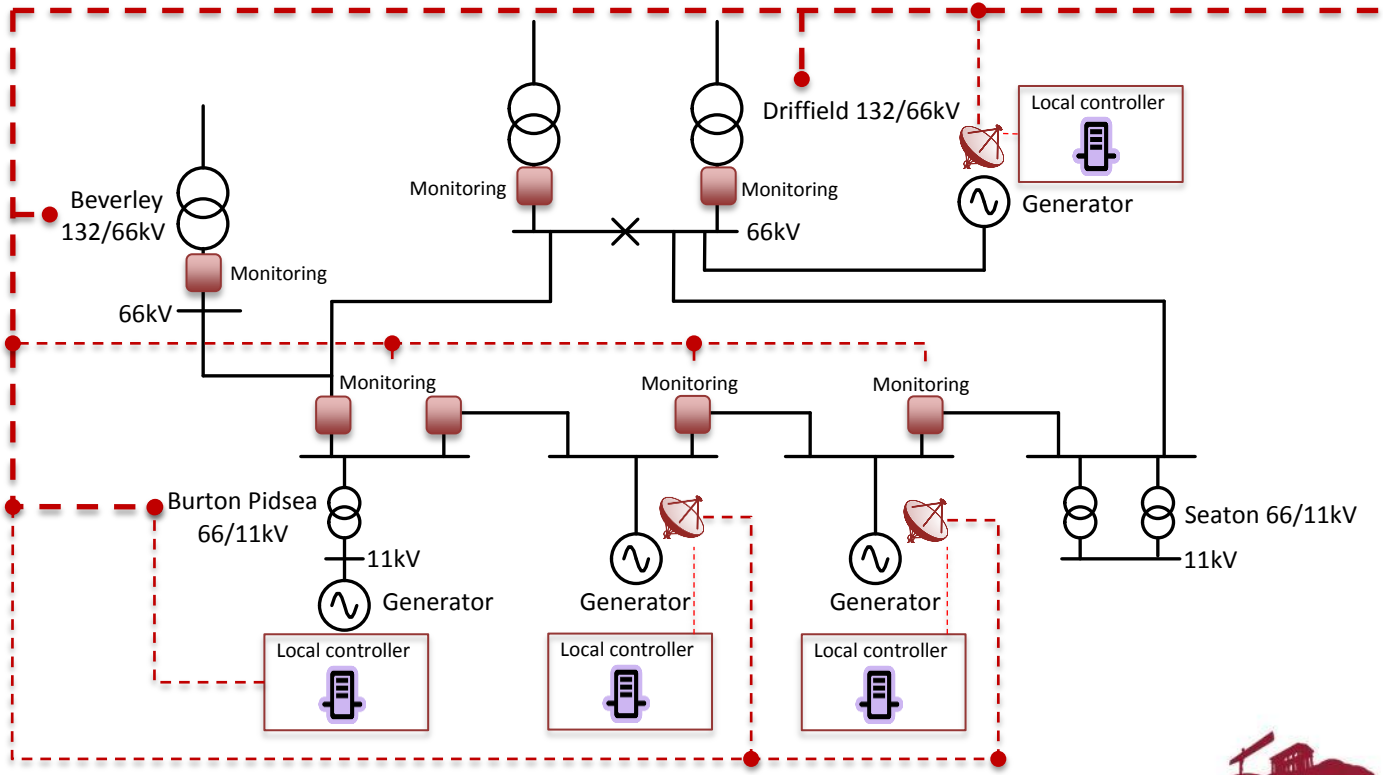
Assumes all HV/EHV generation is operating at maximum output, though this will not occur often. All of the existing generation is wind powered or controllable synchronous plant

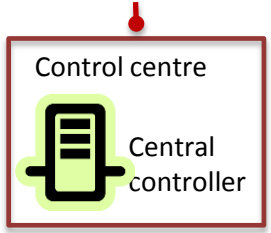
- total generation
- summer network capacity
- summer demand
- total generation limit
- overload

Conventional reinforcement solutions

- Increase network export capacity via reinforcement
  - Increase capacity of existing transformers, or;
  - Install additional capacity
  - Minimum cost reinforcement solution ~£12m
  - Creates up to 30MW of capacity
- Minimum cost new connection solution (from an alternative network point) ~£6m
  - Dedicated long cable routes and/or transformer (sole user assets)
  - No cheap solutions
  - Cost is prohibitive to new entrants

ANM building blocks





Transformer constraints

Circuit constraints

Delivery Programme

John Rowland

Primary Engineering Projects

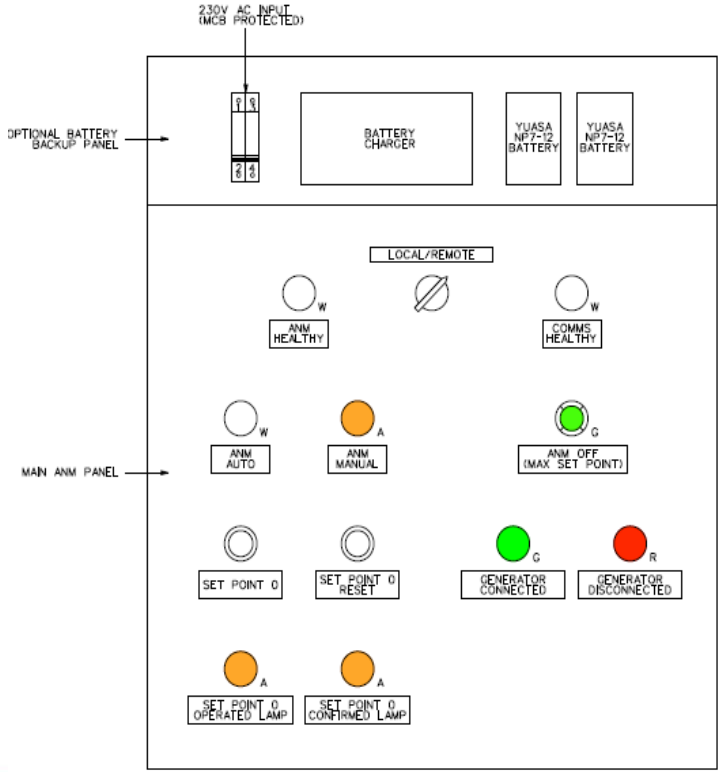
Delivery programme

What?	When?
Develop concepts and principles	2014-2015
Policy development	2015-2016
Detailed technical specifications	2016
Open market for customers to request ANM offers	April 2016
Customer contracts in place	June 2017
Select preferred ANM service provider	June 2017
Complete detailed design and build studies	February 2018
Construction commences	April 2018
Scheme commissioning	November 2018
Identify additional areas for ANM roll-out	September 2018

Current challenges

- Comms
- Functional Design Spec (FDS)
- ANM wall box functionality
- Cyber security
- Design interface
  - Northern Powergrid Plant to ANM wall box
  - ANM wall box to generator controller
  - Install contract

ANM wall box proposal



KEY TO SYMBOLS

- ILLUMINATED PUSH BUTTON (GREEN)
- NON ILLUMINATED PUSH BUTTON (GREEN)
- TRANLAMP (RED)
- TRANLAMP (WHITE)
- TRANLAMP (AMBER)

Commercial Considerations

Gary Camplejohn

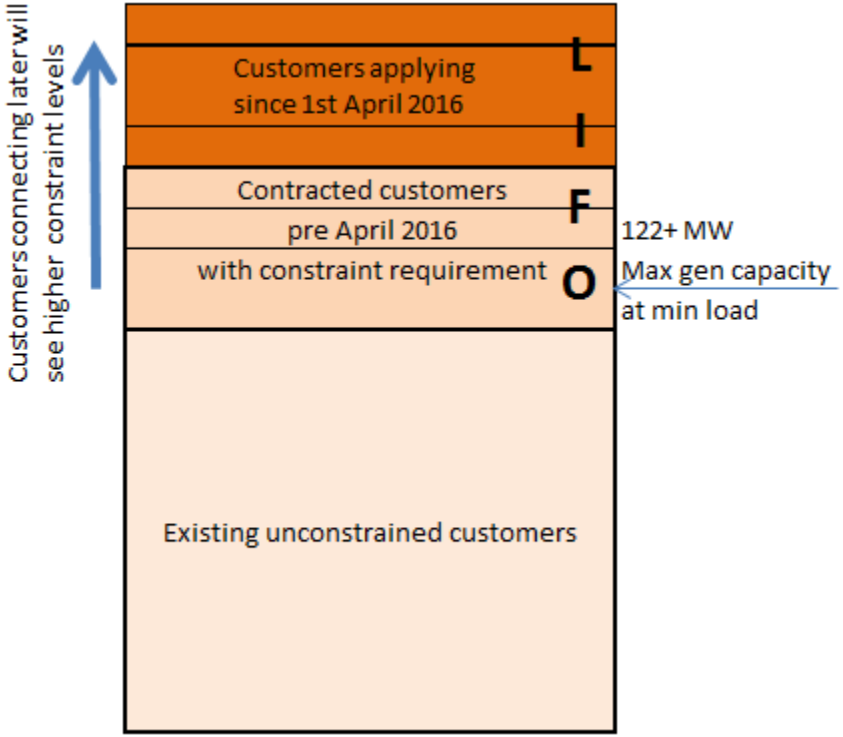
Connections

Requirements for ANM participation

- Connections at LV are excluded but limited to 190kW (200kVA) on existing and new sites
- All new HV or EHV generation connections into the Driffield network must participate
- A customer requesting a generally more expensive conventional connection will not be required to participate in ANM
- Modifications to existing connections will often affect curtailment levels for existing ANM participants
- The following are examples of where a modified connection may be required to participate:
  - increase in export capacity;
  - increase in installed capacity (with or without a change to export capacity);
  - changing the type of generation (with or without a change to export capacity);
  - changing the operating regime (where a customer has an existing connection agreement for a specific operating regime)

ANM application and queue position

- Generation applications in the ANM area are automatically considered for ANM
- Customers can still request a conventional connection offer but we will not process this in parallel with an ANM offer
- Queue position is determined by date of receipt of a competent application, subject to the customer continuing to show adequate progression.
- Queue position is key to the level of curtailment applied to the generator
- General principle is Last In, First Out (LIFO)



Cost structure for ANM elements

Capital costs:

- Shared costs for shared ANM components, on a per MW basis:
  - central controller, shared measurement points, shared comms routes
  - costs are re-apportioned as more customers utilise the equipment utilising the second comer methodology.
    - earlier connected customers may be eligible for rebates (for up to 10 years)
- Sole user costs:
  - local controller, local dedicated comms
  - any dedicated measurement points and associated comms routes
  - sole user elements could become shared if required for future customers

Annual costs:

- No additional site-specific charges,
  - operating costs are currently recovered via our general use of system charges

Indicative costs for Driffield

- Shared asset costs are dependent on the project location and scope of works required.
  - Estimated to cost in the region of £900k
  - Costs shared by the agreed capacity on the respective assets being used
  - Utilises the same methodology as the second comer rule
- Sole asset costs are dependent on the location and scope of works required.
  - Estimated to be in the region of £100k to £150k
- General principles
  - Offers and terms must comply with existing NPg financial policies
  - Each customer required to take the liability of the ANM scheme as if they were a standalone customer
  - Costs reconciled once the project has been delivered

Wider Roll-out

David van Kesteren

System Planning

Wider roll-out plans

What?	When?
Annual network loading assessment	April – August
Annual review of connections activity	August
Identify new areas for potential ANM	September
Assessment and selection of ANM areas	October-December
Approval and advertisement of new areas	January 2019
Issue ANM offers in new areas	March 2019
Re-commence annual cycle	April 2019

Selection process for new areas

- Identify networks with potential / actual loading issues
- Assess levels of customer connection request activity on each network
- Identify potential reinforcement costs for each network
- Identify potential cost of implementing ANM on each network
- Prioritise the networks that provide best overall benefit, taking into account all of the above

Discussion