

Paris Session 2022



Topology Optimisation to Support Constraint Management under Extreme System Conditions

SC C2: Power System Operation and Control

PS 2: Operational Planning Strategies, Methodologies and Supporting Tools

Q 2.9 What new or additional tools will power system operators need in order to be able to foresee, prepare and react to extreme operating conditions?

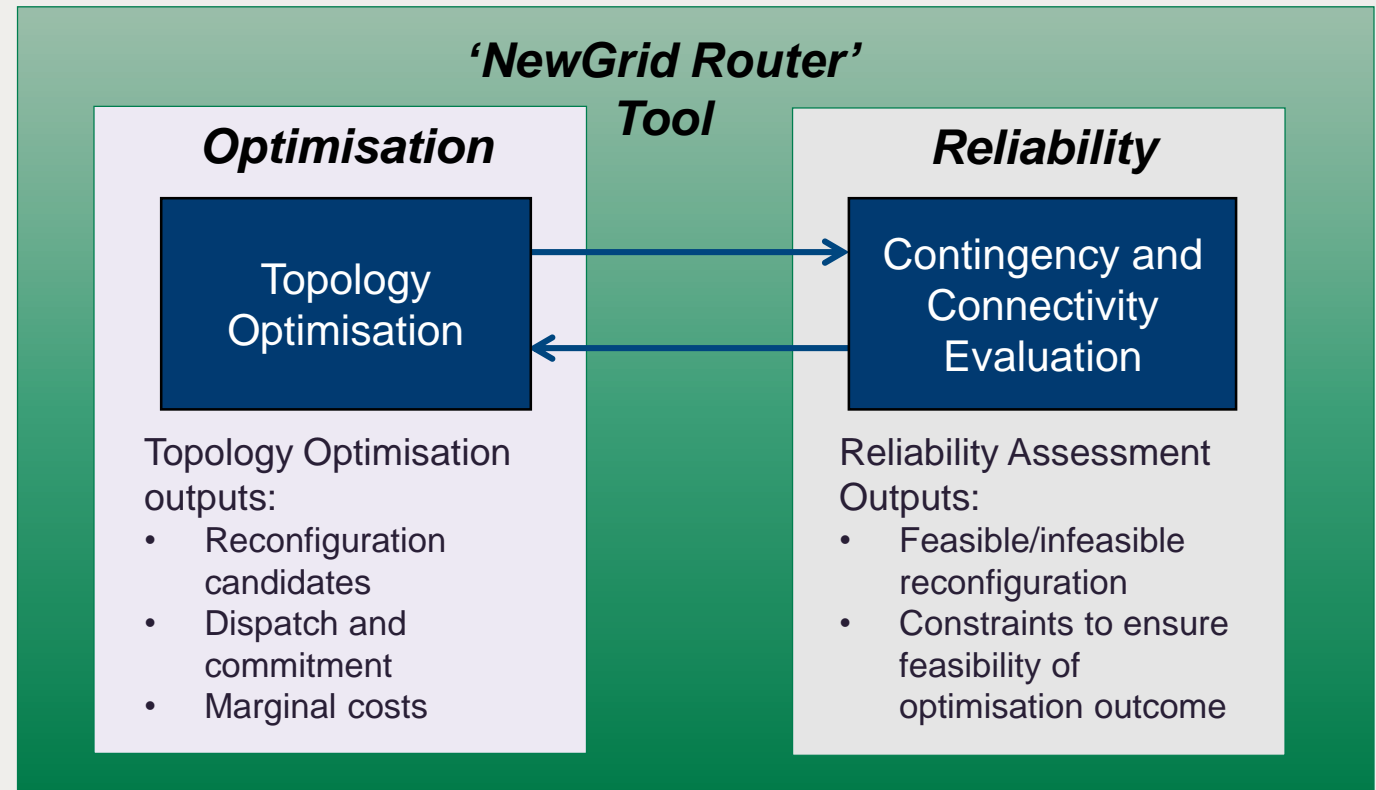
Robin MacLaren, Strategic Advisor, NewGrid, UK



Topology Optimisation to Manage Extreme Conditions

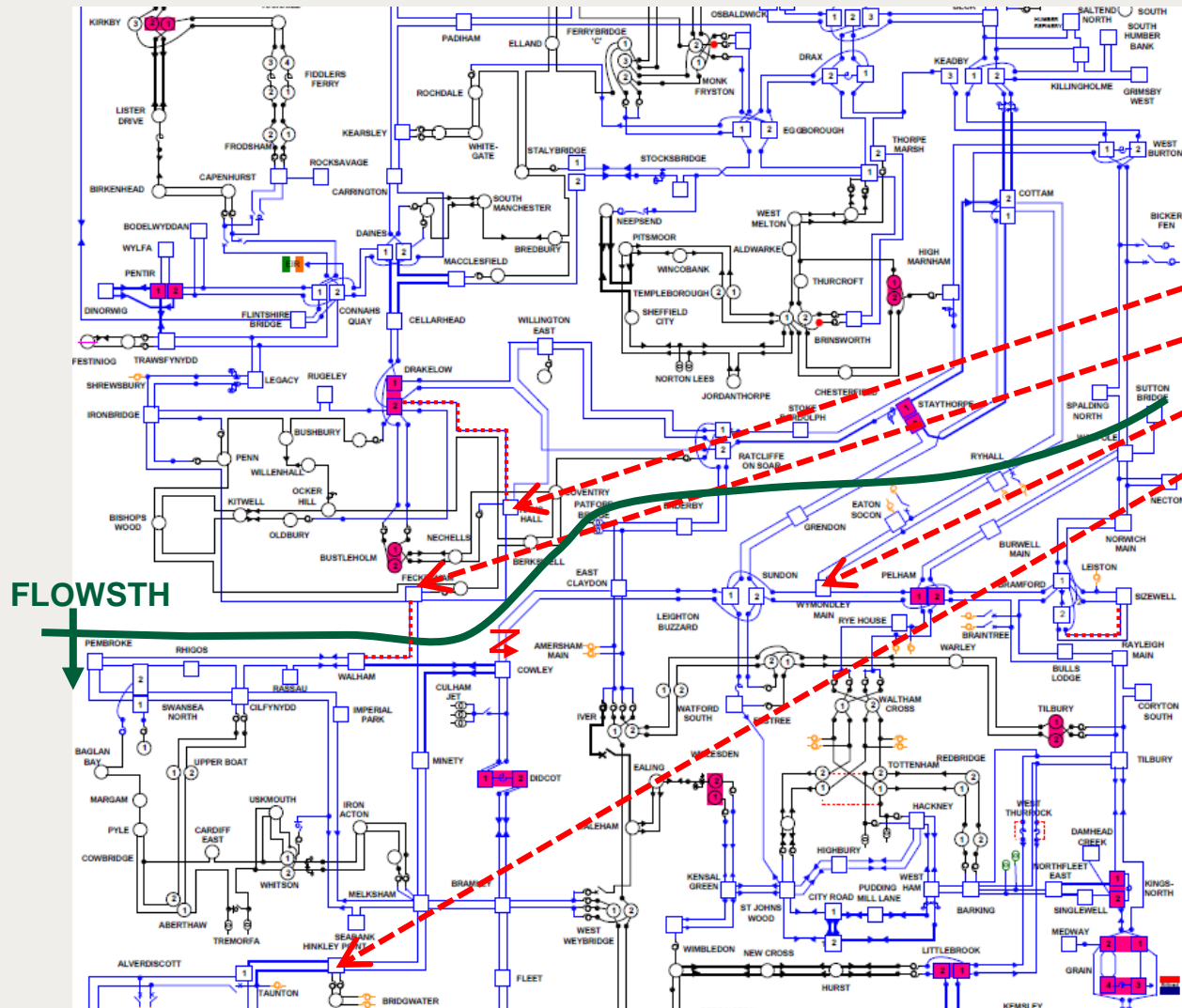
- Decision variables: line switching, substation reconfigurations, phase-shifting transformer settings.
- The user can select the reliability criteria, for instance, N-1 or other options under all specified contingencies and no load radialisation.
- The reconfigurations can be validated for transient and/or voltage stability performance as needed using existing software tools.

Group Discussion Meeting



Transmission Case Study: National Grid ESO

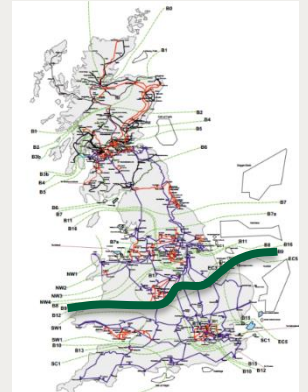
Boundary Constraint Headroom Improvement: +1289 MW (12.3%)



- NGENSO identified scenario with key outages and with thermal limits active on large “boundary constraints.”

Best Solution – Open:

- Hams Hall 400 kV Breaker
- Feckenham 400 kV Breaker
- Wymondly 400 kV Breaker
- Hinckley Point 400 kV Breaker
- *Only substation switching utilized in this example*



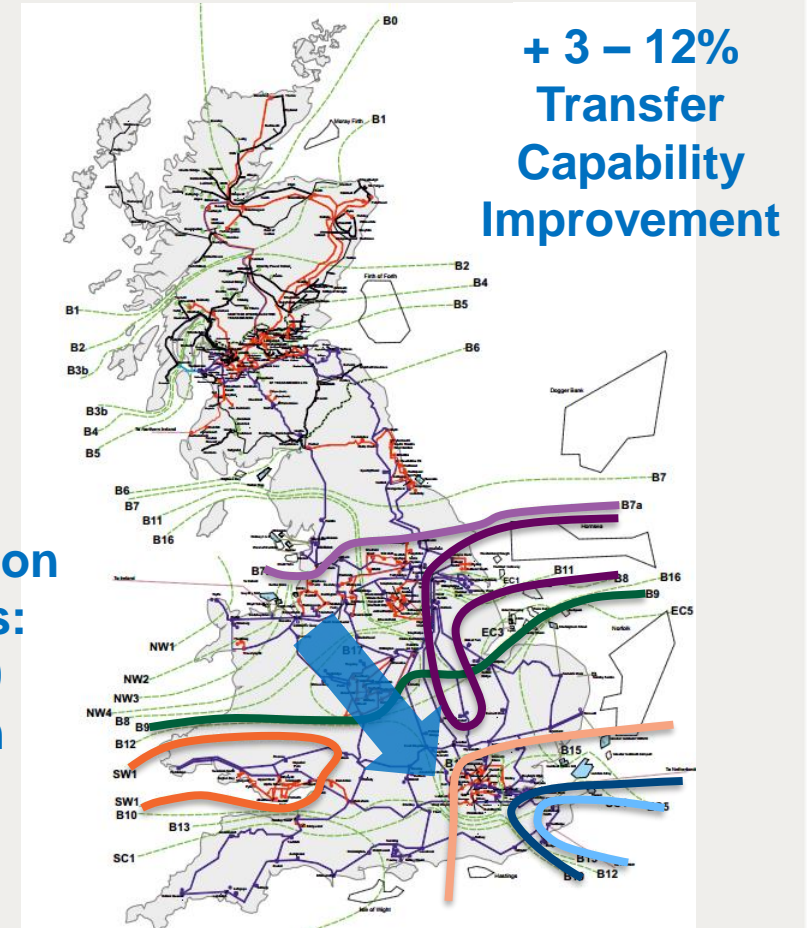
NGESO Solution Criteria

- No load radialisation
- Max six topology changes per solution
- Min 10 MW relief per topology change
- *... Topology Optimisation alleviates extreme operating limits*

Increased Headroom with Multiple Outages in Place

- Topology Optimisation:
 - Provides the operator reconfiguration options to dispatch additional generation across constraint boundaries or, as in the case of UK, avoid constraining off such generation.
 - Increases transfer capability and alleviates operating boundary conditions under stressed system conditions.
 - Provide substantial economic benefits (congestion cost savings).
- ... *NewGrid has developed an innovative software tool and service to provide system operators with network topology optimisation options.*

**Congestion Savings:
£14-40 million**



Map Source: Electricity Ten Year Statement 2018, National Grid, November 2018, Fig. 3.1.