

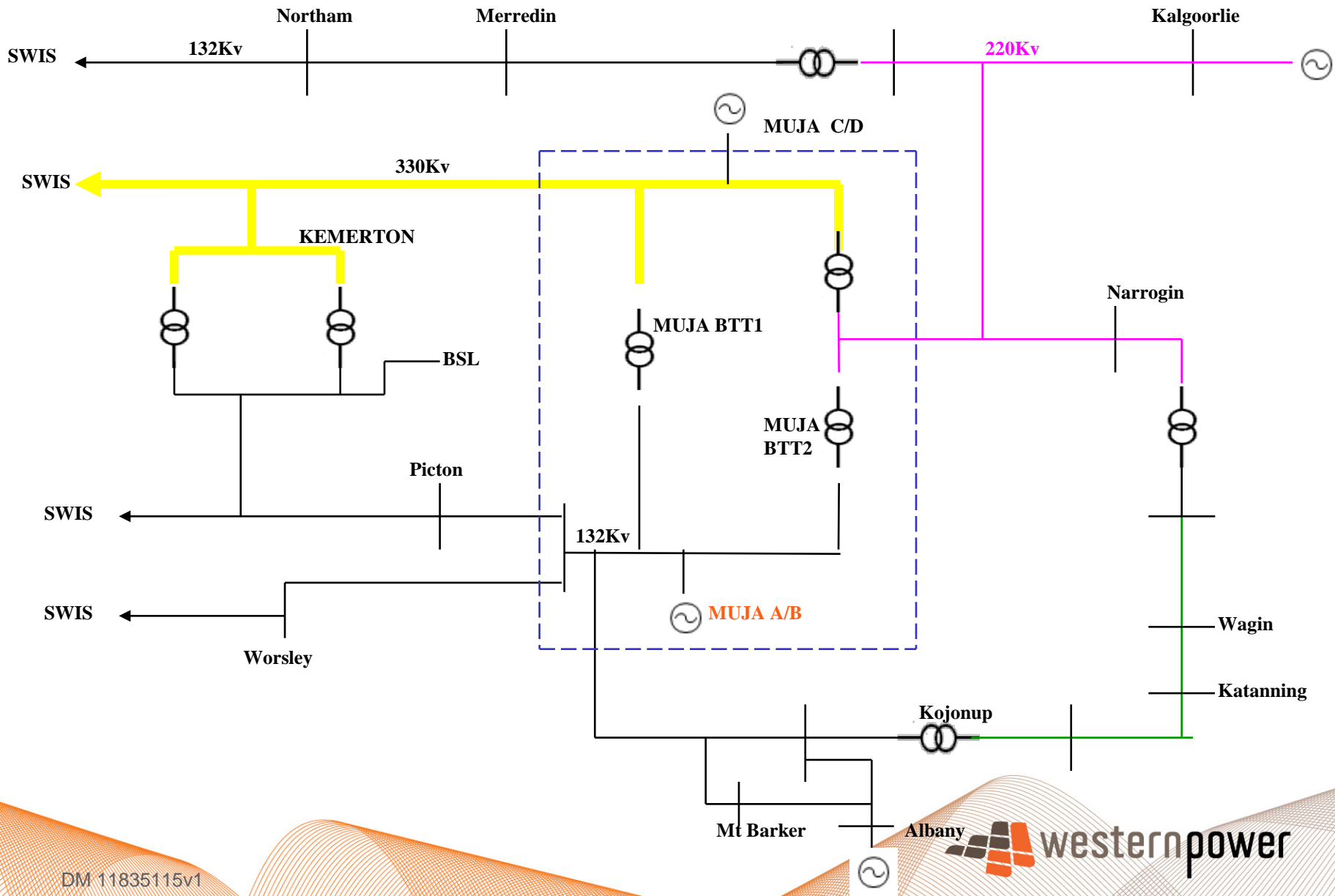
Muja Bus-tie Transformer Failure and Challenges of Power System Operation

Presentation to MAC Meeting, March 2014

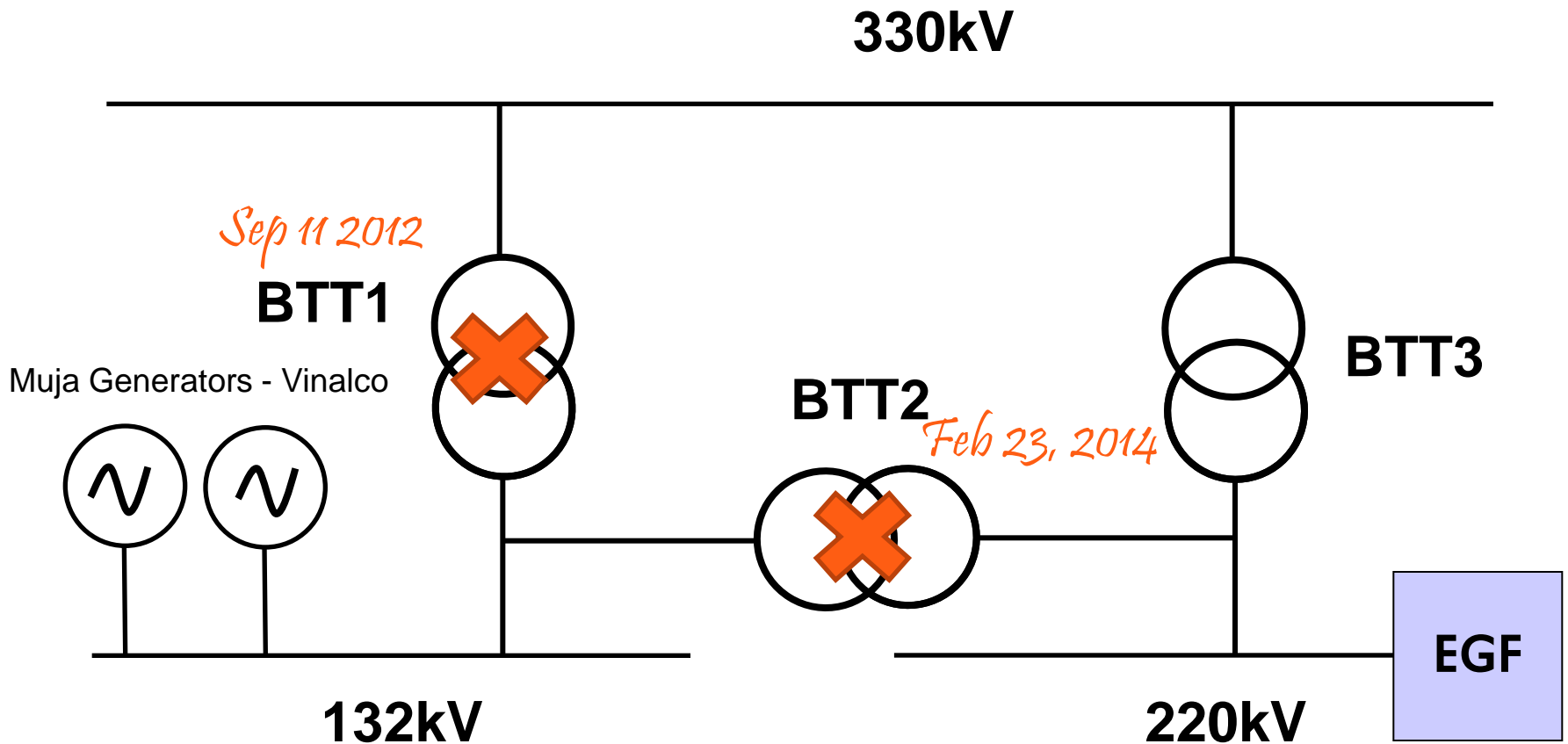
Dean Sharafi

Connecting people with electricity



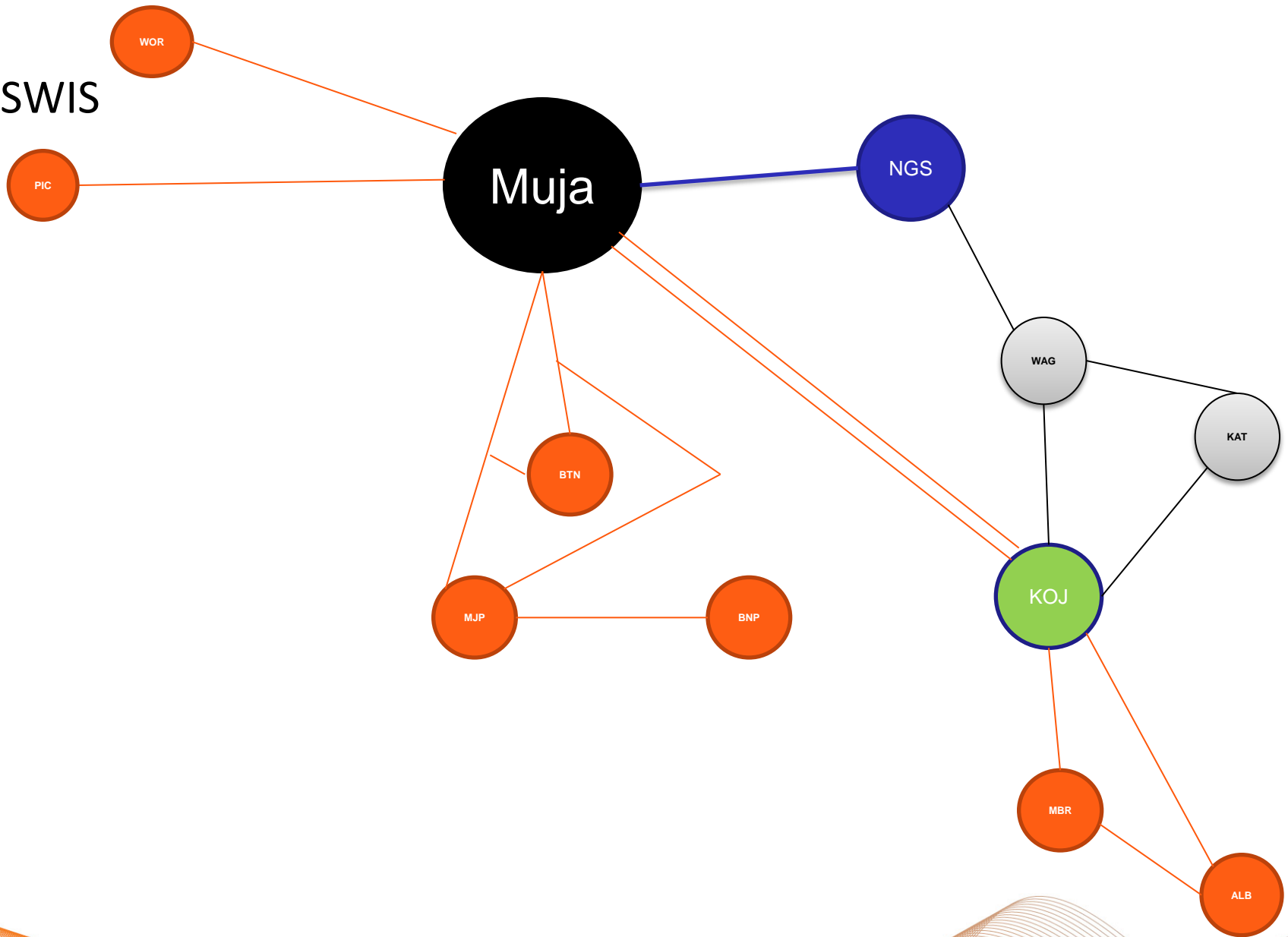


MUJA – Current Situation



High Risk State

SWIS



Overload

- There are two main 132kV lines that connect to Muja
- A trip of one of these lines can cause overloads on the remaining 132kV line
- Muja A/B generation is required to reduce the amount of load transferred through the 132kV network.

MW Support in Great Southern

- For load in the great southern area:
- 1 Muja A/B unit for MW support for loads above 320MW
- 2 Muja A/B units for loads above 360MW
- 3 Muja A/B units for loads above 380MW

Over-voltage

- At periods of low load, voltages at the ends of the network (e.g. Albany) rise above operational limits
- To mitigate this risk Muja A/B generation is required to provide reactive power support.

MVAR Support

- For load below 100MW depending on windfarm output and to avoid over-voltage, system needs:
- 1 Muja A/B unit for loads below 85MW
- 2 Muja A/B units for loads below 65MW
- 3 Muja A/B units for loads below 45MW

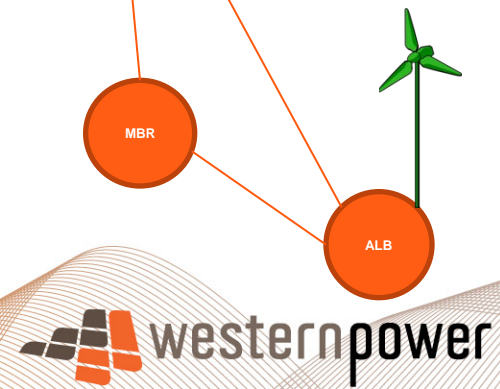
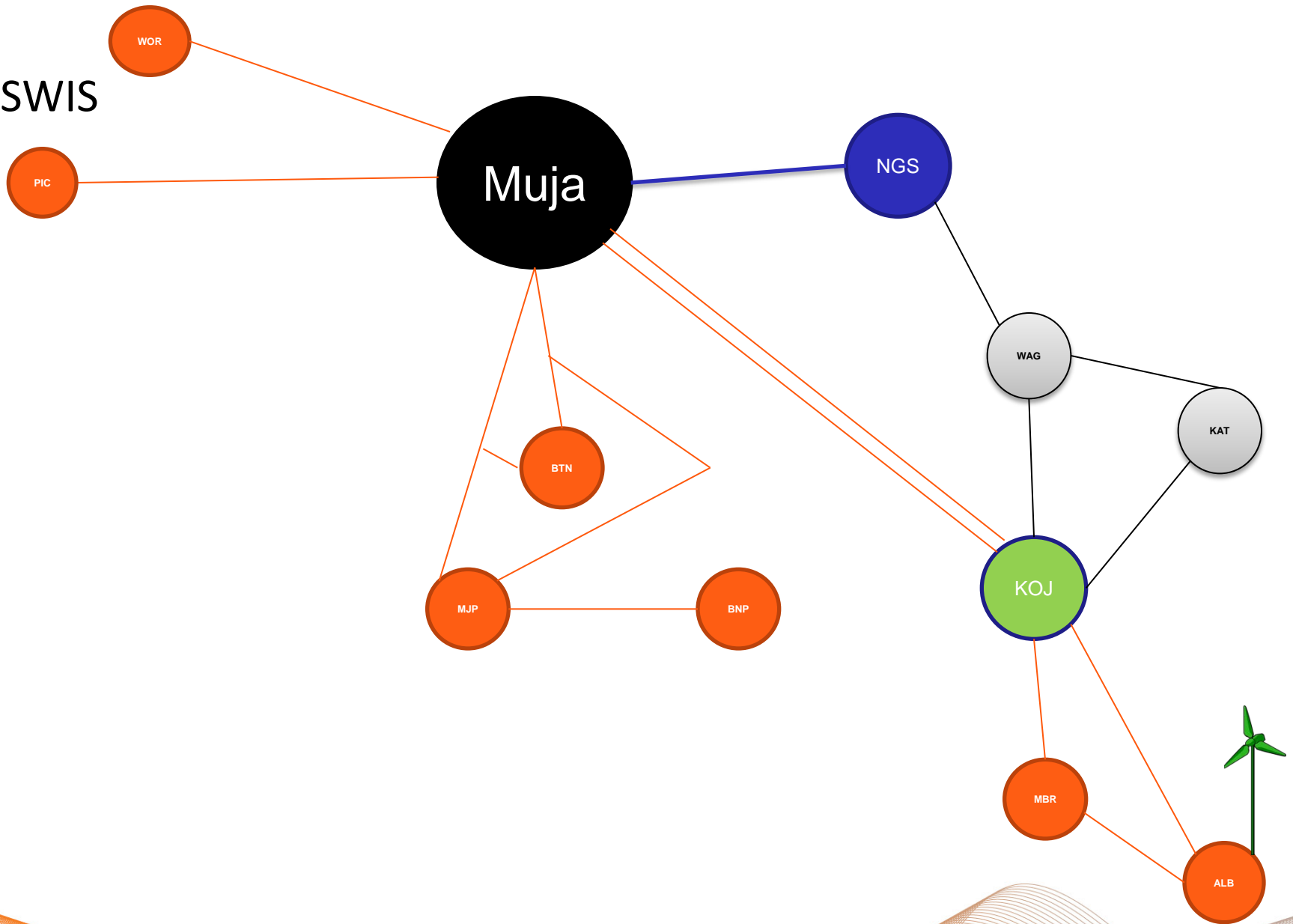
Power Station Supply

- The Muja 132kV busbar supplies three of the power stations in the area, i.e. Muja A/B, Muja C/D and Collie Power Station and Collie substation.

Other Mitigation Options

- Windfarm Curtailment: For the low load scenario, Albany and Grasmere windfarms can be curtailed to effectively increase the load in the southern area and reduce the voltage control risk.
- Line Switching: Transmission lines can be switched out to reduce voltage risk. Involuntary load shedding can happen for the next contingency and should be used as a temporary measure or last resort
- Shifting Load: Shift load from WAG and KAT during the day to the 220kV network to reduce load and back to the 132kV network during lower load periods

SWIS



Islanding Risk

- In adverse weather conditions (e.g. extreme winds, lightening, humidity, bushfire) there is an increased risk of multiple transmission line failures. Multiple Muja A/B units will be required to support the MU 132kV as an island should there be multiple line failures.

Managing System Security

- There are many combinations of load, network configuration, wind farm output, generation output and transformer tap positions, load offloads, open points, planned outages and contingencies.
- At this stage most problems could be overcome by running MU A/B units
- Balance between risk of blackouts, supply quality Vs market impact
- System Management works with the IMO to minimise cost to the market whilst operating the SWIS in a secure and reliable manner

