

Summary of South Transfer Limits

Post May 2006

Update for future “south transfer” events

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High southwards transfer...

- High south transfer through the North Island and across HVDC
 - Effectively operating power system in reverse
 - Different transmission constraints and issues
 - Increase in SI reserve requirements
- Initiatives to enable south transfer
 - Range of measures introduced from 2001 dry year event
 - Additional measures added in 2003
 - Upgrade to Bunnythorpe Haywards route in May 2006



Purpose of this presentation

- Explain the transmission limits for future dry year events
- Clarify when initiatives are implemented
- Comment on SI Reserves and interaction with HVDC dispatch
- Note where future power system changes may impact on limits



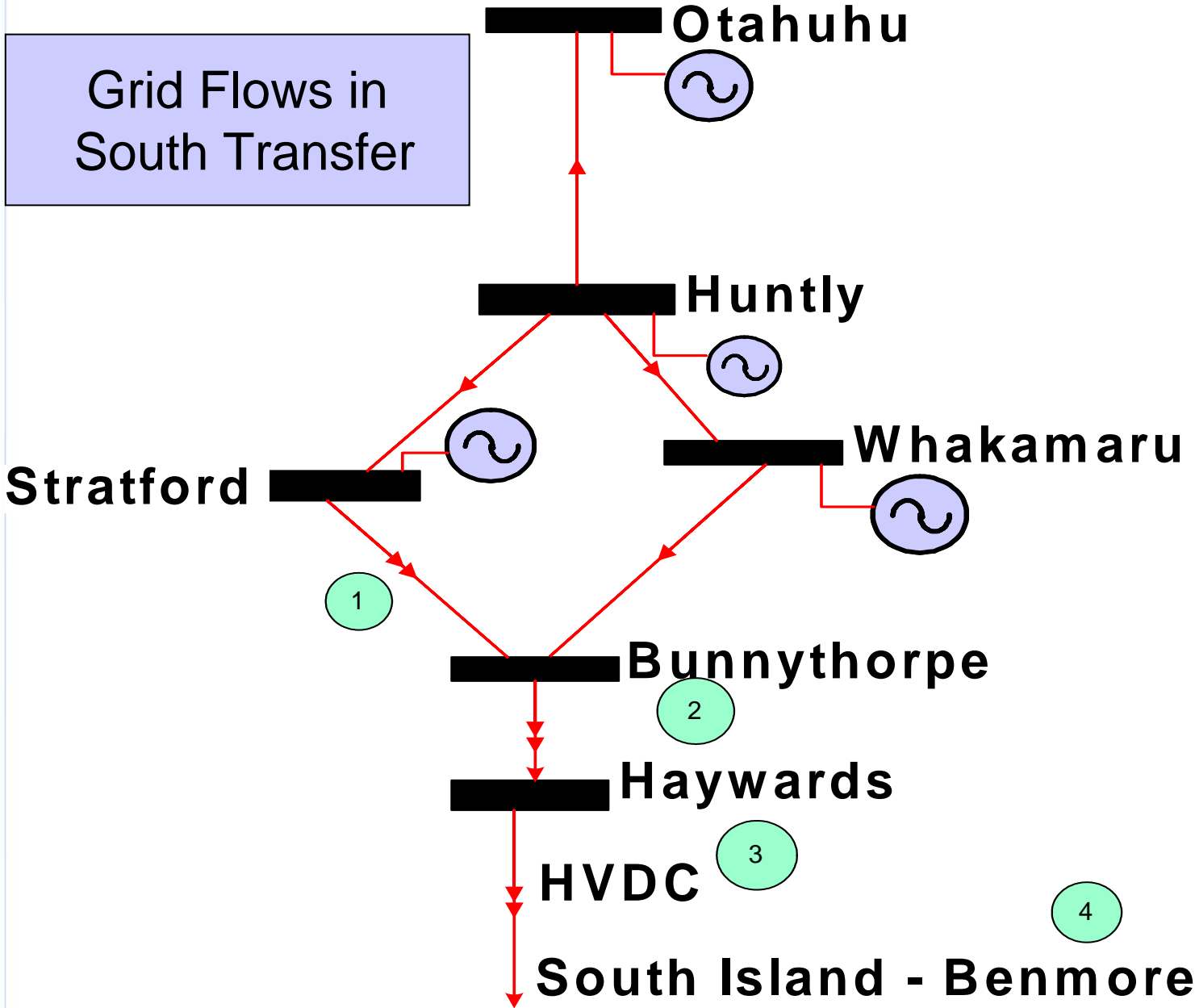
South transfer transmission limits

- Four distinct transmission pinch points
 1. Export south out of the Taranaki
 2. Transfer from Bunnythorpe to Haywards
 3. Transfer over HVDC & Impact of Wellington load
 4. Benmore interconnectors and SI reserve interaction with HVDC configuration

These are shown graphically on the next slide



Grid Flows in South Transfer



1. Export south out of the Taranaki region.

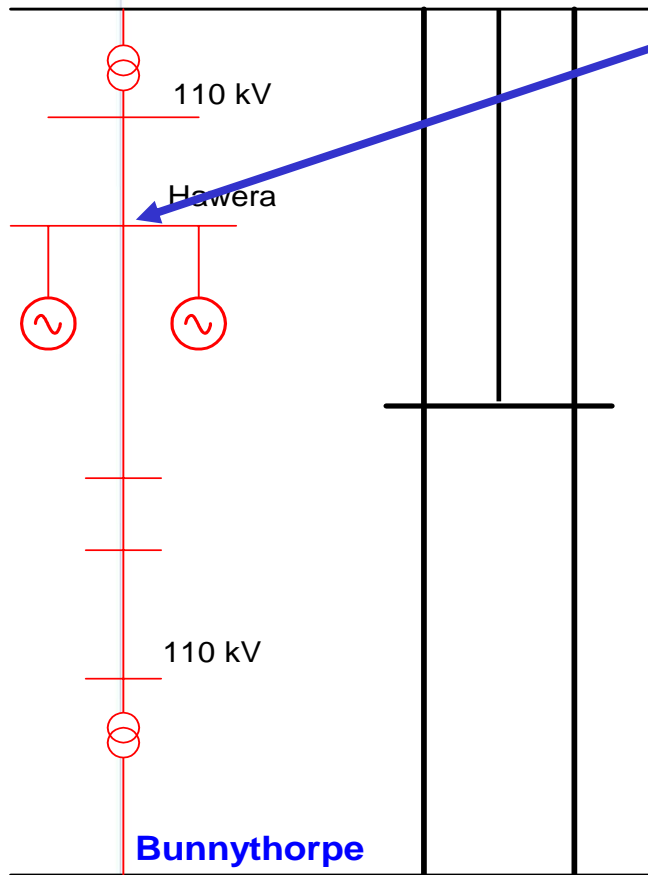
- **Constraint**
 - Due to 110 kV limits that 220 kV transfer south to Bunnythorpe from Stratford
 - Impact on generation from within Taranaki & Huntly
- **Initiatives**
 - Reactor and automatic post fault splitting scheme for 110 kV
 - enabled in stages as constraints appear
 - allows n-1 connection security pre-event



Stratford

220 kV

Reactor and Bus Splitting Scheme



1. Export south out of the Taranaki region.

- Impact of initiatives
 - Increase export limit south out of Taranaki from ~480 up to 690 MW (winter) and 550 MW (summer)
 - Full Taranaki, existing Huntly generation possible in winter
 - Minor constraints possible with
 - low regional demand/summer ratings
 - high local generation on 110 kV at Hawera
- Limits may change with addition of more generation at Huntly - e3p



Grid Flows in South Transfer

Otahuhu

Huntly

Stratford

Whakamaru

SFD to BPE
Summary Transfer Limits
690/550 MW with HWA ABSS

Bunnythorpe

Haywards

HVDC

South Island - Benmore

1

2

3

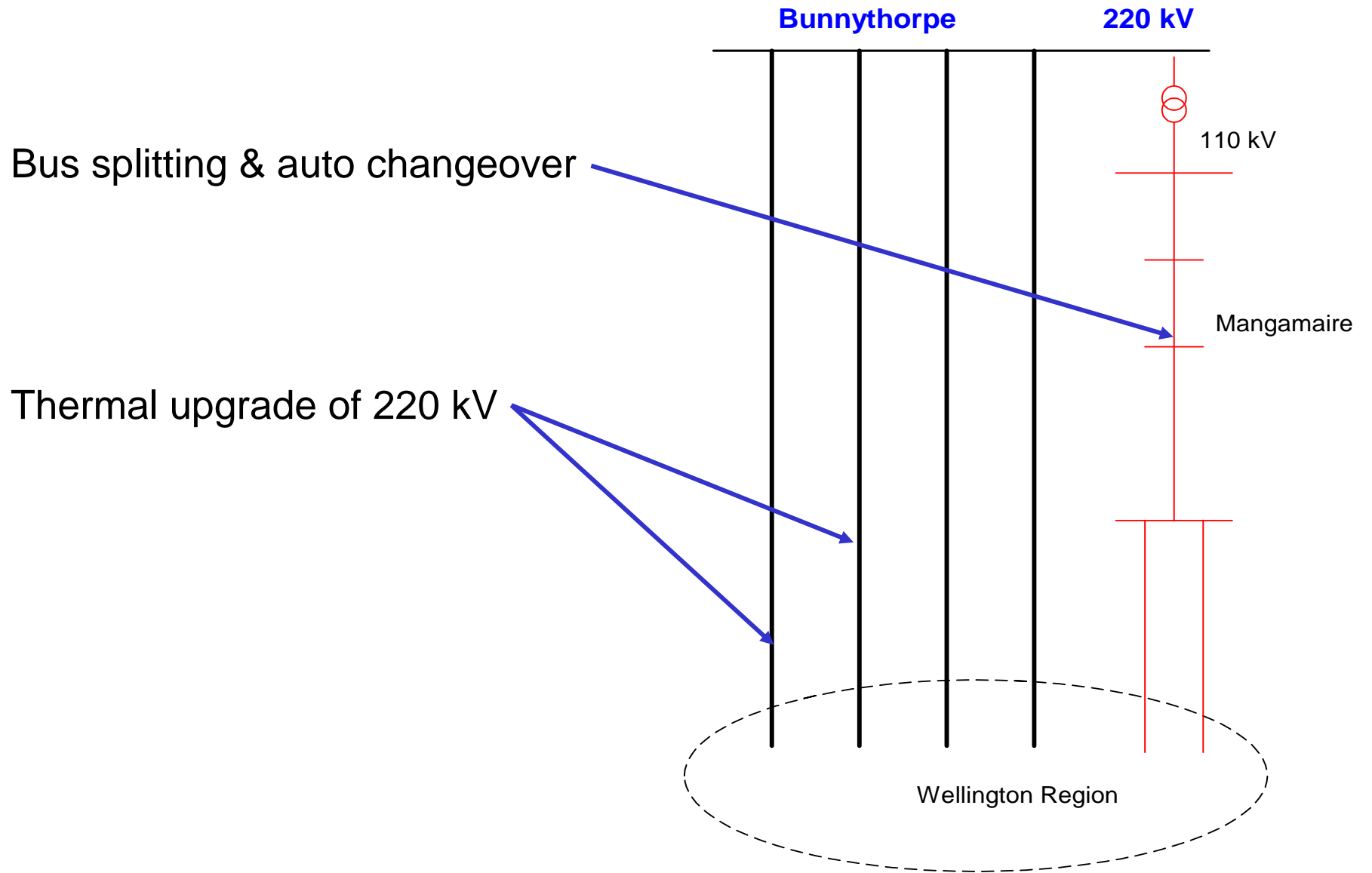
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2. Transfer from Bunnythorpe to Haywards

- Constraint
 - Due to 110 kV in Wairarapa limiting 220 kV transfer south to Haywards from Bunnythorpe
 - Previous limit due to 220 kV addressed in May 2006
 - This route is a critical limitation on south transfer
- Initiatives
 - Automatic post fault splitting scheme for 110 kV enabled as constraints appear allowing n-1 connection security pre-event
 - Operational split for Wairarapa reducing connection security to “n”. GO protocol forms basis for how this action is initiated





Transfer from Bunnythorpe to Haywards (2)

- Impact of initiatives
 - The 110 kV in Wairarapa limits transfer south up to 845 MW (winter) or 655 MW (summer) with post fault splitting scheme enabled
 - Pre-event splitting 110 kV at Mangamarie increases transfer limit up to 868 MW both winter and summer
 - Pre-event splitting at Mangamarie – subject to Grid Owner Protocol

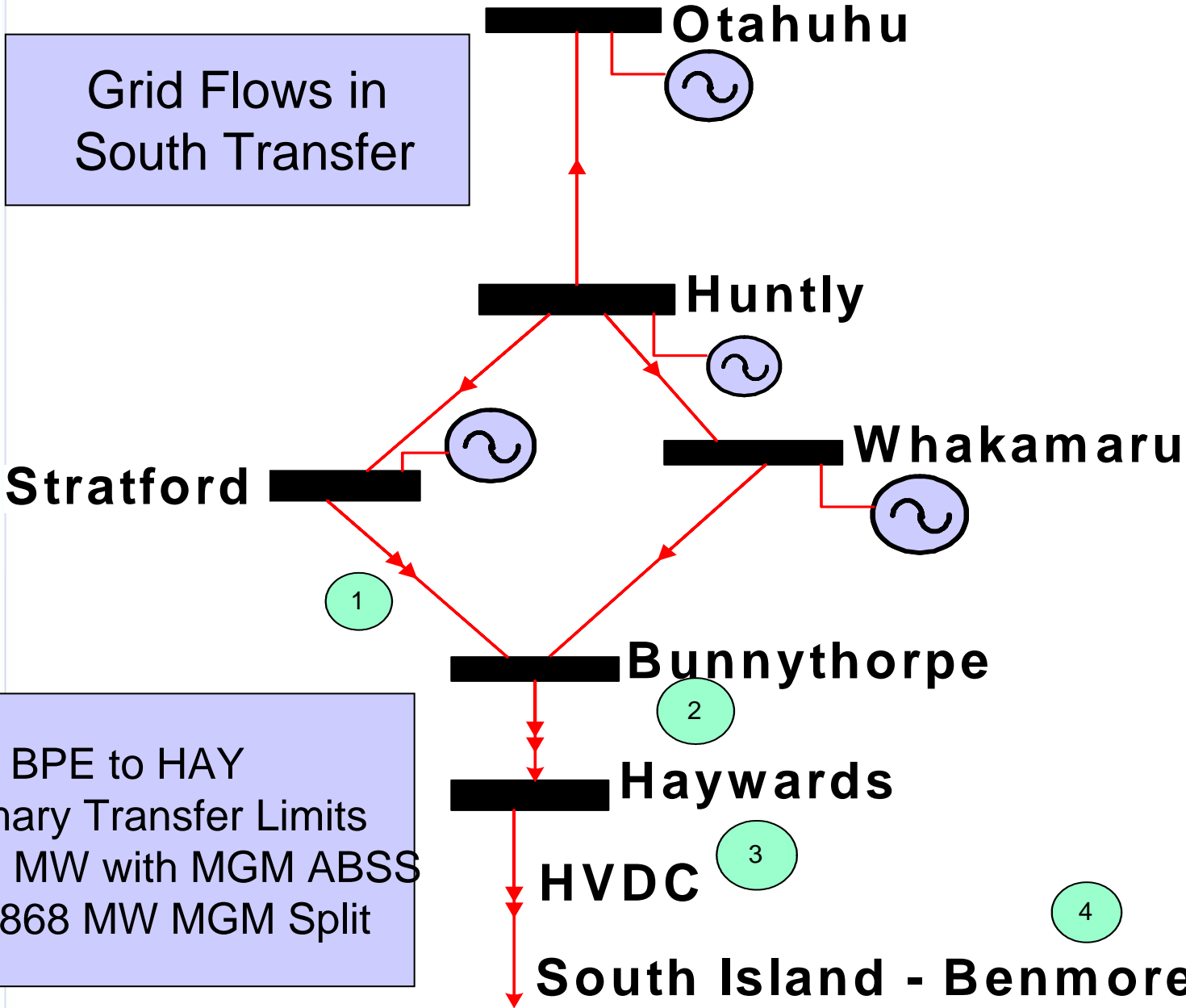


Transfer from Bunnythorpe to Haywards (3)

- Points to note re limits
 - Limits are indicative - vary with Wellington and HVDC load sharing across circuits
 - The limit is due to voltage stability, varies up to 868 MW – related to HVDC transfer and associated reactive plant in service
 - See report attached
 - Limits will need to be reviewed with system changes – eg Wind connection north of Wellington



Grid Flows in South Transfer



BPE to HAY
Summary Transfer Limits
845/655 MW with MGM ABSS
Up to 868 MW MGM Split



3. Impact of combined HVDC & Wellington load

- Constraint
 - HVDC transfer capacity south limited by rating of 220 kV circuits and Wellington load
- Initiatives
 - “HVDC Runback” developed in 2003
 - Automatic ramp back of HVDC if a tripping
 - Operationally complex – only useable overnight when HVDC south transfer high
 - Thermal upgrade of BPE-HAY 1&2 circuits in 2006



3. Impact of combined HVDC & Wellington load

- Impact of initiatives
 - HVDC runback was intended to allow 220 kV circuits to run up to voltage stability limit pre event overnight
 - 2006 thermal upgrade allows up to 868 MW sent at all times with Mangamarie split pre event (including when summer ratings apply)
- Not proposed to rely on runback in future years
 - No real benefit with circuit rating upgrade in 2006



3. Impact of combined HVDC & Wellington load (Cont'd)

- **Constraint**
 - Load in the Wellington 110 kV can require southwards transfer to be reduced to avoid overloading equipment
- **Initiatives**
 - Switching out “Wilton Interconnector” at peak times.
 - Concern is that in future years peak loading in Wellington may require the Wilton Interconnector to remain in service.
 - Ahead of any new assets, grid reconfiguration a short term option – puts up to 100 MW of Wellington city on “n” security



Issue - Reducing connection security

- Mangamarie 110kV Split
 - Mangamarie 110kV Split places this GXP on N security
 - Transpower (GO) does not make this decision unilaterally
 - Transpower seeks a formal agreement for this initiative from Powerco
 - Mangamarie ABSS was re-enabled after the split was put in place - reduces the loss period if disconnection from the grid occurred
 - The trigger for closure of the split is when flows were below the 90% level of the limit without the measure enabled for at least 95% of the time for two consecutive weeks



Bunnythorpe to Haywards post May 2006 Summary

- With Thermal Upgrade of 220 kV
 - Wairarapa 110 kV is the normal limit with MGM ABBS in service
 - If Mangamarie split limit is up to 868 MW, dependency is status of HVDC
 - Upgrade gives potential for significant additional energy to be sent south in summer months



Bunnythorpe to Haywards post May 2006 Summary

- Limits – all circuits in service
 - Mangamarie – auto-changeover enabled 845/655 MW
 - Mangamarie – split with low/medium Wgtn load
 - HVDC Pole 1 & 2 in service at high south transfer 868 MW
 - HVDC Pole 2 and Pole 1a or 1b in service – 829 MW



4. HVDC South transfer limits

- **Constraint**
 - Combination of reserve requirements HVDC configuration and generation at Benmore
- **Initiatives**
 - SI AUFLS in 2003 – reduce FIR/SIR requirement
 - DCSA optimises HVDC and Benmore dispatch in SPD

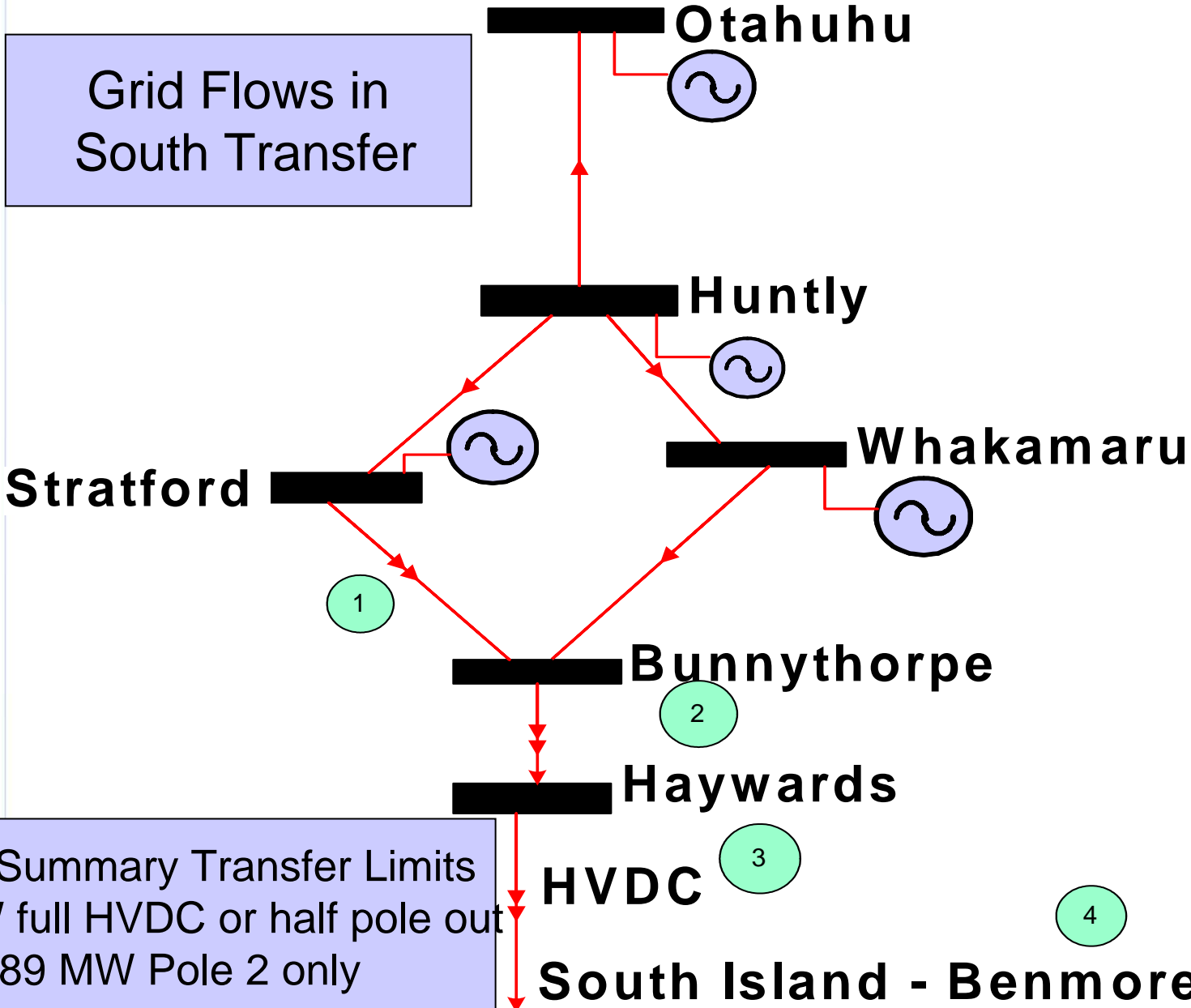


4. HVDC South transfer limits

- Limits for HVDC MW sent at Haywards are
 - Full HVDC availability – 626 MW
 - Pole 2 and Pole1a or 1b available – 626 MW
 - Pole 2 only 489 MW
 - Outages of 220 kV circuits into Haywards limit HVDC to 330/380 MW south (due to HVDC Runback)
 - Outages of other HVDC equipment can result in additional limits



Grid Flows in South Transfer



HVDC Summary Transfer Limits
626 MW full HVDC or half pole out
489 MW Pole 2 only

HVDC
South Island - Benmore



4. HVDC South transfer limits

- Typical HVDC Operation
 - Minimum start on Pole 2 – 30 MW
 - Minimum start on Pole 1a or 1b – 130 MW each
 - Pole 2 is run up to above 190 MW transfer before a half pole started (1a or 1b)
 - When transfer above 320 MW remaining half pole (1a or 1b) put into service
 - With both Poles fully in service, transfer split 60/40% between Pole 1 and Pole 2



4. HVDC South transfer limits

- SI Reserves with HVDC south transfer
 - Reserve risk in South Island usually a Manapouri unit (120 MW)
 - South transfer requires reserves to cover loss of HVDC when risk greater than 120 MW
 - Ability of Pole 1 to ramp up for loss of Pole 2 is limited due to Benmore generation and interconnector limits



4. SI Reserves with HVDC south transfer

- Pole 2 usually sets the reserve risk as a contingent event
- Reserve requirements will change as HVDC poles switched in with increasing transfer
- SI Fast Reserves (FIR) requirement can be higher than Sustained (SIR) – especially when
 - SI demand is low
 - Cleared fast reserves includes Tail Water Depressed reserve
 - There is limited or no HVDC ramp up due to HVDC poles in service or configuration



5. Summary

- Significant change post the 2006 potential dry year event
 - Additional capacity on Bunnythorpe-Haywards route
 - Will provide significant benefit for pre winter high south transfer in future years

