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THE UNIVERSITY OF QUEENSLAND
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Roadmap to Queensland Renewable Energy Target 2020: Scenario Comparison Appendix

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Roadmap to QRET Report 2020: Scenario comparison appendix

Advance Queensland Roadmap to QRET Report 2020 summarises the potential outcomes of various generation investment and transmission conditions for the scenarios modelled. This appendix provides detail of supply-demand outcomes at each node under each scenario.

Section A lists the core generation assumptions for each scenario, Section B provides a detailed discussion of supply-demand outcomes at each node under each scenario and Section C provides data tables for supply-demand outcomes at each node under each scenario

Section A: Generation assumptions for scenarios

Generation assumptions for scenarios modelled are summarised in Table 1 and detailed here:

a) Pipeline Baseline Scenario (PLBL):

   Assumes that solar and wind generation projects throughout the National Electricity Market (NEM), with planning permission as at the end of 2019, will be deployed and commissioned by 2030.

   Renewable energy and storage power station capacity by 2030 includes:

   - Solar 8579MW
   - Wind 5298MW
   - Pump hydro 2860MW

   Power station closures include:

   - Callide B and Swanbank E in Queensland
   - 4 units Liddell, 1 unit Eraring, 2 units Vales Point in New South Wales
   - 4 units Yallourn in Victoria

   Under two transmission scenarios:

   i. N transmission conditions
   ii. N-1 transmission conditions

b) Pipeline Scenario A (PLsA):

   Same assumptions for PLBL but assumes additional plant closure:

   - 4 units Gladstone, 1 unit Stanwell and 1 unit Tarong in Queensland
   - 1 unit Eraring in New South Wales

   Under two transmission scenarios:

   i. N transmission conditions
   ii. N-1 transmission conditions

c) Pipeline Scenario B (PLsB):

   Same assumptions for PLBL but assumes additional plant closure:

- 4 units Gladstone, 2 units Stanwell and 2 units Tarong in Queensland
- 2 units Eraring in New South Wales

Under two transmission scenarios:

i. N transmission conditions
ii. N-1 transmission conditions

d) Pipeline Scenario C (PLsC):

Same assumptions for PLBL but assumes additional plant closure:

- 4 units Gladstone and 4 units Tarong in Queensland
- 3 units Eraring in New South Wales

Under two transmission scenarios:

i. N transmission conditions
ii. N-1 transmission conditions

e) ISP Central Scenario at 2030 (2030C):

Assumes solar and wind generation projects as detailed in the 2020 ISP Draft proposal for the Central Scenario. Power station closures include:

- Callide B and Swanbank E in Queensland
- 4 units Liddell, 1 unit Eraring, 2 units Vales Point in New South Wales
- 4 units Yallourn in Victoria

Renewable energy and storage power station capacity by 2030 includes:

- Solar 4768MW
- Wind 3083MW
- Pump hydro 2860MW

Under two transmission scenarios:

i. N transmission conditions
ii. N-1 transmission conditions

f) ISP Step Change Scenario at 2030 (2030SC):

Assumes solar and wind generation projects as detailed in the 2020 ISP Draft proposal for the Step Change Scenario. Power station closures in addition to 2030C include:

- Kareeya, Mt Stuart, Barcaldine, 2 units Gladstone, 4 units Tarong in Queensland
- 1 unit Newport, 4 units Loy Yang A in Victoria
- 3 units Pelican Point, 2 units New Osborne, 4 units Torrens Island B in South Australia

Renewable energy and storage power station capacity by 2030 includes:

- Solar 3278MW

- Wind 7118MW
- Pump hydro 2860MW

Under two transmission scenarios:

i. N transmission conditions

ii. N-1 transmission conditions

g) ISP Central Scenario at 2040 (2040C):

Assumes solar and wind generation projects as detailed in the 2020 ISP Draft proposal for the Central scenario in 2040. Power station closures in addition to 2030C include:

- Kareeya, Mt Stuart, Barcaldine, 2 units Gladstone, 4 units Tarong in Queensland
- 1 unit Newport, 4 units Loy Yang A in Victoria
- 3 units Pelican Point, 2 units New Osborne, 4 units Torrens Island B in South Australia

Renewable energy and storage power station capacity includes:

- Solar 7242MW
- Wind 5652MW
- Pump hydro 2860MW

Under two transmission scenarios:

i. N transmission conditions

ii. N-1 transmission conditions

Table 1: Generation assumptions

Queensland Generation (MW)	Existing	Pipeline scenarios	ISP 2030 Central	ISP 2030 Step Change	ISP 2040 Central
Coal	8059	7359 (BL) 5539 (sA) 4839 (sB) 4839 (sC)	7359	4279	3836
Gas	3076	2691	2691	2555	2555
Wind	641	5298	3083	7118	5652
Solar	1748	8579	4768	3278	7242
Hydro	148	148	148	60	60
Pump Hydro	570	2860	2860	2860	2860
Total	14242	26935 (BL) 25115 (sA) 24415 (sB) 24415 (sC)	20909	20150	22205

Section B: Nodal supply-demand under each scenario

The most effective roll-out of VRE will require careful consideration of each nodal supply-demand balance and connection to other nodes. To summarise nodal supply-demand outcomes, discussion is limited to two periods during weekdays in each of the seasons; namely 7:00am to 16:00, to understand the impact of solar on the supply-demand balance, and 16:30 to 21:00, to understand the impact of peak load on supply-demand balance. These periods will also be subject to varying seasonal VRE supply on demand, so the discussion considers the average daily dispatch periods for summer and winter. Transmission network plays an increasingly important role in power flow as larger proportions of VRE attach to the network, so both the N (operating at full capacity) and N-1 (operating with largest line removed) transmission scenarios are also detailed.

In the discussion below, note that the flows are averages, not weighted averages, and thus will not always ‘balance’. Also, the flows reflect not only the supply-demand requirements in each node but also the supply-demand requirements across all nodes in the NEM, such that each node no matter where it is located in the NEM is still subject to perturbations in the remainder of the NEM. Consequently, the data reflected in the Nodal supply-demand tables, in Appendix A, may not always reflect expected outcomes.

For clarity, Pipeline scenarios refers jointly to Baseline (BL), Scenario A (sA), Scenario B (sB) and Scenario C (sC) scenarios. ISP scenarios refers jointly to ISP 2030 Central (2030C), ISP 2030 Step Change (2030SC) and ISP 2040 Central (2040C). The ISP higher VRE scenarios refers jointly to 2030SC and 2040C.

a. Far North Queensland (FNQ)

i) Node characteristics

FNQ has no thermal generation, making it Queensland’s least carbon-intensive generation node. Existing generation includes Barron Gorge and Kareeya hydro-electric schemes which together have a capacity of 148MW and 192MW of wind power located at Windy Hill and Mt Emerald.

Native demand in FNQ is estimated to be relatively small, varying between 166MW during the day and 472MW at peak during summer, reducing to 108MW during the day and 340 MW at peak during winter.

Transmission between FNQ and Ross provides transfer capacity of 934 MW in summer and 948 MW winter, reducing to 467 MW in summer and 474 MW in winter under restrictive N-1 conditions. With a small load and small hydro-electric plant, FNQ has historically relied on power flows from southern nodes to balance demand and supply.

Table 2: FNQ generation capacity for scenarios modelled

Far North Queensland Generation	Existing (MW)	Pipeline Scenarios	ISP 2030 Central	ISP 2030 Step Change	ISP 2040 Central
Hydro	148	148	148	0	0
Wind	192	705	700	1500	1675
Solar	50	320	49	49	49
PHES		250	250	250	250
Total	390	1421	1145	1797	1972

ii) FNQ summer day-time flows

(a) N Transmission scenarios

For detail see Table 13 in Section C.

The addition of up to 320MW of solar (Pipeline scenarios), 1675 MW of wind (2040C) and 250MW of PHES (all scenarios), makes a sizeable difference to the nodal balance. The most notable characteristics of day time flows is that there is no dispatch from Kidston PHES as operations are specifically modelled to pump throughout daylight hours to absorb solar dispatch and avoid solar spillage.

The capacity factor of solar energy during summer sunlight hours is more than 76% (that is, between 7:00am and 4pm, solar energy dispatched is 76% of nameplate capacity) in the Pipeline scenarios reducing to 67% in the ISP scenarios. Due to the addition of Kidston PHES, solar energy spilled is negligible.

The capacity factor of wind energy during summer sunlight hours is less than 30% (that is, between 7:00am and 4pm, wind energy dispatched is less than 30% of nameplate capacity) for the Pipeline scenarios. In the higher VRE scenario 2030SC 30% of 1500MW of wind capacity, is dispatched, with 4% spilled due to transmission or thermal power station constraints in other nodes. In 2040C, 27% of 1675MW is dispatched and 7% spilled.

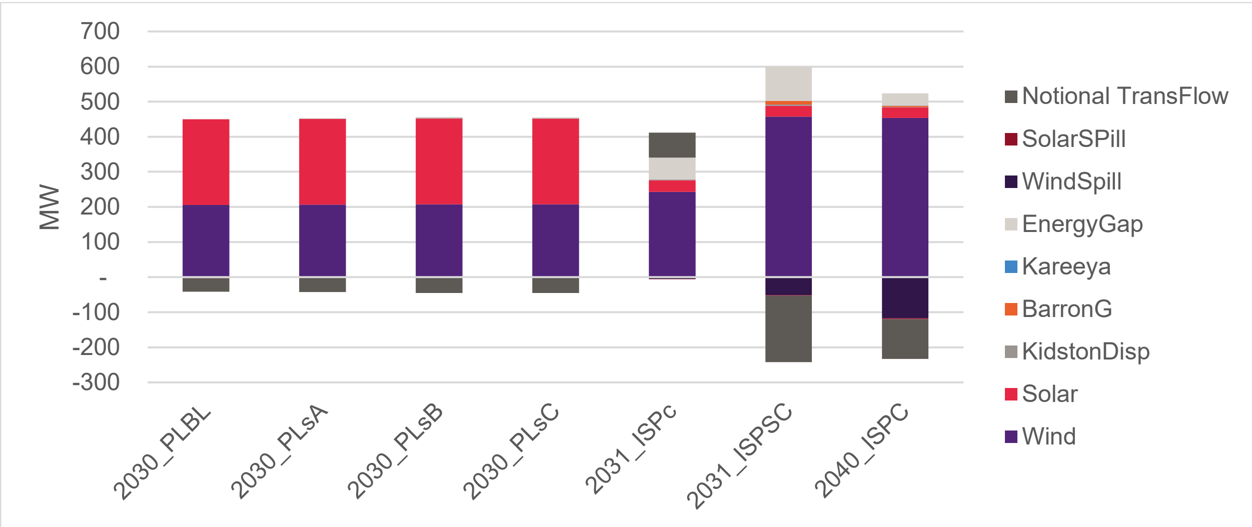

Figure 1: FNQ average Summer Daytime N flows for scenarios modelled

Energy flows to and from Townsville (ROSS), are larger in the ISP 2030 Step Change and 2040 Central scenarios than in the Pipeline and ISP 2030 Central scenarios as a consequence of the high levels of wind energy that needs to be dispatched to other nodes to avoid being spilled. Scenarios sA, sB and sC have 4 units of GPS closed and 2030SC and 2040C scenarios have all 6 units of GPS closed, so surplus wind energy generated in FNQ flows southward to help meet load in GLAD.

Energy-Gap is the lack of available capacity to meet intermittent supply shortfalls. It is negligible in the Pipeline scenarios but is increasingly evident in the ISP scenarios. The emergence of the Energy-Gap in FNQ is partly an artefact of the modelling assumptions for Kidston PHES, Barron Gorge and Kareeya. As a result of high levels of VRE, modelling for Kidston PHES assumes that the plant will be pumping during daylight hours for dispatch at peak. Similarly, to counteract high levels of VRE and still meet Evening Peak, Barron Gorge and Kareeya dispatch strategies are also targeted at morning and Evening Peak. Consequently, ANEM model identifies an Energy-Gap rather than dispatch from Barron Gorge and Kareeya during daylight. Also the emergence of the Energy-Gap is partly related to the high levels of load in GLAD in the absence of GPS which must be served despite VRE availability. The identification of an Energy-Gap in

FNQ in the modelling, is not considered to represent a reliable prediction of the dispatch of available hydro and PHES capacity in FNQ, although it does identify the challenges of co-ordinating pumping activities with variable renewable energy supply. [The modelling assumptions will be carefully analysed for future modelling projects to introduce flexibility into pump and dispatch strategies].

Energy spilled in the Pipeline scenarios is minimalised by Kidston pumping, but increases in the ISP high VRE scenarios, 2030SC and 2040C. This indicates that greater levels of storage or increased transmission capacity would be required to absorb or dispatch very high levels of wind power assumed in the high VRE ISP scenarios to other nodes.

(b) N-1 Transmission scenarios

For detail see Table 14 in Section C..

The ISP high VRE scenarios, have more than 1500MW of wind capacity in FNQ but are unable to fully dispatch to southern nodes due to reduced transmission capacity between FNQ and ROSS of 474MW instead of the higher 934-948 MW capacity under N. Thus wind spillage increases to (10% in 2030SC) and (14% in 2040C). ISP scenarios exhibit increased flows from ROSS node which seems counterintuitive when considering the level of wind spillage displayed. However, the reason for this starts with transmission capacity between CWQ and GLAD. In summary the thermal limit for CWQ-GLAD is 980MW, which is the average flow shown on this line. So, CWG generation totals 2.73GW with a load of 365MW, an average of 511MW is transferred to TAR node and 980MW to GLAD node leaving an average surplus capacity of 875MW much of which is directed back to NQ, and some of which is directed back to ROSS and FNQ. Therefore, under the 2040C scenario, surplus energy originating in CWQ flows to FNQ and surplus wind energy in FNQ is spilled.

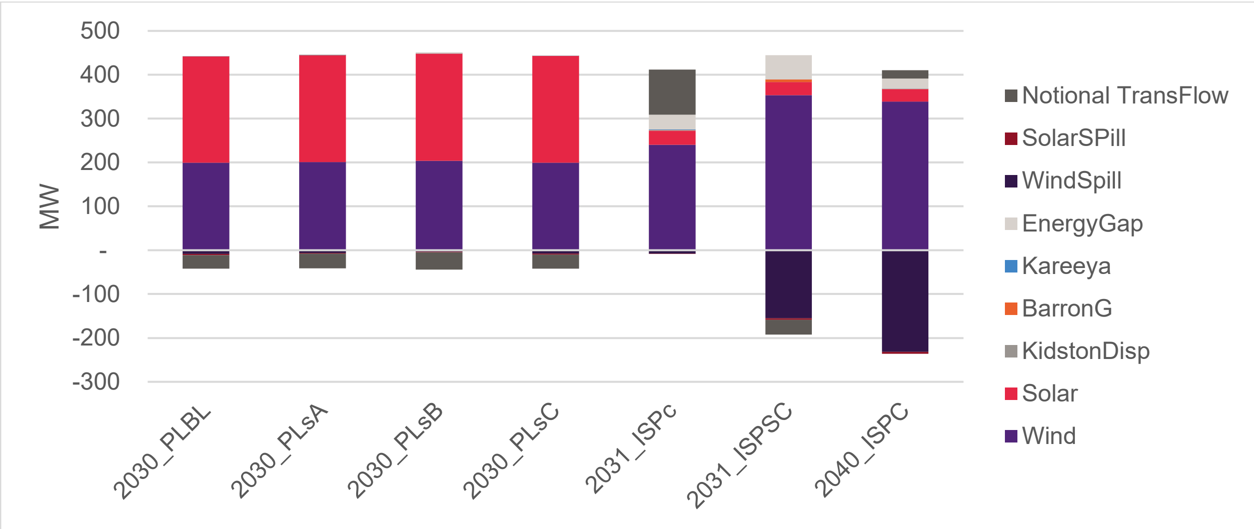

Figure 2: FNQ average Summer Daytime N-1 flows for scenarios modelled

ISP 2030C predicts 61% of energy flows originating in ROSS node which in turn results in a small level of congestion on the transmission line between FNQ and ROSS.

iii) FNQ Summer Evening Peak flows

(a) N Transmission scenarios

For detail see Table 15 in Section C.

Modelling outcomes of Evening Peak demand flows under N transmission indicate efficient dispatch of wind, although dispatch only achieves an average of 30-31% of the 1500-1675MW capacity during Evening Peak.

There is evidence of solar energy being dispatched during the Evening Peak, but this is only for the first few hours. Kidston PHES is dispatched to meet demand, although not at full capacity as would be expected with the quantum of wind capacity dispatched. Barron Gorge and Kareeya are also dispatched but at low levels, in line with the hydro assumptions detailed in the Summer Daytime flows discussed above.

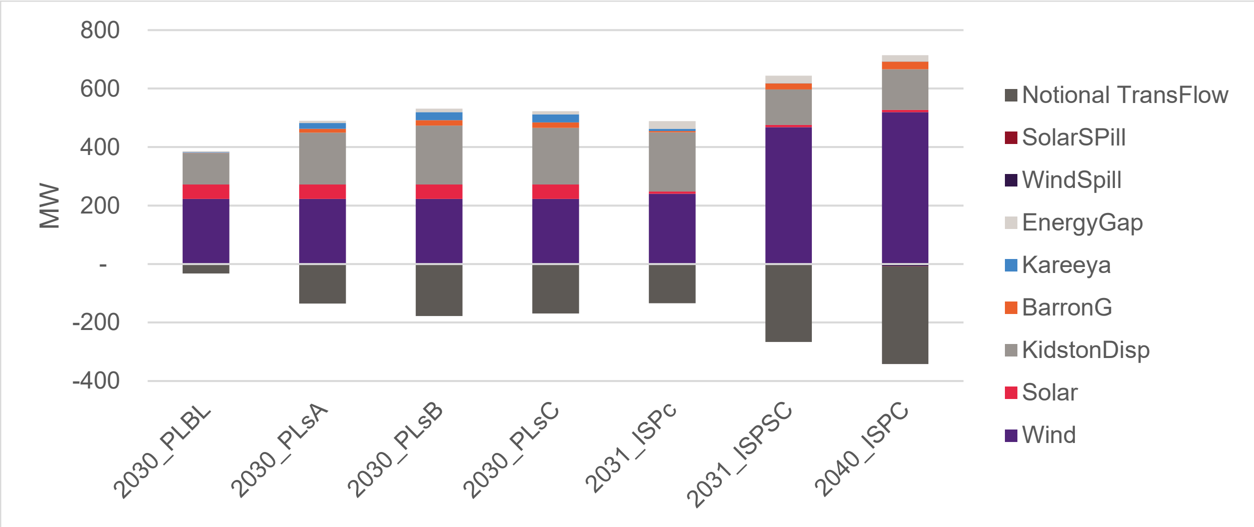

Figure 3: FNQ average Summer Evening Peak N flows for scenarios modelled

In all scenarios energy flows southwards during the Summer Evening Peak reflecting the excess of supply over demand.

As with the Summer Daytime flows, there is evidence of Energy-Gaps developing periodically, but it is not considered to be a concern because of the presence of PHES and run-of-river hydro capacity which is effectively in reserve.

(b) N-1 Transmission scenarios

For detail see Table 16 in Section C.

There is little wind spillage in the Evening Peak for N-1 ISP high VRE scenarios and high levels of outward energy flows which is contrary to the restricted transmission scenario during Summer Daytime. This is primarily due to reduced generation in CWG when the sun goes down. So although supply to GLAD remains at the transmission line thermal limit, there is less energy supplied in CWQ for redistribution to northern nodes, specifically FNQ.

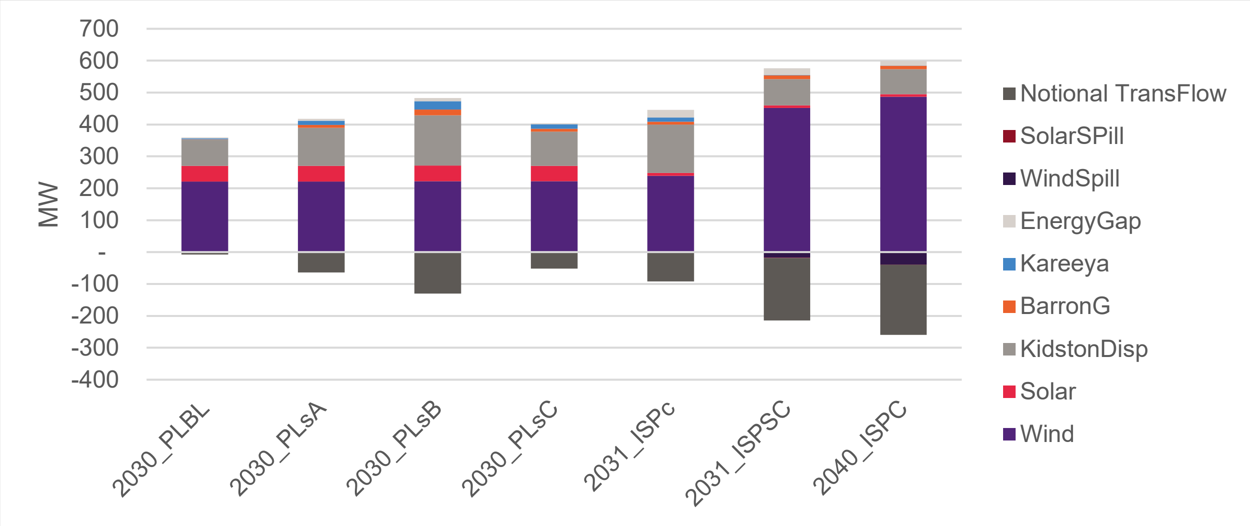

Figure 4: FNQ average Summer Evening Peak N-1 flows for scenarios modelled

All scenario outcomes exhibit evidence of small levels of congestion as energy flows inwards and outwards under N-1 transmission.

iv) FNQ Winter Daytime flows

(a) N Transmission scenarios

For detail see Table 17 in Section C.

The primary difference between Summer and Winter Day-time flows is in the available resource of wind for generation. Under the Pipeline scenarios, 48% more wind is dispatched than in summer, and 37-43% larger dispatch for the ISP high VRE scenarios.

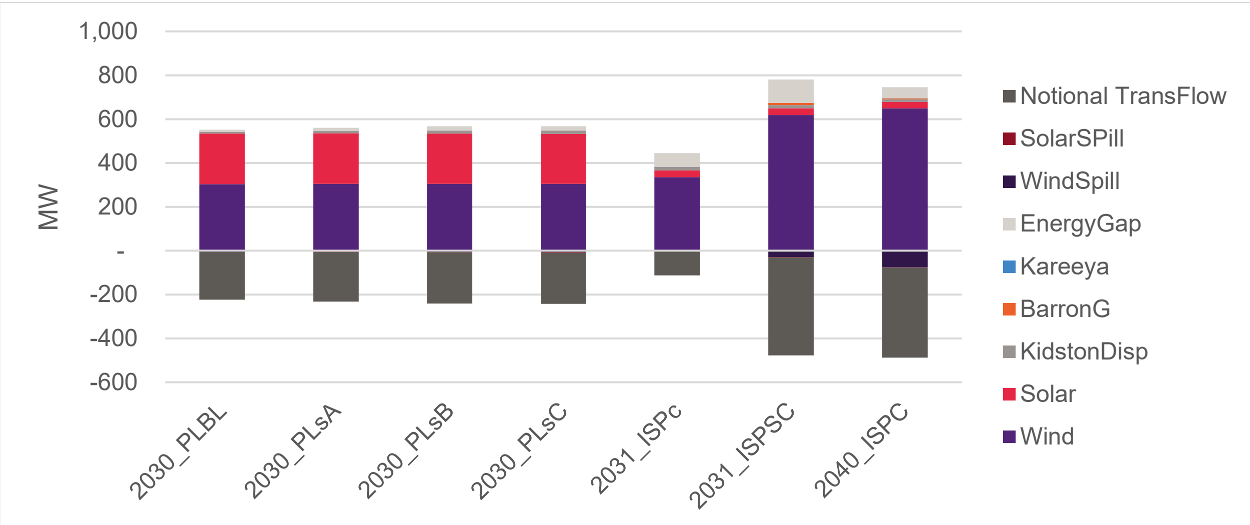

Figure 5: FNQ average Winter Daytime N flows for scenarios modelled

Although solar resource is less than during summer, dispatch is reduced by 6% in the Pipeline scenarios. The large increase in wind power results in greater flows of energy southwards.

ISP 2030C is the scenario with the smallest generation capacity and hence lowest energy flows southwards. All scenarios except 2030C show very small percentage of flows from ROSS to FNQ, and even 2030C shows only 28% of flows are in that direction. ISP high VRE scenarios exhibit small incidence of congestion in flows to ROSS.

(b) N-1 Transmission scenarios

For detail see Table 18 in Section C.

All scenarios show some reduced capacity of outward energy flows under restricted transmission, with consequential spillage but the ISP high VRE scenarios show large spillage as a result of reduced ability for energy to flow to other nodes; 24% in the 2030SC and 32% in the 2040C scenarios.

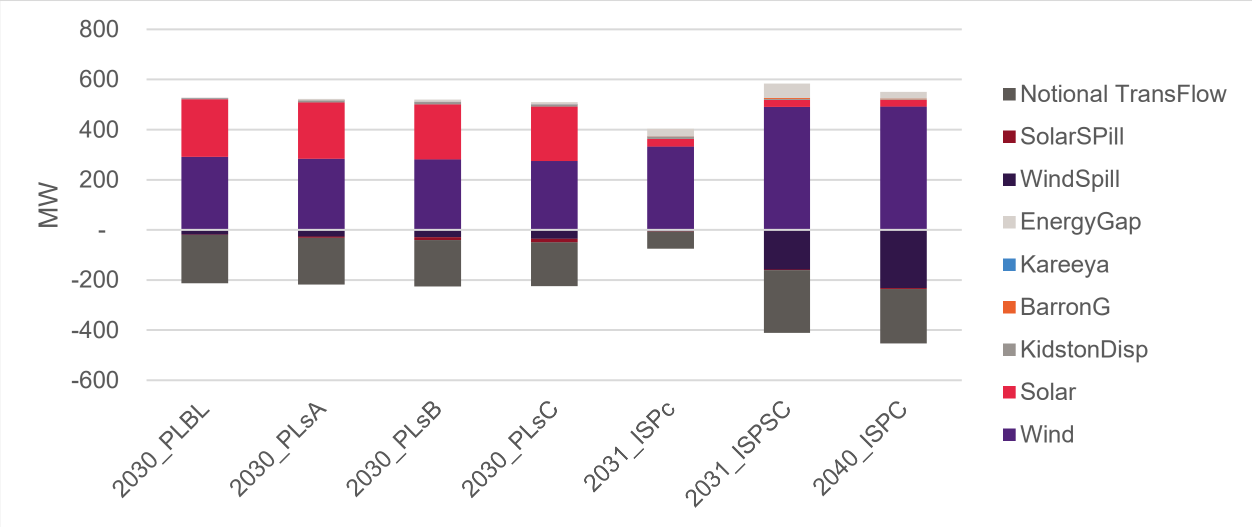

Figure 6: FNQ average Winter Daytime N-1 flows for scenarios modelled

Unlike the Summer N-1 scenario, 2030C shows little evidence of inwards energy flows because of lower demand in winter, and adequate local nodal generation capacity. The ISP high VRE scenarios exhibit small levels of congestion despite increased outward energy flows to other nodes from wind dispatch, as winter thermal limits are higher than summer thermal limits.

v) FNQ Winter Evening Peak flows

(a) N Transmission scenarios

For detail see Table 19 in Section C.

As with Winter Daytime dispatch, wind dispatched during Winter Evening Peak is considerable higher than during Summer Evening Peak; 74% higher in Pipeline scenarios, 20% in 2030SC and 2040C scenarios. The higher wind dispatch facilitates energy to flow to ROSS, approximately double the capacity during Summer Evening Peak.

Kidston Hydro dispatch is at more than 80% capacity for all scenarios except BL which is at 68%. BL's lower dispatch of Kidston at Evening Peak possibly reflects greater levels of thermal generation in the network at CWQ and GLAD and their associated must-run requirements in this scenario, and thus less opportunity for outward energy flows as is possible in the other scenarios with reduced thermal generation.

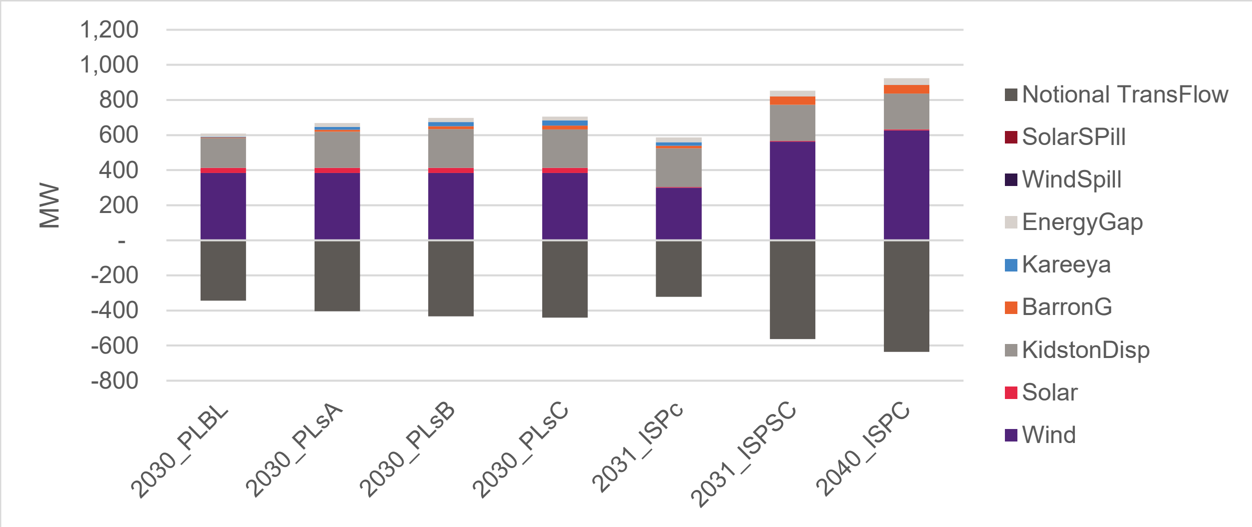

Figure 7: FNQ average Winter Evening Peak N flows for scenarios modelled

(b) N-1 Transmission scenarios

For detail see Table 20 in Section C.

Winter Evening Peak under N-1 shows less effect than Summer Evening Peak of reduced transmission capacity, although there remains evidence of wind spillage but it is low at between 7 and 12%.

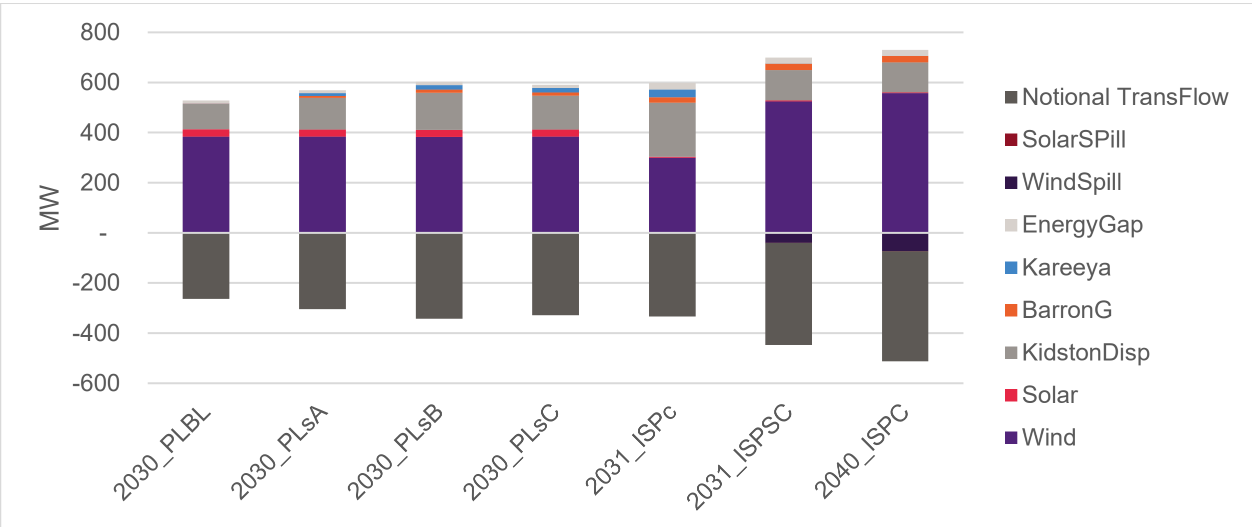

Figure 8: FNQ average Winter Evening Peak N-1 flows for scenarios modelled

vi) Conclusions on FNQ nodal supply-demand

FNQ is at the extremity of the NEM, but it is still heavily influenced by nodal supply-demand on transmission lines connecting nodes as far south as GLAD. Although modelling exhibited some Energy-Gaps, much of this is assessed to be as a result of modelling assumptions rather than an inherent capacity constraint. However, under the ISP high VRE scenarios, there is considerably higher wind generation capacity than transmission capacity even under N scenarios in winter, so there is a case for greater transmission capacity between FNQ and ROSS if high levels of wind generation are pursued in FNQ.

b. ROSS

i. Node characteristics

ROSS has Yabulu, Townsville's combined cycle gas turbine with nameplate capacity of 244MW, which is the only thermal generator within the node. Solar generation already in operation includes Clare (110MW), Ross River (128MW), Sunmetals (127MW) and Haughton1 (132MW).

Native demand in ROSS is estimated to vary between 241MW during the day and 755MW at peak during summer, reducing to 170MW during the day and 560 MW at peak during winter.

Transmission between Ross and FNQ provides transfer capacity of 934 MW in summer and 948 MW winter, reducing to 467 MW in summer and 474 MW in winter under restrictive N-1 conditions. Transmission between Ross and NQ provides transfer capacity of 2157 MW in summer and 2439 MW in winter, reducing to 1303 MW in summer and 1486 MW in winter under restrictive N-1 conditions. ROSS currently relies on power flows from southern nodes to balance.

Table 3: Ross generation capacity for scenarios modelled

ROSS Generation	Existing (MW)	Pipeline Scenarios	ISP 2030 Central	ISP 2030 Step Change	ISP 2040 Central
Gas	244	244	244	244	244
Wind	0	644	43	43	43
Solar	497	1785	477	477	477
Total	741	2673	764	764	764

Pipeline proposals for wind project includes Big Kennedy (644MW), and solar projects include Haughton (500MW), Clare2 (36MW), Hughenden (35MW), Majors Creek (200MW), Big Kennedy (575MW) and Rollingstone (88MW).

ii. ROSS Summer Daytime flows

(a) N Transmission scenarios

Pipeline project proposals indicate a very large increase in solar and wind projects in this node. All ISP scenarios are considerably less ambitious in their VRE aspirations. The large increase in solar with a relatively small nodal load and equally large investments in VRE in CWG result in solar spillage (40% for BL, 32% for sA, 27% for sB,28% for sC) at this node despite significant flows of energy to NQ and closure of coal units in sA, sB, and sC..

The ISP scenarios, with little VRE investment, show small levels of Energy-Gap. Energy flows generally to NQ except in the 2030C scenario where energy flows from NQ 71% of the time, and the 2040C scenario where energy flows from NQ 36% of the time. There is no evidence of congestion in any of the scenarios.

For detail see Table 25 in Section C. Note the small contribution to energy by Yabulu in all scenarios.

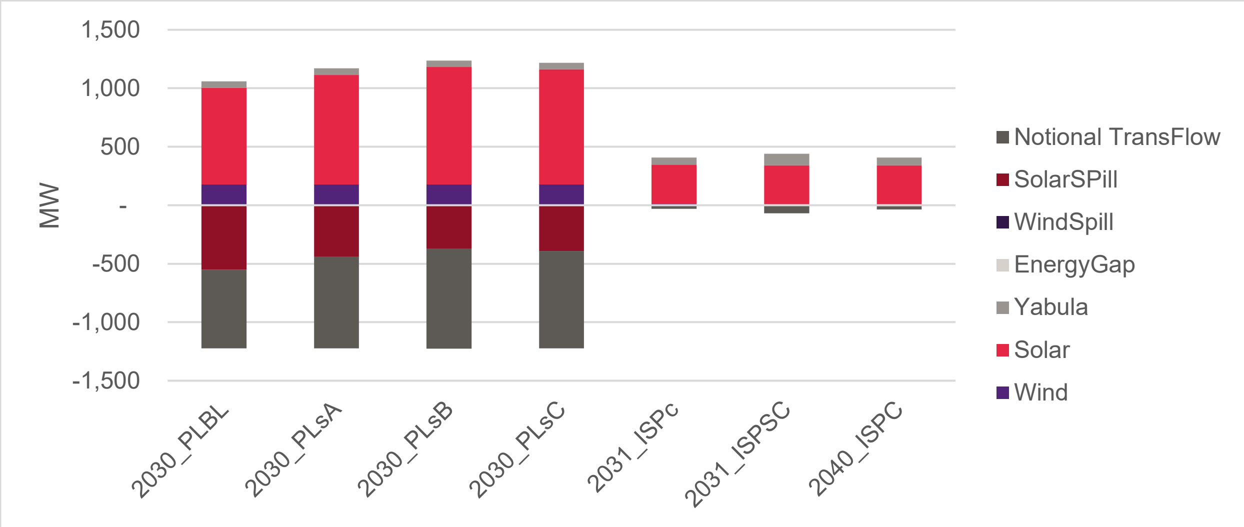

Figure 9: ROSS average Summer Daytime N flows for scenarios modelled

(b) N-1 Transmission scenarios

For detail see Table 26 in Section C. Note the ongoing small contribution by Yabulu.

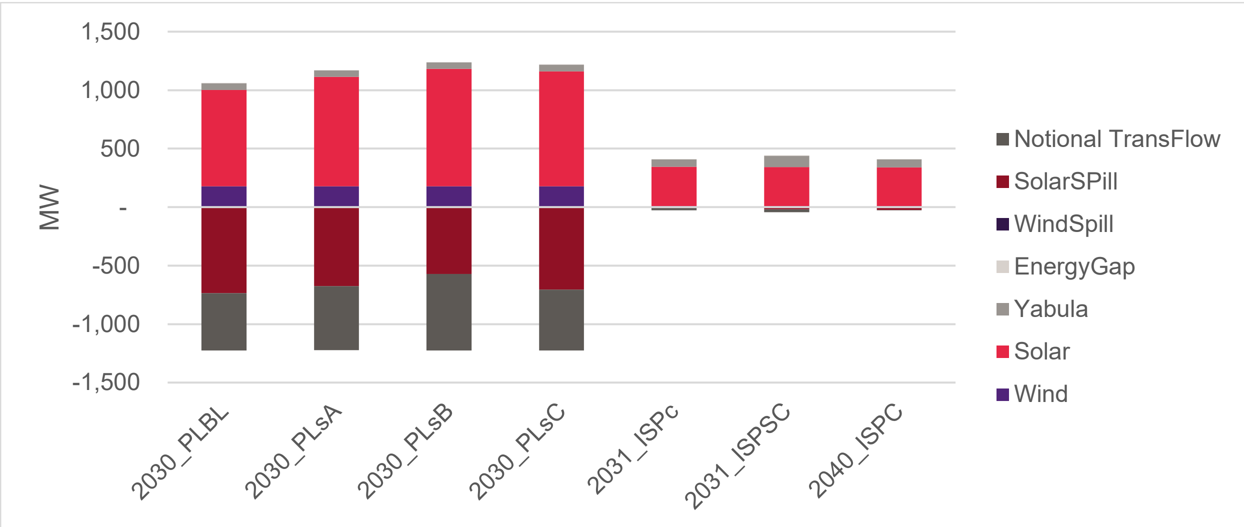

Figure 10: ROSS average Summer Daytime N-1 flows for scenarios modelled

The only change under N-1 is increased spillage resulting from reduced transmission capacity to NQ. Solar spillage in NQ increases to 53% (BL), 49% (sA), 41% (sB) and 51% (sC). Thus, to achieve maximum dispatch of solar in this node (41%), 2 units at Stanwell and 4 units at GPS have to be closed.

iii. ROSS Summer Evening Peak flows

(a) N Transmission scenarios

Solar dispatch is still evident in the late afternoon hours of Evening Peak. Wind and solar contribute the majority of supply for Evening Peak. Yabulu dispatch increases in sA, sB and sC as coal units are excluded in CWQ and GLAD to make up approximately 30% of Evening Peak load. BL is reliant on energy flow from NQ for 44% of Evening Peak but the remaining Pipeline scenarios are less so.

ISP 2030C is reliant on flows from NQ for 59% of Evening Peak demand, 2030SC 40% and 2040C 29%. Yabulu contributes 22-25% to Evening Peak demand in the ISP high VRE scenarios.

There is some evidence of an Energy-Gap in sB and sC. The Energy-Gap results from periods of low wind resource on 6 days, for between 2 and 5 hours, when all schedulable generation is at full capacity. The Energy-Gap varies between 108MW and 423MW but of the 41 periods where an Energy-Gap is present, 29 of them (70%) are above 400MW. There are challenges associated with resolving the Energy-Gap which will be discussed in the next section.

For detail see Table 27 in Section C.

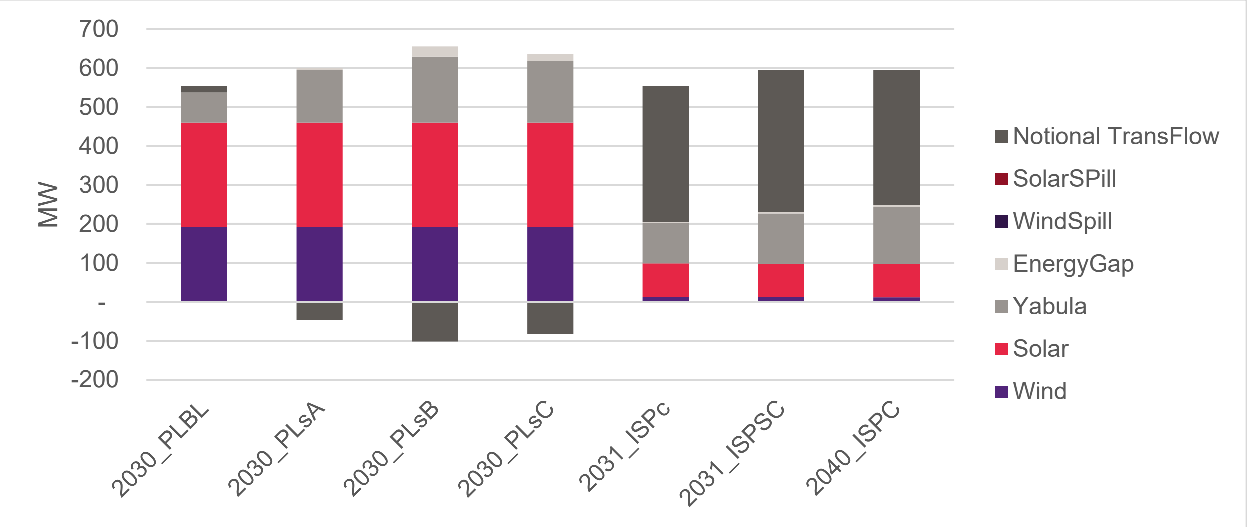

Figure 11: ROSS average Summer Evening Peak N flows for scenarios modelled

(b) N-1 Transmission scenarios

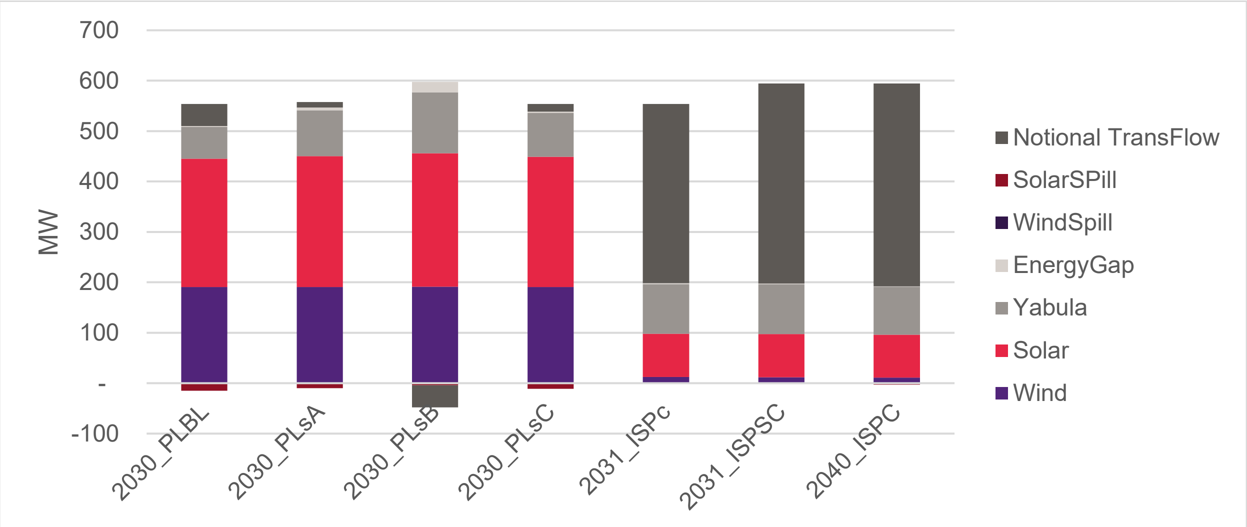

Figure 12: ROSS average Summer Evening Peak N-1 flows

For detail see Table 28 in Section C.

Other than a decrease in outward energy flows of surplus wind energy, there are no significant differences in the outcomes of all scenarios under N-1.

iv. ROSS Winter Daytime flows

(a) N Transmission scenarios

For detail see Table 29 in Section C.

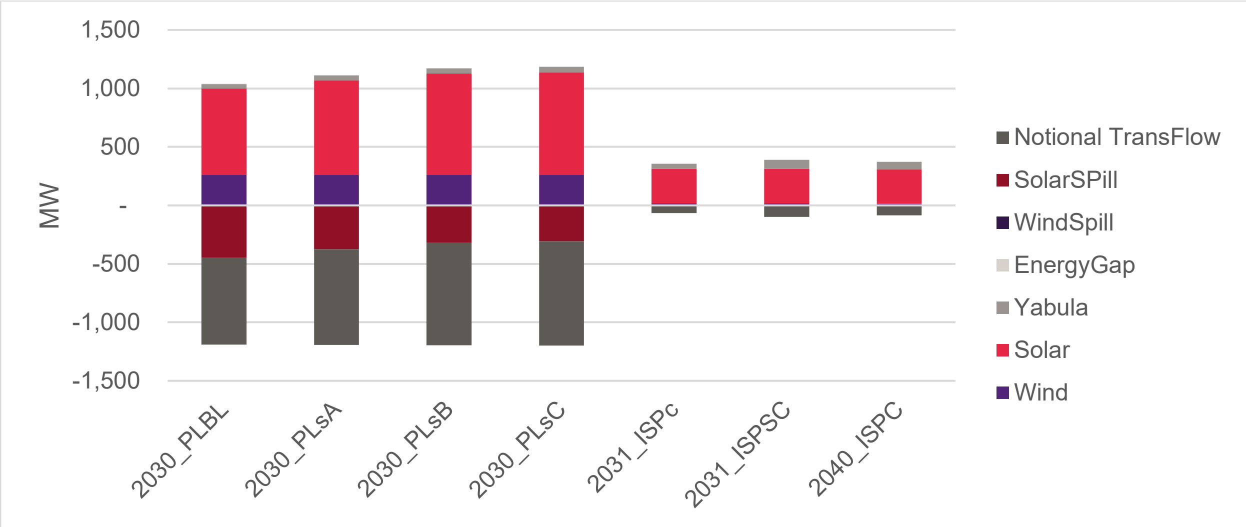

Figure 13: ROSS average Winter Daytime N flows for scenarios modelled

Wind resource is 47% higher during the day in Winter months. This increase allows greater levels of outward energy flows to NQ.

Solar resource is lower during the day in Winter months. However, there is still significant excess supply of solar resource in the Pipeline scenarios as BL (38%), sA (32%), sB (27%), sC (26%) is spilled.

(b) N-1 Transmission scenarios

For detail see Table 30 in Section C.

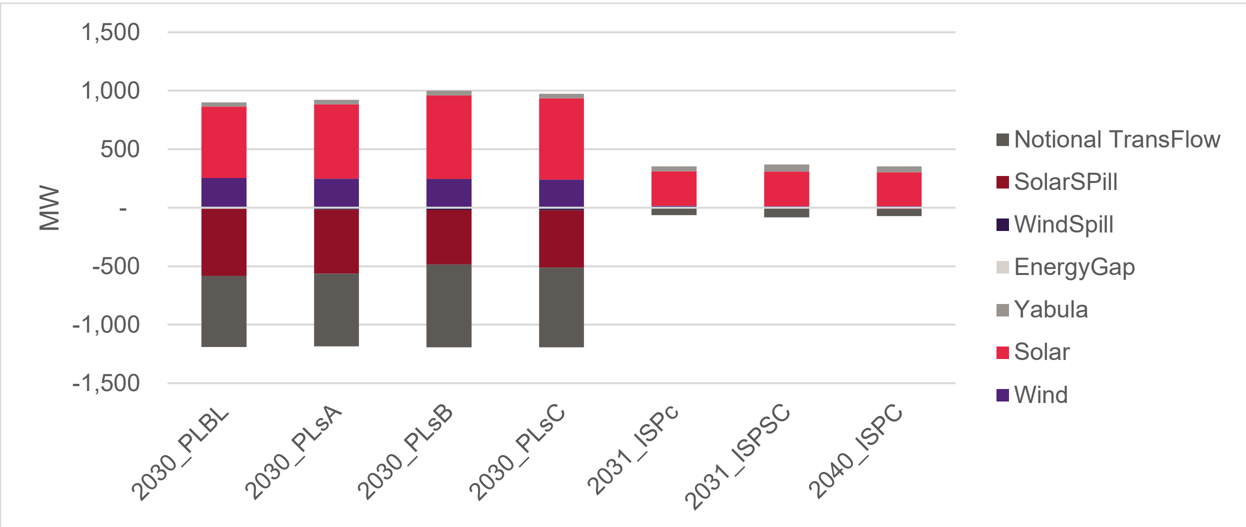

Figure 14: ROSS average Winter Daytime N-1 flows for scenarios modelled

Under reduced N-1 transmission, outward energy flows of surplus wind and solar are reduced and solar spillage increases.

v. ROSS Winter Evening Peak flows

(a) N Transmission scenarios

For detail see Table 31 in Section C.

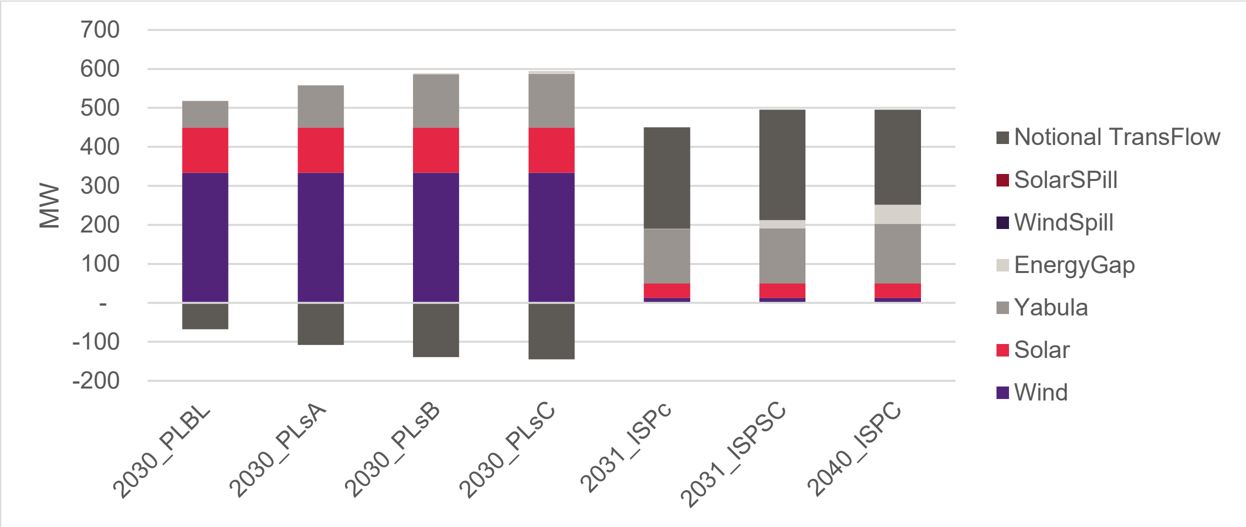

Figure 15: ROSS average Winter Evening Peak N flows for scenarios modelled

Winter wind resource during the Evening Peak is 28% higher than during the day, and 25% higher than during the Evening Peak in Summer. Consequently, outward energy flows for the Pipeline scenarios are higher than during the Summer Evening Peak.

In the ISP scenarios, energy flows inwards primarily from FNQ, but also from NQ.

(b) N-1 Transmission scenarios

For detail see Table 32 in Section C.

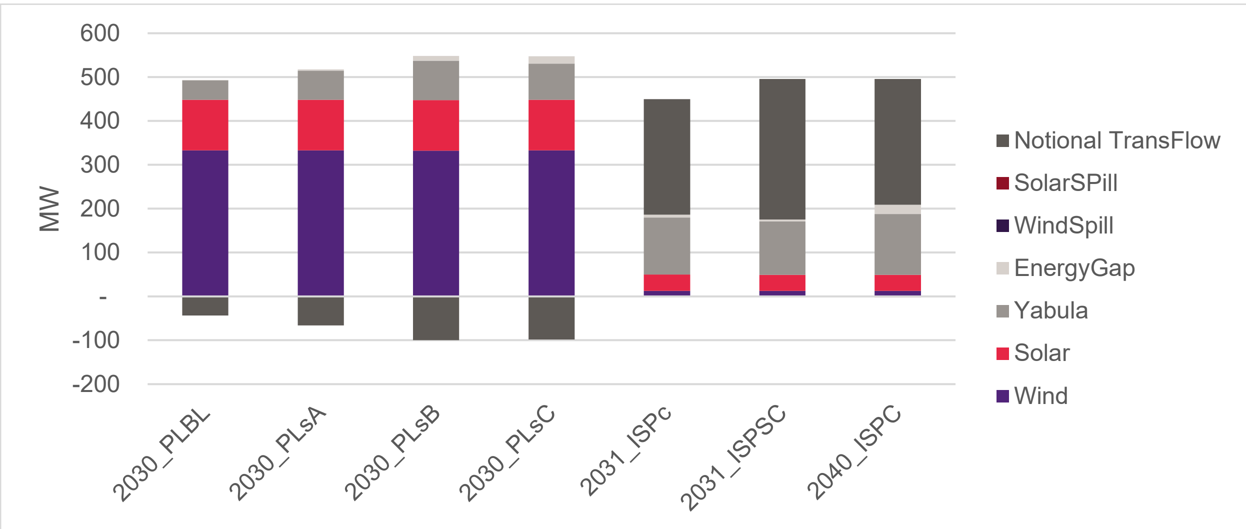

Figure 16: ROSS average Winter Evening Peak N-1 flows for scenarios modelled

There are no significant differences for all scenarios under restricted N-1 transmission.

c. North Queensland (NQ)

i. Node characteristics

NQ has no thermal generation since Collinsville was retired in 2012, although there is discussion about a new coal-fired power station for Collinsville, Solar generation already in operation includes Daydream (167MW), Hamilton (58MW) Hayman (58MW), Whitsunday (57MW) and Collinsville Ratch (42MW).

Native demand in NQ is estimated to vary between 176MW during sunlight hours and 565MW at peak during summer, reducing to 124MW during sunlight hours and 420 MW at peak during winter.

Transmission between NQ and Ross provides transfer capacity of 2157 MW in summer and 2439 MW in winter, reducing to 1303 MW in summer and 1486 MW in winter under restrictive N-1 conditions. Transmission between NQ and CWQ provides transfer capacity of 3343 MW in summer and 3737 MW in winter, reducing to 2247 MW in summer and 2506 MW in winter under restrictive N-1 conditions. NQ currently relies on power flows from southern nodes to balance supply and demand at this node.

Table 4: NQ generation capacity for scenarios modelled

North Queensland Generation	Existing (MW)	Pipeline Scenarios	ISP 2030 Central	ISP 2030 Step Change	ISP 2040 Central
Wind	0	799	0	1000	1000
Solar	382	1027	357	357	357
PHES		1020	1020	1020	1020
Total	382	2664	1377	2377	2377

Pipeline proposals for wind project includes Clark Creek (799MW), and solar projects include North Collinsville (100MW), Bouldercombe (280MW) and Broadsound (290MW).

ISP scenarios show no further deployment of solar over current levels, but 1000MW of wind power for the high VRE scenarios. Modelling of Pipeline scenarios show that spillage could be significantly reduced with the inclusion of PHES, so 1020MW of PHES is assumed for all the scenarios, including the ISP scenarios. AEMOs ISP forecasts include varying levels of storage additions at the state level. The counterfactual case (effectively little transmission investment) forecasts the requirement for no PHES additions by 2030 in 2030C, 2123MW in 2030SC and 3335MW in 2040C, although no detail is supplied as to where this PHES might be located. As the ANEM modelling assumed existing transmission infrastructure, the assumption was that 1020MW of PHES in NQ would adequately reflect ISP assumptions and the Urannah proposal has available public information that is appropriate for modelling assumptions.

ii. NQ Summer Daytime flows

(a) N Transmission scenarios

For detail see Table 3 in Section C.

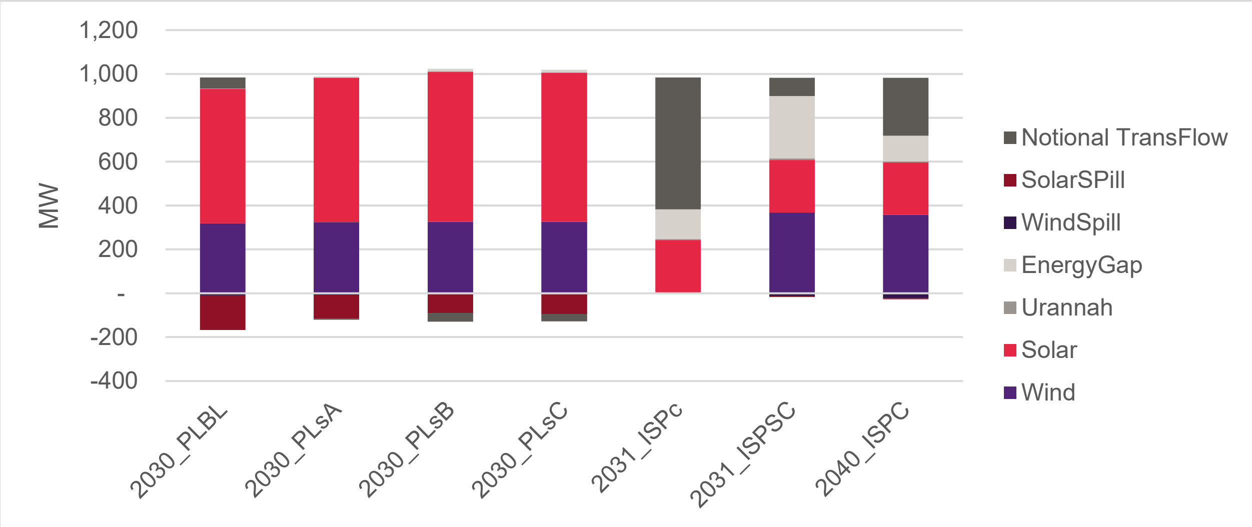

Figure 17: NQ average Summer Daytime N flows for scenarios modelled

Pipeline scenarios include large deployment of solar within the NQ node. Consequently, even with 1020MW of PHES to store excess energy and shift it to Evening Peak, high levels of spillage remain; BL (21%), sA (26%), sB (11%), sC (22%). ISP scenarios do not include increased solar from current levels, and show solar spillage of only 1%.

Large deployment of wind (800MW in Pipeline and 1000MW in the ISP high VRE scenarios) achieves a capacity factor of between 37% and 40% during the day in summer. There is evidence of some spillage, 1-3% in Pipeline scenarios and 3-6% in the ISP high VRE scenarios.

Energy flows in to NQ node from ROSS and out to CWQ in the Pipeline scenarios, the flows increasing as coal units in CWQ and GLAD are removed. Without any increase in VRE in 2030C, energy flows from CWQ to serve the PHES load in NQ. Even with a large increase in wind power in 2040C, energy still flows from CWQ to serve PHES load in this scenario.

A sizeable Energy-Gap emerges in the ISP scenarios. Without large levels of solar on 60 of the 90 days of summer, Urannah pump load is unable to be supplied from current VRE because wind resource is fairly low during the day in summer. This will be discussed further in the next section.

(b) N-1 Transmission scenarios

For detail see Table 38 in Section C.

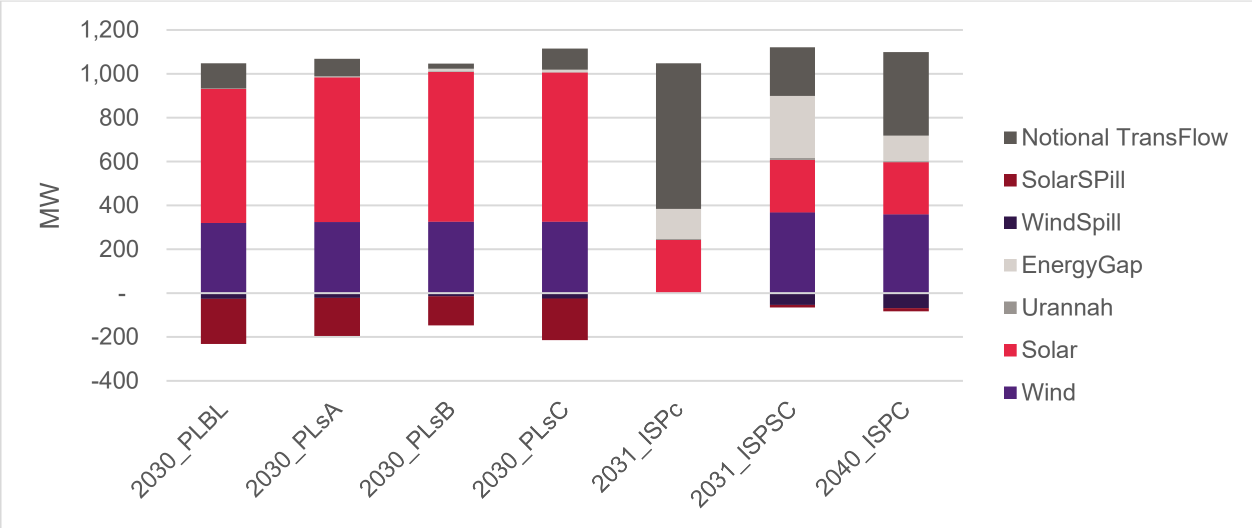

Figure 18: NQ average Summer Daytime N-1 flows for scenarios modelled

NQ under N-1 shows higher solar spillage (17-27%) as less energy can flow to load centres in the Pipeline scenarios and also higher wind spillage (5-8% in Pipeline scenarios and 14-18% in ISP high VRE scenarios) as less energy flows to other nodes.

iii. NQ Summer Evening Peak flows

(a) N Transmission scenarios

For detail see Table 39 in Section C.

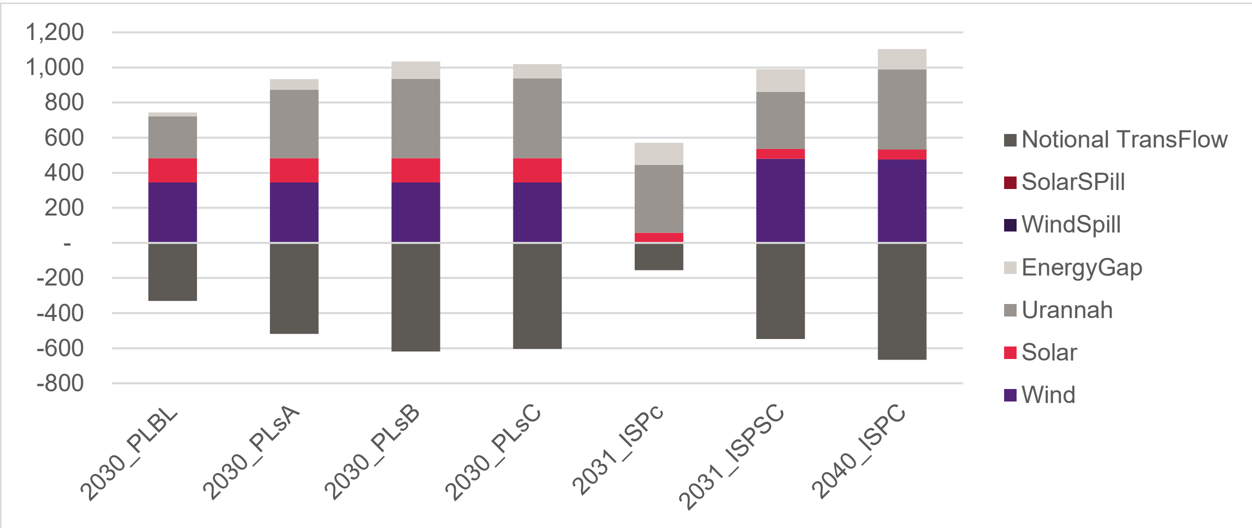

Figure 19: NQ average Summer Evening Peak N flows for scenarios modelled

During the Evening Peak, wind dispatch is greater than during the day, and with Urannah dispatch, energy flows to both ROSS and CWQ. Energy-Gaps increase, becoming larger in ISP scenarios. Inspection of the Energy-Gap shows that although Energy-Gaps occur on 60 out of the 90 Summer Evening Peak periods, gaps of larger than 100MW are clustered around periods at 4:30 pm to 6:00pm. At 4:30 pm 1 unit each of Kidston, Urannah, Wivenhoe and Mt Byron are still engaged in pumping. The combination of this pump load with the start of Evening Peak results in large Energy-Gaps. Pumping for PHES should therefore avoid overlapping with the commencement of the Evening Peak.

(b) N-1 Transmission scenarios

For detail see Table 40 in Section C.

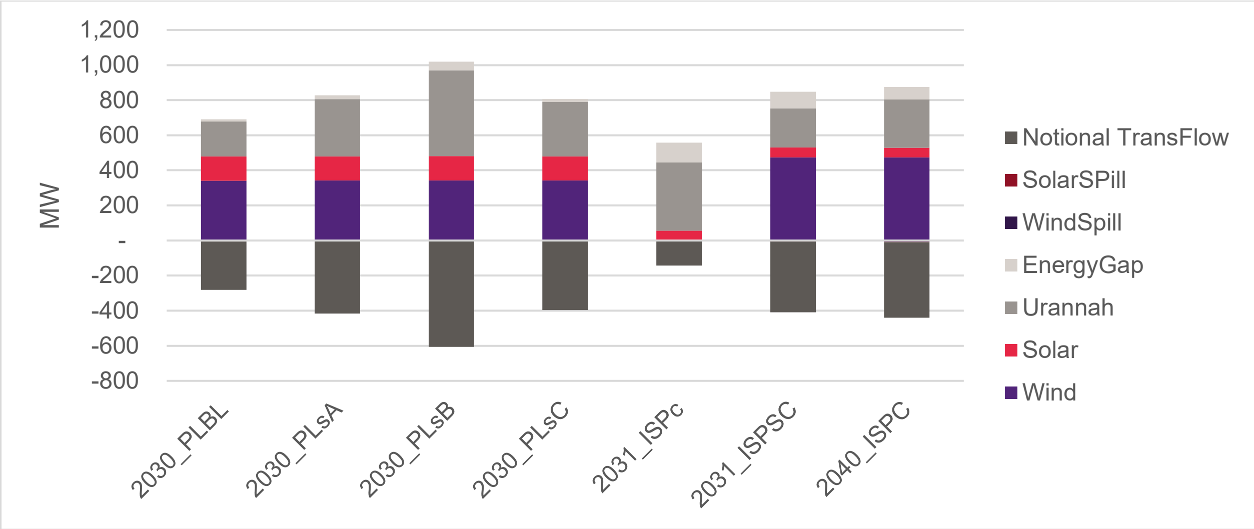

Figure 20: NQ average Summer Evening Peak N-1 flows for scenarios modelled

Under N-1, energy still flows to ROSS in the ISP scenarios, but there is an increase in flows into NQ node from CWQ. Consequently, the Energy-Gap under N-1 decreases for the ISP scenarios.

iv. NQ Winter Daytime flows

(a) N Transmission scenarios

For detail see Table 41 in Section C.

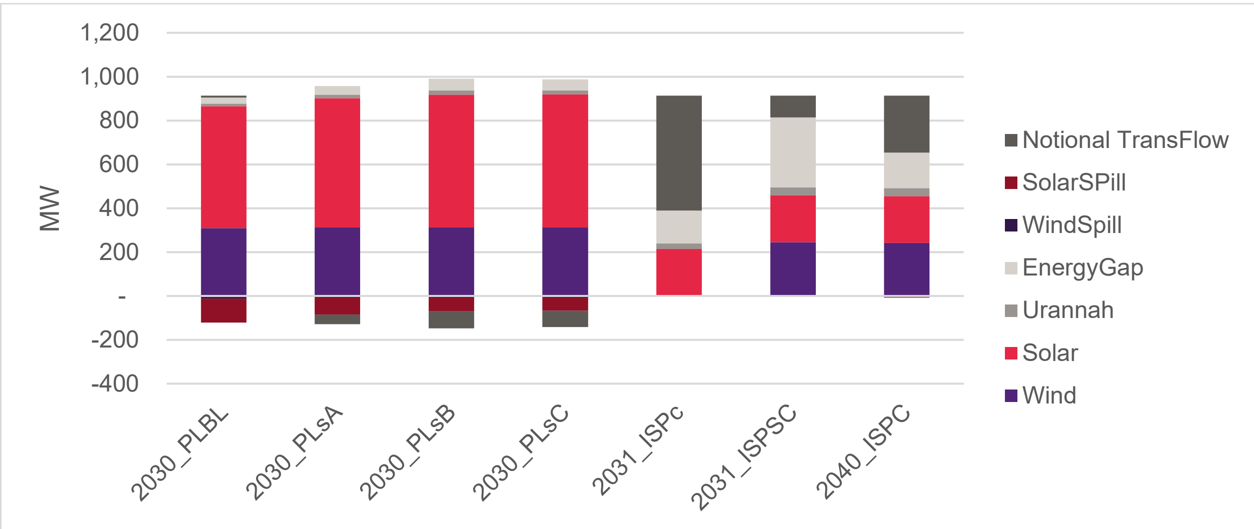

Figure 21: NQ average Winter Daytime N flows for scenarios modelled

There is still solar spillage in the Pipeline scenarios during the day in winter; 16% decreasing to 9% as coal units are removed. Energy-Gap in the ISP scenarios increases over that in summer, reflecting the impact of Urannah pump load on smaller solar capacity. Energy flows in to NQ from ROSS (except in 2030C) and out of NQ to CWQ (except in 2030C).

(b) N-1 Transmission scenarios

For detail see Table 42 in Section C.

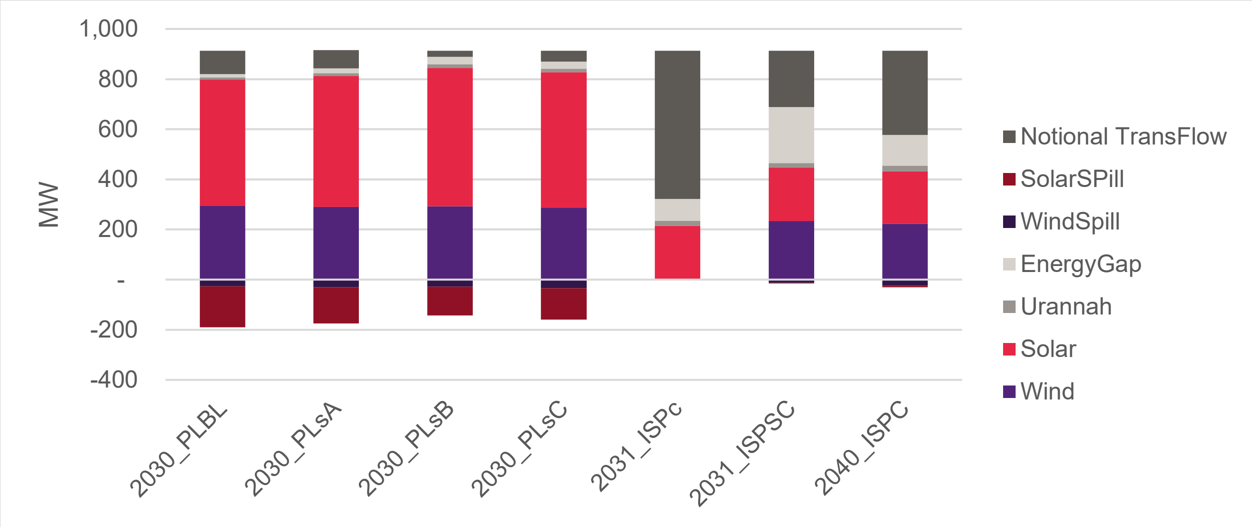

Figure 22: NQ average Winter Daytime N-1 flows for scenarios modelled

Solar spillage increases under restricted N-1 network conditions in the Pipeline scenarios to 24%, decreasing to 17% as coal units are removed. In line with reduced energy flows, Energy-Gap decreases for 2030SC, although energy directional flows remain largely consistent with full network conditions.

v. NQ Winter Evening Peak flows

(a) N Transmission scenarios

For detail see Table 43 in Section C.

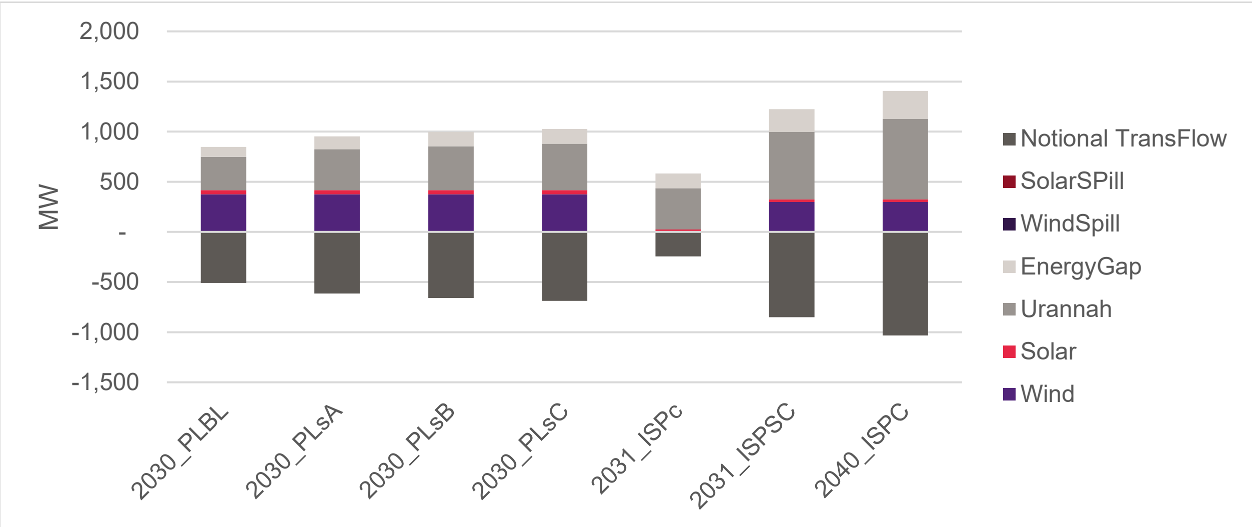

Figure 23: NQ average Winter Evening Peak N flows for scenarios modelled

Under the Pipeline scenarios, inward energy flows continue from ROSS, but flows to CWQ are larger, leading to an increasing Energy-Gap as coal units are removed in CWQ and GLAD. Under the ISP scenarios, flows from ROSS are reduced and as coal units are removed, flows to CWQ increase, which in turn increases the Energy-Gap at the node.

(b) N-1 Transmission scenarios

For detail see Table 44 in Section C.

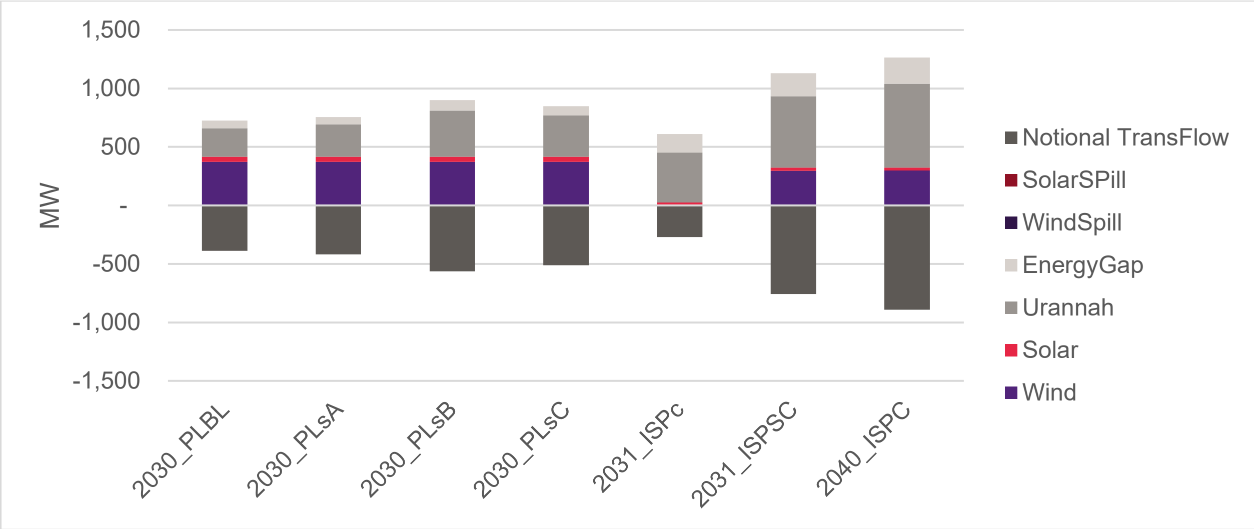

Figure 24: NQ average Winter Evening Peak N-1 flows for scenarios modelled

Although still large, the Energy-Gap is reduced under N-1, as are flows to CWQ.

d. Central West Queensland (CWQ)

i. Node characteristics

CWQ has considerable thermal generation including Callide B (700MW), Callide C (840MW), Stanwell (1400MW) and Barcaldine (56MW). The owner of Callide B has announced that the power station is scheduled to close in 2028. Solar generation already in operation includes Lilyvale, (118MW), Clermont (92MW) Emerald (72MW), Rugby Run (65MW), Barcaldine (20MW) and Longreach (14MW).

Demand in NQ is estimated to vary between 238MW during sunlight hours and 692MW at peak during summer, reducing to 183MW during sunlight hours and 599 MW at peak during winter.

Transmission between CWQ and NQ provides transfer capacity of 3343 MW in summer and 3737 MW in winter, reducing to 2247 MW in summer and 2506 MW in winter under restrictive N-1 conditions. Transmission between CWQ and TAR provides transfer capacity of 2192 MW in summer and 2460 MW in winter, reducing to 1096 MW in summer and 1230 MW in winter under restrictive N-1 conditions. Transmission between CWQ and GLAD provides transfer capacity of 1528 MW in summer and 1741 MW in winter reducing to 980 MW in summer and 1126 MW in winter under restrictive N-1 conditions. CWQ currently distributes energy to both northern and southern nodes.

Table 5: CWQ generation capacity for scenarios modelled

Central West Queensland Generation	Existing (MW)	Pipeline Scenarios	ISP 2030 Central	ISP 2030 Step Change	ISP 2040 Central
Coal	2940	2240 (BL) 1890 (sA) 1540 (sB) 2240 (sC)	2240	2240	2240
Gas	56	56	56	-	-
Wind	0	180	306	900	900
Solar	382	943	1494	343	1494
Total	3378	3419	4096	3483	4634

Pipeline scenarios consider a variety of coal unit closures at Stanwell to assess the impact of the closure on energy flows. Banana Range (180MW) is the only wind project included in Pipeline proposals. ISP scenarios include higher levels of added wind. Solar proposals included in Pipeline scenarios include: Rugby Run2 (105MW), Rolleston (100MW), Ullogie (180MW), Moura (92MW), Tieri (77MW), Longreach (25MW), Barcaldine2 (22MW).

ii. CWQ Summer Daytime flows

(a) N Transmission scenarios

For detail see Table 49 in Section C.

Figure 25: CWQ average Summer Daytime N flows for scenarios modelled

Thermal generation in 2030 ranges between 1953MW in 2030SC under the assumption that GPS is closed and 1012MW in sB under the assumption that 2 units of Stanwell and 4 units of GPS are removed. The addition of around 1100MW of solar in all but the 2030SC scenario and 900MW of wind in the ISP high VRE scenarios creates large generation capacity. In the Pipeline scenarios around 40% of energy generated in CWQ flows to TAR. That reduces in the ISP high VRE scenarios to around 22% as more energy flows to NQ to meet pump load, and more energy flows to GLAD to replace GPS. Except for ISP 2030C, 46-59% of energy generated in CWQ flows to GLAD.

Low addition of wind results in no spillage of wind in the Pipeline scenarios but higher addition in the ISP high VRE scenarios 3-6% of wind is spilled. Solar spillage is 19% in the BL scenario reducing to 10% as coal units are removed. The ISP Central scenarios with high levels of solar additions also experience spillage of 5-8%.

There is some evidence of congestion on the transmission line to GLAD, particularly in the sC (12%) and 2040C (10%) scenarios.

The Energy-Gap appears to be negligible.

(b) N-1 Transmission scenarios

For detail see Table 50 in Section C.

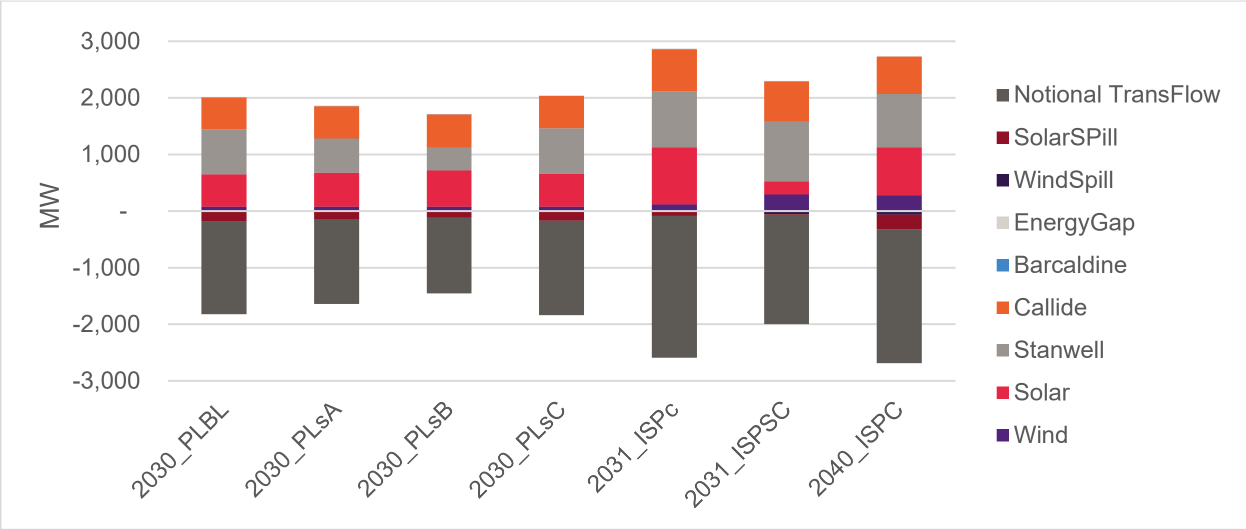

Figure 26: CWQ average Summer Daytime N-1 flows for scenarios modelled

Energy flows away from CWQ are reduced, specifically flows to TAR which mostly decrease by approximately 50% under N-1. Energy flows to GLAD remain higher but because of the thermal limit on the CWQ-GLAD line, is capped at 980MW and there is evidence of significant congestion (76-97% in the Pipeline scenarios, 33-63% in the ISP scenarios.

The consequence of restricted network capacity is higher spillage of solar energy 24% in BL reducing to 15% as coal units are removed. The ISP 2040C scenario also shows 23% solar spillage.

There are also small reductions in coal generation as a result of restricted network capacity.

iii. CWQ Summer Evening Peak flows

(a) N Transmission scenarios

For detail see Table 51 in Section C.

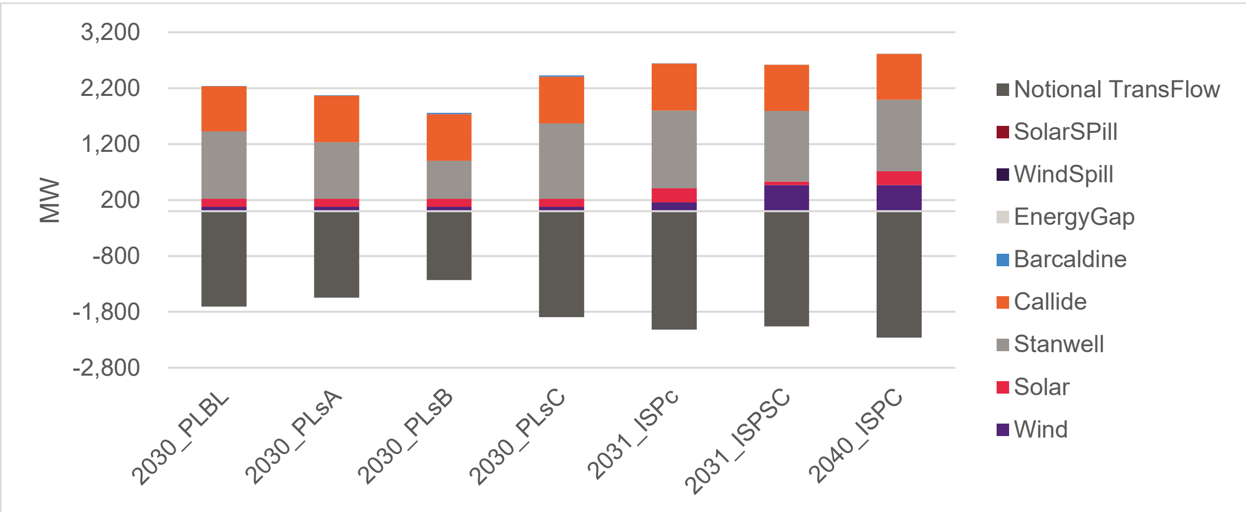

Figure 27: CWQ average Summer Evening Peak N flows for scenarios modelled

The loss of solar at the Evening Peak is filled by additional thermal, and the increase in load for Evening Peak, from Callide but more from Stanwell. Energy flows primarily to GLAD, but also sizeable loads to TAR of 503-821MW in the Pipeline scenarios and 377-710 in the ISP scenarios.

Even under unrestricted network capacity and the higher winter thermal limits, the CWQ-GLAD transmission lines shows congestion 54-58% of the time under the ISP high VRE scenarios.

(b) N-1 Transmission scenarios

For detail see Table 52 in Section C.

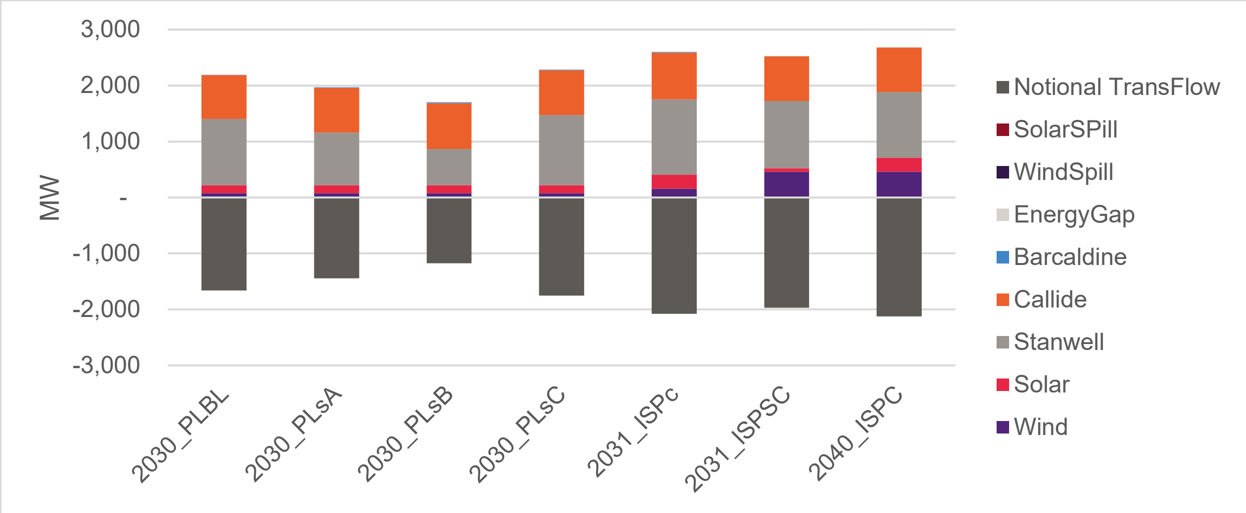

Figure 28: CWQ average Summer Evening Peak N-1 flows for scenarios modelled

Energy flows to GLAD reduce to match the summer thermal limit of 980MW, but flows to TAR also reduce. Due to the quantum of energy flowing to GLAD, specifically in the ISP high VRE scenarios, the transmission line is almost constantly congested.

iv. CWQ Winter Daytime flows

(a) N Transmission scenarios

For detail see Table 53 in Section C.

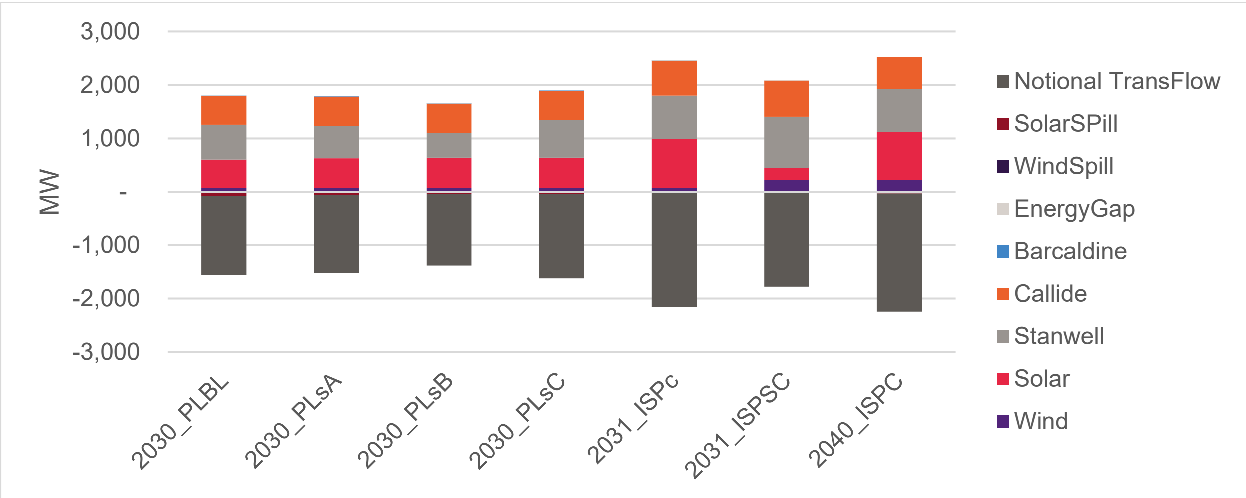

Figure 29: CWQ average Winter Daytime N flows for scenarios modelled

There is still solar spillage in the Pipeline scenarios during the day in winter; 13% decreasing to 7% as coal units are removed and 3% in the ISP 2040C scenario. In line with reduced load, thermal generation also decreases relative to summer.

Energy flows to TAR, as a proportion of energy generated in the node, increase to 43-48% in Pipeline scenarios BL, sA, sB but up to 75% in sC as energy flows to replace TPS units 1-4 which are withdrawn. Flows to TAR under the ISP scenarios are lower at 23-26%.

(b) N-1 Transmission scenarios

For detail see Table 54 in Section C.

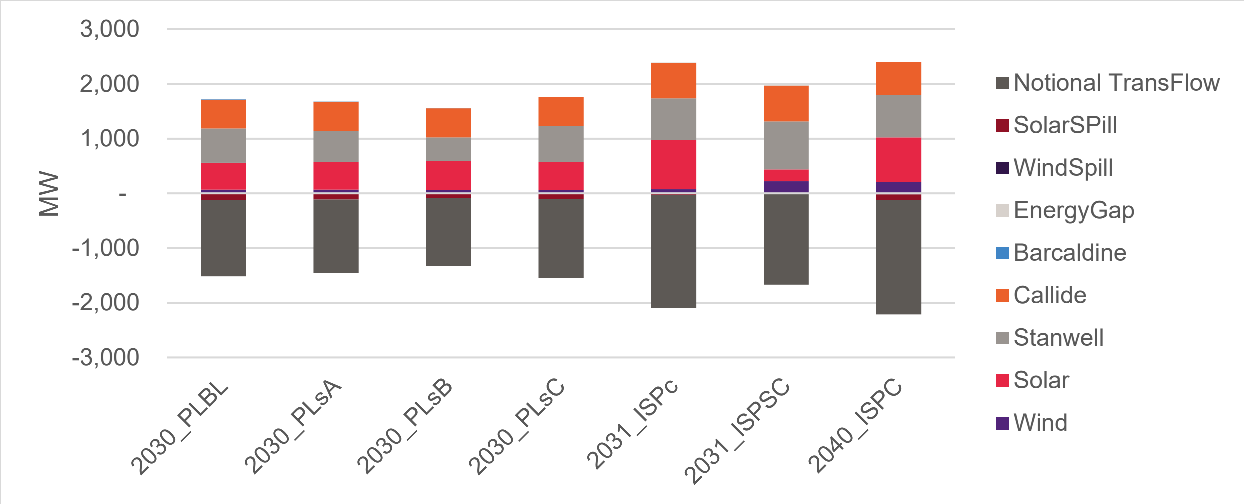

Figure 30: CWQ average Winter Daytime N-1 flows for scenarios modelled

Solar spillage increases under restricted N-1 network conditions in the Pipeline scenarios to 20%, decreasing to 14% as coal units are removed. There are reductions in flows to both TAR and GLAD under N-1, but the thermal limits for the CWQ-GLAD transmission line are higher and therefore congestion is not as severe as in summer.

v. CWQ Winter Evening Peak flows

(a) N Transmission scenarios

For detail see Table 55 in Section C.

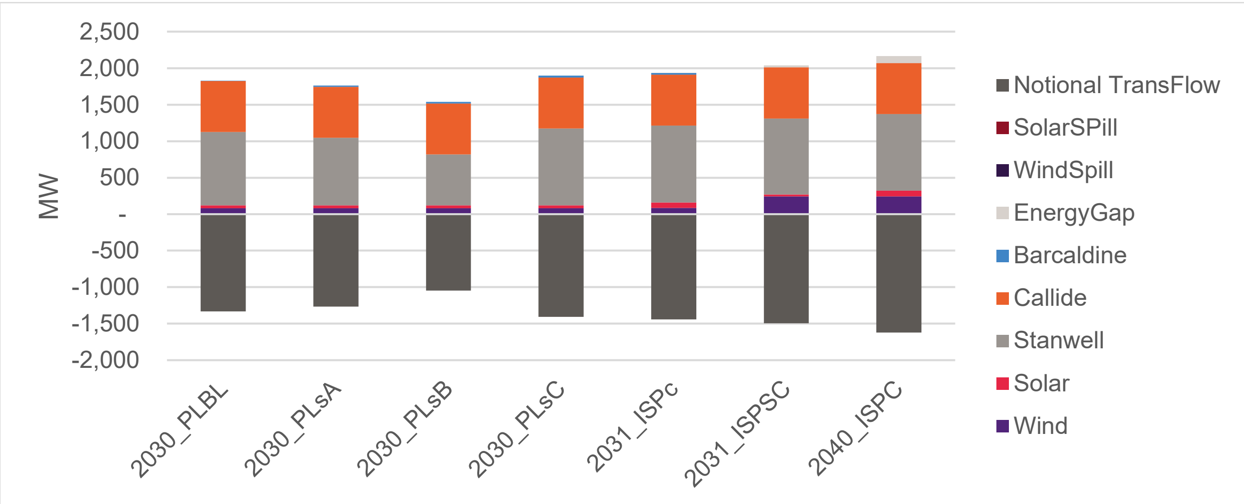

Figure 31: CWQ average Winter Evening Peak N flows for scenarios modelled

Energy flows are as expected in the Winter Evening Peak. The unexpected outcome for the ISP high VRE scenarios is congestion on the CWQ-GLAD transmission line 11-13% of the time, and the emergence of an average Energy-Gap of 96MW in the 2040C scenario. An Energy-Gap in CWQ would appear to be a contradiction for a node with as much capacity as is available in CWQ. The problem however is created by very low levels of wind across the state, which results in a statewide deficit which can only be resolved by the creation of Energy-Gaps in each node.

(b) N-1 Transmission scenarios

For detail see Table 56 in Section C.

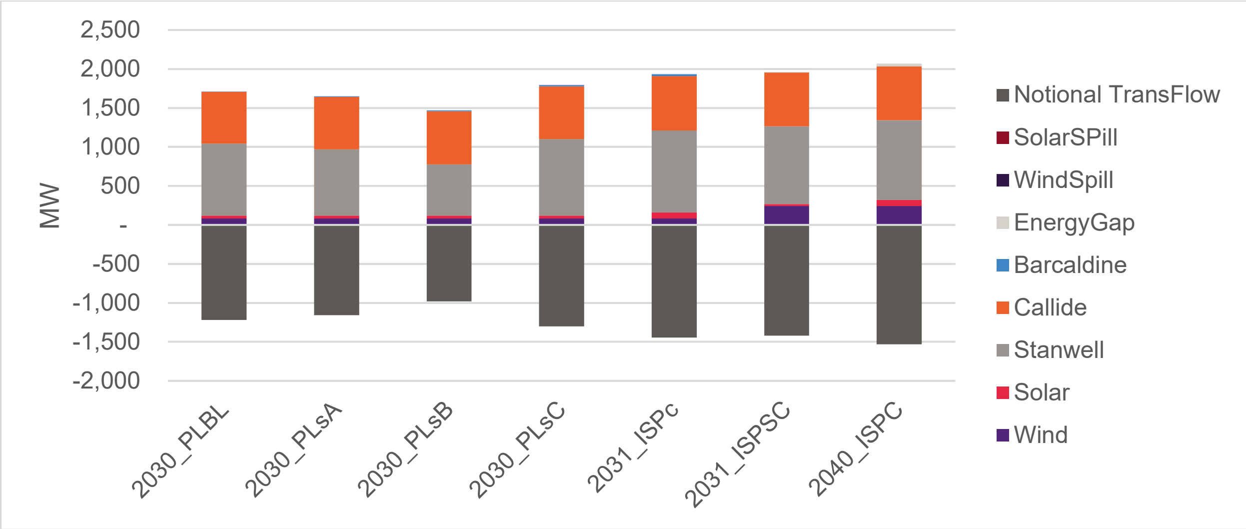

Figure 32: CWQ average Winter Evening Peak N-1 flows for scenarios modelled

The average flows under the restrictive N-1 are broadly similar to the N scenario except for reduced flows, especially flows to GLAD. This reduces the deficit within CWQ in the Winter Evening Peak when wind resource is very low.

e. Gladstone (GLAD)

i. Node characteristics

The 6 units at GPS (1680 MW) were built to supply the Boyne Smelter in the 1980s and is the oldest coal-fired power station in Queensland. GPS has a unique relationship with the smelter in that units 3 and 4 have a direct transmission link to the smelter to guarantee supply in the event of grid failure or congestion. The only other generation in GLAD is the Yarwun combined cycle gas turbine (154 MW) which supplies Queensland Alumina and also to the grid.

Demand in GLAD is relatively constant thanks to the Boyne Smelter, estimated to average between 980MW during sunlight hours and 1114MW at peak during summer and winter.

Transmission between GLAD and CWQ provides transfer capacity of 1528 MW in summer and 1741 MW in winter reducing to 980 MW in summer and 1126 MW in winter under restrictive N-1 conditions. Transmission between GLAD and WB provides transfer capacity of 2302 MW in summer and 2417 MW in winter, reducing to 1506 MW in summer and 1534 MW in winter under restrictive N-1 conditions. Gladstone provides a transmission corridor to WB and NM.

Table 6: GLAD generation capacity for scenarios modelled

Gladstone Generation	Existing (MW)	Pipeline Scenarios	ISP 2030 Central	ISP 2030 Step Change	ISP 2040 Central
Coal	1680	1680 (BL) 560 (sA) 560 (sB) 560 (sC)	1680	-	-
Gas	154	154	154	154	154
Wind	0	0	0	0	0
Solar	0	795	515	515	515
Total	1834	2629	2349	669	669

There are no wind projects in the pipeline for GLAD. Solar projects in the pipeline include Aldoga (265MW), Bororen (250MW) and Raglan (280MW). Other than that GLAD is reliant on flows from CWQ to meet demand. The ISP scenarios include a modest 515MW addition of solar by 2030.

Pipeline scenarios sA, sB and sC consider the closure of units 1,2,5 and 6 of GPS. ISP Scenarios 2030SC and 2040C exclude all GPS units.

ii. GLAD Summer Daytime flows

(a) N Transmission scenarios

For detail see Table 61 in Section C.

Figure 33: GLAD average Summer Daytime N flows for scenarios modelled

In all the scenarios, GLAD serves as a transmission corridor of flows from CWQ and the northern nodes to WB and NM. Across all the Pipeline scenarios, flows to GLAD from CWQ in BL are 954MW increasing to 1205MW in sC. Flows out of GLAD range from 1046MW in BL decreasing to 756MW in sB. In the ISP scenarios, inward flows from CWQ to GLAD increase from 800MW in 2030C to 1398MW in 2040C with outward flows to WB decreasing from 1342MW in 2030C to 621MW in 2030SC.While all units at GPS are generating, GLAD exports energy southwards, but as GPS units are removed, GLAD needs greater flows of energy from CWG to meet its own demand.

The ISP 2030C scenario has GPS generating at 82% capacity which explains the large flows of energy southwards in this scenario. The ISP high VRE scenarios include no capacity from GPS, and thus become heavily reliant on flows of energy from CWQ to meet demand, as VRE capacity in the ISP Central and Step Change scenarios is insufficient to counteract the shortfall in generation in the node.

Solar energy generated during the day is 46% of demand, rising to 51% as units are removed at GPS, in the Pipeline scenarios. THE ISP scenarios have very modest solar additions such that solar only contributes 32-34% to nodal demand.

There is some evidence of an Energy-Gap in the ISP scenarios although these are still relatively small.

(b) N-1 Transmission scenarios

For detail see Table 62 in Section C.

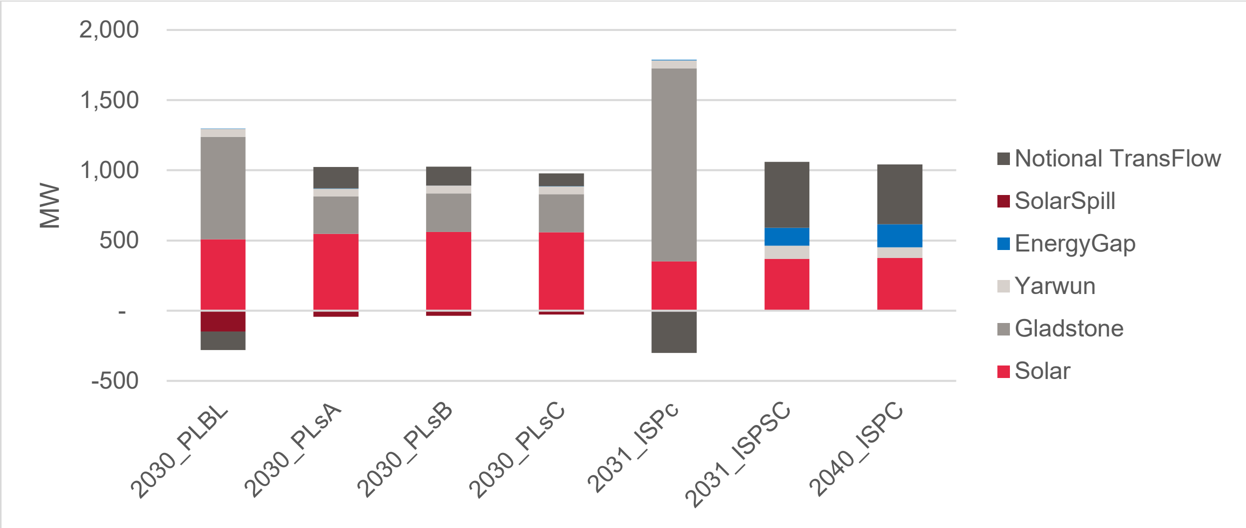

Figure 34: GLAD average Summer Daytime N-1 flows for scenarios modelled

The situation under N-1 does not change significantly from that under the unrestricted network, although energy flows from CWQ reduce because of a 980MW thermal limit on the transmission line, specifically in the ISP high VRE scenarios where they reduce by up to 40%. Energy flows to WB also reduce by up to 40% in the ISP high VRE scenarios but the absolute amount of reduction is insufficient to counteract the reduced supply of energy and the emergence of a sizeable Energy-Gap (128-165MW).

The other consequence of restricted network capacity is higher spillage of solar energy 24% (up from 15%) in BL but reduced spillage as coal units are removed 5% (down from 6%).

iii. GLAD Summer Evening Peak flows

(a) N Transmission scenarios

For detail see Table 63 in Section C.

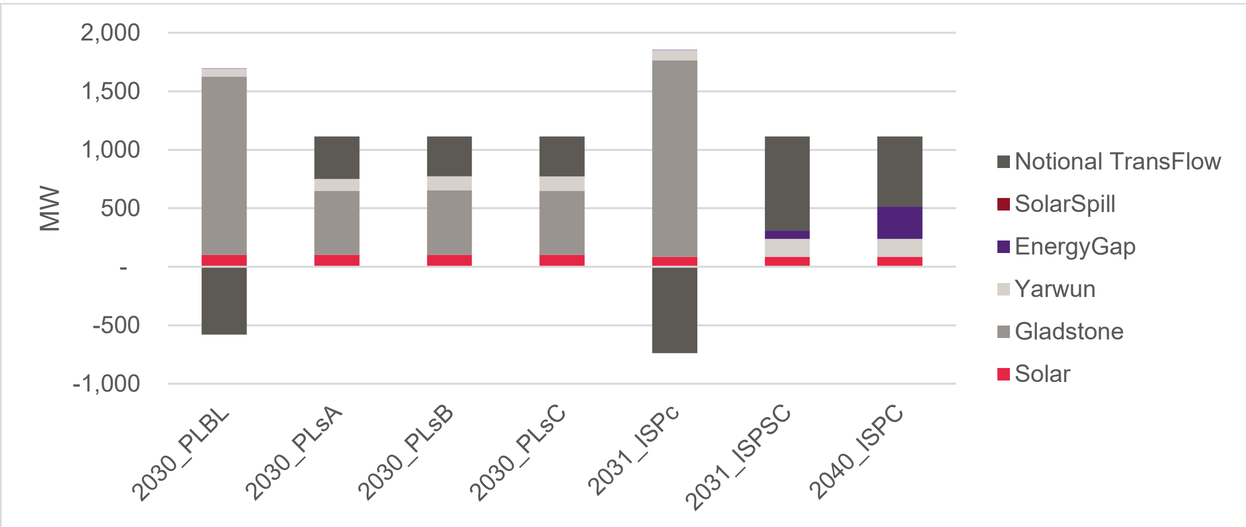

Figure 35: GLAD average Summer Evening Peak N flows for scenarios modelled

While all 6 units are dispatching at GPS, energy flows to WB and NM in large quantities. The loss of solar at the Evening Peak makes GLAD entirely reliant on energy flows from CWQ in the ISP high VRE scenarios. The flows in to GLAD are sufficient to avoid a large Energy-Gap.

(b) N-1 Transmission scenarios

For detail see Table 64 in Section C.

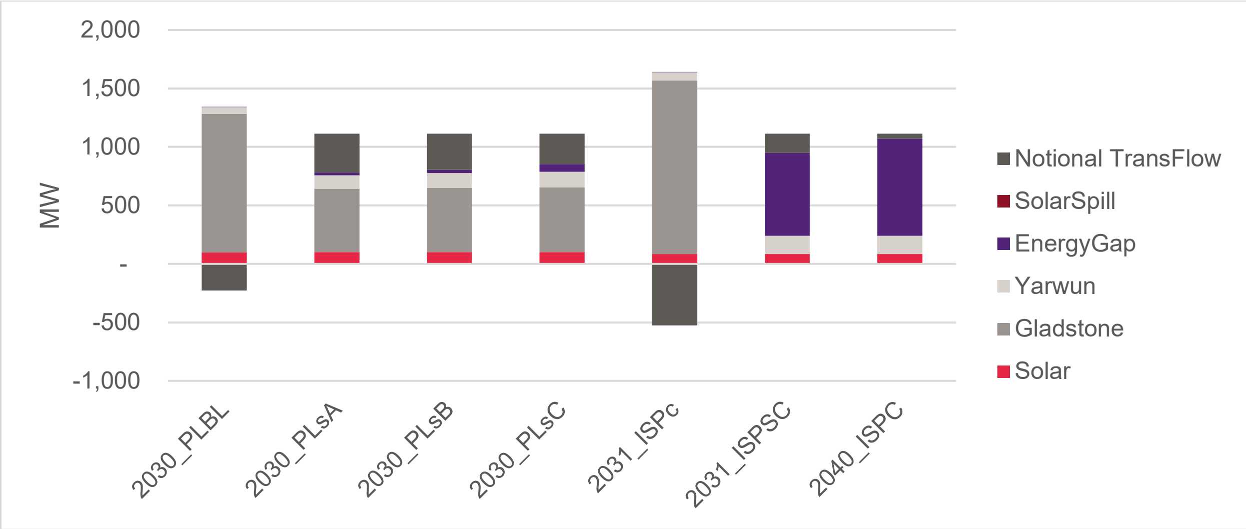

Figure 36: GLAD average Summer Evening Peak N-1 flows for scenarios modelled

Energy flows from CWQ to GLAD reduce to match the summer thermal limit of 980MW, which can be accommodated by GPS when even 2 units are still in operation, but results in large Energy-Gaps in the ISP high VRE scenarios (709-829MW).

iv. GLAD Winter Daytime flows

(a) N Transmission scenarios

For detail see Table 65 in Section C.

Figure 37: GLAD average Winter Daytime N flows for scenarios modelled

Winter Daytime flows are much the same as Summer Daytime flows, except slightly reduced. Solar represents 37-42% of nodal demand in the Pipeline scenarios and 28-29% in the ISP scenarios. Spillage for the Pipeline scenarios decrease from 18% in BL to 8% in sC.

(b) N-1 Transmission scenarios

For detail see Table 66 in Section C.

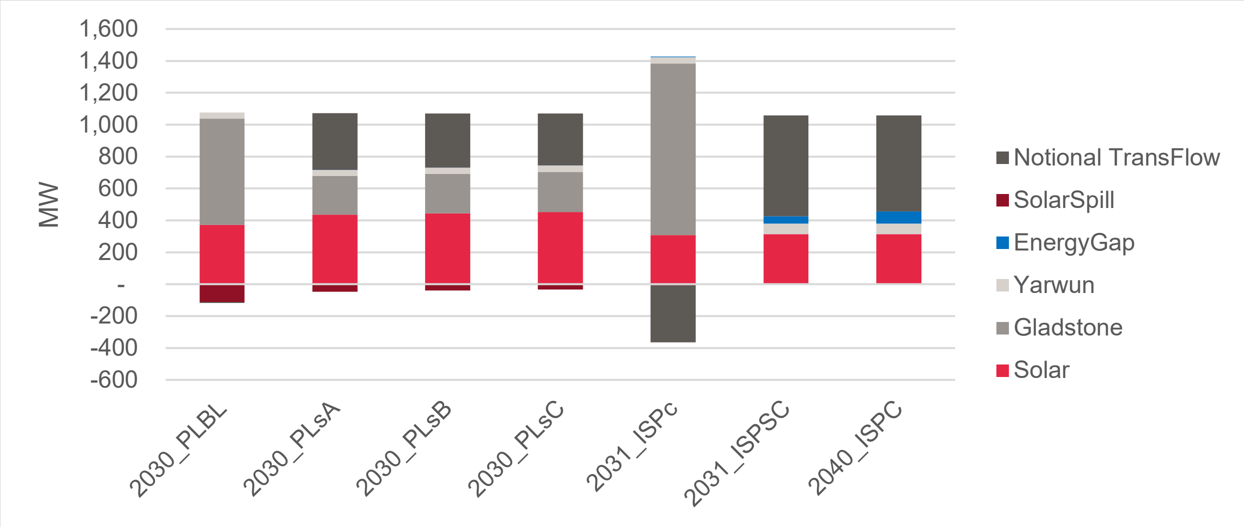

Figure 38: GLAD average Winter Daytime N-1 flows for scenarios modelled

Solar spillage increases under restricted N-1 network conditions in the Pipeline scenarios to 23%, decreasing to 7% as coal units are removed. Solar generation as a percentage of nodal demand remains the same.

v. GLAD Winter Evening Peak flows

(a) N Transmission scenarios

For detail see Table 67 in Section C.

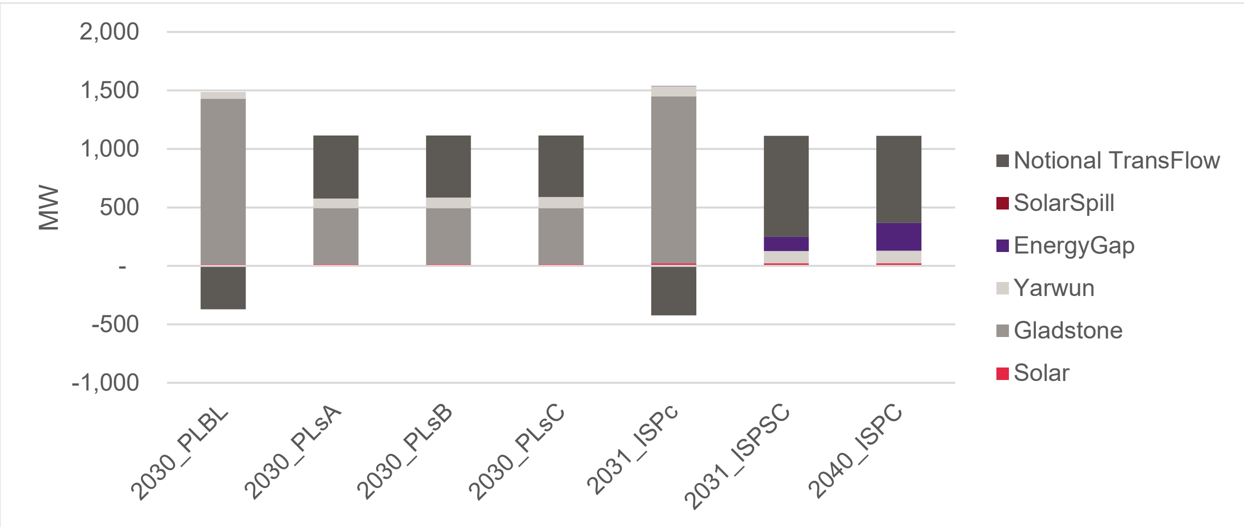

Figure 39: GLAD average Winter Evening Peak N flows for scenarios modelled

Winter Evening Peak is not remarkably different to Summer Evening Peak although the Energy-Gap increases in the ISP high VRE scenarios to 119-238MW, for all the reasons mentioned previously.

(b) N-1 Transmission scenarios

For detail see Table 68 in Section C.

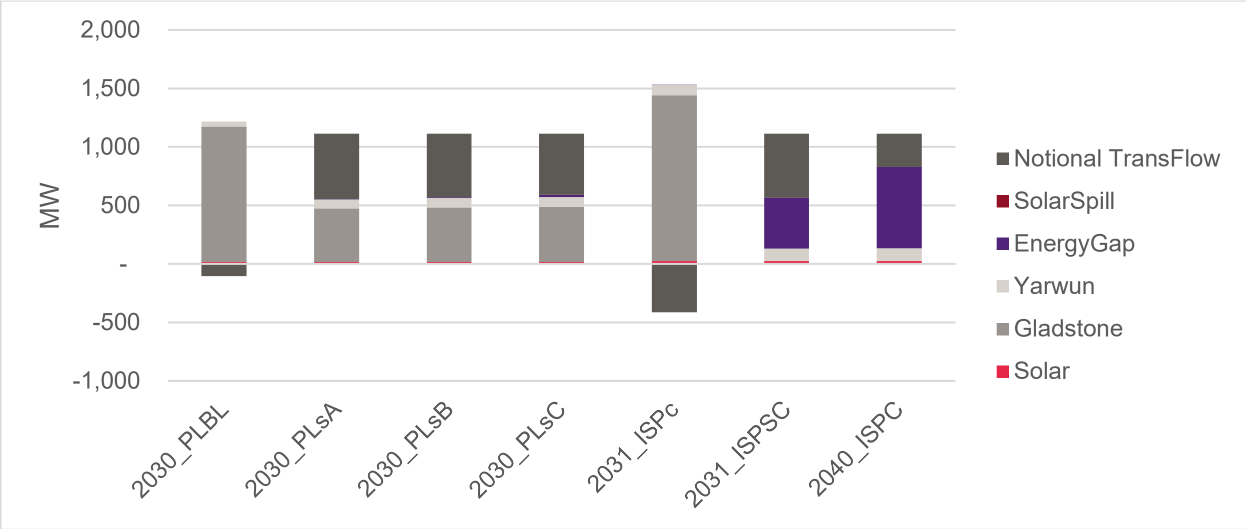

Figure 40: GLAD average Winter Evening Peak N-1 flows for scenarios modelled

With reduced flows from CWQ and an ongoing requirement to serve load in WB and NM, GLAD is unable to source adequate energy for nodal demand and a very large Energy-Gap becomes apparent (434-695MW).

f. Wide Bay (WB)

i. Node characteristics

WB currently has only 141MW of solar generation commissioned (Susan River (85MW), Childers (75MW)) within the node.

Demand in WB is estimated to vary between 122MW during sunlight hours and 361MW at peak during summer, reducing to 82MW during sunlight hours and 282 MW at peak during winter.

Transmission between WB and GLAD provides transfer capacity of 2302 MW in summer and 2417 MW in winter, reducing to 1506 MW in summer and 1534 MW in winter under restrictive N-1 conditions. Transmission between WB and NM provides transfer capacity of 1595 MW in summer and 1767 MW in winter, reducing to 797 MW in summer and 883 MW in winter und restrictive N-1 conditions. WB can also be described as a transmission corridor because it transfers energy from GLAD and CWQ to NM.

Table 7: WB generation capacity for scenarios modelled

Wide Bay Generation	Existing (MW)	Pipeline Scenarios	ISP 2030 Central	ISP 2030 Step Change	ISP 2040 Central
Wind	0	1200	0	0	0
Solar	141	808	173	500	500
Total	141	2008	173	500	500

There is one large wind farm, Forest WF, proposed in the pipeline for WB but not in the ISP scenarios. Solar projects in the pipeline include Munna Creek (120MW), Aramara (112MW), Teebar (52.5MW) and Lower Wonga (350MW). Other than that WB is reliant on flows from GLAD and ultimately CWQ to meet demand. The ISP high VRE scenarios include a modest 500MW addition of solar by 2030.

ii. WB Summer Daytime flows

(a) N Transmission scenarios

For detail see Table 73 in Section C.

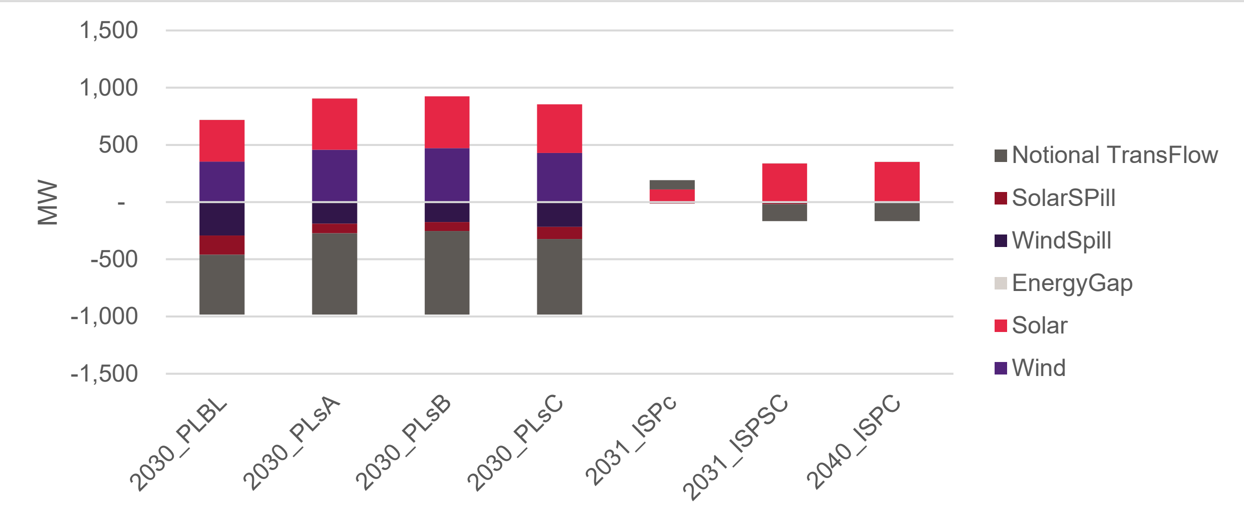

Figure 41: WB average Summer Daytime N flows for scenarios modelled

Solar and wind generate more than enough energy to meet WB demand, such that in all the Pipeline scenarios larger energy flows from WB to NM than flows in to WB from GLAD. Total possible VRE generation is 1175MW in the

Pipeline scenarios but as a result of considerable coal unit operating in CWQ and GLAD in the BL scenario, 45% of wind and 31% of solar is spilled. This reduces to 27% of wind and 14% of solar spilled when 4 units of GPS and 2 units of Stanwell are withdrawn. The ISP scenarios have a modest inclusion of solar and consequently little spillage.

There is evidence of congestion (on 54% - 65% of flows in the Pipeline scenarios) on the transmission line to NM.

(b) N-1 Transmission scenarios

For detail see Table 74 in Section C.

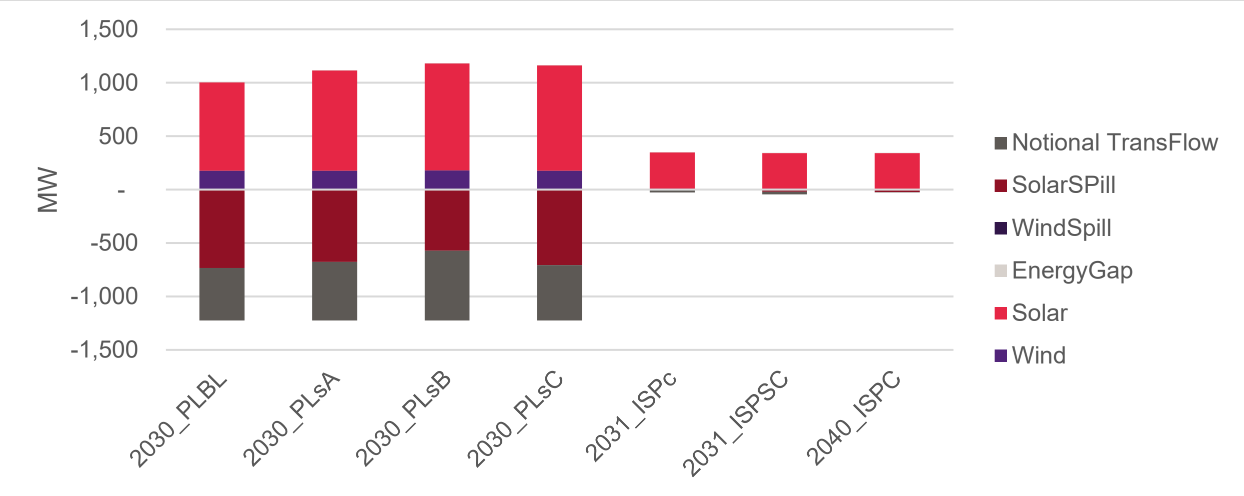

Figure 42: WB average Summer Daytime N-1 flows for scenarios modelled

The situation under N-1 significantly reduces the opportunity to export the surplus energy from VRE generation. Consequently 94% of wind and 91% of solar is spilled in the BL scenario, reducing to 74% and 72% spilled in sB when 2 units and Stanwell and 4 units at GPS are withdrawn. Congestion on the transmission lines to NM becomes habitual between 95% of 98% in the Pipeline scenarios. There are also high levels of congestion on the transmission line to NM in the ISP 2030C scenario.

iii. WB Summer Evening Peak flows

(a) N Transmission scenarios

For detail see Table 75 in Section C.

Figure 43: WB average Summer Evening Peak N flows for scenarios modelled

Spilled wind energy is reduced in the Sumer Evening Peak to 4% of wind, reducing to 2% in sB. There is no evidence of any spillage in the ISP scenarios. However, without solar generating during the Evening Peak and without wind capacity added to meet demand in the ISP high VRE scenarios, there is evidence of a growing Energy-Gap (33-116MW).

(b) N-1 Transmission scenarios

For detail see Table 76 in Section C.

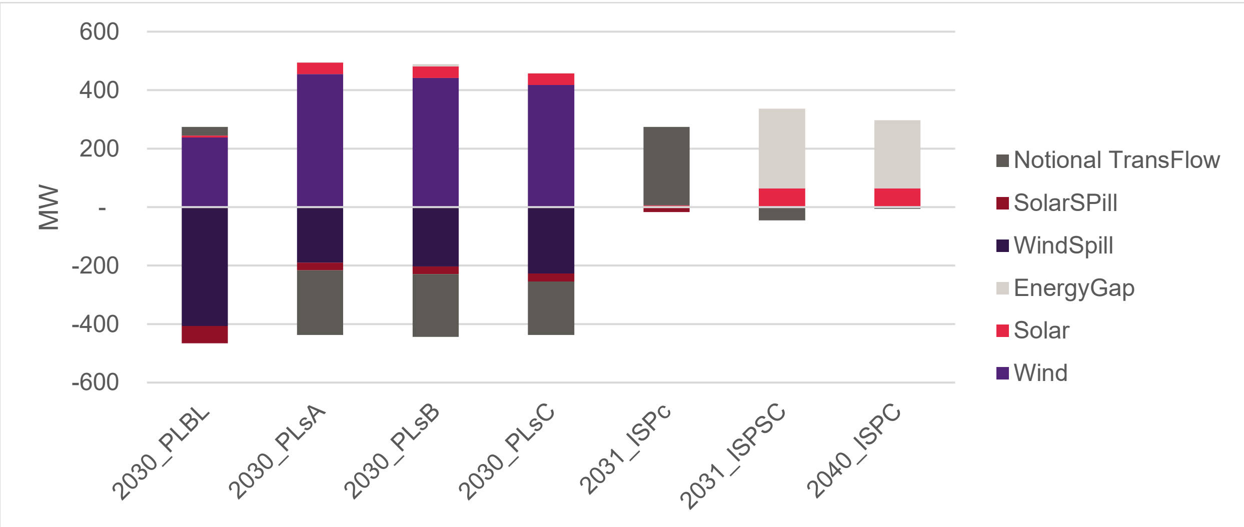

Figure 44: WB average Summer Evening Peak N-1 flows for scenarios modelled

Under a restricted network, very high levels of wind and solar are spilled; 63% of wind in the BL scenario, reducing to 29% in sA. In the ISP high VRE scenarios, a very large Energy-Gap becomes apparent.

iv. WB Winter Daytime flows

(a) N Transmission scenarios

For detail see Table 77 in Section C.

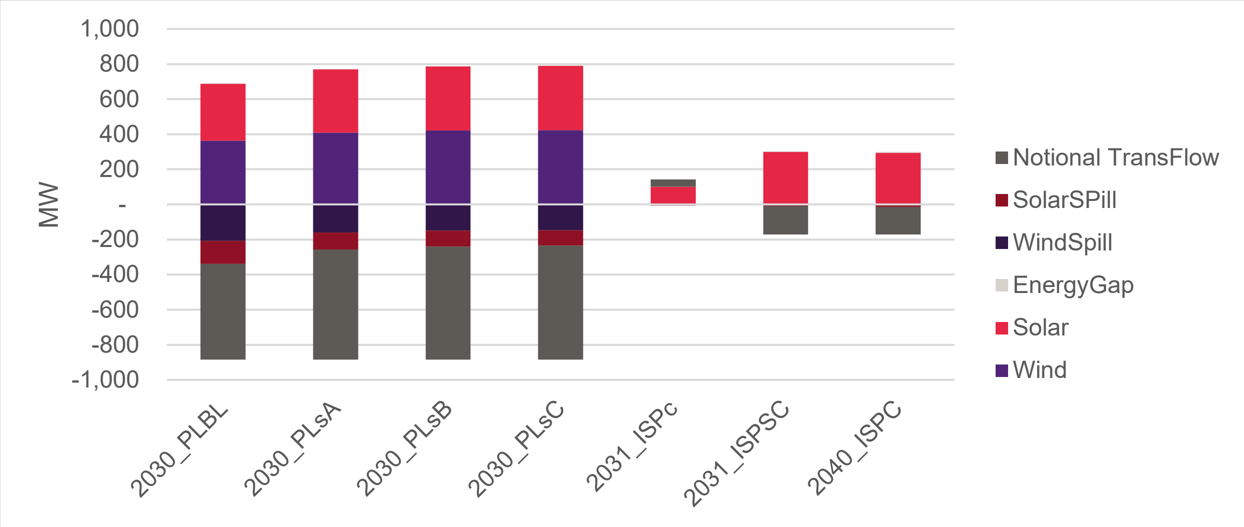

Figure 45: WB average Winter Daytime N flows for scenarios modelled

Winter Daytime flows are much the same as Summer Daytime flows, although spillage reduces from 36% of wind in the BL scenario to 26% as coal units are withdrawn in sB, and solar reduces from 29% in BL to 20% in BL.

(b) N-1 Transmission scenarios

For detail see Table 78 in Section C.

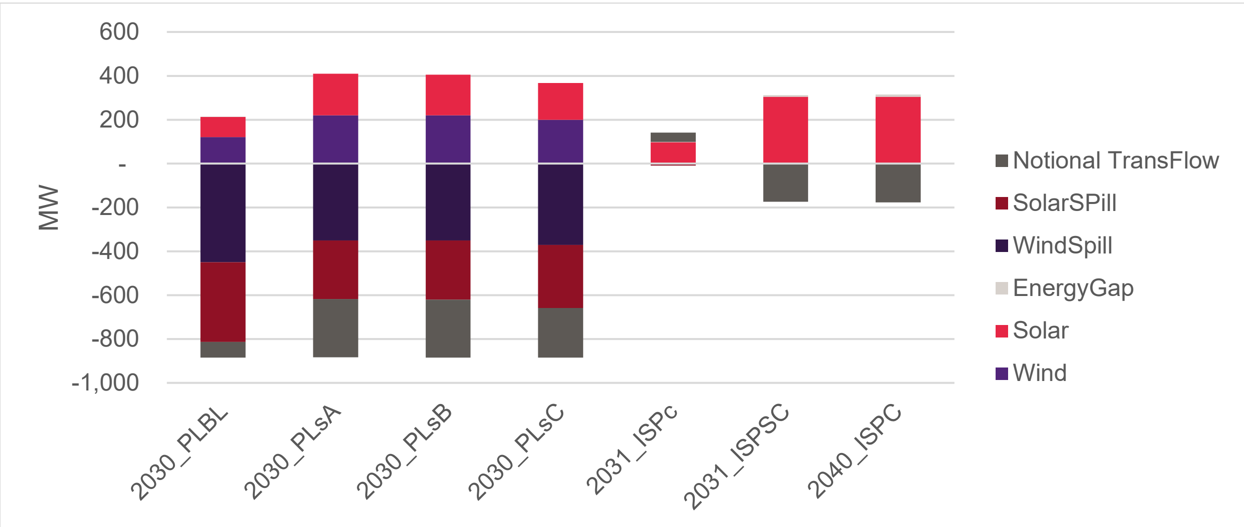

Figure 46: WB average Winter Daytime N-1 flows for scenarios modelled

Solar spillage increases under restricted N-1 network conditions in the Pipeline scenarios to 23%, decreasing to 7% as coal units are removed. Solar generation as a percentage of nodal demand remains the same.

v. WB Winter Evening Peak flows

(a) N Transmission scenarios

For detail see Table 79 in Section C.

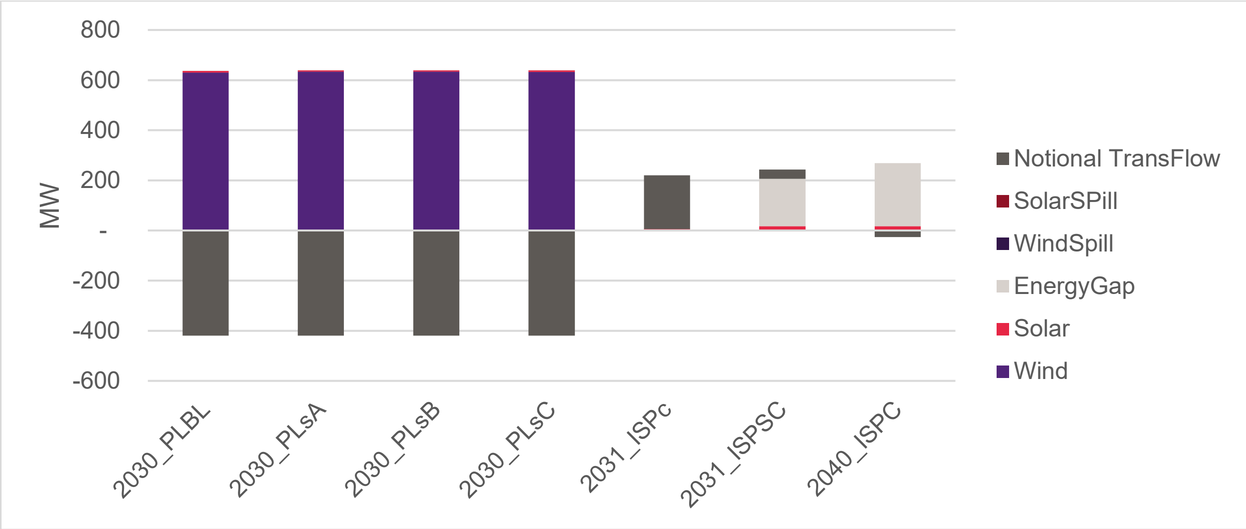

Figure 47: WB average Winter Evening Peak N flows for scenarios modelled

Winter Evening Peak flows are much the same as Summer Evening Peak except that wind spillage is almost eliminated in the Pipeline scenarios and the Energy-Gap increases in the ISP high VRE scenarios to 190-251MW, for all the reasons mentioned previously.

(b) N-1 Transmission scenarios

For detail see Table 80 in Section C.

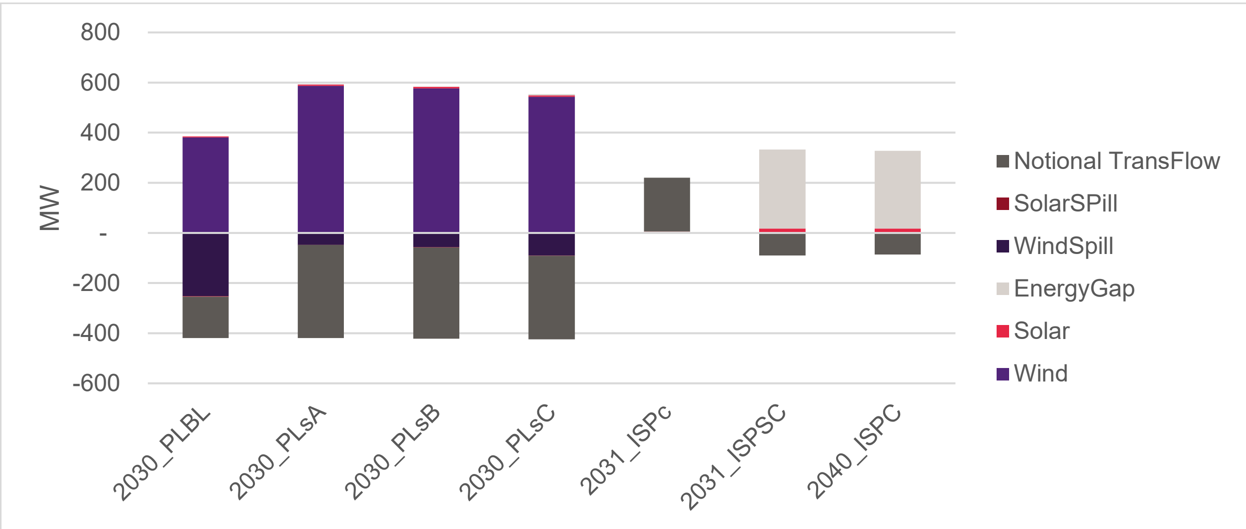

Figure 48: WB average Winter Evening Peak N-1 flows for scenarios modelled

Winter Evening Peak under a restricted network results in significantly reduced wind spillage to 9% in sB but the Energy-Gap increases in the ISP high VRE scenarios to 311-315MW, for all the reasons mentioned previously.

g. Tarong (TAR)

i. Node characteristics

Tarong is home to Tarong Power Stations (TPS) which have a capacity of 1843 MW. Roma, a gas turbine used for peaking, has a capacity of 80 MW. Bakers Board, a 14.7 MW solar farm has been commissioned and Coppers Gap, a 449 MW wind farm, is currently being commissioned.

Demand in TAR is small and estimated to vary between 37 MW during sunlight hours and 119 MW at peak during summer, reducing to 35MW during sunlight hours but increasing to 123 MW at peak during winter.

Transmission between TAR and CWQ provides transfer capacity of 2192 MW in summer and 2460 MW in winter, reducing to 1096 MW in summer and 1230 MW in winter under restrictive N-1 conditions. Transmission between TAR and SWQ provides transfer capacity of 2715 MW in summer and 3047 MW in winter, reducing to 1619 MW in summer and 1817 MW in winter under restrictive N-1 conditions.

Table 8: TAR generation capacity for scenarios modelled

Tarong Generation	Existing (MW)	Pipeline Scenarios	ISP 2030 Central	ISP 2030 Step Change	ISP 2040 Central
Coal	1843	1843 (BL) 1493 (sA) 1143 (sB) 443 (sC)	1843	443	-
Gas	80	80	80		
Wind	449	513	728	1549	728
Solar	15	620	20	20	20
Total	2387	3056	2671	2012	748

There is one additional wind farm, Manneum (64 MW), proposed in the pipeline for TAR. The ISP scenarios. Propose a further 200 MW of wind, 1000 MW in the ISP 2030SC scenario.

Solar projects in the pipeline include Chincilla (100 MW), and Harlan (500 MW). The ISP high scenarios include no further solar by 2030.

ii. TAR Summer Daytime flows

(a) N Transmission scenarios

For detail see Table 85 in Section C.

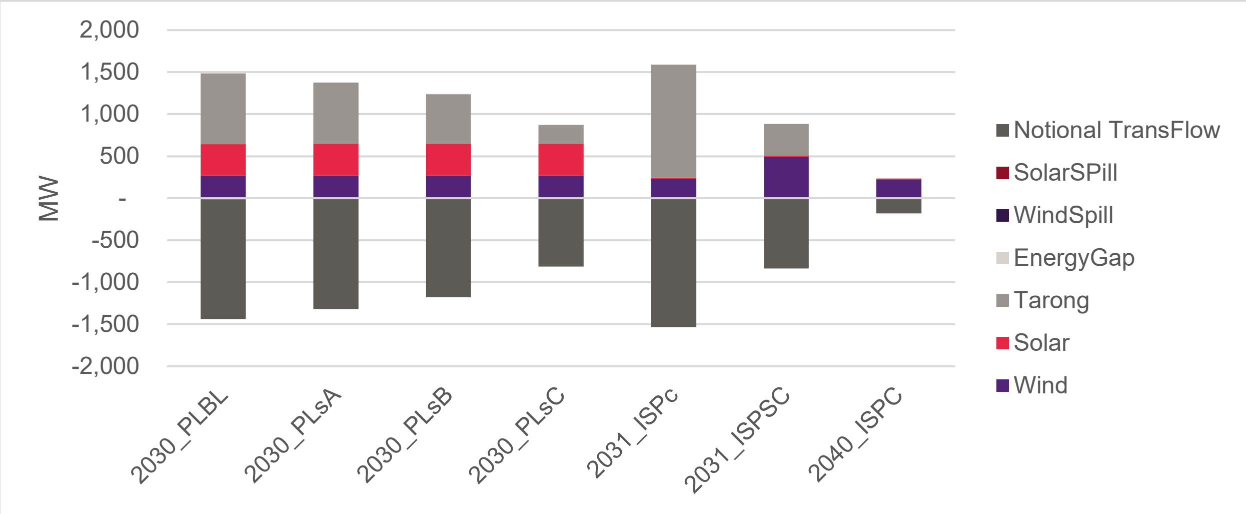

Figure 49: TAR average Summer Daytime N flows for scenarios modelled

Energy flows from CWQ (740–919 MW), to which is added approximately 270 MW of wind, 370-380 MW of solar, and 219 - 850 MW of TPS generation before 350-635 MW flows to SWQ and 1270–1486 MW flows to NM. Flows are similar in the ISP scenarios except for 2040C which adds no generation from TPS as all units are withdrawn, which reduces flows to SWQ to 24 MW and 1084 MW to NM.

There is no evidence of spillage or congestion on either transmission lines to SWQ or NM.

A small Energy-Gap of 5 MW becomes apparent in the 2030SC scenario.

(b) N-1 Transmission scenarios

For detail see Table 86 in Section C.

Figure 50: TAR average Summer Daytime N-1 flows for scenarios modelled

Under a restricted network, flows to SWQ are largely unaffected, and flows to NM reduce, although by only 10-20% except in the 2040C scenario where there is a 48% reduction in flows to NM.

Energy-Gaps of 16-33 MW become apparent in the ISP high VRE scenarios, due to the removal of all TPS units. There is very little spillage of wind and solar in the TAR node.

iii. TAR Summer Evening Peak flows

(a) N Transmission scenarios

For detail see Table 87 in Section C.

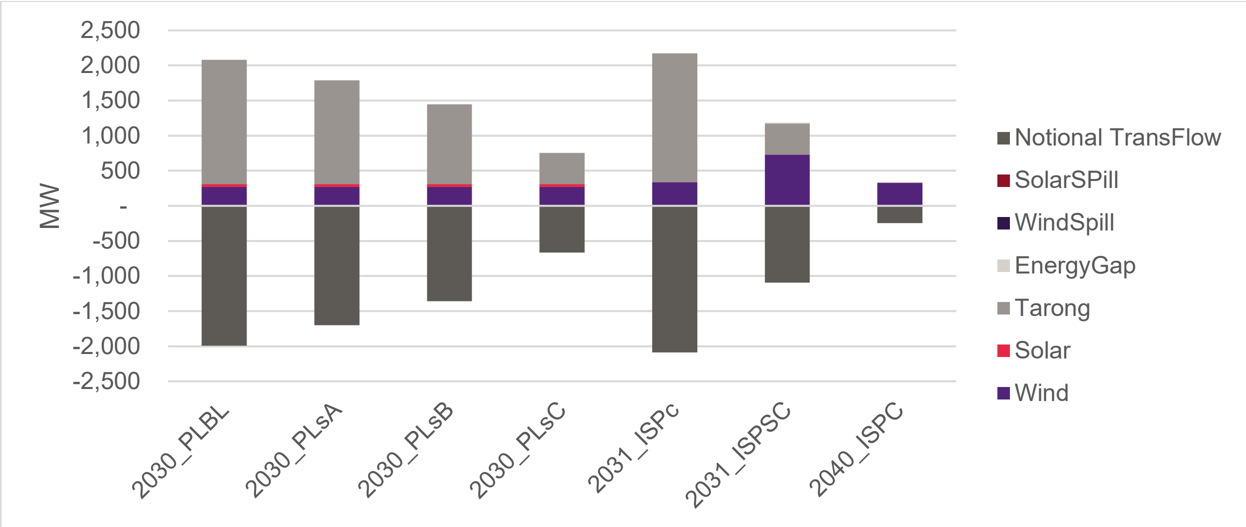

Figure 51: TAR average Summer Evening Peak N flows for scenarios modelled

There is little change in flows in the Summer Evening Peak, other than a reduction in solar energy dispatched, and the increasing evidence of an Energy-Gap in the ISP high VRE scenarios (5-10 MW).

(b) N-1 Transmission scenarios

For detail see Table 88 in Section C.

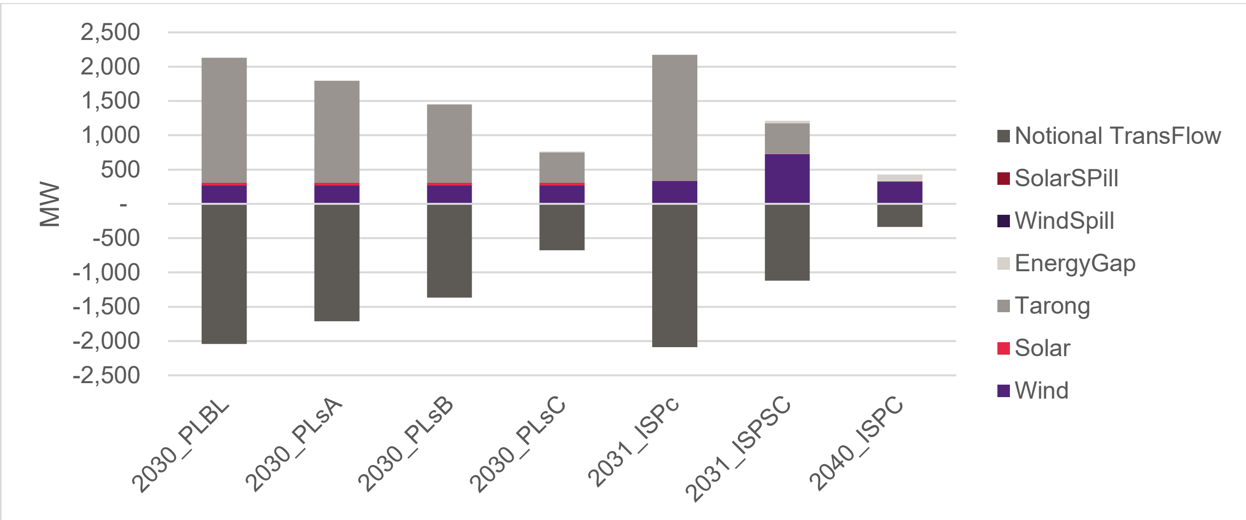

Figure 52: TAR average Summer Evening Peak N-1 flows for scenarios modelled

Under a restricted network, there are small changes to flows but the emergence of sizable Energy-Gaps in the ISP high VRE scenarios with the loss of TPS units and the increasing reliance on wind for meeting the Evening Peak in NM.

iv. TAR Winter Daytime flows

(a) N Transmission scenarios

For detail see Table 89 in Section C.

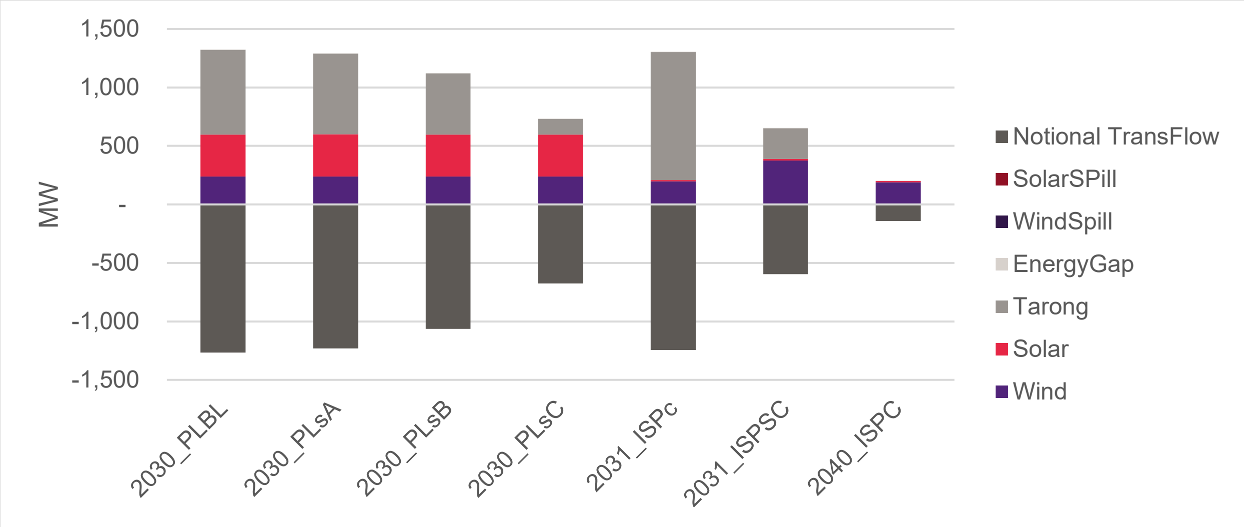

Figure 53: TAR average Winter Daytime N flows for scenarios modelled

Winter Daytime flows are much the same as Summer Daytime flows.

(b) N-1 Transmission scenarios

For detail see Table 90 in Section C.

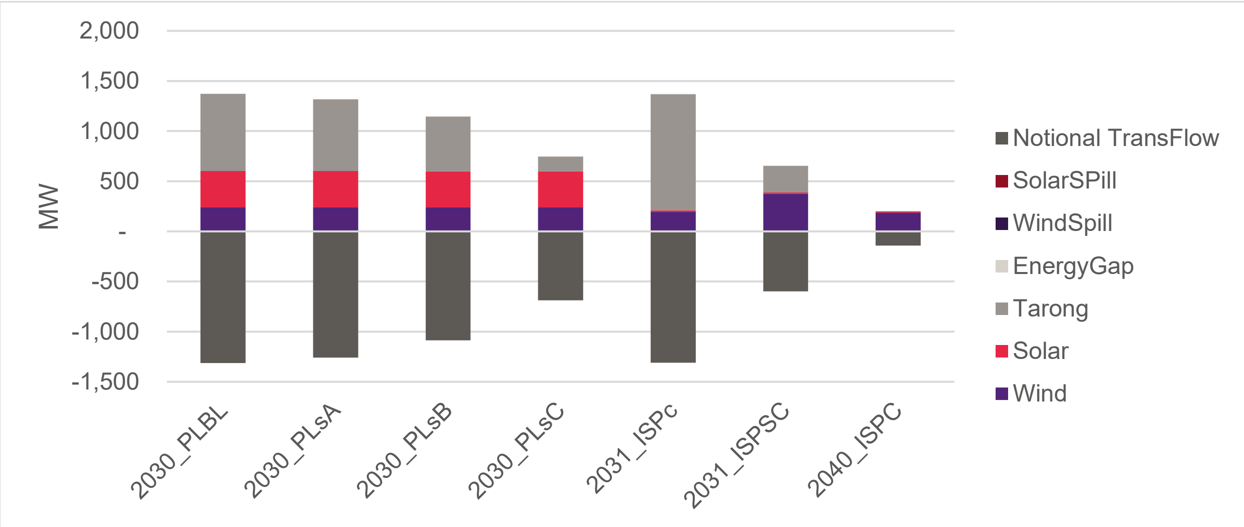

Figure 54: TAR average Winter Daytime N-1 flows for scenarios modelled

Winter Daytime flows under a restricted network are much the same as Summer Daytime flows under a restricted network.

v. TAR Winter Evening Peak flows

(a) N Transmission scenarios

For detail see Table 91 in Section C.

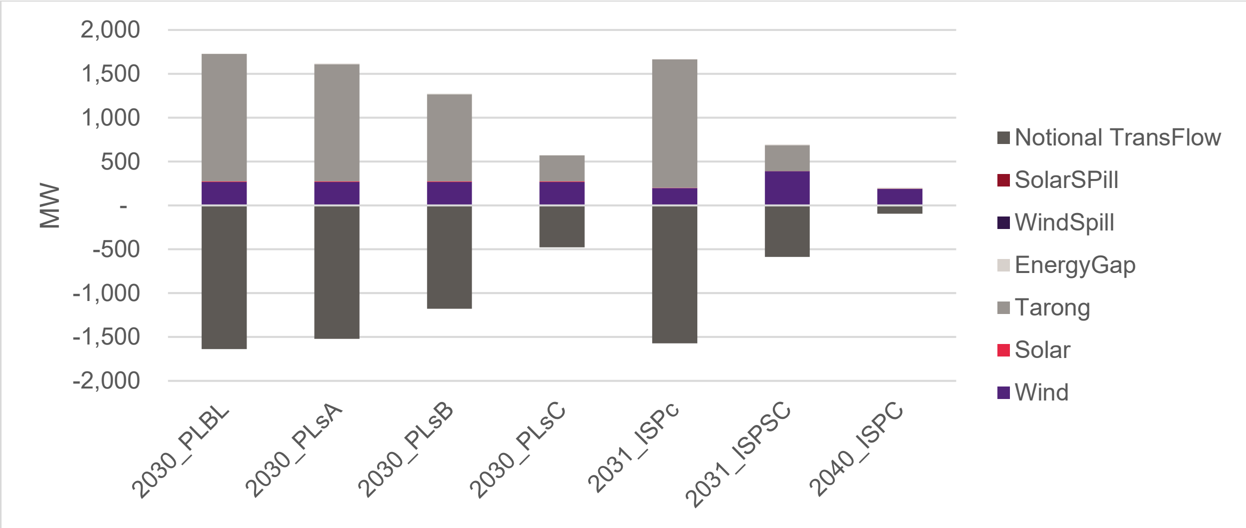

Figure 55: TAR average Winter Evening Peak N flows for scenarios modelled

Winter Evening Peak flows are much the same as Summer Evening Peak.

(b) N-1 Transmission scenarios

For detail see Table 92 in Section C.

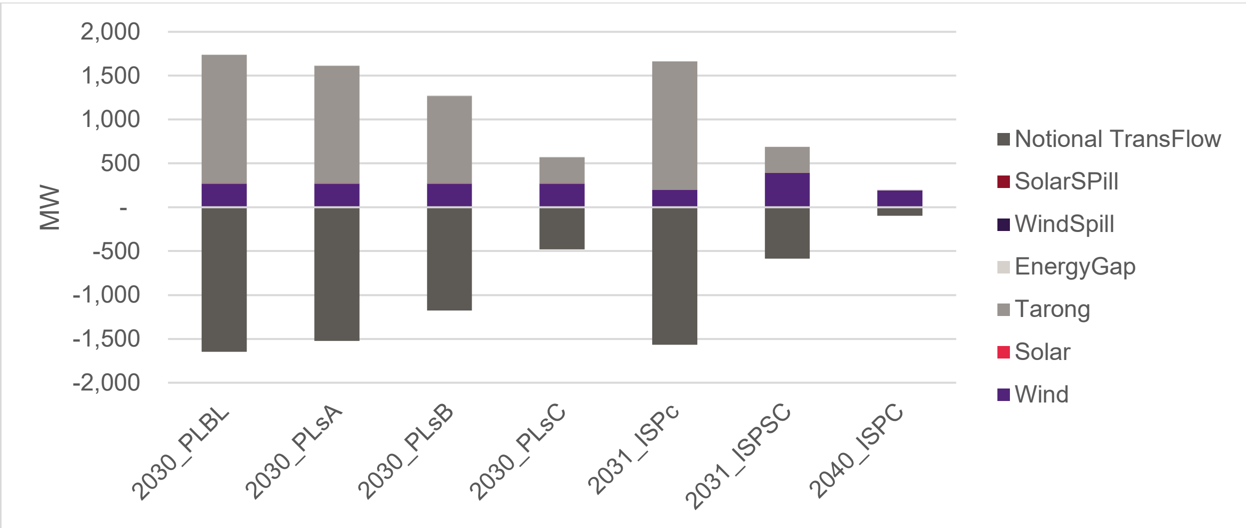

Figure 56: TAR average Winter Evening Peak N-1 flows for scenarios modelled

Winter Evening Peak under a restricted network is not dissimilar from the Summer Evening Peak under a restricted network, although the Energy-Gap for the ISP high VRE scenarios is smaller than that in the Summer Evening Peak.

h. South West Queensland (SWQ)

i. Node characteristics

Generation in SWQ includes Kogan Creek (744 MW) and Millmerran (852 MW) coal power stations. Open cycle gas turbines include Oakey (346 MW), Braemar 1 (504 MW), Braemar 2 (519 MW). Combined cycle gas turbines include Darling Downs (645 MW) and Condamine (143 MW). Solar power stations include Darling Downs (121 MW), Yarranlea (103 MW) and Oakey (25 MW), with Warwick (68 MW) constructed and planned for service in quarter 3, 2020.

Demand in SWQ is large, including supply to coal seam gas production in SWQ, and is estimated to vary from 878 MW during the day and 1088 MW during the Evening Peak during summer and 902 MW during the day and 1117 MW during the Evening Peak in winter.

Transmission from TAR to SWQ provides transmission capacity of 2715 MW in summer and 3047 MW in winter, which reduces to 1619 MW in summer and 1817 MW in winter under N-1 conditions. Transmission from SWQ to SM provides capacity of 2192 MW in summer and 2462 MW in winter, which reduces to 1096 MW in summer and 1231 MW in winter under N-1 conditions. Transmission from SWQ to QNI and NSW provides capacity of 5436 MW. Circa 2030, augmentation of QNI by a double circuit 500 kV branch as part of stage 2 QNI is assumed – northern NSW augmentation to transmit power from Northern NSW REZ's.

Table 9: SWQ generation capacity for scenarios modelled

South West Generation	Existing (MW)	Pipeline Scenarios	ISP 2030 Central	ISP 2030 Step Change	ISP 2040 Central
Coal	1596	1596	1596	1596	1596
Gas	2157	2157	2157	2157	2157
Wind	0	779	1305	2126	1305
Solar	317	2439	1684	1018	3831
Total	4070	6971	6742	6897	8889

There are two additional wind farms, Macintyre (540MW) and Dulucca (240MW), proposed in the Pipeline for SWQ. The ISP scenarios propose a further 526 MW of wind for 2030C and 2040C, and 1347MW MW for 2030SC.

Solar projects in the pipeline include Columboola (162 MW), Gangarri (120 MW), Brigalow (30 MW, Bulli Creek 1 (300 MW), Bulli Creek 2 (300 MW), Wandoan South 1 (250 MW), Wandoan South 2 (250 MW) and Western Downs (500 MW). The ISP high scenarios include variations on additional solar by 2030.

ii. SWQ Summer Daytime flows

(a) N Transmission scenarios

For detail see Table 97 in Section C.

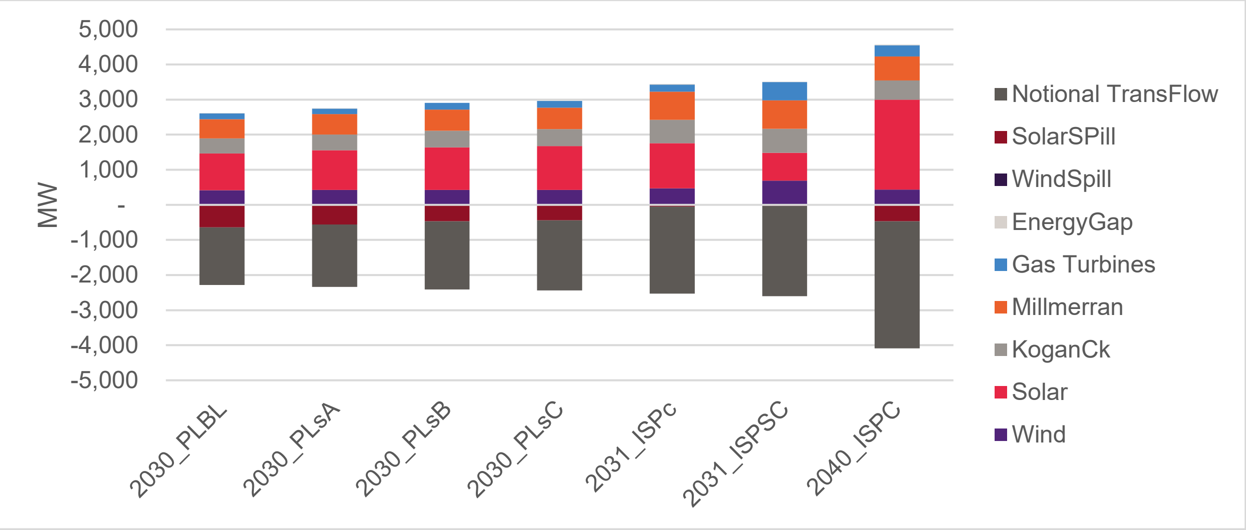

Figure 57: SWQ average Summer Daytime N flows for scenarios modelled

Energy flows in the Pipeline scenarios from TAR (357–637 MW), to which is added 2601-2965 MW of generation within the node (40-42% solar, 15-16% wind, 6% gas and 37-38% coal). Generation in the node is 2.5 to 3 times the nodal load, so generation is mainly for export to NSW (45%) through QNI or SM (55%).

There is evidence of significant solar spillage in the Pipeline scenario from 37% in the BL scenario, reducing to 26% in sC as coal units are withdrawn. Wind spillage is minor at 5% reducing to 2% in the reduced coal scenarios.

With lower solar additions in the ISP 2030C scenario, solar contributes 37% to nodal generation, shifting additional 5% generation to Kogan Creek and Millmerran. Solar spillage is also lower with reduced solar in the mix. With greater energy generated in 2030C, a larger share of energy flows to NSW through QNI. There is evidence of negligible congestion on transmission between SWQ and SM and a small Energy-Gap of 16MW.

2030SC scenario has much lower solar additions but doubled wind additions, which increases the contribution of wind to nodal generation to 20% and reduces solar to 23%. Energy generated from gas also increases in this scenario to provide 14% of nodal generation. There is evidence of an average Energy-Gap of 13 MW.

2040C assumes similar levels of wind as the Pipeline scenarios but much higher levels of solar. This results in an increase in nodal generation of more than 50% from the equivalent Pipeline scenario (sC) and elevated energy flows to NSW and SM. Here solar contributes 54% to nodal generation, wind 10%, coal 27% and gas 7%. There is evidence of an average Energy-Gap of 19 MW although there are occasional incidences of very high Energy-Gaps of up to 1770MW (see Section 5-a-iv). 15% of solar and 1% of wind are spilled.

(b) N-1 Transmission scenarios

For detail see Table 98 in Section C.

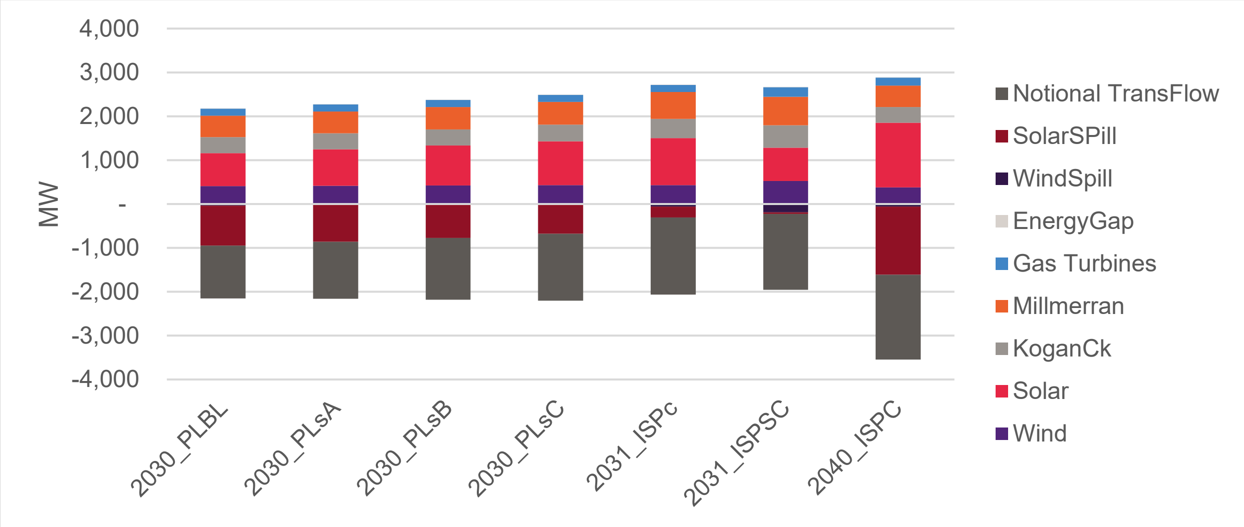

Figure 58: SWQ average Summer Daytime N-1 flows for scenarios modelled

In the Pipeline scenarios there is little change to energy flows from TAR (335–543 MW) under a restricted network. Nodal generation decreases by 16-19%, given up primarily by solar as spillage increases to 40-55%. Reduced nodal generation also results in reduced flows to QNI, which under the restricted network make up around 40% of total flows to QNI and SM.

Under 2030C, generation reduces by 21% which is fairly equally distributed across all generation and outward flows. Consequently, wind spillage increases to 12% and solar to 19% under a restricted network. Energy-Gap reduces to 8 MW as less energy flows out of the node.

Under restricted network 2030SC shows a 24% reduction in nodal generation, given up mostly by reduced gas and coal generation, and reduced flows to QNI and SM. Wind spillage increases to 27% and solar to 5%. Energy-Gap reduces to 6 MW as less energy flows out of the node.

The 2040C scenario under a restricted network shows a 37% decrease in nodal generation, given up primarily through reduced solar dispatch (1088 MW), coal dispatch (390 MW), gas (134 MW) and wind (55 MW), and reduced flows to QNI (50%) and SM (37%). Solar spillage increases to 51% and wind to 14% as there is less opportunity for energy to flow to load centres. Energy-Gap reduces to 1 MW as less energy flows out of the node.

iii. SWQ Summer Evening Peak flows

(a) N Transmission scenarios

For detail see Table 99 in Section C.

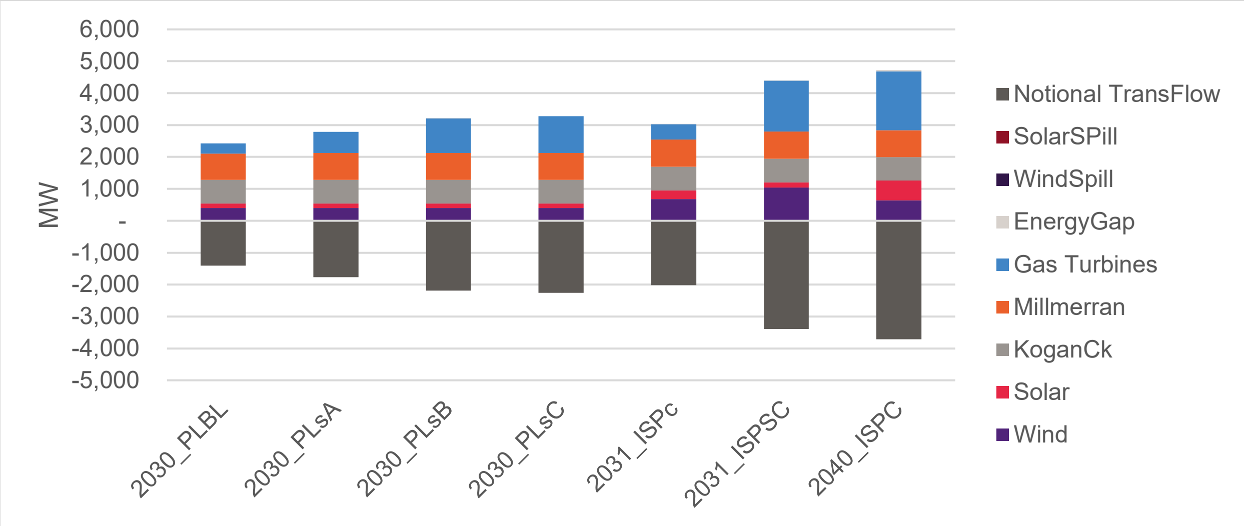

Figure 59: SWQ average Summer Evening Peak N flows for scenarios modelled

The Summer Evening Peak has reduced solar energy, such that solar only contributes 5-6% to nodal generation during the Evening Peak in the Pipeline scenarios. Wind continues to make 12-16% contribution to nodal generation. Coal increases its contribution to 65% in the BL scenario reducing to 48% in sC when 4 units of TPS are withdrawn. Gas turbines make a large contribution to nodal balance during Evening Peak from 13% when coal fleet intact but increasing to 35% when 4 units of TPS withdrawn in sC. Flows to QNI remain at approximately 47% of total flows to QNI and SM.

The ISP scenarios reflect similar trends to the Pipeline scenarios with gas, and to a lesser extent coal, increasing contribution in the absence of solar. The Energy-Gap is in evidence in the ISP scenarios but increasing in size in the 2040C scenario to 38 MW, as gas and coal are generating at full capacity but not able to make up the gap when wind resource is insufficient.

(b) N-1 Transmission scenarios

For detail see Table 100 in Section C.

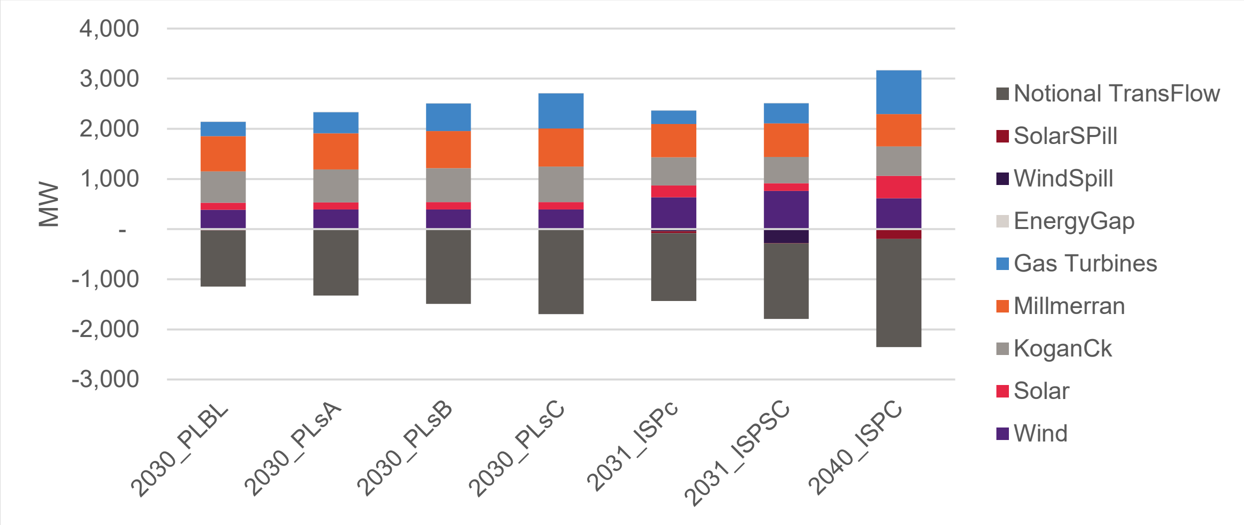

Figure 60: SWQ average Summer Evening Peak N-1 flows for scenarios modelled

Under a restricted network, less energy is generated (12-22% in the Pipeline and ISP 2030C scenarios, 43% less in ISP 2030SC and 32% less in 2040C). Under the restricted network, gas contributes less and coal more, with wind spillage increasing in ISP 2030C to 27% and solar spillage increasing to 28% in ISP 2040C. As discussed in the Summer Daytime reduced network results in smaller Energy-Gaps.

iv. SWQ Winter Daytime flows

(a) N Transmission scenarios

For detail see Table 101 in Section C.

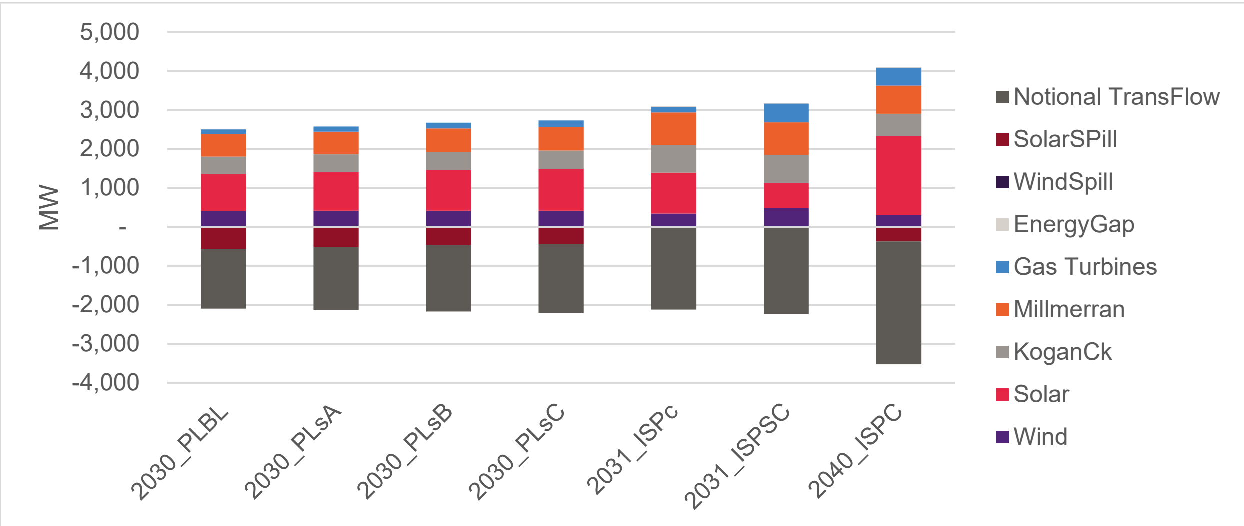

Figure 61: SWQ average Winter Daytime N flows for scenarios modelled

In the Pipeline scenarios, generation falls slightly from that in Summer Daytime, solar makes up less of the nodal generation at 38-39% which is primarily taken up by coal with 40-41% of nodal generation. Flows to QNI are slightly higher but slightly lower to SM. Solar spillage remains high at 29-37%. The same trends are evident in the ISP scenarios.

(b) N-1 Transmission scenarios

For detail see Table 102 in Section C.

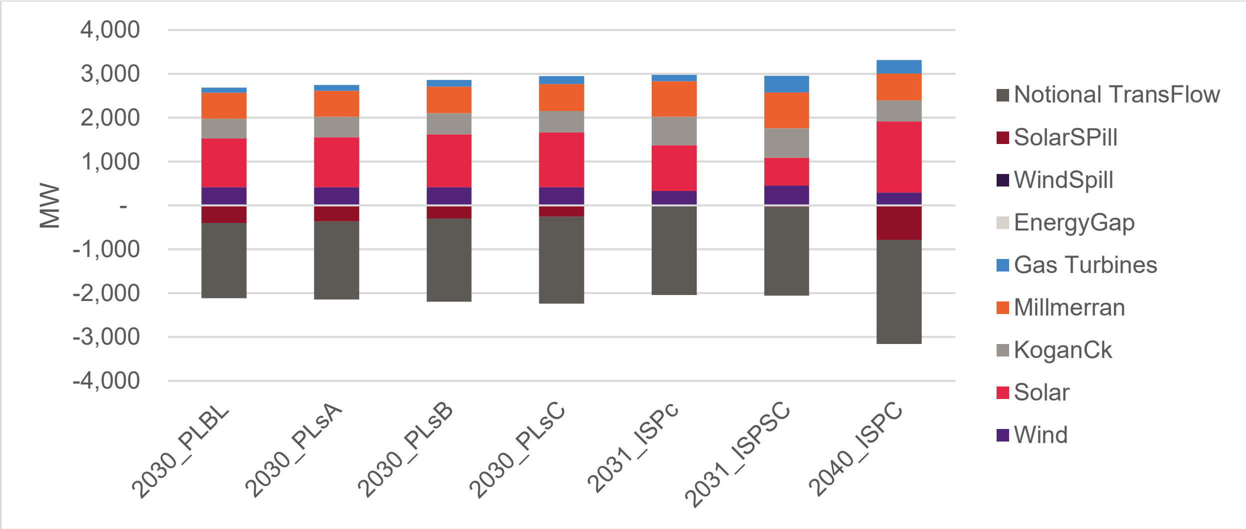

Figure 62: SWQ average Winter Daytime N-1 flows for scenarios modelled

Winter Daytime flows under a restricted network show significantly improved dispatch of solar, reducing spillage to 17-26% and wind spillage to 1-2% in the Pipeline scenarios. This flows through to greater nodal generation which compensates for reduced flows from TAR. The ISP 2030C and 2030SC scenarios show little variation under a restricted network, but the 2040C scenario displays a 404 MW reduction in solar, 202 MW reduction in coal and 154 MW reduction in gas dispatch as flows to QNI reduce by 28% and SM by 19%. Consequently solar spillage in the 2040C scenario increases to 32%.

v. SWQ Winter Evening Peak flows

(a) N Transmission scenarios

For detail see Table 103 in Section C.

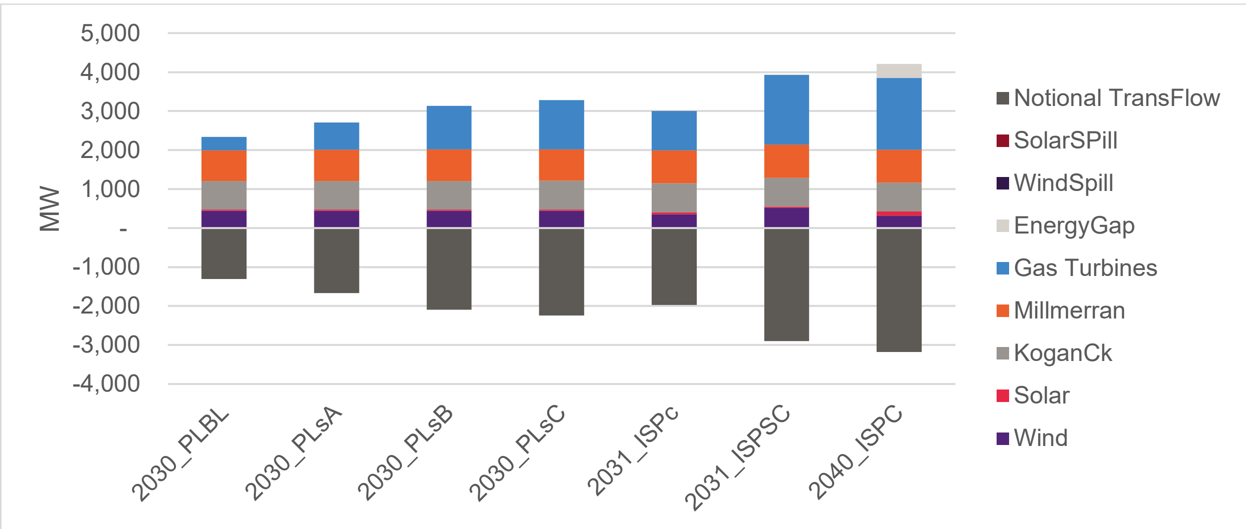

Figure 63: SWQ average Winter Evening Peak N flows for scenarios modelled

Nodal generation during Winter Evening Peak is slightly lower than in Summer Evening Peak particularly in the ISP high VRE scenarios, with gas playing a proportionately larger role in Winter Evening Peak, where gas contributes 45% to nodal generation in 2030SC and 48% in 2040C. This is primarily because flows to SM are reduced with a lower requirement for generation. In 2040C, a very large Energy-Gap of 362MW emerges, possibly as a result of periods of low wind resource.

(b) N-1 Transmission scenarios

For detail see Table 104 in Section C.

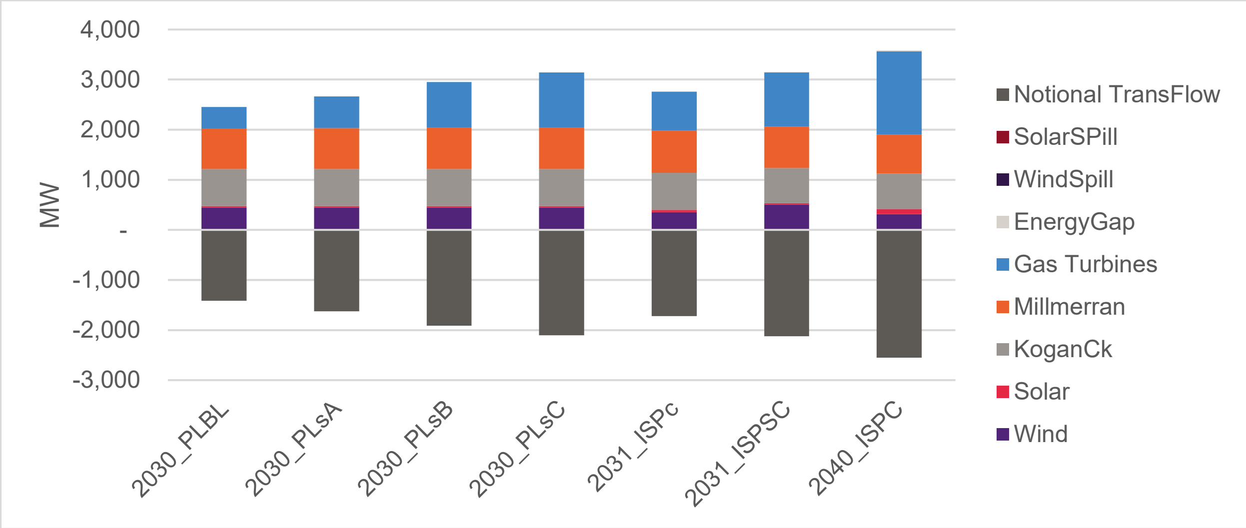

Figure 64: SWQ average Winter Evening Peak N-1 flows for scenarios modelled

Winter Evening Peak in the Pipeline scenarios under a restricted network is not dissimilar from the Summer Evening Peak under a restricted network.

The ISP high VRE scenarios have a much smaller nodal generation, particularly in 2030SC which has 958 MW less of generation than under an unrestricted network, and in 2040C there is 706MW lower generation under N-1. The lower generation is primarily associated with lower flows to QNI and SM.

i. North Moreton (NM)

i. Node characteristics

The only generation in NM is PHES of 570 MW at Wivenhoe. There is no solar or wind generation within the node.

Demand in NM is large, as it supplies northern greater Brisbane and the Sunshine Coast and is estimated to vary from 674 MW overnight and 1851 MW during the Evening Peak over summer and 455 MW during the day and 1568 MW during the Evening Peak in winter.

Transmission between NM and WB provides transfer capacity of 1595 MW in summer and 1767 MW in winter, reducing to 797 MW in summer and 883 MW in winter under restrictive N-1 conditions. Transmission between NM and TAR provides transfer capacity of 5428 MW in summer and 5975 MW in winter, reducing to 4332 MW in summer and 4745 MW in winter under restrictive N-1 conditions. Transmission between NM and SM provides transfer capacity of 4752 MW in summer and 5343 MW in winter, reducing to 3602 MW in summer and 4058 MW in winter under restrictive N-1 conditions.

Table 10: NM generation capacity for scenarios modelled

North Moreton Generation	Existing (MW)	Pipeline Scenarios	ISP 2030 Central	ISP 2030 Step Change	ISP 2040 Central
PHES	570	1590	1590	1590	1590
Total	570	1590	1590	1590	1590

There are no solar or wind projects proposed for the NM node.

ii. NM Summer Daytime flows

(a) N Transmission scenarios

For detail see Table 109 in Section C.

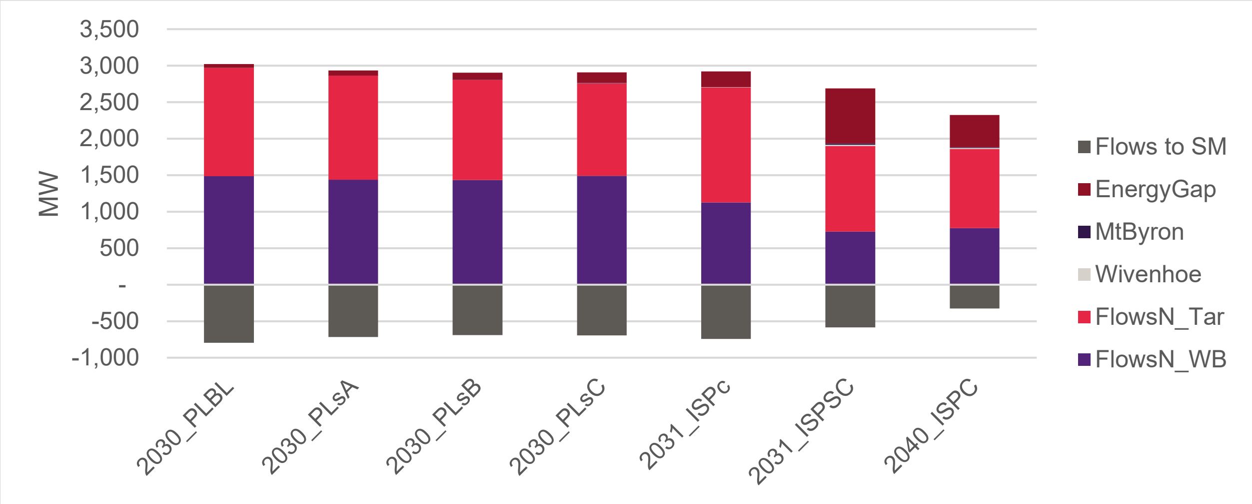

Figure 65: NM average Summer Daytime N flows for scenarios modelled

During the day, NM is reliant on flows of energy from WB and TAR to meet demand, plus the load from PHES pump operations. In the Pipeline scenarios WB supplies 50-51% of the inflows of energy in BL, sA and sB. There is a reduction in energy from TAR in sC as 4 units at TPS are withdrawn, so that WB supplies 54% of the energy for the node. NM is reliant on energy flows from WB for 54% and sC scenarios, reducing to 42-43% in sA and sB. Approximately 25% of energy flowing from WB and TAR flows onward from NM to SM.

In the ISP scenarios, energy flows from WB reduce by 25% in 2030C, 51% in 2030SC and 48% in 2040C from the Pipeline scenarios reflecting the reduced generation from GPS and low wind and solar generation at WB. For this reason WB supplies 38-42% of energy for the node. There is also reduction in energy flow from TAR but it is lower at 21% in 2030SC and 27% in 2040C. Energy flow to SM decreases by 26% in the ISP 2030SC and 59% in the 2040C scenarios.

NM demand during the day is estimated at 1016 MW, but this is increased by 1590 MW as PHES is set to pump to be able to accommodate Evening Peak.

The consequence of the reduced inflows of energy from WB and TAR, is an Energy-Gap of 53-147MW in the Pipeline scenarios, increasing to 216 MW in 2030C, 443 MW in 2040C and 754 MW in 2030SC. This will be discussed in more detail in Section 5: Energy Generation Adequacy.

(b) N-1 Transmission scenarios

For detail see Table 110 in Section C.

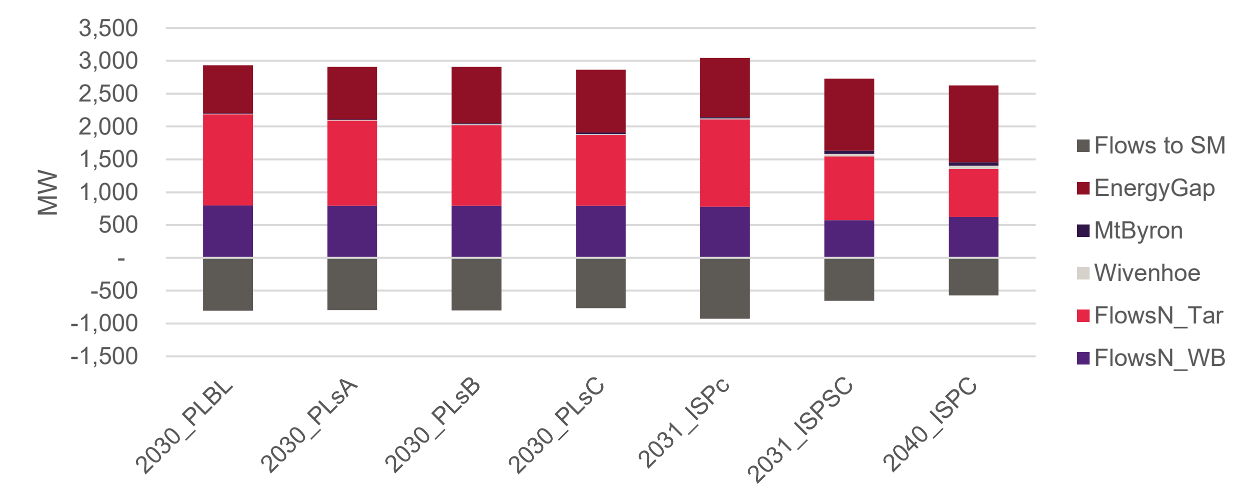

Figure 66: NM average Summer Daytime N-1 flows for scenarios modelled

Under a restricted network, energy flows from WB decrease 45-47% in the Pipeline scenarios reflecting the 797 MW limit on transmission from WB to NM. Consequently the transmission shows congestion of 95.75 - 99.67%. The ISP scenarios show lower reductions because flows from WB are much lower due to the lack of any wind generation added to WB and the closure of GPS.

Energy flows from TAR are less affected by restricted network availability, reducing by 10% in sB and 15% in sC as units at TPS are withdrawn. However, in the ISP 2030SC and 2040C scenarios, energy flows from TAR are reduced by 18% and 33% under a restricted network, reflecting the withdrawal of 4 units at TPS in 2030SC and all units at TPS in 2040C.

Reduced flows of energy from WB and TAR are counteracted by increased flows of energy to SM: 10-15% in the Pipeline scenarios and 12-43% in the ISP scenarios. Thus, in 2040C, energy flows from WB and TAR total 1354 MW, less 571 MW flowing to SM, leaving considerably less than 2513 MW required to meet demand – resulting in a large Energy-Gap. The nature of the Energy-Gap will be discussed in Section 5.

iii. NW Summer Evening Peak flows

(a) N Transmission scenarios

For detail see Table 111 in Section C.

Figure 67: NM average Summer Evening Peak N flows for scenarios modelled

Demand in the Evening Peak reduces by 1590 MW as PHES switches from pumping to dispatch. Wivenhoe and Mt Byron dispatch 639-942 MW in the Pipeline scenarios, contributing 44-65% of demand. In the ISP 2030SC and 2040C scenarios, PHES supplies 1149 and 1254 MW, or 74% and 81% respectively. This makes NM node less reliant on large inflows of energy from WB and TAR.

In the ISP scenarios, energy from WB and TAR is still roughly evenly shared but in the ISP scenarios, TAR provides 62-80% of the total energy flows into NM. As a result of dispatch from PHES, flows to SM increase significantly over the Summer Daytime flows, transiting 63-75% of energy to SM from WB and TAR.

The Energy-Gap varies from 120 MW in BL increasing to 219 MW in sC, and 186 MW in 2030C increasing to 266 MW in 2030SC and 263 MW in 2040C.

(b) N-1 Transmission scenarios

For detail see Table 112 in Section C.

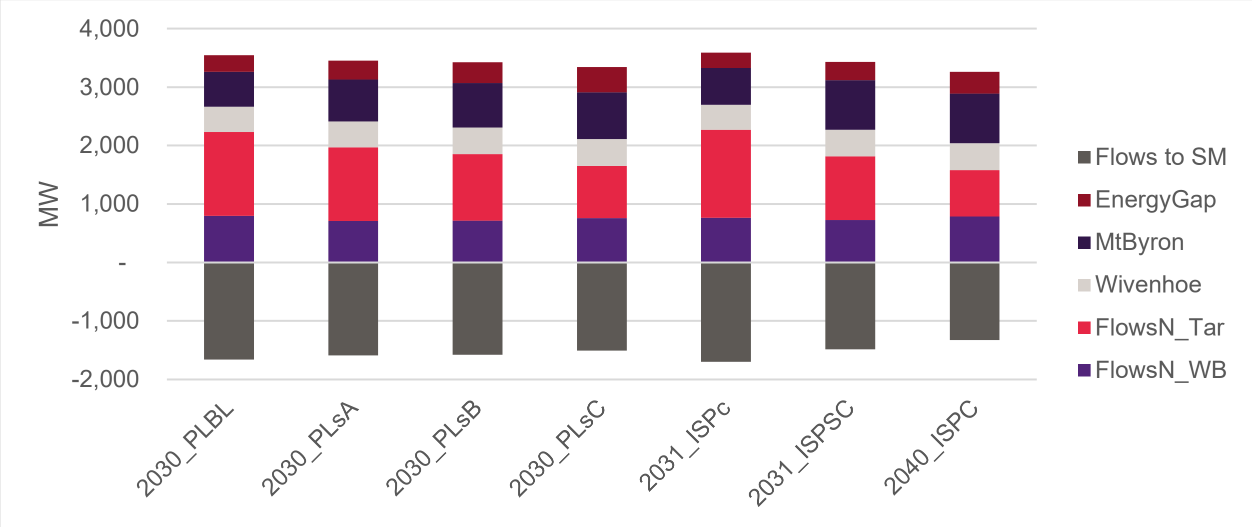

Figure 68: NM average Summer Evening Peak N-1 flows for scenarios modelled

Under a restricted network, flows from WB reduce in line with thermal limits, but flows from TAR also decrease reflecting reduced supply from TAR especially in 2030SC and 2040C. The reduced inflows increase reliance on dispatch from PHES, such that in 2030SC and 2040C, PHES dispatches at 100% of targeted dispatch (ie, based on modelling assumptions). Reduced transmission flows result in an increase in Energy-Gap across all scenarios but in sC and 2040C, to 429 MW and 370 MW.

iv. NM Winter Daytime flows

(a) N Transmission scenarios

For detail see Table 113 in Section C.

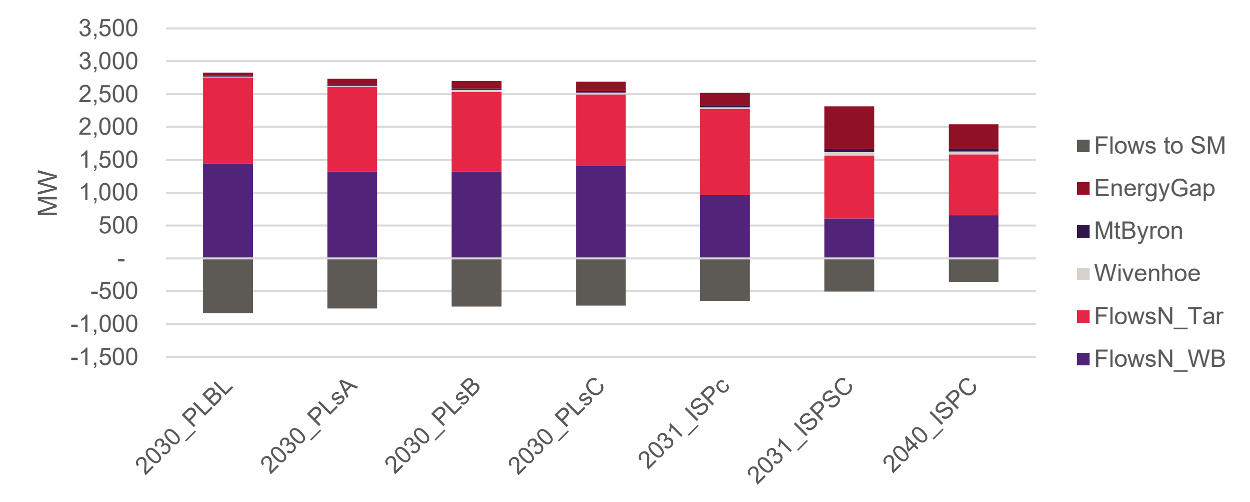

Figure 69: NM average Winter Daytime N flows for scenarios modelled

In all scenarios, flows into NM are similar but slightly reduced to those in Summer Daytime, and flows to SM are essentially the same. The Energy-Gap is persistently large, although slightly less than that in Summer Daytime.

(b) N-1 Transmission scenarios

For detail see Table 114 in Section C.

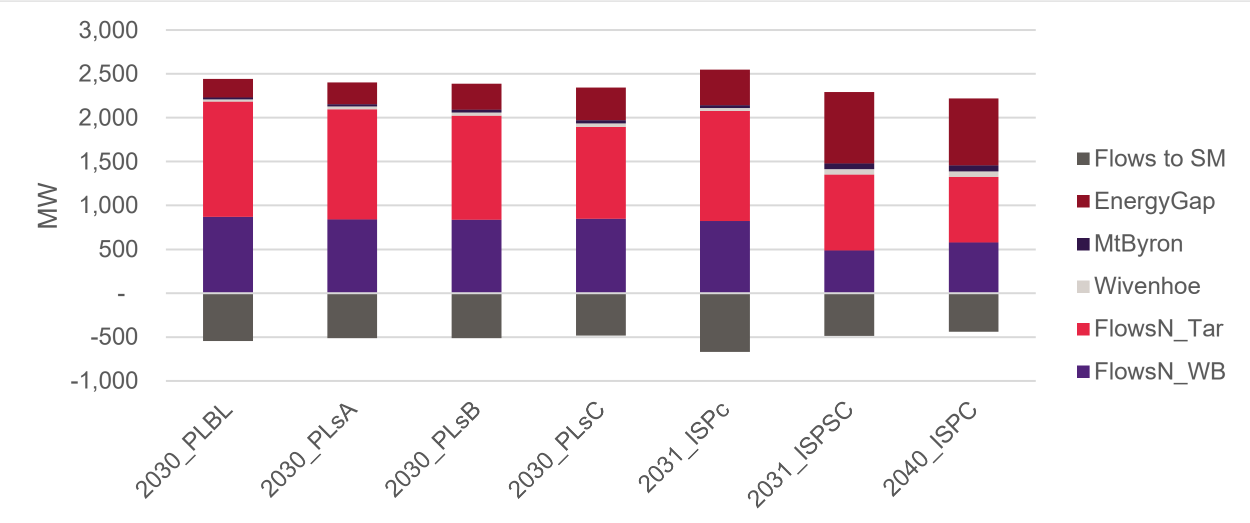

Figure 70: NM average Winter Daytime N-1 flows for scenarios modelled

Under a reduced network, flows from WB are reduced although not as low as the Summer Daytime reductions, reflecting higher thermal limits in winter. The Energy-Gaps increase to 814 MW in 2030SC and 761 MW in 2040C.

v. NM Winter Evening Peak flows

(a) N Transmission scenarios

For detail see Table 115 in Section C.

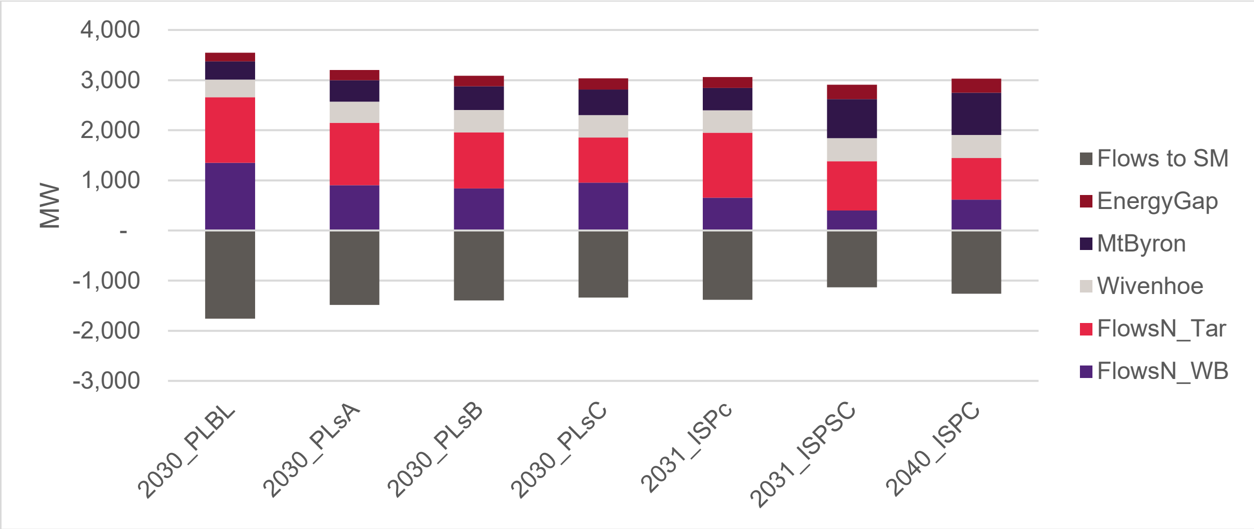

Figure 71: NM average Winter Evening Peak N flows for scenarios modelled

All flows into NM are reduced from Summer Evening Peak, but under 2030SC and 2040C, flows from TAR are reduced 19-25% from Summer Evening Peak. Due to reduced load with no PHES pumping, meeting demand is primarily achieved through PHES dispatch, although Energy-Gap remains relatively high at 289 MW in the 2030C and 282 MW in 2040C.

(b) N-1 Transmission scenarios

For detail see Table 116 in Section C.

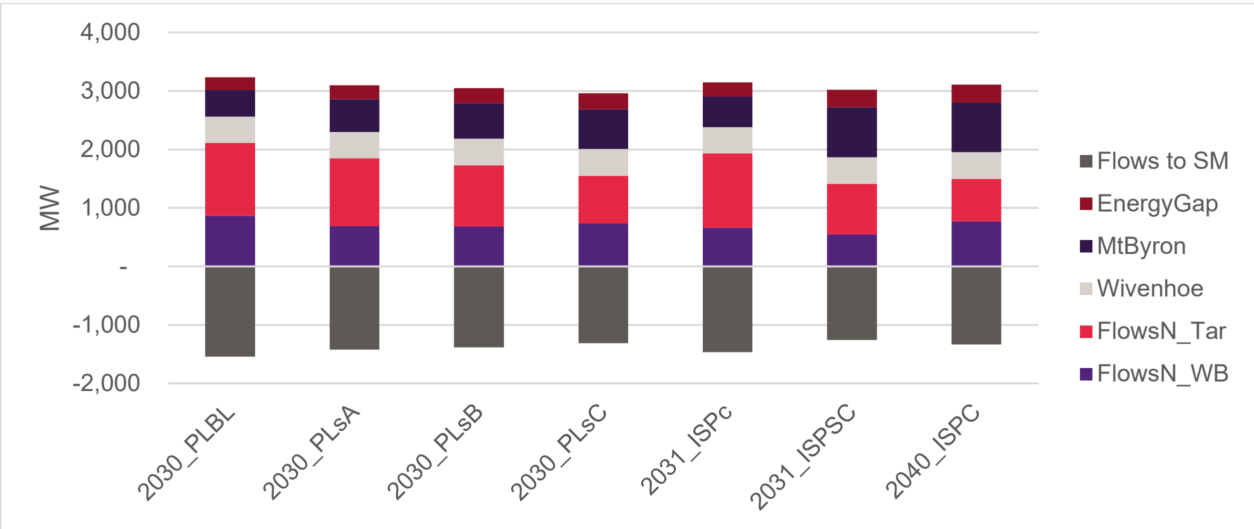

Figure 72: NM average Winter Evening Peak N-1 flows for scenarios modelled

NM Winter Evening Peak under restricted network is effectively the same as Summer Evening Peak under restricted network.

j. South Moreton (NM)

i. Node characteristics

The only generation SM is Swanbank E combined cycle gas turbine which is scheduled for closure in 2028.

Demand in SM is very large, as it supplies southern greater Brisbane and is estimated to vary from 972 MW during the day and 2700 MW during the Evening Peak over summer and 704 MW during the day and 2332 MW during the Evening Peak in winter.

Transmission between NM and SM provides transfer capacity of 4752 MW in summer and 5343 MW in winter, reducing to 3602 MW in summer and 4058 MW in winter under restrictive N-1 conditions. Transmission between SWQ and SM provides transfer capacity of 2192 MW in summer and 2462 MW in winter, reducing to 1096 MW in summer and 1231 MW in winter under restrictive N-1 conditions. Transmission between SM and GC provides transfer capacity of 2720 MW in summer and 3088 MW in winter, reducing to 1866 MW in summer and 2136 MW in winter und restrictive N-1 conditions.

Table 11: SM generation capacity for scenarios modelled

South Moreton Generation	Existing (MW)	Pipeline Scenarios	ISP 2030 Central	ISP 2030 Step Change	ISP 2040 Central
Gas	385	0	0	0	0
Total	385	0	0	0	0

There are no solar or wind projects proposed for the SM node.

ii. SM Summer Daytime flows

(a) N Transmission scenarios

For detail see Table 121 in Section C.

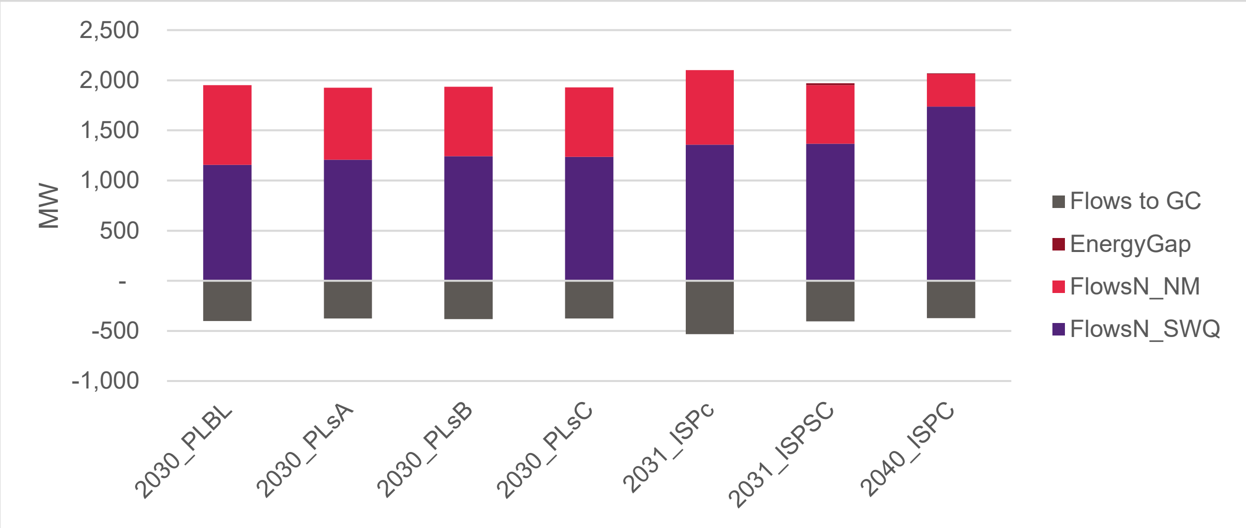

Figure 73: SM average Summer Daytime N flows for scenarios modelled

The primary source of energy for SM is from SWQ – 59% in Pipeline BL increasing to 64% in sC and sB, and 70% in 2030SC and 84% in 2040C. These flows are adequate to supply SM load and the required flows to GC with relatively small Energy-Gaps appearing in 2030SC and 2040C of 18M mw and 6 MW.

(b) N-1 Transmission scenarios

For detail see Table 122 in Section C.

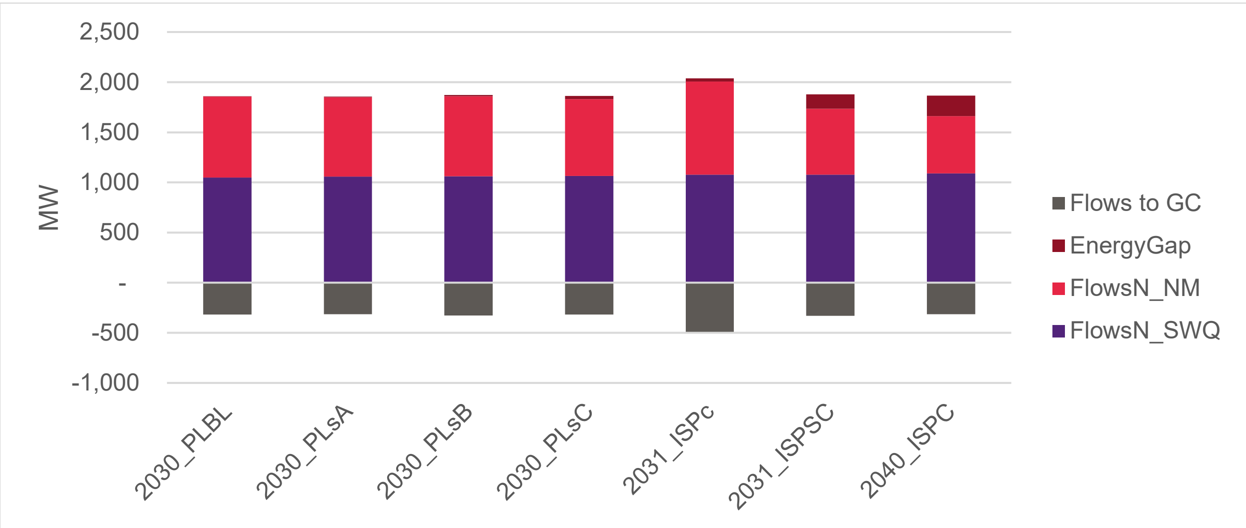

Figure 74: SM average Summer Daytime N-1 flows for scenarios modelled

Under a restricted network, flows from SWQ reduce which allows a large Energy-Gap to appear in the ISP high VRE scenarios of 144 MW in 2030SC and 205 MW in 2040C.

iii. SM Summer Evening Peak flows

(a) N Transmission scenarios

For detail see Table 123 in Section C.

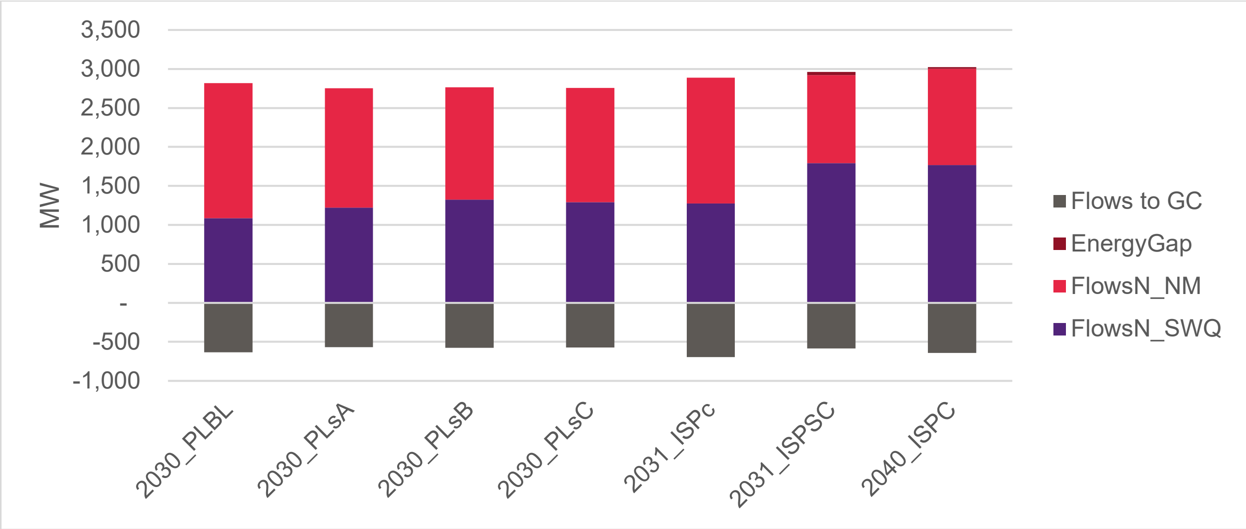

Figure 75: SM average Summer Evening Peak N flows for scenarios modelled

As with Summer Daytime flows, inward flows from SWQ and NM are adequate to meet load and flows to GC with a relatively small Energy-Gap appearing in the ISP high VRE scenarios.

(b) N-1 Transmission scenarios

For detail see Table 124 in Section C.

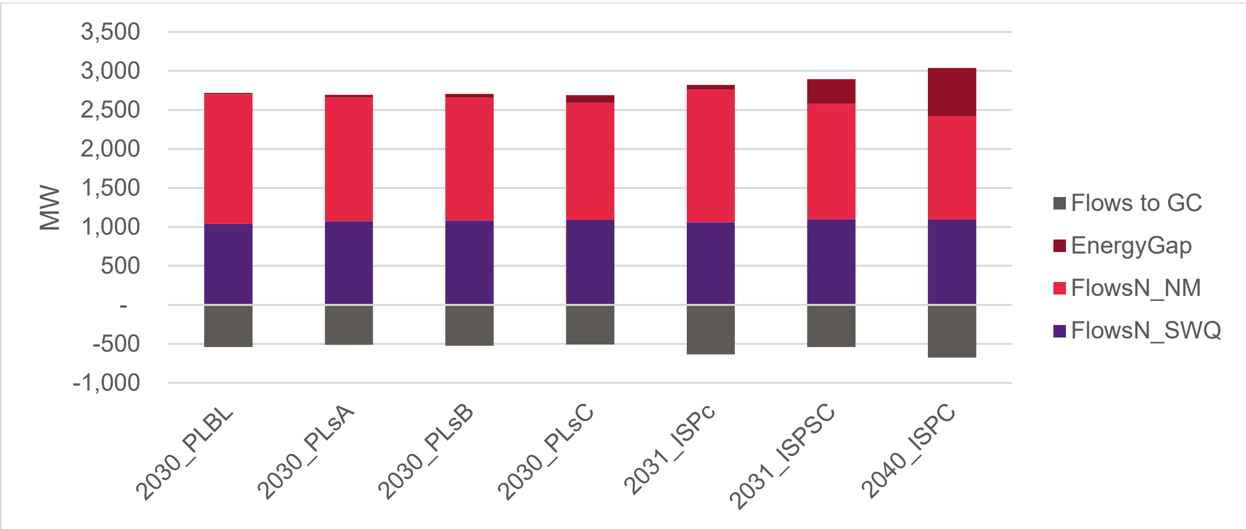

Figure 76: SM average Summer Evening Peak N-1 flows for scenarios modelled

Under a restricted network, reduced flows from SWQ result in larger Energy-Gaps rising to 313 MW in 2030SC and 618 MW in 2040C.

iv. SM Winter Daytime flows

(a) N Transmission scenarios

For detail see Table 125 in Section C.

Figure 77: SM average Winter Daytime N flows for scenarios modelled

Winter Daytime flows are reduced but adequate for reduced demand and shows little evidence of Energy-Gaps.

(b) N-1 Transmission scenarios

For detail see Table 126 in Section C.

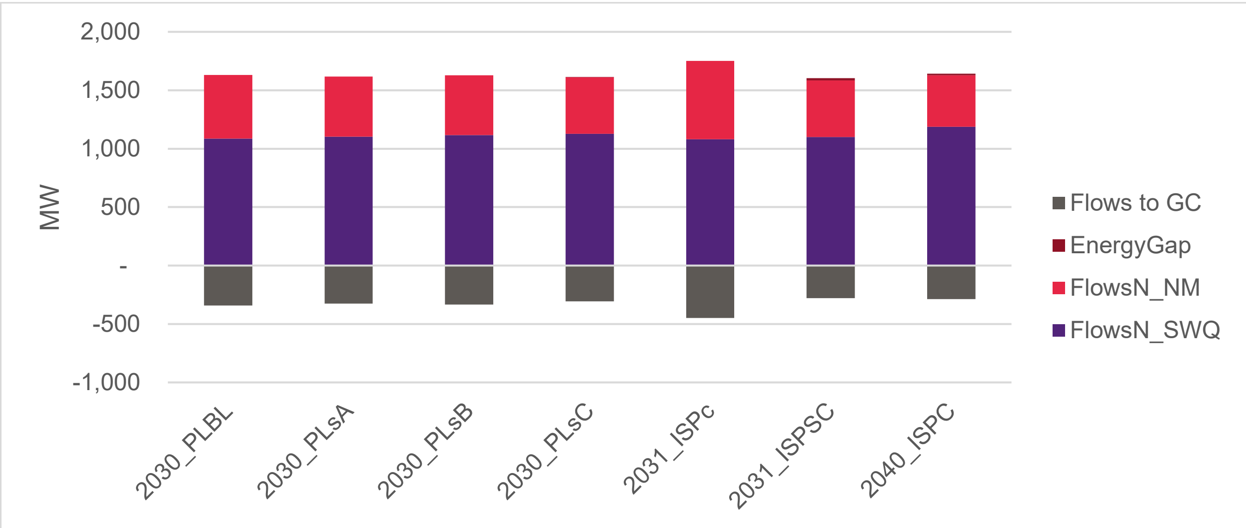

Figure 78: SM average Winter Daytime N-1 flows for scenarios modelled

Even under restricted network, reduced Winter Daytime flows are adequate for demand in SM and GC.

v. SM Winter Evening Peak flows

(a) N Transmission scenarios

For detail see Table 127 in Section C.

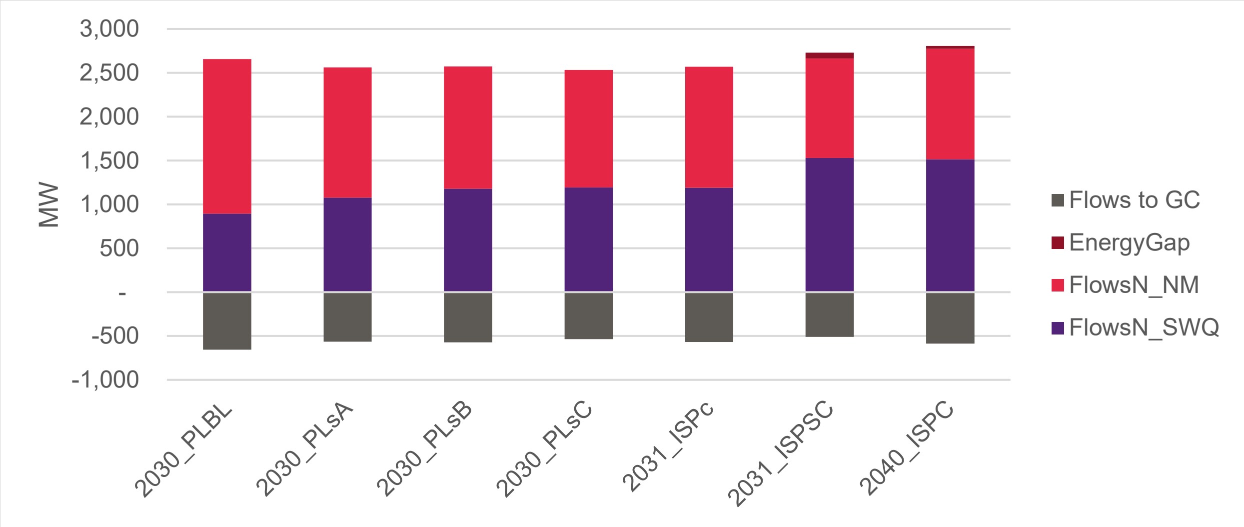

Figure 79: SM average Winter Evening Peak N flows for scenarios modelled

Inward flows to SM are adequate for demand in SM and for flows to GC with evidence of only relatively Energy-Gaps in 2030SC of 67 MW and 2040C of 34 MW.

(b) N-1 Transmission scenarios

For detail see Table 128 in Section C.

Figure 80: SM average Winter Evening Peak N-1 flows for scenarios modelled

Under a restrictive network, flows from SWQ and NM are not sufficient to meet demand, opening up a 207 MW Energy-Gap in 2030SC and 287 MW in 2040C.

k. Gold Coast (GC)

i. Node characteristics

There is no generation capacity in the GC node

Demand in GC is estimated to vary from 298 MW during the day and 848 MW during the Evening Peak over summer and 211 MW during the day and 718 MW during the Evening Peak in winter.

Transmission between GC and SM provides transfer capacity of 2720 MW in summer and 3088 MW in winter, reducing to 1866 MW in summer and 2136 MW in winter under restrictive N-1 conditions. Transmission between GC and Lismore in NSW via DirectLink interconnector provides transfer capacity of 180 MW.

Table 12: GC generation capacity for scenarios modelled

Gold Coast Generation	Existing (MW)	Pipeline Scenarios	ISP 2030 Central	ISP 2030 Step Change	ISP 2040 Central
Total	0	0	0	0	0

There are no solar or wind projects proposed for the GC node.

ii. GC Summer Daytime flows

(a) N Transmission scenarios

For detail see Table 133 in Section C.

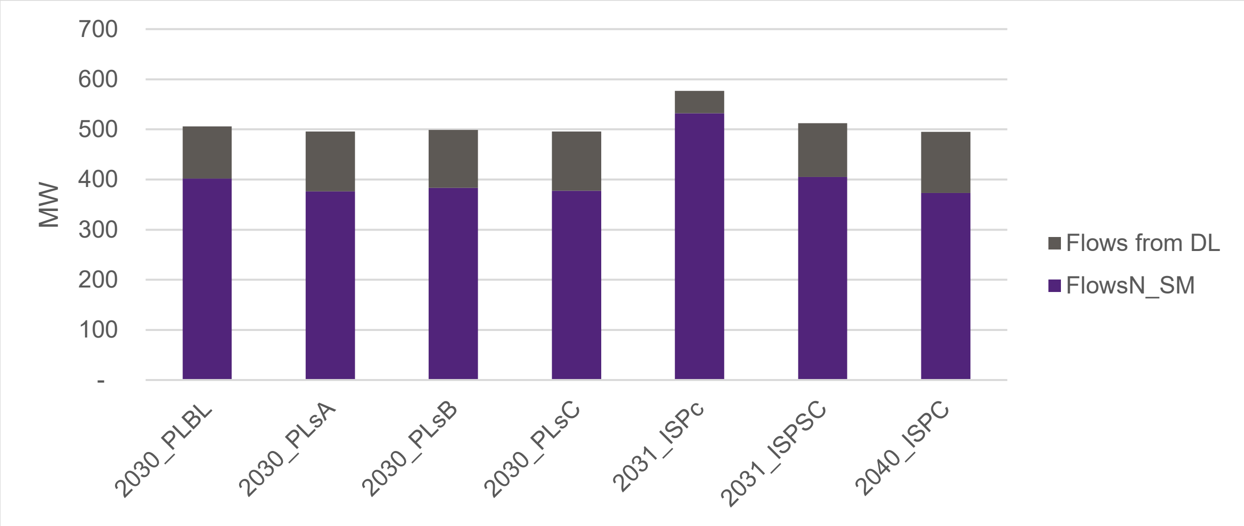

Figure 81: GC average Summer Daytime N flows for scenarios modelled

GC is reliant on flows from SM, but also flows from NSW through DirectLink (DL). Even under unrestricted network, 61-66% of flows on the DL line is subject to congestion in the Pipeline scenarios. Although there is still evidence of congestion on the line in the ISP high VRE scenarios, it is lower.

(b) N-1 Transmission scenarios

For detail see Table 134 in Section C.

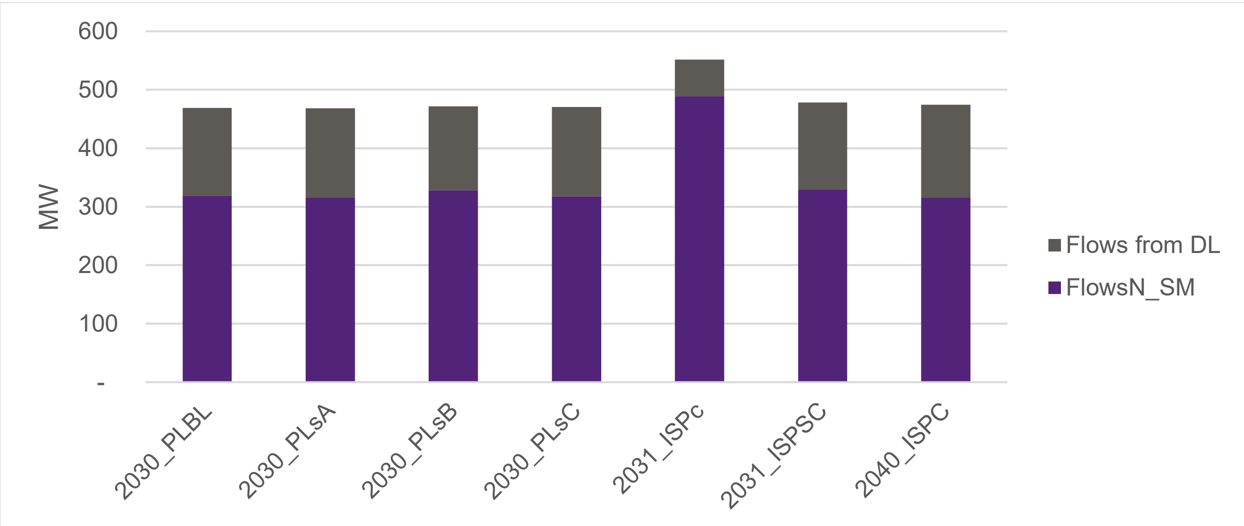

Figure 82: GC average Summer Daytime N-1 flows for scenarios modelled

Under a restricted network, greater flows are required from NSW through DL, and the line becomes more congested, 68%-77% in the Pipeline scenarios.

iii. GC Summer Evening Peak flows

(a) N Transmission scenarios

For detail see Table 135 in Section C.

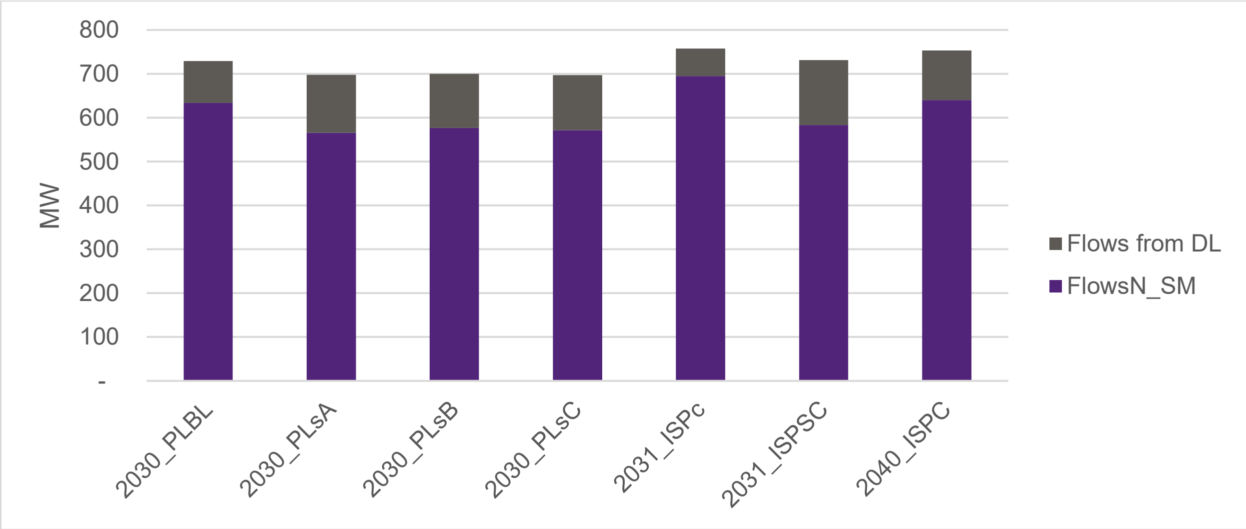

Figure 83: GC average Summer Evening Peak N flows for scenarios modelled

Greater flows from SM, reduce flows from NSW, although there is still congestion on the line.

(b) N-1 Transmission scenarios

For detail see Table 136 in Section C.

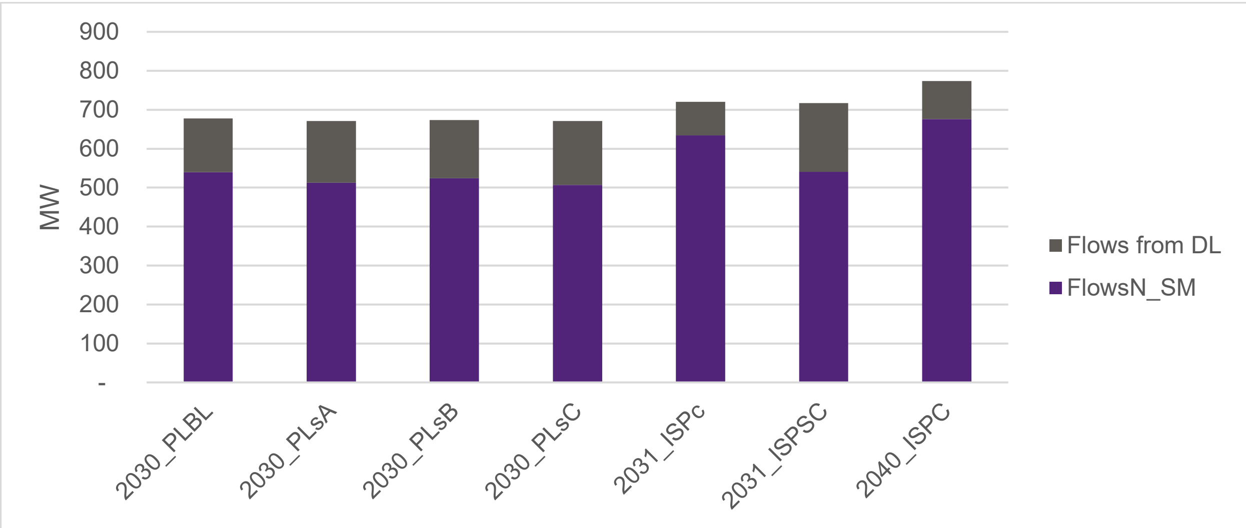

Figure 84: GC average Summer Evening Peak N-1 flows for scenarios modelled

A restrictive network reduces the flows from SM and increases the flows from DL.

iv. GC Winter Daytime flows

(a) N Transmission scenarios

For detail see Table 137 in Section C.

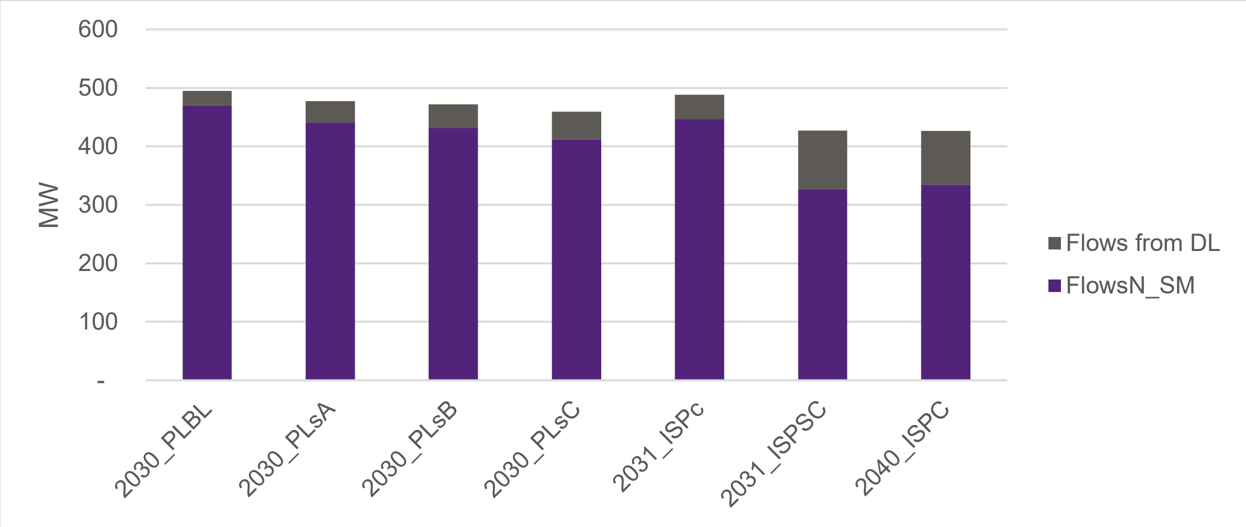

Figure 85: GC average Winter Daytime N flows for scenarios modelled

There is little difference to Summer Daytime flows in Winter Daytime flows.

(b) N-1 Transmission scenarios

For detail see Table 138 in Section C.

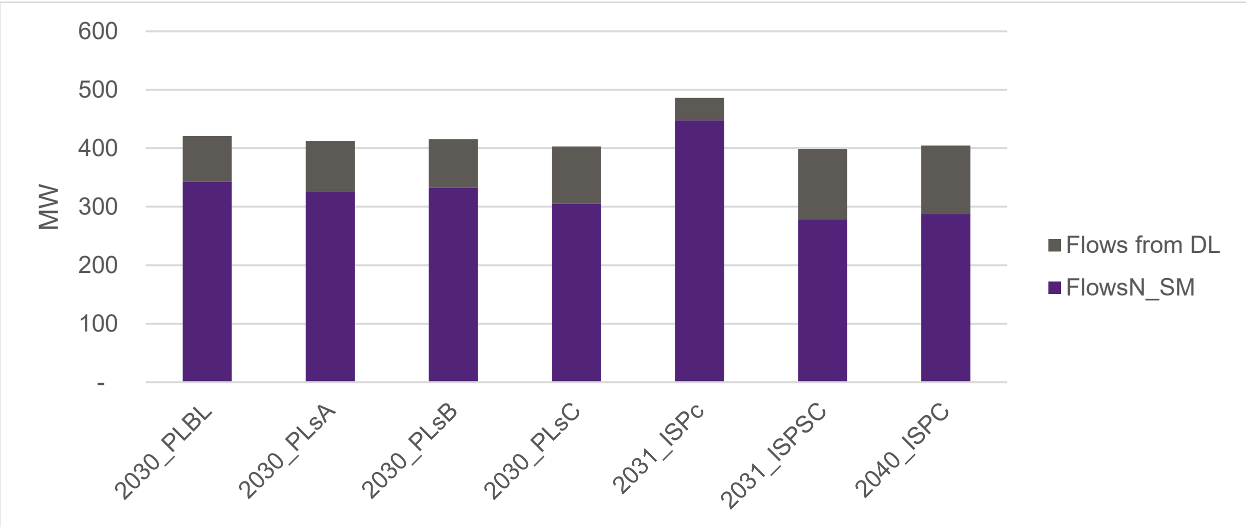

Figure 86: GC average Winter Daytime N-1 flows for scenarios modelled

There is little difference to Summer Daytime flows under restrictive network.

v. GC Winter Evening Peak flows

(a) N Transmission scenarios

For detail see Table 139 in Section C.

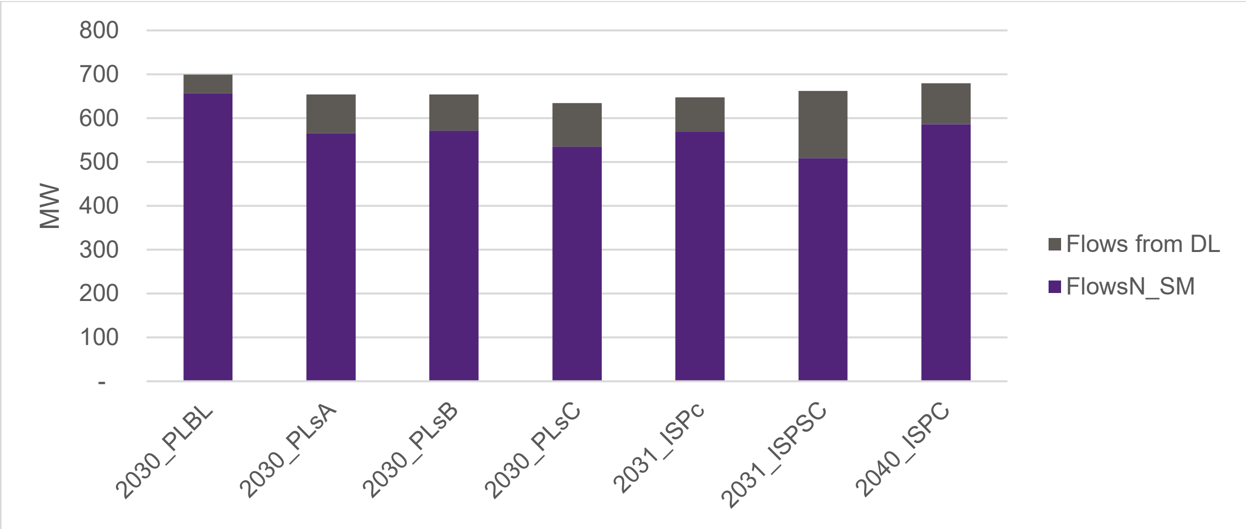

Figure 87: GC average Winter Evening Peak N flows for scenarios modelled

There is little difference to Summer Evening Peak flows.

(b) N-1 Transmission scenarios

For detail see Table 140 in Section C.

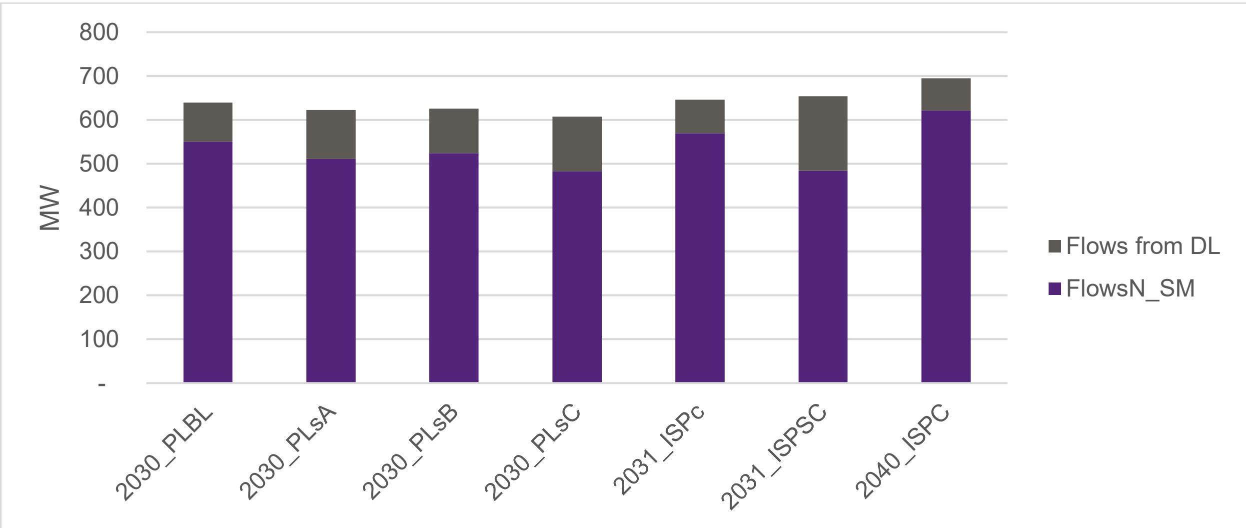

Figure 88: GC average Winter Evening Peak N-1 flows for scenarios modelled

There is little difference to Summer Evening Peak under restrictive network.

Appendix C: Scenario analysis of nodal supply-demand tables

Table 13: FNQ average Summer flows in MW 7:00 to 16:00 for each N transmission scenario

Scenario	Wind spill	Solar spill	Wind dispatch	Solar dispatch	Kidston PumpDis	Barron Gorge	Kareeya	Energy-Gap	Load	Pump load	Flows RossN	Flows RossR	% of flows R	% Congestion
Baseline (N)	2	1	206	244	0	0	0	1	250	162	82	-49	37%	0%
Scen A (N)	1	1	207	245	0	0	0	1	250	162	84	-49	37%	0%
Scen B (N)	0	1	207	245	0	0	0	4	250	162	85	-47	35%	0%
Scen C (N)	0	1	207	245	0	0	0	3	250	162	85	-47	35%	0%
ISP 2030 Central (N)	5	0	243	33	1	1	0	62	250	162	60	-143	71%	0%
ISP StepChange (N)	52	2	457	31	3	10	0	98	249	162	240	-59	20%	0.2%
ISP 2040 Central (N)	117	2	453	30	1	3	0	36	249	162	205	-103	33%	0%

Table 14: FNQ average Summer flows in MW from 7:00 to 16:00 for each N-1 transmission scenario

Baseline (N-1)	8	3	199	242	0	0	0	0	250	162	74	-49	40%	0%
Scen A (N-1)	7	1	201	244	0	0	0	1	250	162	78	-49	39%	0%
Scen B (N-1)	4	1	204	244	0	0	0	3	249	162	81	-47	37%	0%
Scen C (N-1)	8	2	200	243	0	0	0	0	250	162	76	-49	39%	0%
ISP 2030 Central (N-1)	8	0	240	33	0	1	1	34	250	162	52	-167	76%	3.2%
ISP StepChange (N-1)	155	4	354	29	0	6	0	55	249	162	114	-88	44%	0.1%
ISP 2040 Central (N-1)	232	5	339	28	0	1	0	23	249	162	88	-117	57%	0.1%

Table 15: FNQ average Summer flows in MW 16:30 – 21:00 for each N transmission scenario

Scenario	Wind spill	Solar spill	Wind dispatch	Solar dispatch	Kidston PumpDis	Barron Gorge	Kareeya	Energy-Gap	Load	Pump load	Flows RossN	Flows RossR	% of flows R	% Congestion
Baseline (N)	0	0	223	49	107	2	3	3	354	60	52	-88	63%	0%
Scen A (N)	0	0	223	49	177	13	20	7	354	60	107	-38	26%	0%
Scen B (N)	0	0	223	49	201	18	27	13	354	60	130	-19	13%	0%
Scen C (N)	0	0	223	49	194	18	28	11	354	60	126	-24	16%	0%
ISP 2030 Central (N)	0	0	240	9	202	5	7	26	354	60	111	-44	28%	0%
ISP StepChange (N)	2	0	468	8	121	21	0	26	380	60	222	-24	10%	0%
ISP 2040 Central (N)	7	0	519	8	138	26	0	22	380	60	292	-26	8%	0%

Table 16: FNQ average Summer flows in MW from 16:30 to 21:00 for each N-1 transmission scenario

Baseline (N-1)	2	0	221	49	83	2	2	3	354	60	34	-97	74%	0.2%
Scen A (N-1)	2	0	221	49	119	9	13	6	354	60	62	-65	51%	0%
Scen B (N-1)	1	0	222	49	158	18	26	10	354	60	99	-37	27%	0.3%
Scen C (N-1)	2	0	222	49	108	9	13	3	354	60	57	-74	57%	0.2%
ISP 2030 Central (N-1)	0	0	239	9	152	9	13	24	354	60	88	-65	42%	1.5%
ISP StepChange (N-1)	18	0	452	8	82	13	0	21	380	60	169	-40	19%	0.7%
ISP 2040 Central (N-1)	39	1	487	8	79	11	0	15	380	60	198	-47	19%	1.0%

Table 17: FNQ average Winter flows in MW 7:00 – 16:00 for each N transmission scenario

Scenario	Wind spill	Solar spill	Wind dispatch	Solar dispatch	Kidston PumpDis	Barron Gorge	Kareeya	Energy-Gap	Load	Pump load	Flows RossN	Flows RossR	% of flows R	% Congestion
Baseline (N)	6	0	304	231	7	0	0	9	172	162	218	- 7	3%	0.00%
Scen A (N)	5	1	305	230	10	0	0	15	172	162	227	- 6	3%	0.00%
Scen B (N)	5	2	305	228	13	1	1	20	172	162	233	- 6	2%	0.00%
Scen C (N)	6	3	304	228	14	1	1	20	172	162	233	- 5	2%	0.00%
ISP 2030 Central (N)	2	0	336	31	14	1	1	63	172	162	167	- 64	28%	0.00%
ISP StepChange (N)	30	1	619	30	16	9	0	107	172	162	465	- 26	5%	2.27%
ISP 2040 Central (N)	75	2	649	29	11	5	0	50	172	162	439	- 36	8%	1.67%

Table 18: FNQ average Winter flows in MW from 7:00 to 16:00 for each N-1 transmission scenario

Baseline (N-1)	19	0	291	230	4	0	0	3	172	162	197	- 9	4%	0.38%
Scen A (N-1)	27	6	284	225	7	0	0	7	175	162	190	- 7	4%	0.30%
Scen B (N-1)	29	11	281	220	8	0	1	9	172	162	187	- 7	3%	0.76%
Scen C (N-1)	35	14	275	217	8	1	1	9	172	162	176	- 6	3%	0.15%
ISP 2030 Central (N-1)	5	1	332	30	9	1	1	30	172	162	137	- 75	35%	0.23%
ISP StepChange (N-1)	158	3	491	28	3	5	0	57	172	162	272	- 28	9%	2.35%
ISP 2040 Central (N-1)	233	4	492	27	3	2	0	27	172	162	247	- 37	13%	1.74%

Table 19: FNQ average Winter flows in MW 16:30 – 21:00 for each N transmission scenario

Scenario	Wind spill	Solar spill	Wind dispatch	Solar dispatch	Kidston PumpDis	Barron Gorge	Kareeya	Energy-Gap	Load	Pump load	Flows RossN	Flows RossR	% of flows R	%Congestion
Baseline (N)	0	0	384	29	170	3	4	17	264	60	281	- 4	2%	0.00%
Scen A (N)	0	0	384	29	207	11	16	23	264	60	339	- 2	0%	0.00%
Scen B (N)	0	0	384	29	221	16	24	24	264	60	368	- 1	0%	0.00%
Scen C (N)	0	0	384	29	220	20	30	22	264	60	375	- 1	0%	0.00%
ISP 2030 Central (N)	0	0	300	4	221	14	20	27	264	60	267	- 12	4%	0.00%
ISP StepChange (N)	1	0	563	4	205	47	0	33	291	60	497	- 3	1%	2.12%
ISP 2040 Central (N)	3	0	627	4	205	49	0	38	291	60	566	- 3	1%	4.24%

Table 20: FNQ average winter flows in MW from 16:30 to 21:00 for each N-1 transmission scenario

Baseline (N-1)	0	0	384	29	102	1	1	11	264	60	210	- 12	5%	0.15%
Scen A (N-1)	1	0	384	29	127	7	11	11	265	60	242	- 3	1%	0.45%
Scen B (N-1)	2	0	382	29	148	12	18	14	264	60	276	- 2	1%	1.21%
Scen C (N-1)	1	0	383	29	136	12	18	13	264	60	263	- 2	1%	0.76%
ISP 2030 Central (N-1)	0	0	300	4	216	21	31	27	264	60	278	- 11	4%	0.91%
ISP StepChange (N-1)	40	0	525	4	122	25	0	24	291	60	345	- 4	1%	18.64%
ISP 2040 Central (N-1)	73	0	557	4	119	25	0	25	291	60	375	- 4	1%	18.64%

Table 21: FNQ average Autumn flows in MW 7:00 - 16:00 for each N transmission scenario

Scenario	Wind spill	Solar spill	Wind dispatch	Solar dispatch	Kidston PumpDis	Barron Gorge	Kareeya	Energy-Gap	Load	Pump load	Flows RossN	Flows RossR	% of flows R	% Congestion
Baseline (N)	12	0	362	249	2	0	0	3	220	162	235	- 8	3%	0.00%
Scen A (N)	4	0	369	249	5	0	0	7	220	162	248	- 7	3%	0.00%
Scen B (N)	5	2	369	247	7	0	0	10	220	162	251	- 7	3%	0.00%
Scen C (N)	6	2	367	247	6	0	0	8	220	162	248	- 7	3%	0.00%
ISP 2030 Central (N)	2	0	310	32	4	1	1	52	220	162	93	- 84	47%	0.00%
ISP StepChange (N)	24	1	569	31	8	10	-	102	218	162	357	- 25	6%	0.09%
ISP 2040 Central (N)	67	2	595	29	4	3	0	41	218	162	330	- 46	12%	0.28%

Table 22: FNQ average Autumn flows in MW from 7:00 to 16:00 for each N-1 transmission scenario

Baseline (N-1)	42	2	331	247	1	0	0	1	220	162	200	- 9	4%	0.00%
Scen A (N-1)	36	2	337	247	3	0	0	3	218	162	210	- 7	3%	0.00%
Scen B (N-1)	30	6	343	243	4	0	0	5	220	162	215	- 7	3%	0.09%
Scen C (N-1)	48	7	325	242	2	0	0	2	220	162	191	- 8	4%	0.00%
ISP 2030 Central (N-1)	5	0	307	31	2	1	1	24	220	162	78	- 102	57%	0.00%
ISP StepChange (N-1)	125	4	468	28	1	4	0	50	218	162	204	- 40	16%	0.83%
ISP 2040 Central (N-1)	203	5	460	27	1	1	0	21	218	162	177	- 55	24%	0.37%

Table 23: FNQ average Autumn flows in MW 16:30 – 21:00 for each N transmission scenario

Scenario	Wind spill	Solar spill	Wind dispatch	Solar dispatch	Kidston PumpDis	Barron Gorge	Kareeya	Energy-Gap	Load	Pump load	Flows RossN	Flows RossR	% of flows R	% Congestion
Baseline (N)	0	0	411	43	115	1	2	8	311	60	216	- 13	6%	0.00%
Scen A (N)	0	0	411	43	190	10	15	13	311	60	310	- 5	2%	0.00%
Scen B (N)	0	0	411	43	215	16	24	17	311	60	351	- 3	1%	0.00%
Scen C (N)	0	0	411	43	190	13	19	13	311	60	314	- 3	1%	0.00%
ISP 2030 Central (N)	-	0	298	7	220	8	11	28	311	60	205	- 10	5%	0.00%
ISP StepChange (N)	3	0	552	7	149	30	0	29	339	60	367	- 7	2%	0.19%
ISP 2040 Central (N)	6	0	613	7	167	36	0	29	339	60	450	- 6	1%	0.93%

Table 24: FNQ average Autumn flows in MW from 16:30 to 21:00 for each N-1 transmission scenario

Baseline (N-1)	1	0	410	43	53	0	0	6	311	60	152	- 16	9%	0.00%
Scen A (N-1)	2	0	409	43	84	3	5	7	311	60	183	- 8	4%	0.00%
Scen B (N-1)	3	0	409	43	135	9	13	9	311	60	245	- 3	1%	0.74%
Scen C (N-1)	2	0	409	43	68	3	4	6	311	60	167	- 9	5%	0.19%
ISP 2030 Central (N-1)	-	0	298	7	176	10	14	25	311	60	176	- 23	12%	0.56%
ISP StepChange (N-1)	27	0	528	7	89	14	0	24	339	60	268	- 13	5%	5.74%
ISP 2040 Central (N-1)	51	1	568	6	85	13	0	21	339	60	301	- 14	4%	5.37%

Table 25: ROSS average Summer flows in MW 7:00 – 16:00 for each N transmission scenario

Scenario	Wind spill	Solar spill	Wind dispatch	Solar dispatch	Yabulu	Energy-Gap	Load	Flows NQ_N	Flows NQ_R	% of flows R	% Congestion
Baseline (N)	1	548	177	826	56	0	383	675	- 2	0%	0.00%
Scen A (N)	1	438	178	936	56	0	383	787	- 2	0%	0.00%
Scen B (N)	0	371	178	1,003	56	0	383	857	- 2	0%	0.00%
Scen C (N)	0	390	178	983	56	0	383	837	- 2	0%	0.00%
ISP 2030 Central (N)	1	1	9	337	61	3	383	62	- 152	71%	0.00%
ISP StepChange (N)	2	5	8	333	98	4	381	246	- 53	18%	0.00%
ISP 2040 Central (N)	3	5	8	333	66	2	381	193	- 109	36%	0.00%

Table 26: ROSS average Summer flows in MW from 7:00 to 16:00 for each N-1 transmission scenario

Baseline (N-1)	6	729	172	645	56	0	383	485	- 2	0%	0.00%
Scen A (N-1)	5	672	174	702	56	0	385	545	- 2	0%	0.00%
Scen B (N-1)	3	568	176	805	56	0	383	655	- 3	0%	0.00%
Scen C (N-1)	6	700	173	673	56	0	383	515	- 3	0%	0.00%
ISP 2030 Central (N-1)	1	1	9	337	59	4	383	57	- 180	76%	0.00%
ISP StepChange (N-1)	3	17	7	321	75	3	381	115	- 99	46%	0.00%
ISP 2040 Central (N-1)	4	22	7	317	59	2	381	82	- 142	63%	0.00%

Table 27: ROSS average Summer flows in MW 16:30 – 21:00 for each N transmission scenario

Scenario	Wind spill	Solar spill	Wind dispatch	Solar dispatch	Yabulu	Energy-Gap	Load	Flows NQ_N	Flows NQ_R	% of flows R	% Congestion
Baseline (N)	0	0	192	268	77	0	554	146	- 241	62%	0.00%
Scen A (N)	0	0	192	268	134	6	554	190	- 113	37%	0.00%
Scen B (N)	0	0	192	268	169	26	554	248	- 74	23%	0.00%
Scen C (N)	0	0	192	268	157	19	554	220	- 73	25%	0.00%
ISP 2030 Central (N)	0	0	12	86	104	2	554	3	- 328	99%	0.00%
ISP StepChange (N)	1	0	12	86	129	4	595	25	- 241	91%	0.00%
ISP 2040 Central (N)	1	1	11	86	146	5	595	39	- 174	82%	0.00%

Table 28: ROSS average Summer flows in MW from 16:30 to 21:00 for each N-1 transmission scenario

Baseline (N-1)	2	13	190	255	63	2	554	124	- 272	69%	0.00%
Scen A (N-1)	2	8	191	260	91	5	558	138	- 185	57%	0.00%
Scen B (N-1)	1	3	192	264	121	20	554	177	- 108	38%	0.00%
Scen C (N-1)	1	10	191	258	87	3	554	131	- 201	61%	0.00%
ISP 2030 Central (N-1)	0	1	12	86	99	2	554	1	- 378	100%	0.00%
ISP StepChange (N-1)	1	1	12	86	99	1	595	9	- 325	97%	0.00%
ISP 2040 Central (N-1)	1	2	11	85	95	1	595	9	- 308	97%	0.00%

Table 29: ROSS average Winter flows in MW 7:00 – 16:00 for each N transmission scenario

Scenario	Wind spill	Solar spill	Wind dispatch	Solar dispatch	Yabulu	Energy-Gap	Load	Flows NQ_N	Flows NQ_R	% of flows R	% Congestion
Baseline (N)	3	445	261	738	38	0	294	893	- 10	1%	0.00%
Scen A (N)	3	373	261	810	40	0	294	974	- 7	1%	0.00%
Scen B (N)	4	314	260	869	43	0	294	1,038	- 5	0%	0.00%
Scen C (N)	5	303	259	880	45	0	294	1,051	- 4	0%	0.00%
ISP 2030 Central (N)	1	1	15	297	44	3	294	158	- 52	25%	0.00%
ISP StepChange (N)	1	1	15	297	75	3	293	448	- 15	3%	0.00%
ISP 2040 Central (N)	2	2	14	296	61	2	293	405	- 24	6%	0.00%

Table 30: ROSS average Winter flows in MW from 7:00 to 16:00 for each N-1 transmission scenario

Baseline (N-1)	9	574	255	608	37	0	294	740	- 12	2%	0.30%
Scen A (N-1)	16	548	248	634	39	0	299	752	- 8	1%	0.08%
Scen B (N-1)	19	467	245	716	41	0	294	828	- 7	1%	0.38%
Scen C (N-1)	24	488	240	695	40	0	294	791	- 6	1%	0.15%
ISP 2030 Central (N-1)	1	2	15	296	42	3	294	126	- 63	33%	0.00%
ISP StepChange (N-1)	2	4	14	294	60	3	293	273	- 21	7%	0.00%
ISP 2040 Central (N-1)	3	8	13	290	48	2	293	232	- 29	11%	0.00%

Table 31: ROSS average Winter flows in MW 16:30 – 21:00 for each N transmission scenario

Scenario	Wind spill	Solar spill	Wind dispatch	Solar dispatch	Yabulu	Energy-Gap	Load	Flows NQ_N	Flows NQ_R	% of flows R	% Congestion
Baseline (N)	0	0	334	116	68	0	450	333	- 62	16%	0.00%
Scen A (N)	0	0	334	116	108	0	450	404	- 39	9%	0.00%
Scen B (N)	0	0	334	116	137	3	450	453	- 30	6%	0.00%
Scen C (N)	0	0	334	116	138	7	450	462	- 28	6%	0.00%
ISP 2030 Central (N)	0	0	13	37	140	1	450	49	- 126	72%	0.00%
ISP StepChange (N)	0	0	13	37	141	22	496	167	- 66	28%	0.00%
ISP 2040 Central (N)	0	0	13	37	153	49	496	249	- 51	17%	0.00%

Table 32: ROSS average Winter flows in MW from 16:30 to 21:00 for each N-1 transmission scenario

Baseline (N-1)	0	0	333	115	44	0	450	262	- 90	26%	0.00%
Scen A (N-1)	1	0	333	115	66	3	452	284	- 48	15%	0.00%
Scen B (N-1)	2	0	332	116	90	11	450	336	- 37	10%	0.00%
Scen C (N-1)	1	0	333	116	83	16	450	323	- 37	10%	0.00%
ISP 2030 Central (N-1)	0	0	13	37	130	7	450	51	- 121	70%	0.00%
ISP StepChange (N-1)	1	0	13	36	122	5	496	51	- 111	68%	0.00%
ISP 2040 Central (N-1)	1	0	12	36	139	22	496	79	- 77	49%	0.00%

Table 33: ROSS average Autumn flows in MW 7:00 - 16:00 for each N transmission scenario

Scenario	Wind spill	Solar spill	Wind dispatch	Solar dispatch	Yabulu	Energy-Gap	Load	Flows NQ_N	Flows NQ_R	% of flows R	% Congestion
Baseline (N)	6	567	311	735	56	0	358	942	- 6	1%	0.00%
Scen A (N)	2	463	314	840	57	0	358	1,060	- 4	0%	0.00%
Scen B (N)	3	386	313	916	58	0	358	1,138	- 2	0%	0.28%
Scen C (N)	4	438	312	864	58	0	358	1,083	- 3	0%	0.00%
ISP 2030 Central (N)	1	1	13	306	61	3	358	95	- 83	47%	0.00%
ISP StepChange (N)	1	4	13	304	96	3	354	356	- 12	3%	0.00%
ISP 2040 Central (N)	2	5	12	303	69	2	354	302	- 34	10%	0.00%

Table 34: ROSS average Autumn flows in MW from 7:00 to 16:00 for each N-1 transmission scenario

Baseline (N-1)	25	791	291	512	56	0	358	670	- 8	1%	0.00%
Scen A (N-1)	22	755	295	547	56	0	355	717	- 5	1%	0.19%
Scen B (N-1)	19	666	298	636	57	0	358	813	- 3	0%	1.30%
Scen C (N-1)	30	779	287	523	57	0	358	668	- 5	1%	0.00%
ISP 2030 Central (N-1)	1	2	13	305	59	3	358	81	- 104	56%	0.00%
ISP StepChange (N-1)	2	13	11	295	71	2	354	200	- 40	17%	0.00%
ISP 2040 Central (N-1)	3	17	10	290	60	2	354	158	- 55	26%	0.00%

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Table 35: ROSS average Autumn flows in MW 16:30 – 21:00 for each N transmission scenario

Scenario	Wind spill	Solar spill	Wind dispatch	Solar dispatch	Yabulu	Energy-Gap	Load	Flows NQ_N	Flows NQ_R	% of flows R	% Congestion
Baseline (N)	0	0	353	164	76	0	514	311	- 60	16%	0.00%
Scen A (N)	0	0	353	165	129	0	514	420	- 21	5%	0.00%
Scen B (N)	0	0	353	165	176	2	514	497	- 11	2%	0.00%
Scen C (N)	0	0	353	165	138	0	514	426	- 12	3%	0.00%
ISP 2030 Central (N)	0	0	14	56	138	1	514	20	- 161	89%	0.00%
ISP StepChange (N)	0	0	14	56	158	4	562	91	- 112	55%	0.00%
ISP 2040 Central (N)	1	0	13	56	180	13	562	142	- 59	30%	0.00%

Table 36: ROSS average Autumn flows in MW from 16:30 to 21:00 for each N-1 transmission scenario

Baseline (N-1)	1	14	352	151	59	0	514	234	- 77	25%	0.00%
Scen A (N-1)	2	11	351	154	72	0	515	258	- 48	16%	0.00%
Scen B (N-1)	2	5	351	159	101	1	514	334	- 27	8%	0.19%
Scen C (N-1)	2	11	351	154	69	0	514	243	- 52	18%	0.00%
ISP 2030 Central (N-1)	0	0	14	56	113	4	514	17	- 222	93%	0.00%
ISP StepChange (N-1)	1	0	13	56	118	1	562	30	- 186	86%	0.00%
ISP 2040 Central (N-1)	1	1	13	56	126	2	562	36	- 154	81%	0.00%

Table 37: NQ average Summer flows in MW 7:00 – 16:00 for each N transmission scenario

Scenario	Wind spill	Solar spill	Wind dispatch	Solar dispatch	Urannah PumpDis	Energy-Gap	Load	Pump load	Flows CWQ_N	Flows CWQ_R	% of flows R	% Congestion
Baseline (N)	10	158	319	612	-	2	288	697	592	- 11	2%	0.00%
Scen A (N)	5	111	324	660	1	5	288	697	739	- 4	1%	0.00%
Scen B (N)	3	87	326	683	2	12	288	697	834	- 3	0%	0.00%
Scen C (N)	4	91	325	680	2	12	288	697	811	- 2	0%	0.00%
ISP 2030 Central (N)	-	1	-	243	4	137	288	697	31	- 826	96%	0.00%
ISP StepChange (N)	13	4	368	239	8	284	286	697	253	- 203	44%	0.00%
ISP 2040 Central (N)	23	4	359	239	4	117	286	697	166	- 406	71%	0.00%

Table 38: NQ average Summer flows in MW from 7:00 to 16:00 for each N-1 transmission scenario

Baseline (N-1)	26	205	303	565	0	2	288	697	344	- 5	2%	0.00%
Scen A (N-1)	21	174	308	596	0	2	289	697	432	- 4	1%	0.00%
Scen B (N-1)	15	131	315	637	2	7	288	697	583	- 1	0%	0.00%
Scen C (N-1)	24	191	305	580	1	3	288	697	386	- 4	1%	0.00%
ISP 2030 Central (N-1)	-		-	243	1	76	288	697	26	- 918	97%	0.08%
ISP StepChange (N-1)	53	12	328	232	1	202	286	697	60	- 310	84%	0.00%
ISP 2040 Central (N-1)	69	15	313	229	2	60	286	697	37	- 532	93%	0.00%

Table 39: NQ average Summer flows in MW 16:30 – 21:00 for each N transmission scenario

Scenario	Wind spill	Solar spill	Wind dispatch	Solar dispatch	Urannah PumpDis	Energy-Gap	Load	Pump load	Flows CWQ_N	Flows CWQ_R	% of flows R	% Congestion
Baseline (N)	0	0	345	139	238	23	415	204	200	- 222	53%	0.00%
Scen A (N)	0	0	345	139	390	59	415	204	430	- 98	19%	0.00%
Scen B (N)	0	0	345	139	452	97	415	204	587	- 66	10%	0.00%
Scen C (N)	0	0	345	139	453	82	415	204	543	- 62	10%	0.00%
ISP 2030 Central (N)	-	-	-	57	388	125	415	204	70	- 544	89%	0.00%
ISP StepChange (N)	2	2	479	57	325	130	445	204	194	- 119	38%	0.00%
ISP 2040 Central (N)	4	4	476	57	456	117	445	204	354	- 96	21%	0.00%

Table 40: NQ average Summer flows in MW from 16:00 to 21:00 for each N-1 transmission scenario

Baseline (N-1)	4	1	341	138	199	14	415	204	120	- 242	67%	0.00%
Scen A (N-1)	3	1	342	138	326	23	416	204	180	- 63	26%	0.00%
Scen B (N-1)	2	0	343	139	488	49	415	204	422	- 14	3%	0.00%
Scen C (N-1)	3	1	342	138	309	18	415	204	140	- 64	31%	0.00%
ISP 2030 Central (N-1)	-	0	-	57	389	111	415	204	11	- 545	98%	0.00%
ISP StepChange (N-1)	6	1	475	57	221	95	445	204	45	- 206	82%	0.00%
ISP 2040 Central (N-1)	8	2	473	56	274	72	445	204	92	- 212	70%	0.00%

Table 41: NQ average Winter flows in MW 7:00 – 16:00 for each N transmission scenario

Scenario	Wind spill	Solar spill	Wind dispatch	Solar dispatch	Urannah PumpDis	Energy-Gap	Load	Pump load	Flows CWQ_N	Flows CWQ_R	% of flows R	% Congestion
Baseline (N)	12	111	309	557	12	27	216	697	815	- 13	2%	0.00%
Scen A (N)	9	76	312	590	16	39	216	697	934	- 9	1%	0.00%
Scen B (N)	8	61	312	605	19	55	216	697	1,021	- 6	1%	0.00%
Scen C (N)	9	59	312	608	17	50	216	697	1,030	- 6	1%	0.00%
ISP 2030 Central (N)	-	1	-	215	24	151	216	697	81	- 569	87%	0.00%
ISP StepChange (N)	2	1	245	215	34	320	216	697	456	- 203	31%	0.00%
ISP 2040 Central (N)	5	2	241	214	37	162	216	697	345	- 292	46%	0.00%

Table 42: NQ average Winter flows in MW from 7:00 to 16:00 for each N-1 transmission scenario

Baseline (N-1)	27	163	294	504	10	12	216	697	598	- 21	3%	0.00%
Scen A (N-1)	30	145	290	522	11	19	218	697	622	- 10	2%	0.00%
Scen B (N-1)	28	115	292	552	15	30	216	697	734	- 8	1%	0.00%
Scen C (N-1)	34	126	287	541	14	28	216	697	680	- 5	1%	0.00%
ISP 2030 Central (N-1)	-	2	-	214	21	87	216	697	52	- 647	93%	0.00%
ISP StepChange (N-1)	12	3	234	213	18	224	216	697	193	- 217	53%	0.00%
ISP 2040 Central (N-1)	24	6	222	210	22	124	216	697	127	- 306	71%	0.00%

Table 43: NQ average Winter flows in MW 16:30 – 21:00 for each N transmission scenario

Scenario	Wind spill	Solar spill	Wind dispatch	Solar dispatch	Urannah PumpDis	Energy-Gap	Load	Pump load	Flows CWQ_N	Flows CWQ_R	% of flows R	% Congestion
Baseline (N)	0	0	374	42	333	99	339	204	578	- 67	10%	0.00%
Scen A (N)	0	0	374	42	411	125	339	204	741	- 43	6%	0.00%
Scen B (N)	0	0	374	42	436	144	339	204	824	- 32	4%	0.00%
Scen C (N)	0	0	374	42	464	145	339	204	860	- 31	4%	0.00%
ISP 2030 Central (N)	-	-	-	25	410	149	339	204	200	- 310	61%	0.00%
ISP StepChange (N)	0	0	298	25	675	226	373	204	699	- 43	6%	0.00%
ISP 2040 Central (N)	0	0	298	25	805	277	373	204	946	- 32	3%	0.00%

Table 44: NQ average Winter flows in MW from 16:30 to 21:00 for each N-1 transmission scenario

Baseline (N-1)	0	0	374	42	245	65	339	204	410	- 107	21%	0.00%
Scen A (N-1)	1	0	373	42	276	64	338	204	436	- 38	8%	0.00%
Scen B (N-1)	1	0	373	42	394	91	339	204	617	- 27	4%	0.00%
Scen C (N-1)	1	0	373	42	353	81	339	204	555	- 22	4%	0.00%
ISP 2030 Central (N-1)	-	-	-	25	426	158	339	204	198	- 274	58%	0.00%
ISP StepChange (N-1)	2	0	297	25	612	197	373	204	443	- 27	6%	0.00%
ISP 2040 Central (N-1)	1	0	297	25	719	223	373	204	624	- 23	4%	0.00%

Table 45: NQ average Autumn flows in MW 7:00 - 16:00 for each N transmission scenario

Scenario	Wind spill	Solar spill	Wind dispatch	Solar dispatch	Urannah PumpDis	Energy-Gap	Load	Pump load	Flows CWQ_N	Flows CWQ_R	% of flows R	% Congestion
Baseline (N)	15	154	353	576	6	10	264	697	851	- 7	1%	0.00%
Scen A (N)	7	102	360	628	10	20	264	697	1,021	- 4	0%	0.00%
Scen B (N)	7	80	361	650	9	26	264	697	1,115	- 3	0%	0.00%
Scen C (N)	8	91	360	639	11	22	264	697	1,053	- 3	0%	0.00%
ISP 2030 Central (N)	-	1	-	226	10	117	264	697	40	- 720	95%	0.00%
ISP StepChange (N)	11	3	295	224	18	291	261	697	300	- 147	33%	0.00%
ISP 2040 Central (N)	16	4	290	223	10	114	261	697	194	- 301	61%	0.00%

Table 46: NQ average Autumn flows in MW from 7:00 to 16:00 for each N-1 transmission scenario

Baseline (N-1)	47	250	321	480	3	5	264	697	469	- 7	2%	0.00%
Scen A (N-1)	41	225	326	505	5	7	261	697	543	- 5	1%	0.00%
Scen B (N-1)	33	174	335	556	8	13	264	697	695	- 3	0%	0.00%
Scen C (N-1)	48	244	319	486	6	7	264	697	475	- 5	1%	0.00%
ISP 2030 Central (N-1)	-	2	-	225	6	58	264	697	28	- 805	97%	0.00%
ISP StepChange (N-1)	40	10	266	217	3	174	261	697	71	- 249	78%	0.00%
ISP 2040 Central (N-1)	51	13	254	214	4	61	261	697	44	- 411	90%	0.00%

Table 47: NQ average Autumn flows in MW 16:30 – 21:00 for each N transmission scenario

Scenario	Wind spill	Solar spill	Wind dispatch	Solar dispatch	Urannah PumpDis	Energy-Gap	Load	Pump load	Flows CWQ_N	Flows CWQ_R	% of flows R	% Congestion
Baseline (N)	0	0	400	71	243	48	380	204	454	- 76	14%	0.00%
Scen A (N)	0	0	400	71	408	80	380	204	728	- 26	4%	0.00%
Scen B (N)	0	0	400	71	452	108	380	204	868	- 20	2%	0.00%
Scen C (N)	0	0	400	71	420	80	380	204	745	- 19	2%	0.00%
ISP 2030 Central (N)	-	-	-	35	412	130	380	204	154	- 381	71%	0.00%
ISP StepChange (N)	2	0	394	35	442	167	414	204	388	- 53	12%	0.00%
ISP 2040 Central (N)	4	0	391	35	571	176	414	204	601	- 41	6%	0.00%

Table 48: NQ average Autumn flows in MW from 16:30 to 21:00 for each N-1 transmission scenario

Baseline (N-1)	4	1	396	70	124	24	380	204	246	- 92	27%	0.00%
Scen A (N-1)	4	1	396	70	208	32	378	204	316	- 25	7%	0.00%
Scen B (N-1)	3	0	396	70	356	51	380	204	550	- 12	2%	0.00%
Scen C (N-1)	3	1	396	70	173	23	380	204	267	- 33	11%	0.00%
ISP 2030 Central (N-1)	-	0	-	35	372	128	380	204	63	- 394	86%	0.00%
ISP StepChange (N-1)	10	0	385	35	304	128	414	204	141	- 110	44%	0.00%
ISP 2040 Central (N-1)	8	1	388	35	401	120	414	204	256	- 104	29%	0.00%

Table 49: CWQ average Summer flows in MW 7:00 to 16:00 for each N transmission scenario

Scenario	Wind spill	Solar spill	Wind disp	Solar disp	Stanwell	Callide	Barcald	Energy-Gap	Load	Flows Tar_N	Flows Tar_R	% of flows R	% Cong	Flows Glad_N	Flows Glad_R	% of flows R	% Cong
Baseline (N)	0	142	77	613	795	565	-	0	366	830	-	0%	0.00%	954	-	0%	4.75%
Scen A (N)	0	95	77	659	616	585	0	0	366	749	-	0%	0.00%	1,091	-	0%	6.08%
Scen B (N)	0	73	77	682	418	594	0	0	366	741	-	0%	0.00%	1,041	-	0%	5.75%
Scen C (N)	0	76	77	678	829	588	0	0	366	919	-	0%	0.00%	1,205	-	0%	11.92%
ISP 2030 Central (N)	0	54	116	1,042	1,083	768	1	11	366	750	- 0	0%	0.00%	800	-	0%	0.17%
ISP StepChange (N)	12	4	331	244	1,181	772	-	5	365	565	- 4	1%	0.00%	1,335	-	0%	6.42%
ISP 2040 Central (N)	20	90	322	1,006	1,006	695	-	8	365	658	- 1	0%	0.00%	1,398	-	0%	10.42%

Table 50: CWQ average Summer flows in MW from 7:00 to 16:00 for each N-1 transmission scenario

Baseline (N-1)	0	184	77	570	797	562	0	1	366	560	-	0%	0.00%	950	-	0%	76.25%
Scen A (N-1)	0	154	77	600	606	569	0	1	367	490	-	0%	0.00%	972	-	0%	89.50%
Scen B (N-1)	0	114	77	640	409	579	0	1	366	518	-	0%	0.00%	965	-	0%	85.75%
Scen C (N-1)	0	171	77	583	804	567	0	1	366	602	-	0%	0.00%	978	-	0%	97.42%
ISP 2030 Central (N-1)	1	87	116	1,009	997	740	1	10	366	513	-	0%	0.00%	777	- 0	0%	33.17%
ISP StepChange (N-1)	52	12	291	236	1,048	722	-	4	365	379	- 2	1%	0.00%	968	-	0%	46.75%
ISP 2040 Central (N-1)	65	250	277	846	943	664	-	6	365	511	- 0	0%	0.00%	979	-	0%	62.75%

Table 51: CWQ average Summer flows in MW 16:30 to 21:00 for each N transmission scenario

Scenario	Wind spill	Solar spill	Wind disp	Solar disp	Stanwell	Callide	Barcald	Energy-Gap	Load	Flows Tar_N	Flows Tar_R	% of flows R	% Cong	Flows Glad_N	Flows Glad_R	% of flows R	% Cong
Baseline (N)	0	0	79	141	1,206	808	2	0	531	725	-	0%	0.00%	674	-	0%	0.67%
Scen A (N)	0	0	79	141	1,011	829	16	0	531	523	- 2	0%	0.00%	1,093	-	0%	4.50%
Scen B (N)	0	0	79	141	684	832	24	0	531	503	- 8	2%	0.00%	1,011	-	0%	5.83%
Scen C (N)	0	0	79	141	1,353	831	23	0	531	821	-	0%	0.00%	1,255	-	0%	20.50%
ISP 2030 Central (N)	0	0	159	252	1,388	840	7	4	531	629	- 0	0%	0.00%	751	-	0%	0.17%
ISP StepChange (N)	1	0	467	61	1,268	824	-	10	569	377	- 3	1%	0.00%	1,482	-	0%	55.83%
ISP 2040 Central (N)	4	2	465	251	1,278	818	-	11	569	710	-	0%	0.00%	1,508	-	0%	58.67%

Table 52: CWQ average Summer flows in MW from 16:30 to 21:00 for each N-1 transmission scenario

Baseline (N-1)	0	1	79	140	1,184	784	2	1	531	451	- 0	0%	0.00%	789	- 0	0%	35.50%
Scen A (N-1)	0	1	79	140	940	801	9	2	531	352	- 0	0%	0.00%	941	-	0%	58.17%
Scen B (N-1)	0	1	79	141	647	818	18	1	531	409	- 0	0%	0.00%	937	-	0%	62.83%
Scen C (N-1)	0	1	79	140	1,251	804	9	1	531	566	-	0%	0.00%	974	-	0%	78.00%
ISP 2030 Central (N-1)	0	4	159	249	1,346	835	9	5	531	520	-	0%	0.00%	753	-	0%	26.67%
ISP StepChange (N-1)	6	1	462	61	1,203	801	-	5	569	537	- 0	0%	0.00%	980	-	0%	99.17%
ISP 2040 Central (N-1)	6	5	462	248	1,176	793	-	6	569	722	-	0%	0.00%	980	-	0%	93.33%

Table 53: CWQ average Winter flows in MW 7:00 to 16:00 for each N transmission scenario

Scenario	Wind spill	Solar spill	Wind disp	Solar disp	Stanwell	Callide	Barcald	Energy-Gap	Load	Flows Tar_N	Flows Tar_R	% of flows R	% Cong	Flows Glad_N	Flows Glad_R	% of flows R	% Cong
Baseline (N)	0	79	71	531	650	541	0	0	317	855	- 0	0%	0.00%	973	- 0	0%	2.50%
Scen A (N)	1	53	70	558	604	548	0	0	317	770	- 1	0%	0.00%	1,164	-	0%	4.09%
Scen B (N)	2	43	69	567	461	552	1	0	317	773	- 1	0%	0.00%	1,127	-	0%	1.06%
Scen C (N)	2	42	69	569	700	553	1	0	317	919	-	0%	0.00%	1,211	-	0%	0.91%
ISP 2030 Central (N)	1	12	76	912	814	651	1	9	317	649	- 0	0%	0.00%	745	- 0	0%	0.00%
ISP StepChange (N)	1	1	225	221	961	677	-	5	316	510	- 12	2%	0.00%	1,242	-	0%	5.15%
ISP 2040 Central (N)	4	30	222	894	805	596	-	8	316	586	- 4	1%	0.00%	1,320	-	0%	4.77%

Table 54: CWQ average Winter flows in MW from 7:00 to 16:00 for each N-1 transmission scenario

Baseline (N-1)	0	122	71	489	625	528	0	0	317	566	- 0	0%	0.00%	954	- 0	0%	41.97%
Scen A (N-1)	3	107	68	503	569	529	0	0	321	482	- 1	0%	0.00%	1,038	-	0%	43.03%
Scen B (N-1)	6	86	65	525	433	532	1	0	317	501	- 1	0%	0.00%	1,023	-	0%	23.64%
Scen C (N-1)	7	96	64	515	651	531	1	0	317	596	-	0%	0.00%	1,070	-	0%	28.03%
ISP 2030 Central (N-1)	1	22	76	901	759	645	1	9	317	520	- 0	0%	0.00%	692	-	0%	0.08%
ISP StepChange (N-1)	8	3	218	219	880	653	-	3	316	348	- 7	2%	0.00%	1,017	-	0%	26.59%
ISP 2040 Central (N-1)	17	108	209	816	777	595	-	6	316	487	- 0	0%	0.00%	1,089	-	0%	33.03%

Table 55: CWQ average Winter flows in MW 16:30 to 21:00 for each N transmission scenario

Scenario	Wind spill	Solar spill	Wind disp	Solar disp	Stanwell	Callide	Barcald	Energy-Gap	Load	Flows Tar_N	Flows Tar_R	% of flows R	% Cong	Flows Glad_N	Flows Glad_R	% of flows R	% Cong
Baseline (N)	0	0	82	37	1,007	695	5	0	492	782	- 0	0%	0.00%	796	- 0	0%	0.00%
Scen A (N)	0	0	82	37	927	697	15	0	492	515	- 5	1%	0.00%	1,171	-	0%	2.88%
Scen B (N)	0	0	82	37	698	698	23	0	492	478	- 7	1%	0.00%	1,087	-	0%	0.61%
Scen C (N)	0	0	82	37	1,053	698	27	0	492	698	-	0%	0.00%	1,221	-	0%	2.88%
ISP 2030 Central (N)	0	0	83	76	1,054	700	21	2	492	437	- 3	1%	0.00%	661	- 0	0%	0.00%
ISP StepChange (N)	0	0	245	23	1,044	698	-	26	543	451	- 6	1%	0.00%	1,421	-	0%	13.33%
ISP 2040 Central (N)	0	0	245	76	1,048	699	-	96	543	705	- 0	0%	0.00%	1,502	-	0%	11.52%

Table 56: CWQ average Winter flows in MW from 16:30 to 21:00 for each N-1 transmission scenario

Baseline (N-1)	0	0	82	37	922	667	1	0	492	476	- 1	0%	0.00%	771	- 1	0%	1.97%
Scen A (N-1)	0	0	82	37	850	673	9	0	495	311	- 3	1%	0.00%	984	-	0%	22.58%
Scen B (N-1)	0	0	82	37	655	681	16	0	492	349	- 4	1%	0.00%	970	-	0%	23.18%
Scen C (N-1)	0	0	82	37	980	680	15	0	492	516	-	0%	0.00%	1,044	-	0%	36.06%
ISP 2030 Central (N-1)	0	0	83	76	1,050	700	25	2	492	458	- 0	0%	0.00%	674	-	0%	0.00%
ISP StepChange (N-1)	2	0	244	23	997	689	-	8	543	470	- 0	0%	0.00%	1,105	-	0%	79.55%
ISP 2040 Central (N-1)	1	0	244	76	1,021	690	-	40	543	736	-	0%	0.00%	1,115	-	0%	69.55%

Table 57: CWQ average Autumn flows in MW 7:00 to 16:00 for each N transmission scenario

Scenario	Wind spill	Solar spill	Wind disp	Solar disp	Stanwell	Callide	Barcald	Energy-Gap	Load	Flows Tar_N	Flows Tar_R	% of flows R	% Cong	Flows Glad_N	Flows Glad_R	% of flows R	% Cong
Baseline (N)	0	130	79	569	821	586	0	0	353	930	-	0%	0.00%	1,087	-	0%	6.76%
Scen A (N)	0	81	79	617	646	606	0	0	353	848	- 0	0%	0.00%	1,233	-	0%	13.98%
Scen B (N)	1	63	78	635	440	616	0	0	353	831	- 1	0%	0.00%	1,176	-	0%	7.31%
Scen C (N)	1	71	78	627	863	605	0	0	353	990	-	0%	0.00%	1,323	-	0%	19.81%
ISP 2030 Central (N)	1	25	96	988	1,096	789	1	10	353	762	-	0%	0.00%	826	-	0%	0.37%
ISP StepChange (N)	12	3	274	224	1,204	788	-	4	349	567	- 3	1%	0.00%	1,349	-	0%	5.83%
ISP 2040 Central (N)	17	63	268	950	1,039	705	-	8	349	669	- 0	0%	0.00%	1,420	-	0%	9.26%

Table 58: CWQ average Autyumn flows in MW from 7:00 to 16:00 for each N-1 transmission scenario

Baseline (N-1)	0	221	79	478	807	571	0	0	353	576	-	0%	0.00%	969	-	0%	83.33%
Scen A (N-1)	0	196	78	502	620	576	0	0	349	487	- 0	0%	0.00%	988	-	0%	89.63%
Scen B (N-1)	3	148	76	550	419	583	0	0	353	506	- 1	0%	0.00%	981	-	0%	74.17%
Scen C (N-1)	3	215	76	483	823	575	0	0	353	580	-	0%	0.00%	995	-	0%	84.72%
ISP 2030 Central (N-1)	1	54	96	959	970	758	1	9	353	520	-	0%	0.00%	771	-	0%	21.76%
ISP StepChange (N-1)	43	10	242	217	1,076	734	-	3	349	364	- 4	1%	0.00%	988	-	0%	41.57%
ISP 2040 Central (N-1)	55	198	230	815	925	662	-	6	349	492	- 0	0%	0.00%	998	-	0%	54.54%

Table 59: CWQ average Autumn flows in MW 16:30 to 21:00 for each N transmission scenario

Scenario	Wind spill	Solar spill	Wind disp	Solar disp	Stanwell	Callide	Barcald	Energy-Gap	Load	Flows Tar_N	Flows Tar_R	% of flows R	% Cong	Flows Glad_N	Flows Glad_R	% of flows R	% Cong
Baseline (N)	0	0	87	71	1,260	821	2	0	511	853	-	0%	0.00%	881	-	0%	0.56%
Scen A (N)	0	0	87	71	1,022	831	13	0	511	595	- 0	0%	0.00%	1,238	-	0%	11.48%
Scen B (N)	0	0	87	71	691	834	21	0	511	538	- 2	0%	0.00%	1,135	-	0%	6.30%
Scen C (N)	0	0	87	71	1,362	832	15	0	511	821	-	0%	0.00%	1,349	-	0%	23.89%
ISP 2030 Central (N)	0	0	114	130	1,398	840	12	2	511	617	- 0	0%	0.00%	790	-	0%	0.00%
ISP StepChange (N)	1	0	335	38	1,299	823	-	8	558	423	- 1	0%	0.00%	1,484	-	0%	55.93%
ISP 2040 Central (N)	3	0	333	129	1,314	822	-	29	558	722	-	0%	0.00%	1,508	-	0%	47.22%

Table 60: CWQ average Autumn flows in MW from 16:30 to 21:00 for each N-1 transmission scenario

Baseline (N-1)	0	1	87	70	1,159	787	0	0	511	512	- 0	0%	0.00%	858	-	0%	21.85%	0
Scen A (N-1)	0	0	86	70	917	798	4	0	511	340	- 0	0%	0.00%	962	-	0%	47.59%	0
Scen B (N-1)	1	0	86	70	645	811	10	0	511	376	- 1	0%	0.00%	940	-	0%	53.15%	1
Scen C (N-1)	0	1	86	70	1,198	796	3	0	511	513	-	0%	0.00%	985	-	0%	66.67%	0
ISP 2030 Central (N-1)	0	1	114	129	1,371	839	12	2	511	528	- 0	0%	0.00%	749	-	0%	11.30%	0
ISP StepChange (N-1)	7	0	330	38	1,244	806	-	5	558	530	-	0%	0.00%	997	-	0%	97.59%	7
ISP 2040 Central (N-1)	5	2	331	128	1,236	803	-	7	558	724	-	0%	0.00%	998	-	0%	84.26%	5

Table 61: GLAD average Summer flows in MW 7:00 to 16:00 for each N transmission scenario

Scenario	Solar spill	Solar disp	Glad	Yarwun	Energy-Gap	Load	Flows WB_N	Flows WB_R	% of flows R	% Cong
Baseline (N)	88	508	731	55	0	1,102	1,046	-	0%	0.00%
Scen A (N)	48	548	266	55	0	1,102	781	-	0%	0.00%
Scen B (N)	36	560	275	56	0	1,102	756	-	0%	0.00%
Scen C (N)	38	558	271	56	0	1,102	899	-	0%	0.00%
ISP 2030 Central (N)	28	351	1,374	58	3	1,102	1,342	-	0%	0.00%
ISP StepChange (N)	9	370	-	92	4	1,093	621	- 1	0%	0.00%
ISP 2040 Central (N)	3	377	-	74	9	1,093	668	- 0	0%	0.00%

Table 62: GLAD average Summer flows in MW from 7:00 to 16:00 for each N-1 transmission scenario

Baseline (N-1)	149	447	731	55	0	1,102	975	-	0%	0.00%
Scen A (N-1)	43	553	332	64	1	1,103	741	-	0%	0.00%
Scen B (N-1)	37	559	342	66	1	1,102	753	- 0	0%	0.00%
Scen C (N-1)	27	569	367	72	1	1,102	802	-	0%	0.00%
ISP 2030 Central (N-1)	6	373	965	55	4	1,102	958	-	0%	0.00%
ISP StepChange (N-1)	1	379	-	116	128	1,093	436	- 1	0%	0.00%
ISP 2040 Central (N-1)	0	379	-	121	165	1,093	486	- 0	0%	0.00%

Table 63: GLAD average Summer flows in MW 16:30 to 21:00 for each N transmission scenario

Scenario	Solar spill	Solar disp	Glad	Yarwun	Energy-Gap	Load	Flows WB_N	Flows WB_R	% of flows R	% Cong
Baseline (N)	0	100	1,526	69	0	1,114	1,111	-	0%	0.00%
Scen A (N)	0	100	547	103	0	1,114	630	- 0	0%	0.00%
Scen B (N)	0	100	553	122	1	1,114	579	- 2	0%	0.00%
Scen C (N)	0	100	549	123	4	1,114	797	-	0%	0.00%
ISP 2030 Central (N)	-	86	1,678	88	1	1,114	1,330	-	0%	0.00%
ISP StepChange (N)	0	86	-	152	73	1,113	568	-	0%	0.00%
ISP 2040 Central (N)	0	86	-	152	277	1,113	789	-	0%	0.00%

Table 64: GLAD average Summer flows in MW from 16:30 to 21:00 for each N-1 transmission scenario

Baseline (N-1)	1	99	1,185	57	0	1,114	889	- 0	0%	0.00%
Scen A (N-1)	1	99	544	115	23	1,114	521	- 1	0%	0.00%
Scen B (N-1)	0	100	552	125	26	1,114	538	- 1	0%	0.00%
Scen C (N-1)	1	100	555	132	66	1,114	618	-	0%	0.00%
ISP 2030 Central (N-1)	1	85	1,483	70	1	1,114	1,131	-	0%	0.00%
ISP StepChange (N-1)	-	86	-	154	709	1,113	730	-	0%	0.00%
ISP 2040 Central (N-1)	0	86	-	154	829	1,113	841	-	0%	0.00%

Table 65: GLAD average Winter flows in MW 7:00 to 16:00 for each N transmission scenario

Scenario	Solar spill	Solar disp	Glad	Yarwun	Energy-Gap	Load	Flows WB_N	Flows WB_R	% of flows R	% Cong
Baseline (N)	88	396	746	38	0	1,069	979	-	0%	0.00%
Scen A (N)	51	434	270	39	0	1,069	753	- 0	0%	0.00%
Scen B (N)	46	438	278	41	0	1,069	733	- 1	0%	0.00%
Scen C (N)	37	447	283	42	0	1,069	822	- 0	0%	0.00%
ISP 2030 Central (N)	14	300	1,204	41	3	1,069	1,096	-	0%	0.00%
ISP StepChange (N)	4	310	-	61	3	1,059	482	- 6	1%	0.00%
ISP 2040 Central (N)	8	307	-	52	6	1,059	540	- 3	1%	0.00%

Table 66: GLAD average Winter flows in MW from 7:00 to 16:00 for each N-1 transmission scenario

Baseline (N-1)	112	372	666	38	0	1,069	862	- 0	0%	0.00%
Scen A (N-1)	48	436	242	39	0	1,072	613	- 1	0%	0.00%
Scen B (N-1)	40	444	247	40	0	1,069	613	- 1	0%	0.00%
Scen C (N-1)	33	452	251	41	0	1,069	666	- 0	0%	0.00%
ISP 2030 Central (N-1)	7	307	1,077	40	3	1,069	934	-	0%	0.00%
ISP StepChange (N-1)	1	313	-	68	44	1,059	330	- 4	1%	0.00%
ISP 2040 Central (N-1)	1	314	-	65	78	1,059	422	- 1	0%	0.00%

Table 67: GLAD average Winter flows in MW 16:30 to 21:00 for each N transmission scenario

Scenario	Solar spill	Solar disp	Glad	Yarwun	Energy-Gap	Load	Flows WB_N	Flows WB_R	% of flows R	% Cong
Baseline (N)	0	15	1,414	57	0	1,114	1,024	-	0%	0.00%
Scen A (N)	0	15	479	81	0	1,114	527	- 3	1%	0.00%
Scen B (N)	0	15	479	89	0	1,114	462	- 7	1%	0.00%
Scen C (N)	0	15	479	94	0	1,114	583	- 2	0%	0.00%
ISP 2030 Central (N)	-	24	1,425	88	0	1,114	946	-	0%	0.00%
ISP StepChange (N)	-	24	-	104	119	1,113	455	- 3	1%	0.00%
ISP 2040 Central (N)	0	24	-	106	238	1,113	639	- 1	0%	0.00%

Table 68: GLAD average Winter flows in MW from 16:30 to 21:00 for each N-1 transmission scenario

Baseline (N-1)	0	15	1,158	44	0	1,114	750	- 1	0%	0.00%
Scen A (N-1)	0	15	458	76	2	1,114	341	- 5	1%	0.00%
Scen B (N-1)	0	15	466	83	5	1,114	347	- 7	2%	0.00%
Scen C (N-1)	0	15	472	84	19	1,114	430	- 2	0%	0.00%
ISP 2030 Central (N-1)	-	24	1,419	85	0	1,114	952	-	0%	0.00%
ISP StepChange (N-1)	0	24	-	107	434	1,113	488	- 4	1%	0.00%
ISP 2040 Central (N-1)	-	24	-	111	695	1,113	743	- 2	0%	0.00%

Table 69: GLAD average Autumn flows in MW 7:00 to 16:00 for each N transmission scenario

Scenario	Solar spill	Solar disp	Glad	Yarwun	Energy-Gap	Load	Flows WB_N	Flows WB_R	% of flows R	% Cong
Baseline (N)	100	459	725	55	0	1,098	1,115	-	0%	0.00%
Scen A (N)	49	511	246	56	0	1,098	854	-	0%	0.00%
Scen B (N)	37	522	252	57	0	1,098	820	- 0	0%	0.00%
Scen C (N)	41	519	247	57	0	1,098	944	-	0%	0.00%
ISP 2030 Central (N)	18	334	1,318	58	3	1,098	1,300	-	0%	0.00%
ISP StepChange (N)	10	342	-	90	3	1,085	610	- 0	0%	0.00%
ISP 2040 Central (N)	6	346	-	78	3	1,085	663	- 0	0%	0.00%

Table 70: GLAD average Autumn flows in MW from 7:00 to 16:00 for each N-1 transmission scenario

Baseline (N-1)	120	440	690	55	0	1,098	950	-	0%	0.00%
Scen A (N-1)	32	527	276	62	0	1,098	679	- 0	0%	0.00%
Scen B (N-1)	28	531	282	64	0	1,098	684	- 0	0%	0.00%
Scen C (N-1)	22	537	302	67	0	1,098	724	-	0%	0.00%
ISP 2030 Central (N-1)	2	350	980	55	3	1,098	947	-	0%	0.00%
ISP StepChange (N-1)	2	350	-	114	106	1,085	413	- 1	0%	0.00%
ISP 2040 Central (N-1)	0	352	-	120	148	1,085	466	- 0	0%	0.00%

Table 71: GLAD average Autumn flows in MW 16:30 to 21:00 for each N transmission scenario

Scenario	Solar spill	Solar disp	Glad	Yarwun	Energy-Gap	Load	Flows WB_N	Flows WB_R	% of flows R	% Cong
Baseline (N)	0	42	1,432	68	0	1,114	1,159	-	0%	0.00%
Scen A (N)	0	42	466	113	0	1,114	633	- 0	0%	0.00%
Scen B (N)	0	42	469	132	0	1,114	561	- 2	0%	0.00%
Scen C (N)	0	42	468	132	1	1,114	751	-	0%	0.00%
ISP 2030 Central (N)	0	41	1,540	109	0	1,114	1,212	-	0%	0.00%
ISP StepChange (N)	0	41	-	153	98	1,113	553	- 0	0%	0.00%
ISP 2040 Central (N)	0	41	-	153	273	1,113	741	- 0	0%	0.00%

Table 72: GLAD average Autumn flows in MW from 16:30 to 21:00 for each N-1 transmission scenario

Baseline (N-1)	0	42	1,180	57	0	1,114	891	- 0	0%	0.00%
Scen A (N-1)	0	42	464	117	43	1,114	430	- 1	0%	0.00%
Scen B (N-1)	0	42	470	128	56	1,114	439	- 2	0%	0.00%
Scen C (N-1)	0	42	472	131	80	1,114	507	-	0%	0.00%
ISP 2030 Central (N-1)	0	41	1,455	85	0	1,114	1,072	-	0%	0.00%
ISP StepChange (N-1)	-	41	-	154	647	1,113	649	- 0	0%	0.00%
ISP 2040 Central (N-1)	-	41	-	154	796	1,113	787	-	0%	0.00%

Table 73:WB Average Summer flows in MW 7:00 to 16:00 for each N transmission scenario

Scenario	Wind spill	Solar spill	Wind disp	Solar disp	Energy-Gap	Load	Flows NM_N	Flows NM_R	% of flows R	% Cong
Baseline (N)	293	165	353	363	0	193	1,485	-	0%	63.83%
Scen A (N)	189	82	457	447	0	193	1,437	-	0%	56.33%
Scen B (N)	176	76	471	453	0	193	1,434	-	0%	54.42%
Scen C (N)	217	105	430	424	0	193	1,489	-	0%	65.75%
ISP 2030 Central (N)	-	12	-	110	1	193	1,127	-	0%	7.83%
ISP StepChange (N)	-	17	-	337	4	192	726	- 1	0%	0.00%
ISP 2040 Central (N)	-	4	-	350	3	192	777	- 1	0%	0.33%

Table 74:WB Average Summer flows in MW 7:00 to 16:00 for each N-1 transmission scenario

Baseline (N-1)	605	483	42	45	0	193	797	-	0%	99.67%
Scen A (N-1)	503	373	144	156	0	193	795	-	0%	95.75%
Scen B (N-1)	508	379	139	150	0	193	794	-	0%	96.67%
Scen C (N-1)	528	401	118	128	0	193	795	-	0%	98.25%
ISP 2030 Central (N-1)	-	37	-	85	1	193	778	-	0%	86.75%
ISP StepChange (N-1)	-	4	-	351	4	192	576	- 1	0%	27.08%
ISP 2040 Central (N-1)	-	1	-	353	3	192	624	- 1	0%	36.08%

Table 75: WB average Summer flows in MW 16:30 to 21:00 for each N transmission scenario

Scenario	Wind spill	Solar spill	Wind disp	Solar disp	Energy-Gap	Load	Flows NM_N	Flows NM_R	% of flows R	% Cong
Baseline (N)	28	3	617	63	0	274	1,416	-	0%	31.83%
Scen A (N)	7	0	638	65	0	274	1,014	-	0%	11.67%
Scen B (N)	15	1	630	64	5	274	962	- 0	0%	12.33%
Scen C (N)	29	2	616	64	5	274	1,142	-	0%	17.83%
ISP 2030 Central (N)	-	0	-	22	0	274	937	-	0%	1.00%
ISP StepChange (N)	-	0	-	66	33	294	340	- 2	1%	0.00%
ISP 2040 Central (N)	-	0	-	66	116	294	624	-	0%	1.17%

Table 76: WB average Summer flows in MW from 16:30 to 21:00 for each N-1 transmission scenario

Baseline (N-1)	407	59	238	7	0	274	795	-	0%	54.17%
Scen A (N-1)	190	26	455	40	1	274	708	-	0%	47.17%
Scen B (N-1)	203	26	442	39	7	274	718	-	0%	54.00%
Scen C (N-1)	227	27	418	39	1	274	760	-	0%	66.50%
ISP 2030 Central (N-1)	-	17	-	6	0	274	767	-	0%	46.17%
ISP StepChange (N-1)	-	2	-	64	273	294	728	-	0%	67.83%
ISP 2040 Central (N-1)	-	2	-	64	233	294	788	-	0%	85.67%

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Table 77: WB average Winter flows in MW 7:00 – 16:00 for each N transmission scenario

Scenario	Wind spill	Solar spill	Wind disp	Solar disp	Energy-Gap	Load	Flows NM_N	Flows NM_R	% of flows R	% Cong
Baseline (N)	208	131	363	324	0	142	1,447	-	0%	23.86%
Scen A (N)	161	96	410	360	0	142	1,327	- 0	0%	11.44%
Scen B (N)	149	92	422	364	0	142	1,324	- 0	0%	6.74%
Scen C (N)	147	89	424	367	0	142	1,407	- 0	0%	9.70%
ISP 2030 Central (N)	-	6	-	100	1	142	964	-	0%	0.00%
ISP StepChange (N)	-	9	-	299	3	141	607	- 3	0%	0.00%
ISP 2040 Central (N)	-	14	-	295	5	141	657	- 1	0%	0.00%

Table 78: WB average Winter flows in MW from 7:00 – 16:00 for each N-1 transmission scenario

Baseline (N-1)	450	363	120	92	0	142	872	-	0%	87.88%
Scen A (N-1)	351	266	219	190	0	143	842	- 0	0%	73.48%
Scen B (N-1)	351	270	220	185	0	142	837	- 0	0%	48.86%
Scen C (N-1)	371	287	199	169	0	142	848	-	0%	42.42%
ISP 2030 Central (N-1)	-	9	-	97	1	142	823	-	0%	4.77%
ISP StepChange (N-1)	-	4	-	305	7	141	487	- 7	1%	0.98%
ISP 2040 Central (N-1)	-	4	-	305	10	141	577	- 4	1%	2.80%

Table 79: WB average Winter flows in MW 16:30 to 21:00 for each N transmission scenario

Scenario	Wind spill	Solar spill	Wind disp	Solar disp	Energy-Gap	Load	Flows NM_N	Flows NM_R	% of flows R	% Cong
Baseline (N)	3	0	630	6	0	220	1,347	-	0%	3.64%
Scen A (N)	0	0	633	6	0	220	904	- 0	0%	0.30%
Scen B (N)	0	0	633	6	0	220	840	- 0	0%	0.15%
Scen C (N)	1	0	633	6	0	220	952	-	0%	0.30%
ISP 2030 Central (N)	-	0	-	6	0	220	653	-	0%	0.00%
ISP StepChange (N)	-	0	-	17	190	243	397	- 7	2%	0.00%
ISP 2040 Central (N)	-	0	-	17	251	243	616	- 0	0%	0.00%

Table 80: WB average Winter flows in MW from 16:30 to 21:00 for each N-1 transmission scenario

Baseline (N-1)	252	2	381	5	0	220	865	-	0%	30.00%
Scen A (N-1)	47	0	586	6	1	221	688	- 0	0%	13.94%
Scen B (N-1)	57	0	577	6	2	220	683	- 0	0%	17.12%
Scen C (N-1)	90	1	543	6	5	220	735	-	0%	26.21%
ISP 2030 Central (N-1)	-	1	-	5	1	220	664	-	0%	5.76%
ISP StepChange (N-1)	-	-	-	17	315	243	548	- 1	0%	8.94%
ISP 2040 Central (N-1)	-	-	-	17	311	243	772	- 0	0%	30.91%

Table 81: WB average Autumn flows in MW 7:00 – 16:00 for each N transmission scenario

Scenario	Wind spill	Solar spill	Wind disp	Solar disp	Energy-Gap	Load	Flows NM_N	Flows NM_R	% of flows R	% Cong
Baseline (N)	222	190	314	330	0	174	1,485	-	0%	62.50%
Scen A (N)	144	106	392	414	0	174	1,418	-	0%	50.74%
Scen B (N)	132	94	404	426	0	174	1,411	- 0	0%	43.89%
Scen C (N)	155	120	381	399	0	174	1,467	-	0%	53.15%
ISP 2030 Central (N)	-	7	-	96	1	174	1,100	-	0%	3.43%
ISP StepChange (N)	-	17	-	281	4	172	681	- 0	0%	0.00%
ISP 2040 Central (N)	-	7	-	291	3	172	735	- 1	0%	0.00%

Table 82: WB average Autumn flows in MW from 7:00 – 16:00 for each N-1 transmission scenario

Baseline (N-1)	483	471	53	48	0	174	805	-	0%	96.57%
Scen A (N-1)	371	354	165	166	0	172	789	-	0%	90.09%
Scen B (N-1)	373	356	163	163	0	174	788	- 0	0%	78.15%
Scen C (N-1)	389	372	147	148	0	174	792	-	0%	83.89%
ISP 2030 Central (N-1)	-	16	-	87	1	174	790	-	0%	70.00%
ISP StepChange (N-1)	-	2	-	295	3	172	524	- 6	1%	15.28%
ISP 2040 Central (N-1)	-	0	-	297	5	172	574	- 3	0%	22.96%

Table 83: WB average Autumn flows in MW 16:30 to 21:00 for each N transmission scenario

Scenario	Wind spill	Solar spill	Wind disp	Solar disp	Energy-Gap	Load	Flows NM_N	Flows NM_R	% of flows R	% Cong
Baseline (N)	20	1	585	25	0	247	1,412	-	0%	19.63%
Scen A (N)	6	0	599	26	0	247	962	-	0%	6.30%
Scen B (N)	8	0	597	26	0	247	892	- 0	0%	4.44%
Scen C (N)	16	0	589	25	0	247	1,054	-	0%	7.04%
ISP 2030 Central (N)	-	0	-	7	0	247	849	-	0%	0.19%
ISP StepChange (N)	-	0	-	22	70	270	344	- 2	1%	0.00%
ISP 2040 Central (N)	-	0	-	22	165	270	609	- 0	0%	0.00%

Table 84: WB average Autumn flows in MW from 16:30 to 21:00 for each N-1 transmission scenario

Baseline (N-1)	379	23	226	3	0	247	808	-	0%	42.96%
Scen A (N-1)	118	7	487	19	2	247	666	-	0%	28.52%
Scen B (N-1)	122	8	483	18	3	247	671	-	0%	36.48%
Scen C (N-1)	143	9	462	17	4	247	713	-	0%	48.33%
ISP 2030 Central (N-1)	-	5	-	3	0	247	739	-	0%	26.48%
ISP StepChange (N-1)	-	0	-	22	332	270	693	-	0%	55.00%
ISP 2040 Central (N-1)	-	1	-	21	297	270	783	-	0%	66.85%

Table 85: TAR average Summer flows in MW 7:00 to 16:00 for each N transmission scenario

Scenario	Wind spill	Solar spill	Wind disp	Solar disp	Tarong	Energy-Gap	Load	Flows SWQ_N	Flows SWQ_R	% of flows R	% Cong	Flows NM_N	Flows NM_R	% of flows R	% Cong
Baseline (N)	3	8	269	374	844	0	60	637	-	0%	0.00%	1,486	-	0%	0.00%
Scen A (N)	1	3	271	379	727	0	60	523	-	0%	0.00%	1,426	-	0%	0.00%
Scen B (N)	1	2	271	381	586	0	60	443	-	0%	0.00%	1,372	-	0%	0.00%
Scen C (N)	1	2	271	381	219	0	60	357	- 0	0%	0.00%	1,270	-	0%	0.00%
ISP 2030 Central (N)	1	0	233	16	1,340	2	60	549	- 1	0%	0.00%	1,576	-	0%	0.00%
ISP StepChange (N)	9	1	489	15	378	5	60	172	- 31	15%	0.00%	1,175	-	0%	0.00%
ISP 2040 Central (N)	2	1	221	14	-	1	60	24	- 343	93%	0.00%	1,084	-	0%	0.00%

Table 86: TAR average Summer flows in MW from 7:00 to 16:00 for each N-1 transmission scenario

Baseline (N-1)	1	4	270	379	983	0	60	638	-	0%	0.00%	1,391	-	0%	0.00%
Scen A (N-1)	1	2	271	380	841	1	60	543	-	0%	0.00%	1,294	-	0%	0.00%
Scen B (N-1)	0	1	271	381	671	1	60	482	-	0%	0.00%	1,228	-	0%	0.00%
Scen C (N-1)	0	1	271	382	255	2	60	335	-	0%	0.00%	1,074	-	0%	0.00%
ISP 2030 Central (N-1)	1	0	232	16	1,339	2	60	594	-	0%	0.00%	1,330	-	0%	0.00%
ISP StepChange (N-1)	5	0	493	15	372	16	60	203	- 4	2%	0.00%	966	-	0%	0.00%
ISP 2040 Central (N-1)	0	0	222	15	-	33	60	31	- 75	71%	0.00%	730	-	0%	0.00%

Table 87: TAR average Summer flows in MW 16:30 to 21:00 for each N transmission scenario

Scenario	Wind spill	Solar spill	Wind disp	Solar disp	Tarong	Energy-Gap	Load	Flows SWQ_N	Flows SWQ_R	% of flows R	% Cong	Flows NM_N	Flows NM_R	% of flows R	% Cong
Baseline (N)	0	0	271	38	1,770	1	86	988	-	0%	0.00%	1,546	-	0%	0.00%
Scen A (N)	0	0	271	38	1,479	1	86	700	-	0%	0.00%	1,400	-	0%	0.00%
Scen B (N)	0	0	271	38	1,137	1	86	492	- 0	0%	0.00%	1,281	-	0%	0.00%
Scen C (N)	0	0	271	38	443	1	86	345	- 4	1%	0.00%	1,075	-	0%	0.00%
ISP 2030 Central (N)	0	0	336	3	1,830	3	86	898	-	0%	0.00%	1,643	-	0%	0.00%
ISP StepChange (N)	0	0	728	3	443	10	92	113	- 27	19%	0.00%	1,324	-	0%	0.00%
ISP 2040 Central (N)	0	0	327	3	-	5	92	45	- 176	79%	0.00%	1,027	-	0%	0.00%

Table 88: TAR average Summer flows in MW from 16:30 to 21:00 for each N-1 transmission scenario

Baseline (N-1)	0	0	271	38	1,819	1	86	911	-	0%	0.00%	1,439	-	0%	0.00%
Scen A (N-1)	0	0	271	38	1,485	2	85	710	-	0%	0.00%	1,262	-	0%	0.00%
Scen B (N-1)	0	0	271	38	1,140	5	86	588	-	0%	0.00%	1,137	-	0%	0.00%
Scen C (N-1)	0	0	271	38	443	11	86	347	-	0%	0.00%	893	-	0%	0.00%
ISP 2030 Central (N-1)	0	0	336	3	1,833	3	86	962	-	0%	0.00%	1,503	-	0%	0.00%
ISP StepChange (N-1)	0	0	728	3	443	35	92	504	- 0	0%	0.00%	1,085	-	0%	0.00%
ISP 2040 Central (N-1)	0	0	327	3	-	97	92	205	- 3	1%	0.00%	794	-	0%	0.00%

Table 89: TAR average Winter flows in MW 7:00 to 16:00 for each N transmission scenario

Scenario	Wind spill	Solar spill	Wind disp	Solar disp	Tarong	Energy-Gap	Load	Flows SWQ_N	Flows SWQ_R	% of flows R	% Cong	Flows NM_N	Flows NM_R	% of flows R	% Cong
Baseline (N)	1	5	239	357	725	0	60	675	-	0%	0.00%	1,308	-	0%	0.00%
Scen A (N)	1	3	239	360	689	0	60	599	-	0%	0.00%	1,278	-	0%	0.00%
Scen B (N)	1	4	238	359	523	0	60	514	- 1	0%	0.00%	1,211	-	0%	0.00%
Scen C (N)	2	4	238	359	133	0	60	405	- 3	1%	0.00%	1,087	-	0%	0.00%
ISP 2030 Central (N)	0	0	197	12	1,094	2	60	467	- 14	3%	0.00%	1,311	-	0%	0.00%
ISP StepChange (N)	1	0	376	12	263	5	60	153	- 79	34%	0.00%	955	-	0%	0.00%
ISP 2040 Central (N)	1	1	188	11	-	1	60	31	- 294	90%	0.00%	924	-	0%	0.00%

Table 90: TAR average Winter flows in MW from 7:00 to 16:00 for each N-1 transmission scenario

Baseline (N-1)	0	1	239	362	772	0	60	470	-	0%	0.00%	1,311	-	0%	0.00%
Scen A (N-1)	0	1	239	362	715	0	60	397	-	0%	0.00%	1,255	-	0%	0.00%
Scen B (N-1)	1	2	239	361	545	0	60	324	- 0	0%	0.00%	1,187	-	0%	0.00%
Scen C (N-1)	1	1	239	362	146	0	60	186	- 3	2%	0.00%	1,048	-	0%	0.00%
ISP 2030 Central (N-1)	0	0	197	12	1,159	2	60	458	- 1	0%	0.00%	1,257	-	0%	0.00%
ISP StepChange (N-1)	1	0	376	12	265	4	60	92	- 56	38%	0.00%	863	-	0%	0.00%
ISP 2040 Central (N-1)	1	1	188	12	-	2	60	10	- 163	94%	0.00%	749	-	0%	0.00%

Table 91: TAR average Winter flows in MW 16:30 to 21:00 for each N transmission scenario

Scenario	Wind spill	Solar spill	Wind disp	Solar disp	Tarong	Energy-Gap	Load	Flows SWQ_N	Flows SWQ_R	% of flows R	% Cong	Flows NM_N	Flows NM_R	% of flows R	% Cong
Baseline (N)	0	0	266	7	1,451	6	95	934	-	0%	0.00%	1,309	-	0%	0.00%
Scen A (N)	0	0	266	7	1,335	6	95	664	- 0	0%	0.00%	1,243	-	0%	0.00%
Scen B (N)	0	0	267	7	993	6	95	456	- 7	2%	0.00%	1,119	-	0%	0.00%
Scen C (N)	0	0	267	7	295	6	95	263	- 34	12%	0.00%	900	-	0%	0.00%
ISP 2030 Central (N)	0	0	199	0	1,465	2	95	597	- 0	0%	0.00%	1,299	-	0%	0.00%
ISP StepChange (N)	0	0	391	0	295	6	105	80	- 85	52%	0.00%	988	-	0%	0.00%
ISP 2040 Central (N)	0	0	191	0	-	9	105	52	- 154	75%	0.00%	833	-	0%	0.00%

Table 92: TAR average Winter flows in MW from 16:30 to 21:00 for each N-1 transmission scenario

Baseline (N-1)	0	0	266	7	1,463	6	95	741	-	0%	0.00%	1,249	-	0%	0.00%
Scen A (N-1)	0	0	267	7	1,338	6	94	571	-	0%	0.00%	1,161	-	0%	0.00%
Scen B (N-1)	0	0	267	7	994	6	95	418	- 0	0%	0.00%	1,046	-	0%	0.00%
Scen C (N-1)	0	0	267	7	295	6	95	174	- 5	3%	0.00%	816	-	0%	0.00%
ISP 2030 Central (N-1)	0	0	199	0	1,462	2	95	662	-	0%	0.00%	1,265	-	0%	0.00%
ISP StepChange (N-1)	0	0	391	0	295	5	105	183	- 37	17%	0.00%	863	-	0%	0.00%
ISP 2040 Central (N-1)	0	0	191	0	-	11	105	88	- 38	30%	0.00%	723	-	0%	0.00%

Table 93: TAR average Autumn flows in MW 7:00 to 16:00 for each N transmission scenario

Scenario	Wind spill	Solar spill	Wind disp	Solar disp	Tarong	Energy-Gap	Load	Flows SWQ_N	Flows SWQ_R	% of flows R	% Cong	Flows NM_N	Flows NM_R	% of flows R	% Cong
Baseline (N)	0	11	224	379	768	0	60	675	-	0%	0.00%	1,417	-	0%	0.00%
Scen A (N)	0	5	225	384	645	0	60	561	-	0%	0.00%	1,351	-	0%	0.00%
Scen B (N)	1	4	224	385	534	0	60	495	-	0%	0.00%	1,300	-	0%	0.00%
Scen C (N)	0	4	224	385	217	0	60	423	- 0	0%	0.00%	1,212	-	0%	0.00%
ISP 2030 Central (N)	0	0	237	13	1,231	2	60	556	- 3	0%	0.00%	1,482	-	0%	0.00%
ISP StepChange (N)	5	1	470	13	393	5	60	216	- 22	9%	0.00%	1,118	-	0%	0.00%
ISP 2040 Central (N)	1	2	227	12	-	2	60	32	- 270	89%	0.00%	1,019	-	0%	0.00%

Table 94: TAR average Autumn flows in MW from 7:00 to 16:00 for each N-1 transmission scenario

Baseline (N-1)	0	3	225	386	892	0	60	576	-	0%	0.00%	1,338	-	0%	0.00%
Scen A (N-1)	0	2	225	387	733	0	59	461	-	0%	0.00%	1,228	-	0%	0.00%
Scen B (N-1)	0	1	224	388	608	0	60	416	-	0%	0.00%	1,178	-	0%	0.00%
Scen C (N-1)	0	1	224	388	254	0	60	290	- 0	0%	0.00%	1,046	-	0%	0.00%
ISP 2030 Central (N-1)	0	0	237	13	1,282	2	60	569	-	0%	0.00%	1,304	-	0%	0.00%
ISP StepChange (N-1)	5	1	470	13	395	5	60	200	- 2	1%	0.00%	939	-	0%	0.00%
ISP 2040 Central (N-1)	0	1	228	13	-	6	60	16	- 87	85%	0.00%	716	-	0%	0.00%

Table 95: TAR average Autumn flows in MW 16:30 to 21:00 for each N transmission scenario

Scenario	Wind spill	Solar spill	Wind disp	Solar disp	Tarong	Energy-Gap	Load	Flows SWQ_N	Flows SWQ_R	% of flows R	% Cong	Flows NM_N	Flows NM_R	% of flows R	% Cong
Baseline (N)	0	0	254	18	1,618	4	88	1,035	-	0%	0.00%	1,431	-	0%	0.00%
Scen A (N)	0	0	254	18	1,296	4	88	687	-	0%	0.00%	1,269	-	0%	0.00%
Scen B (N)	0	0	254	18	1,025	4	88	489	- 0	0%	0.00%	1,173	-	0%	0.00%
Scen C (N)	0	0	254	18	443	4	88	367	- 1	0%	0.00%	1,002	-	0%	0.00%
ISP 2030 Central (N)	-	0	253	1	1,648	3	88	816	- 0	0%	0.00%	1,463	-	0%	0.00%
ISP StepChange (N)	-	0	529	1	443	7	96	94	- 28	23%	0.00%	1,183	-	0%	0.00%
ISP 2040 Central (N)	0	0	244	1	-	6	96	41	- 140	77%	0.00%	916	-	0%	0.00%

Table 96: TAR average Autumn flows in MW from 16:30 to 21:00 for each N-1 transmission scenario

Baseline (N-1)	0	0	254	18	1,636	4	88	849	-	0%	0.00%	1,344	-	0%	0.00%
Scen A (N-1)	0	0	254	18	1,296	4	88	595	-	0%	0.00%	1,150	-	0%	0.00%
Scen B (N-1)	0	0	254	18	1,026	4	88	488	-	0%	0.00%	1,053	-	0%	0.00%
Scen C (N-1)	0	0	254	18	443	5	88	288	-	0%	0.00%	852	-	0%	0.00%
ISP 2030 Central (N-1)	-	0	253	1	1,647	3	88	839	-	0%	0.00%	1,372	-	0%	0.00%
ISP StepChange (N-1)	-	0	529	1	443	12	96	381	- 1	0%	0.00%	978	-	0%	0.00%
ISP 2040 Central (N-1)	-	0	244	1	-	37	96	132	- 6	5%	0.00%	727	-	0%	0.00%

Table 97: SWQ average Summer flows in MW 7:00 to 16:00 for each N transmission scenario

Scenario	Wind spill	Solar spill	Wind disp	Solar disp	Oakey	Braem	Darling _Downs	Cond	Kogan Ck	Mill-Merr	Energy-Gap	Load	Flows QNIN	Flows QNIR	% of flowsR	% Cong	Flows SMN	Flows SMR	% of flows R	% Cong
Baseline (N)	20	624	420	1,045	-	-	129	26	429	552	0	963	1,000	-	0%	0.00%	1,156	-	0%	0.00%
Scen A (N)	14	541	426	1,128	0	1	133	27	454	577	0	963	981	-	0%	0.00%	1,208	-	0%	0.00%
Scen B (N)	10	458	430	1,210	4	13	142	30	475	604	0	963	1,028	-	0%	0.00%	1,242	-	0%	0.58%
Scen C (N)	10	427	430	1,242	4	14	147	30	485	613	0	963	1,007	-	0%	0.00%	1,235	-	0%	0.25%
ISP 2030 Cent (N)	11	42	476	1,282	4	11	151	32	668	801	16	963	1,515	-	0%	0.00%	1,358	-	0%	0.17%
ISP StepCh (N)	25	6	689	791	35	116	295	68	689	813	13	940	1,193	-	0%	0.00%	1,367	-	0%	0.17%
ISP 2040 Cent (N)	6	460	432	2,565	16	52	200	45	549	687	19	940	1,434	-	0%	0.00%	1,736	-	0%	4.33%

Table 98: SWQ average Summer flows in MW from 7:00 to 16:00 for each N-1 transmission scenario

Scenario	Wind spill	Solar spill	Wind disp	Solar disp	Oakey	Braem	Darling _Downs	Cond	Kogan Ck	Mill-Merr	Energy-Gap	Load	Flows QNIN	Flows QNIR	% of flowsR	% Cong	Flows SMN	Flows SMR	% of flows R	% Cong
Baseline (N-1)	33	912	407	756	0	0	129	26	360	493	0	963	692	-	0%	0.00%	1,050	-	0%	76.67%
Scen A (N-1)	22	835	418	834	0	1	129	26	360	500	0	963	689	-	0%	0.00%	1,057	-	0%	79.25%
Scen B (N-1)	15	758	425	910	0	1	129	26	368	508	0	963	726	-	0%	0.00%	1,061	-	0%	81.83%
Scen C (N-1)	8	672	432	997	0	1	130	27	379	520	0	963	701	-	0%	0.00%	1,064	-	0%	83.00%
ISP2030 Cen (N-1)	56	251	430	1,073	0	0	132	28	436	616	8	963	1,158	-	0%	0.00%	1,077	-	0%	83.92%
ISP StepCh (N-1)	190	37	523	760	2	3	168	44	511	651	6	940	740	-	0%	0.00%	1,077	-	0%	46.42%
ISP2040 Cen (N-1)	61	1,548	377	1,477	2	5	142	30	359	487	1	940	716	-	0%	0.00%	1,091	-	0%	63.00%

Table 99: SWQ average Summer flows in MW 16:30 to 21:00 for each N transmission scenario

Scenario	Wind spill	Solar spill	Wind disp	Solar disp	Oakey	Braem	Darling _Downs	Cond	Kogan Ck	Mill-Merr	Energy-Gap	Load	Flows QNIN	Flows QNIR	% of flowsR	% Cong	Flows SMN	Flows SMR	% of flows R	% Cong
Baseline (N)	0	0	395	149	9	24	227	54	737	827	0	1,018	1,118	-	0%	0.00%	1,088	-	0%	0.00%
Scen A (N)	0	0	395	149	47	145	382	89	742	837	0	1,018	1,065	-	0%	0.00%	1,224	-	0%	0.00%
Scen B (N)	0	0	395	149	112	379	482	111	742	841	0	1,018	1,182	-	0%	0.00%	1,325	-	0%	0.00%
Scen C (N)	0	0	395	149	119	402	513	118	743	843	0	1,018	1,138	-	0%	0.00%	1,291	-	0%	0.00%
ISP 2030 Cent (N)	0	-	679	270	24	74	306	76	744	852	9	1,018	1,441	-	0%	0.00%	1,276	-	0%	0.67%
ISP StepCh (N)	0	-	1,038	161	190	658	611	138	744	852	12	1,010	1,504	-	0%	0.00%	1,794	-	0%	2.50%
ISP 2040 Cent (N)	0	-	637	622	238	855	615	139	737	839	38	1,010	1,629	-	0%	0.00%	1,768	-	0%	4.67%

Table 100: SWQ average Summer flows in MW from 16:30 to 21:00 for each N-1 transmission scenario

Baseline (N-1)	9	12	386	137	1	2	219	67	631	700	0	1,018	836	-	0%	0.00%	1,040	-	0%	41.83%
Scen A (N-1)	4	8	391	141	4	6	311	98	657	723	0	1,018	795	-	0%	0.00%	1,072	-	0%	59.83%
Scen B (N-1)	1	4	394	144	14	25	392	115	679	739	0	1,018	833	-	0%	0.00%	1,082	-	0%	68.50%
Scen C (N-1)	1	2	394	146	31	61	474	132	705	764	0	1,018	794	-	0%	0.00%	1,088	-	0%	78.17%
ISP2030 Cen (N-1)	44	34	635	236	2	4	204	59	559	668	7	1,018	1,096	-	0%	0.00%	1,060	-	0%	51.33%
ISP StepCh (N-1)	278	6	760	155	16	33	285	73	526	665	2	1,010	780	-	0%	0.00%	1,098	-	0%	100.00%
ISP2040 Cen (N-1)	20	174	618	447	84	273	418	100	585	642	6	1,010	1,129	-	0%	0.00%	1,099	-	0%	93.33%

Table 101: SWQ average Winter flows in MW 7:00 to 16:00 for each N transmission scenario

Scenario	Wind spill	Solar spill	Wind disp	Solar disp	Oakey	Braem	Darling _Downs	Cond	Kogan Ck	Mill-Merr	Energy-Gap	Load	Flows QNIN	Flows QNIR	% of flowsR	% Cong	Flows SMN	Flows SMR	% of flows R	% Cong
Baseline (N)	18	550	406	950	0	0	89	27	448	577	0	966	1,168	-	0%	0.00%	915	-	0%	0.00%
Scen A (N)	14	512	410	989	1	2	96	29	458	587	0	966	1,128	-	0%	0.00%	956	-	0%	0.00%
Scen B (N)	12	455	412	1,045	3	10	102	32	470	600	0	966	1,124	-	0%	0.00%	979	-	0%	0.00%
Scen C (N)	11	436	413	1,064	5	17	107	34	478	606	0	966	1,071	-	0%	0.00%	974	-	0%	0.00%
ISP 2030 Cent (N)	0	2	336	1,053	2	7	104	32	705	837	12	966	1,297	-	0%	0.00%	1,131	-	0%	0.00%
ISP StepCh (N)	5	1	482	638	50	166	199	67	721	839	10	943	999	-	0%	0.00%	1,157	-	0%	0.00%
ISP 2040 Cent (N)	2	372	297	2,028	52	183	167	58	576	719	15	943	1,290	-	0%	0.00%	1,465	-	0%	0.08%

Table 102: SWQ average Winter flows in MW from 7:00 to 16:00 for each N-1 transmission scenario

Baseline (N-1)	7	393	417	1,108	0	0	92	28	453	588	0	966	992	-	0%	0.00%	1,086	-	0%	32.80%
Scen A (N-1)	6	360	418	1,141	1	4	98	31	460	593	0	967	964	-	0%	0.00%	1,104	-	0%	28.26%
Scen B (N-1)	6	294	418	1,206	4	11	105	34	475	609	0	966	992	-	0%	0.00%	1,118	-	0%	20.00%
Scen C (N-1)	5	253	419	1,248	7	21	114	38	484	618	0	966	929	-	0%	0.00%	1,127	-	0%	19.24%
ISP2030 Cen (N-1)	4	16	333	1,040	2	4	106	33	651	807	11	966	1,256	-	0%	0.00%	1,080	-	0%	4.24%
ISP StepCh (N-1)	31	4	455	634	32	89	194	69	673	811	9	943	823	-	0%	0.00%	1,099	-	0%	21.59%
ISP2040 Cen (N-1)	9	776	290	1,624	26	84	145	51	479	614	5	943	924	-	0%	0.00%	1,188	-	0%	32.80%

Table 103: SWQ average Winter flows in MW 16:30 to 21:00 for each N transmission scenario

Scenario	Wind spill	Solar spill	Wind disp	Solar disp	Oakey	Braem	Darling _Downs	Cond	Kogan Ck	Mill-Merr	Energy-Gap	Load	Flows QNIN	Flows QNIR	% of flowsR	% Cong	Flows SMN	Flows SMR	% of flows R	% Cong
Baseline (N)	0	0	443	32	20	56	203	68	727	793	0	1,040	1,161	-	0%	0.00%	894	-	0%	0.00%
Scen A (N)	0	0	443	32	70	219	311	102	731	803	0	1,040	1,085	-	0%	0.00%	1,075	-	0%	0.00%
Scen B (N)	0	0	443	32	143	488	367	121	732	808	0	1,040	1,193	-	0%	0.00%	1,178	-	0%	0.00%
Scen C (N)	0	0	443	32	168	583	383	127	735	810	0	1,040	1,112	-	0%	0.00%	1,194	-	0%	0.00%
ISP 2030 Cent (N)	0	0	354	47	123	415	351	118	744	852	4	1,040	1,198	-	0%	0.00%	1,190	-	0%	0.00%
ISP StepCh (N)	0	0	518	28	263	947	434	142	744	851	14	1,038	1,202	-	0%	0.00%	1,528	-	0%	0.00%
ISP 2040 Cent (N)	0	0	318	107	274	995	433	142	741	841	362	1,038	1,390	-	0%	0.00%	1,514	-	0%	0.00%

Table 104: SWQ average Winter flows in MW from 16:30 to 21:00 for each N-1 transmission scenario

Baseline (N-1)																				
Scen A (N-1)	0	0	443	32	19	42	268	102	737	811	0	1,040	984	-	0%	0.00%	1,002	-	0%	8.33%
Scen B (N-1)	0	0	443	32	50	130	338	119	739	816	0	1,040	952	-	0%	0.00%	1,080	-	0%	12.88%
Scen C (N-1)	0	0	443	32	101	296	386	132	740	821	0	1,040	1,033	-	0%	0.00%	1,133	-	0%	20.45%
ISP2030 Cen (N-1)	0	0	443	32	135	418	409	137	741	827	0	1,040	950	-	0%	0.00%	1,163	-	0%	26.67%
ISP StepCh (N-1)	0	0	354	47	81	237	346	117	735	844	4	1,040	1,116	-	0%	0.00%	1,096	-	0%	13.03%
ISP2040 Cen (N-1)	12	0	505	28	138	453	367	125	702	827	4	1,038	874	-	0%	0.00%	1,230	-	0%	89.09%

Table 105: SWQ average Autumn flows in MW 7:00 to 16:00 for each N transmission scenario

Scenario	Wind spill	Solar spill	Wind disp	Solar disp	Oakey	Braem	Darling _Downs	Cond	Kogan Ck	Mill-Merr	Energy-Gap	Load	Flows QNIN	Flows QNIR	% of flowsR	% Cong	Flows SMN	Flows SMR	% of flows R	% Cong
Baseline (N)	5	646	325	982	0	0	129	26	431	471	0	956	931	-	0%	0.00%	1,033	-	0%	0.00%
Scen A (N)	4	575	326	1,053	0	0	133	27	458	490	0	956	899	-	0%	0.00%	1,079	-	0%	0.00%
Scen B (N)	3	500	327	1,128	1	2	139	29	476	505	0	956	930	-	0%	0.00%	1,101	-	0%	0.00%
Scen C (N)	3	479	327	1,149	1	3	140	29	485	513	0	956	907	-	0%	0.00%	1,093	-	0%	0.00%
ISP 2030 Cent (N)	3	14	434	1,124	1	2	141	30	703	690	15	956	1,356	-	0%	0.00%	1,234	-	0%	0.00%
ISP StepCh (N)	9	1	631	690	26	78	282	64	709	689	13	932	1,066	-	0%	0.00%	1,234	-	0%	0.00%
ISP 2040 Cent (N)	5	333	388	2,245	25	84	226	50	580	596	18	932	1,338	-	0%	0.00%	1,571	-	0%	0.83%

Table 106: SWQ average Autumn flows in MW from 7:00 to 16:00 for each N-1 transmission scenario

Baseline (N-1)	7	708	323	920	0	0	130	27	411	454	0	956	740	-	0%	0.00%	1,041	-	0%	67.41%
Scen A (N-1)	5	633	325	995	0	1	139	30	422	464	0	954	725	-	0%	0.00%	1,054	-	0%	69.44%
Scen B (N-1)	5	572	326	1,056	1	2	146	32	428	468	0	956	760	-	0%	0.00%	1,057	-	0%	61.11%
Scen C (N-1)	2	515	328	1,112	1	3	157	35	439	477	0	956	729	-	0%	0.00%	1,059	-	0%	64.17%
ISP2030 Cen (N-1)	48	139	390	998	0	0	134	29	545	588	10	956	1,129	-	0%	0.00%	1,053	-	0%	56.67%
ISP StepCh (N-1)	130	18	510	673	7	16	231	61	599	589	7	932	791	-	0%	0.00%	1,048	-	0%	36.48%
ISP2040 Cen (N-1)	43	1,092	350	1,487	5	13	178	40	418	465	3	932	759	-	0%	0.00%	1,100	-	0%	52.50%

Table 107: SWQ average Autumn flows in MW 16:30 to 21:00 for each N transmission scenario

Scenario	Wind spill	Solar spill	Wind disp	Solar disp	Oakey	Braem	Darling _Downs	Cond	Kogan Ck	Mill-Merr	Energy-Gap	Load	Flows QNIN	Flows QNIR	% of flowsR	% Cong	Flows SMN	Flows SMR	% of flows R	% Cong
Baseline (N)	0	0	347	75	7	19	217	53	737	682	0	1,010	1,061	-	0%	0.00%	917	-	0%	0.00%
Scen A (N)	0	0	347	75	52	163	413	97	741	691	0	1,010	990	-	0%	0.00%	1,091	-	0%	0.00%
Scen B (N)	0	0	347	75	108	360	524	122	742	695	0	1,010	1,079	-	0%	0.00%	1,199	-	0%	0.00%
Scen C (N)	0	0	347	75	114	377	546	126	743	697	0	1,010	1,040	-	0%	0.00%	1,170	-	0%	0.00%
ISP 2030 Cent (N)	-	0	494	107	47	146	386	94	744	710	6	1,010	1,200	-	0%	0.00%	1,151	-	0%	0.00%
ISP StepCh (N)	0	0	738	65	236	839	631	141	744	710	8	1,006	1,343	-	0%	0.00%	1,658	-	0%	0.93%
ISP 2040 Cent (N)	0	1	453	242	270	976	635	142	740	704	96	1,006	1,381	-	0%	0.00%	1,600	-	0%	2.78%

Table 108: SWQ average Autumn flows in MW from 16:30 to 21:00 for each N-1 transmission scenario

Baseline (N-1)	1	3	345	71	10	22	327	90	695	630	0	1,010	871	-	0%	0.00%	994	-	0%	25.37%
Scen A (N-1)	0	1	346	74	36	89	463	120	708	643	0	1,009	842	-	0%	0.00%	1,062	-	0%	41.30%
Scen B (N-1)	0	1	347	74	55	137	534	134	715	650	0	1,010	881	-	0%	0.00%	1,082	-	0%	50.37%
Scen C (N-1)	0	0	347	75	74	193	584	140	725	660	0	1,010	830	-	0%	0.00%	1,090	-	0%	63.33%
ISP2030 Cen (N-1)	14	8	480	100	14	28	323	88	670	646	5	1,010	986	-	0%	0.00%	1,031	-	0%	27.59%
ISP StepCh (N-1)	119	2	620	64	57	159	414	101	622	622	3	1,006	782	-	0%	0.00%	1,114	-	0%	99.44%
ISP2040 Cen (N-1)	9	43	444	199	148	509	521	123	663	604	5	1,006	1,077	-	0%	0.00%	1,114	-	0%	85.74%

Table 109: NORTH MORETON average Summer flows in MW 7:00 to 16:00 for each N transmission scenario

Scenario	Flows WB_N	Flows WB_R	Cong %	Flows Tar_N	Flows Tar_R	Cong %	WivenH	MtByron	Energy-Gap	Load	WivenH Pump	MtByron Pump	Flows SM_N	Flows SM_R	Cong %
Baseline (N)	1,485	-	63.83%	1,486	-	0.00%	-	-	53	1,016	312	663	794	-	0%
Scen A (N)	1,437	-	56.33%	1,426	-	0.00%	0	1	69	1,016	312	663	717	-	0%
Scen B (N)	1,434	-	54.42%	1,372	-	0.00%	1	1	96	1,016	312	663	692	-	0%
Scen C (N)	1,489	-	65.75%	1,270	-	0.00%	1	1	147	1,016	312	663	693	-	0%
ISP 2030 Central (N)	1,127	-	7.83%	1,576	-	0.00%	1	1	216	1,016	312	663	742	-3	0%
ISP StepChange (N)	726	-1	0.00%	1,175	-	0.00%	17	17	754	1,013	312	663	585	-3	0%
ISP 2040 Central (N)	777	-1	0.33%	1,084	-	0.00%	10	10	443	1,013	312	663	326	-103	0%

Table 110: NORTH MORETON average Summer flows in MW from 7:00 to 16:00 for each N-1 transmission scenario

Baseline (N-1)	797	-	99.67%	1,391	-	0.00%	7	8	729	1,016	312	663	807	-	0%
Scen A (N-1)	795	-	95.75%	1,294	-	0.00%	10	11	800	1,018	312	663	794	-	0%
Scen B (N-1)	794	-	96.67%	1,228	-	0.00%	13	15	859	1,016	312	663	799	-	0%
Scen C (N-1)	795	-	98.25%	1,074	-	0.00%	17	22	956	1,016	312	663	768	-	0%
ISP 2030 Central (N-1)	778	-	86.75%	1,330	-	0.00%	17	18	902	1,016	312	663	929	-	0%
ISP StepChange (N-1)	576	-1	27.08%	966	-	0.00%	42	47	1,096	1,013	312	663	657	-0	0%
ISP 2040 Central (N-1)	624	-1	36.08%	730	-	0.00%	47	56	1,172	1,013	312	663	571	-0	0%

Table 111: NORTH MORETON average Summer flows in MW 16:30 to 21:00 for each N transmission scenario

Scenario	Flows WB_N	Flows WB_R	Cong %	Flows Tar_N	Flows Tar_R	Cong %	WivenH	MtByron	Energy-Gap	Load	WivenH Pump	MtByron Pump	Flows SM_N	Flows SM_R	Cong %
Baseline (N)	1,416	-	31.83%	1,546	-	0.00%	310	329	120	1,443	96	204	1,732	-	0%
Scen A (N)	1,014	-	11.67%	1,400	-	0.00%	404	459	168	1,443	96	204	1,527	-	0%
Scen B (N)	962	-0	12.33%	1,281	-	0.00%	424	479	191	1,443	96	204	1,438	-	0%
Scen C (N)	1,142	-	17.83%	1,075	-	0.00%	438	504	219	1,443	96	204	1,466	-	0%
ISP 2030 Central (N)	937	-	1.00%	1,643	-	0.00%	390	394	186	1,443	96	204	1,613	-0	0%
ISP StepChange (N)	340	-2	0.00%	1,324	-	0.00%	455	694	266	1,548	96	204	1,127	-0	0%
ISP 2040 Central (N)	624	-	1.17%	1,027	-	0.00%	455	799	263	1,548	96	204	1,234	-1	0%

Table 112: NORTH MORETON average Summer flows in MW from 16:30 to 21:00 for each N-1 transmission scenario

Baseline (N-1)	795	-	54.17%	1,439	-	0.00%	431	598	285	1,443	96	204	1,662	-	0%
Scen A (N-1)	708	-	47.17%	1,262	-	0.00%	442	717	320	1,443	96	204	1,588	-	0%
Scen B (N-1)	718	-	54.00%	1,137	-	0.00%	450	762	359	1,443	96	204	1,576	-	0%
Scen C (N-1)	760	-	66.50%	893	-	0.00%	455	803	429	1,443	96	204	1,505	-	0%
ISP 2030 Central (N-1)	767	-	46.17%	1,503	-	0.00%	429	626	264	1,443	96	204	1,698	-	0%
ISP StepChange (N-1)	728	-	67.83%	1,085	-	0.00%	456	850	312	1,548	96	204	1,482	-	0%
ISP 2040 Central (N-1)	788	-	85.67%	794	-	0.00%	456	850	370	1,548	96	204	1,323	-	0%

Table 113: NORTH MORETON average Winter flows in MW 7:00 to 16:00 for each N transmission scenario

Scenario	Flows WB_N	Flows WB_R	Cong %	Flows Tar_N	Flows Tar_R	Cong %	WivenH	MtByron	Energy-Gap	Load	WivenH Pump	MtByron Pump	Flows SM_N	Flows SM_R	Cong %
Baseline (N)	1,447	-	23.86%	1,308	-	0.00%	12	11	47	800	312	663	834	-	0%
Scen A (N)	1,327	-0	11.44%	1,278	-	0.00%	23	20	86	800	312	663	764	-	0%
Scen B (N)	1,324	-0	6.74%	1,211	-	0.00%	29	22	112	800	312	663	733	-0	0%
Scen C (N)	1,407	-0	9.70%	1,087	-	0.00%	32	23	141	800	312	663	717	-0	0%
ISP 2030 Central (N)	964	-	0.00%	1,311	-	0.00%	22	23	199	800	312	663	645	-36	0%
ISP StepChange (N)	607	-3	0.00%	955	-	0.00%	54	49	651	799	312	663	506	-52	0%
ISP 2040 Central (N)	657	-1	0.00%	924	-	0.00%	46	46	369	799	312	663	356	-177	0%

Table 114: NORTH MORETON average Winter flows in MW from 7:00 to 16:00 for each N-1 transmission scenario

Baseline (N-1)	872	-	87.88%	1,311	-	0.00%	25	22	212	800	312	663	544	-3	0%
Scen A (N-1)	842	-0	73.48%	1,255	-	0.00%	31	25	248	810	312	663	513	-6	0%
Scen B (N-1)	837	-0	48.86%	1,187	-	0.00%	36	30	298	800	312	663	511	-11	0%
Scen C (N-1)	848	-	42.42%	1,048	-	0.00%	41	37	370	800	312	663	484	-20	0%
ISP 2030 Central (N-1)	823	-	4.77%	1,257	-	0.00%	31	32	407	800	312	663	671	-13	0%
ISP StepChange (N-1)	487	-7	0.98%	863	-	0.00%	64	66	814	799	312	663	487	-39	0%
ISP 2040 Central (N-1)	577	-4	2.80%	749	-	0.00%	62	71	761	799	312	663	440	-63	0%

Table 115: NORTH MORETON average Winter flows in MW 16:30 to 21:00 for each N transmission scenario

Scenario	Flows WB_N	Flows WB_R	Cong %	Flows Tar_N	Flows Tar_R	Cong %	WivenH	MtByron	Energy-Gap	Load	WivenH Pump	MtByron Pump	Flows SM_N	Flows SM_R	Cong %
Baseline (N)	1,347	-	3.64%	1,309	-	0.00%	355	363	172	1,265	96	204	1,761	-	0%
Scen A (N)	904	-0	0.30%	1,243	-	0.00%	422	428	205	1,265	96	204	1,487	-	0%
Scen B (N)	840	-0	0.15%	1,119	-	0.00%	444	474	212	1,265	96	204	1,393	-	0%
Scen C (N)	952	-	0.30%	900	-	0.00%	451	506	228	1,265	96	204	1,339	-	0%
ISP 2030 Central (N)	653	-	0.00%	1,299	-	0.00%	448	446	215	1,265	96	204	1,380	-	0%
ISP StepChange (N)	397	-7	0.00%	988	-	0.00%	456	778	289	1,394	96	204	1,136	-1	0%
ISP 2040 Central (N)	616	-0	0.00%	833	-	0.00%	456	842	282	1,394	96	204	1,260	-1	0%

Table 116: NORTH MORETON average Winter flows in MW from 16:30 to 21:00 for each N-1 transmission scenario

Baseline (N-1)	865	-	30.00%	1,249	-	0.00%	447	453	222	1,265	96	204	1,543	-	0%
Scen A (N-1)	688	-0	13.94%	1,161	-	0.00%	451	555	242	1,271	96	204	1,424	-	0%
Scen B (N-1)	683	-0	17.12%	1,046	-	0.00%	454	609	255	1,265	96	204	1,386	-	0%
Scen C (N-1)	735	-	26.21%	816	-	0.00%	455	679	276	1,265	96	204	1,312	-	0%
ISP 2030 Central (N-1)	664	-	5.76%	1,265	-	0.00%	449	529	238	1,265	96	204	1,468	-	0%
ISP StepChange (N-1)	548	-1	8.94%	863	-	0.00%	456	850	303	1,394	96	204	1,258	-0	0%
ISP 2040 Central (N-1)	772	-0	30.91%	723	-	0.00%	456	850	308	1,394	96	204	1,336	-0	0%

Table 117: NORTH MORETON average Autumn flows in MW 7:00 to 16:00 for each N transmission scenario

Scenario	Flows WB_N	Flows WB_R	Cong %	Flows Tar_N	Flows Tar_R	Cong %	WivenH	MtByron	Energy-Gap	Load	WivenH Pump	MtByron Pump	Flows SM_N	Flows SM_R	Cong %
Baseline (N)	1,485	-	62.50%	1,417	-	0.00%	3	4	46	939	312	663	808	-	0%
Scen A (N)	1,418	-	50.74%	1,351	-	0.00%	11	8	78	939	312	663	734	-	0%
Scen B (N)	1,411	-0	43.89%	1,300	-	0.00%	14	13	108	939	312	663	718	-	0%
Scen C (N)	1,467	-	53.15%	1,212	-	0.00%	15	14	145	939	312	663	720	-	0%
ISP 2030 Central (N)	1,100	-	3.43%	1,482	-	0.00%	6	10	205	939	312	663	724	-7	0%
ISP StepChange (N)	681	-0	0.00%	1,118	-	0.00%	40	34	721	929	312	663	603	-20	0%
ISP 2040 Central (N)	735	-1	0.00%	1,019	-	0.00%	32	28	458	929	312	663	359	-96	0%

Table 118: NORTH MORETON average Autumn flows in MW from 7:00 to 16:00 for each N-1 transmission scenario

Baseline (N-1)	805	-	96.57%	1,338	-	0.00%	18	17	585	939	312	663	723	-0	0%
Scen A (N-1)	789	-	90.09%	1,228	-	0.00%	24	21	666	928	312	663	698	-1	0%
Scen B (N-1)	788	-0	78.15%	1,178	-	0.00%	29	24	714	939	312	663	706	-1	0%
Scen C (N-1)	792	-	83.89%	1,046	-	0.00%	34	30	796	939	312	663	682	-1	0%
ISP 2030 Central (N-1)	790	-	70.00%	1,304	-	0.00%	23	27	737	939	312	663	848	-0	0%
ISP StepChange (N-1)	524	-6	15.28%	939	-	0.00%	60	63	1,054	929	312	663	656	-2	0%
ISP 2040 Central (N-1)	574	-3	22.96%	716	-	0.00%	60	68	1,095	929	312	663	549	-8	0%

Table 119: NORTH MORETON average Autumn flows in MW 16:30 to 21:00 for each N transmission scenario

Scenario	Flows WB_N	Flows WB_R	Cong %	Flows Tar_N	Flows Tar_R	Cong %	WivenH	MtByron	Energy-Gap	Load	WivenH Pump	MtByron Pump	Flows SM_N	Flows SM_R	Cong %
Baseline (N)	1,412	-	19.63%	1,431	-	0.00%	336	339	171	1,351	96	204	1,798	-	0%
Scen A (N)	962	-	6.30%	1,269	-	0.00%	429	479	208	1,351	96	204	1,533	-	0%
Scen B (N)	892	-0	4.44%	1,173	-	0.00%	445	487	222	1,351	96	204	1,424	-	0%
Scen C (N)	1,054	-	7.04%	1,002	-	0.00%	450	524	227	1,351	96	204	1,449	-	0%
ISP 2030 Central (N)	849	-	0.19%	1,463	-	0.00%	419	412	210	1,351	96	204	1,541	-	0%
ISP StepChange (N)	344	-2	0.00%	1,183	-	0.00%	456	727	282	1,475	96	204	1,129	-0	0%
ISP 2040 Central (N)	609	-0	0.00%	916	-	0.00%	455	829	277	1,475	96	204	1,236	-0	0%

Table 120: NORTH MORETON average Autumn flows in MW from 16:30 to 21:00 for each N-1 transmission scenario

Baseline (N-1)	808	-	42.96%	1,344	-	0.00%	436	547	260	1,351	96	204	1,610	-	0%
Scen A (N-1)	666	-	28.52%	1,150	-	0.00%	452	690	298	1,350	96	204	1,500	-	0%
Scen B (N-1)	671	-	36.48%	1,053	-	0.00%	455	731	319	1,351	96	204	1,481	-	0%
Scen C (N-1)	713	-	48.33%	852	-	0.00%	455	779	365	1,351	96	204	1,427	-	0%
ISP 2030 Central (N-1)	739	-	26.48%	1,372	-	0.00%	435	568	254	1,351	96	204	1,587	-	0%
ISP StepChange (N-1)	693	-	55.00%	978	-	0.00%	456	850	306	1,475	96	204	1,420	-	0%
ISP 2040 Central (N-1)	783	-	66.85%	727	-	0.00%	456	850	338	1,475	96	204	1,299	-	0%

Table 121: SOUTH MORETON average Summer flows in MW 7:00 to 16:00 for each N transmission scenario

Scenario	Flows SWQ_N	Flows NM_N	Energy-Gap	Load	Flows GC_N	Cong %
Baseline (N)	1,156	794	-	1,485	402	0.00%
Scen A (N)	1,208	717	-	1,485	377	0.00%
Scen B (N)	1,242	692	-	1,485	383	0.00%
Scen C (N)	1,235	693	-	1,485	377	0.00%
ISP 2030 Central (N)	1,358	742	-	1,485	532	0.00%
ISP StepChange (N)	1,367	585	18	1,483	405	0.00%
ISP 2040 Central (N)	1,736	326	6	1,483	373	0.00%

Table 122: SOUTH MORETON average Summer flows in MW from 7:00 to 16:00 for each N-1 transmission scenario

Baseline (N-1)	1,050	807	4	1,485	319	0.00%
Scen A (N-1)	1,057	794	7	1,489	316	0.00%
Scen B (N-1)	1,061	799	11	1,485	328	0.00%
Scen C (N-1)	1,064	768	30	1,485	318	0.00%
ISP 2030 Central (N-1)	1,077	929	33	1,485	489	0.00%
ISP StepChange (N-1)	1,077	657	144	1,483	329	0.00%
ISP 2040 Central (N-1)	1,091	571	205	1,483	316	0.00%

Table 123: SOUTH MORETON average Summer flows in MW 16:30 to 21:00 for each N transmission scenario

Scenario	Flows SWQ_N	Flows NM_N	Energy-Gap	Load	Flows GC_N	Cong %
Baseline (N)	1,088	1,732	-	2,091	633	0.00%
Scen A (N)	1,224	1,527	-	2,091	566	0.00%
Scen B (N)	1,325	1,438	-	2,091	576	0.00%
Scen C (N)	1,291	1,466	-	2,091	571	0.00%
ISP 2030 Central (N)	1,276	1,613	-	2,091	695	0.00%
ISP StepChange (N)	1,794	1,127	39	2,243	583	0.00%
ISP 2040 Central (N)	1,768	1,234	21	2,243	640	0.00%

Table 124: SOUTH MORETON average Summer flows in MW from 16:30 to 21:00 for each N-1 transmission scenario

Baseline (N-1)	1,040	1,662	19	2,091	540	0.00%
Scen A (N-1)	1,072	1,588	32	2,089	513	0.00%
Scen B (N-1)	1,082	1,576	47	2,091	524	0.00%
Scen C (N-1)	1,088	1,505	97	2,091	507	0.00%
ISP 2030 Central (N-1)	1,060	1,698	63	2,091	634	0.00%
ISP StepChange (N-1)	1,098	1,482	313	2,243	540	0.00%
ISP 2040 Central (N-1)	1,099	1,323	618	2,243	676	0.00%

Table 125: SOUTH MORETON average Winter flows in MW 7:00 to 16:00 for each N transmission scenario

Scenario	Flows SWQ_N	Flows NM_N	Energy-Gap	Load	Flows GC_N	Cong %
Baseline (N)	915	834	-	1,236	470	0.00%
Scen A (N)	956	764	-	1,236	441	0.00%
Scen B (N)	979	733	-	1,236	431	0.00%
Scen C (N)	974	717	-	1,236	412	0.00%
ISP 2030 Central (N)	1,131	645	-	1,236	447	0.00%
ISP StepChange (N)	1,157	506	7	1,234	327	0.00%
ISP 2040 Central (N)	1,465	356	1	1,234	334	0.00%

Table 126: SOUTH MORETON average Winter flows in MW from 7:00 to 16:00 for each N-1 transmission scenario

Baseline (N-1)	1,086	544	-	1,236	343	0.00%
Scen A (N-1)	1,104	513	-	1,251	326	0.00%
Scen B (N-1)	1,118	511	-	1,236	332	0.00%
Scen C (N-1)	1,127	484	0	1,236	305	0.00%
ISP 2030 Central (N-1)	1,080	671	-	1,236	448	0.00%
ISP StepChange (N-1)	1,099	487	19	1,234	279	0.00%
ISP 2040 Central (N-1)	1,188	440	13	1,234	287	0.00%

Table 127: SOUTH MORETON average Winter flows in MW 16:30 to 21:00 for each N transmission scenario

Scenario	Flows SWQ_N	Flows NM_N	Energy-Gap	Load	Flows GC_N	Cong %
Baseline (N)	894	1,761	-	1,918	657	0.00%
Scen A (N)	1,075	1,487	-	1,918	565	0.00%
Scen B (N)	1,178	1,393	-	1,918	572	0.00%
Scen C (N)	1,194	1,339	-	1,918	535	0.00%
ISP 2030 Central (N)	1,190	1,380	-	1,918	569	0.00%
ISP StepChange (N)	1,528	1,136	67	2,113	509	0.00%
ISP 2040 Central (N)	1,514	1,260	34	2,113	586	0.00%

Table 128: SOUTH MORETON average Winter flows in MW from 16:30 to 21:00 for each N-1 transmission scenario

Baseline (N-1)	1,002	1,543	-	1,918	551	0.00%
Scen A (N-1)	1,080	1,424	-	1,925	511	0.00%
Scen B (N-1)	1,133	1,386	0	1,918	525	0.00%
Scen C (N-1)	1,163	1,312	2	1,918	482	0.00%
ISP 2030 Central (N-1)	1,096	1,468	1	1,918	569	0.00%
ISP StepChange (N-1)	1,230	1,258	207	2,113	484	0.00%
ISP 2040 Central (N-1)	1,219	1,336	287	2,113	622	0.00%

Table 129: SOUTH MORETON average Autumn flows in MW 7:00 to 16:00 for each N transmission scenario

Scenario	Flows SWQ_N	Flows NM_N	Energy-Gap	Load	Flows GC_N	Cong %
Baseline (N)	1,033	808	-	1,413	379	0.00%
Scen A (N)	1,079	734	-	1,413	351	0.00%
Scen B (N)	1,101	718	-	1,413	355	0.00%
Scen C (N)	1,093	720	-	1,413	349	0.00%
ISP 2030 Central (N)	1,234	724	-	1,413	474	0.00%
ISP StepChange (N)	1,234	603	8	1,399	363	0.00%
ISP 2040 Central (N)	1,571	359	5	1,399	353	0.00%

Table 130: SOUTH MORETON average Autumn flows in MW from 7:00 to 16:00 for each N-1 transmission scenario

Baseline (N-1)	1,041	723	1	1,413	302	0.00%
Scen A (N-1)	1,054	698	2	1,393	292	0.00%
Scen B (N-1)	1,057	706	4	1,413	305	0.00%
Scen C (N-1)	1,059	682	13	1,413	292	0.00%
ISP 2030 Central (N-1)	1,053	848	14	1,413	448	0.00%
ISP StepChange (N-1)	1,048	656	70	1,399	320	0.00%
ISP 2040 Central (N-1)	1,100	549	104	1,399	290	0.00%

Table 131: SOUTH MORETON average Autumn flows in MW 16:30 to 21:00 for each N transmission scenario

Scenario	Flows SWQ_N	Flows NM_N	Energy-Gap	Load	Flows GC_N	Cong %
Scenario	917	1,798	-	2,005	627	0.00%
Baseline (N)	1,091	1,533	-	2,005	539	0.00%
Scen A (N)	1,199	1,424	-	2,005	536	0.00%
Scen B (N)	1,170	1,449	-	2,005	532	0.00%
Scen C (N)	1,151	1,541	-	2,005	601	0.00%
ISP 2030 Central (N)	1,658	1,129	50	2,187	532	0.00%
ISP StepChange (N)	1,600	1,236	33	2,187	566	0.00%
ISP 2040 Central (N)	917	1,798	-	2,005	627	0.00%

Table 132: SOUTH MORETON average Autumn flows in MW from 16:30 to 21:00 for each N-1 transmission scenario

Baseline (N-1)	994	1,610	5	2,005	526	0.00%
Scen A (N-1)	1,062	1,500	12	2,000	491	0.00%
Scen B (N-1)	1,082	1,481	19	2,005	500	0.00%
Scen C (N-1)	1,090	1,427	43	2,005	477	0.00%
ISP 2030 Central (N-1)	1,031	1,587	26	2,005	557	0.00%
ISP StepChange (N-1)	1,114	1,420	253	2,187	501	0.00%
ISP 2040 Central (N-1)	1,114	1,299	497	2,187	615	0.00%

Table 133: GOLD COAST average Summer flows in MW 7:00 to 16:00 for each N transmission scenario

Scenario	Flows SM_N	Flows SM_R	Load	Flows DL_N	Flows DL_R	% flows R%	Cong
Baseline (N)	402	-	456	40	-104	72%	61%
Scen A (N)	377	-	456	30	-119	80%	65%
Scen B (N)	383	-	456	34	-116	77%	66%
Scen C (N)	377	-	456	31	-118	79%	66%
ISP 2030 Central (N)	532	-	456	109	-44	29%	68%
ISP StepChange (N)	405	-	454	49	-107	69%	24%
ISP 2040 Central (N)	373	-	454	31	-122	80%	20%

Table 134: GOLD COAST average Summer flows in MW from 7:00 to 16:00 for each N-1 transmission scenario

Baseline (N-1)	319	-	456	4	-150	97%	71%
Scen A (N-1)	316	-	456	4	-153	98%	72%
Scen B (N-1)	328	-	456	7	-143	95%	68%
Scen C (N-1)	318	-	456	6	-152	96%	77%
ISP 2030 Central (N-1)	489	-	456	86	-62	42%	63%
ISP StepChange (N-1)	329	-	454	15	-149	91%	45%
ISP 2040 Central (N-1)	316	-	454	11	-158	94%	56%

Table 135: GOLD COAST average Summer flows in MW 16:30 to 21:00 for each N transmission scenario

Scenario	Flows SM_N	Flows SM_R	Load	Flows DL_N	Flows DL_R	% flows R	Cong %
Baseline (N)	633	-	653	59	-96	62%	41%
Scen A (N)	566	-	653	30	-131	82%	55%
Scen B (N)	576	-	653	32	-123	80%	42%
Scen C (N)	571	-	653	29	-126	81%	45%
ISP 2030 Central (N)	695	-	653	86	-63	42%	36%
ISP StepChange (N)	583	-	700	15	-148	91%	56%
ISP 2040 Central (N)	640	-	700	36	-113	76%	47%

Table 136: GOLD COAST average Summer flows in MW from 16:30 to 21:00 for each N-1 transmission scenario

Baseline (N-1)	540	-	653	11	-138	93%	44%
Scen A (N-1)	513	-	653	4	-158	97%	57%
Scen B (N-1)	524	-	653	7	-149	96%	58%
Scen C (N-1)	507	-	653	4	-164	97%	74%
ISP 2030 Central (N-1)	634	-	653	51	-86	63%	32%
ISP StepChange (N-1)	540	-	700	1	-176	99%	97%
ISP 2040 Central (N-1)	676	-	700	55	-98	64%	64%

Table 137: GOLD COAST average Winter flows in MW 7:00 to 16:00 for each N transmission scenario

Scenario	Flows SM_N	Flows SM_R	Load	Flows DL_N	Flows DL_R	% flows R	Cong %
Baseline (N)	470	-	362	125	-25	17%	58%
Scen A (N)	441	-	362	107	-37	26%	44%
Scen B (N)	431	-	362	102	-41	28%	29%
Scen C (N)	412	-	362	90	-47	34%	23%
ISP 2030 Central (N)	447	-	362	118	-42	26%	15%
ISP StepChange (N)	327	-0	361	58	-100	63%	28%
ISP 2040 Central (N)	334	-0	361	58	-92	61%	21%

Table 138: GOLD COAST average Winter flows in MW from 7:00 to 16:00 for each N-1 transmission scenario

Baseline (N-1)	343	-	362	53	-78	60%	44%
Scen A (N-1)	326	-	362	44	-86	66%	37%
Scen B (N-1)	332	-	362	47	-83	64%	26%
Scen C (N-1)	305	-	362	35	-98	74%	26%
ISP 2030 Central (N-1)	448	-	362	116	-38	25%	11%
ISP StepChange (N-1)	279	-0	361	30	-120	80%	30%
ISP 2040 Central (N-1)	287	-0	361	36	-117	76%	30%

Table 139: GOLD COAST average Winter flows in MW 16:30 to 21:00 for each N transmission scenario

Scenario	Flows SM_N	Flows SM_R	Load	Flows DL_N	Flows DL_R	% flows R	Cong %
Baseline (N)	657	-	579	104	-42	29%	25%
Scen A (N)	565	-	579	61	-89	59%	27%
Scen B (N)	572	-	579	61	-82	57%	20%
Scen C (N)	535	-	579	42	-99	70%	18%
ISP 2030 Central (N)	569	-	579	54	-78	59%	21%
ISP StepChange (N)	509	-	638	10	-153	94%	55%
ISP 2040 Central (N)	586	-	638	26	-93	78%	30%

Table 140: GOLD COAST average Winter flows in MW from 16:30 to 21:00 for each N-1 transmission scenario

Baseline (N-1)	551	-	579	47	-89	65%	15%
Scen A (N-1)	511	-	579	31	-111	78%	23%
Scen B (N-1)	525	-	579	34	-101	75%	22%
Scen C (N-1)	482	-	579	17	-125	88%	29%
ISP 2030 Central (N-1)	569	-	579	54	-77	59%	13%
ISP StepChange (N-1)	484	-	638	3	-170	98%	85%
ISP 2040 Central (N-1)	622	-	638	42	-73	64%	29%

Table 141: GOLD COAST average Autumn flows in MW 7:00 to 16:00 for each N transmission scenario

Scenario	Flows SM_N	Flows SM_R	Load	Flows DL_N	Flows DL_R	% flows R	Cong %
Baseline (N)	379	-	417	49	-96	66%	59%
Scen A (N)	351	-	417	37	-112	75%	62%
Scen B (N)	355	-	417	39	-109	74%	55%
Scen C (N)	349	-	417	36	-112	76%	59%
ISP 2030 Central (N)	474	-	417	96	-48	33%	45%
ISP StepChange (N)	363	-	413	48	-107	69%	23%
ISP 2040 Central (N)	353	-	413	42	-110	72%	17%

Table 142: GOLD COAST average Autumn flows in MW from 7:00 to 16:00 for each N-1 transmission scenario

Baseline (N-1)	302	-	417	18	-141	89%	75%
Scen A (N-1)	292	-	417	14	-147	91%	75%
Scen B (N-1)	305	-	417	20	-140	88%	65%
Scen C (N-1)	292	-	417	16	-149	90%	71%
ISP 2030 Central (N-1)	448	-	417	85	-63	43%	50%
ISP StepChange (N-1)	320	-	413	27	-127	83%	38%
ISP 2040 Central (N-1)	290	-	413	16	-146	90%	46%

Table 143: GOLD COAST average Autumn flows in MW 16:30 to 21:00 for each N transmission scenario

Scenario	Flows SM_N	Flows SM_R	Load	Flows DL_N	Flows DL_R	% flows R	Cong %
Baseline (N)	627	-	607	78	-74	49%	30%
Scen A (N)	539	-	607	35	-117	77%	40%
Scen B (N)	536	-	607	35	-120	77%	34%
Scen C (N)	532	-	607	31	-120	79%	35%
ISP 2030 Central (N)	601	-	607	62	-84	58%	29%
ISP StepChange (N)	532	-	662	9	-154	94%	62%
ISP 2040 Central (N)	566	-	662	18	-129	88%	45%

Table 144: GOLD COAST average Autumn flows in MW from 16:30 to 21:00 for each N-1 transmission scenario

Baseline (N-1)	526	-	607	26	-121	82%	31%
Scen A (N-1)	491	-	607	16	-144	90%	50%
Scen B (N-1)	500	-	607	19	-140	88%	53%
Scen C (N-1)	477	-	607	11	-153	94%	65%
ISP 2030 Central (N-1)	557	-	607	37	-101	73%	22%
ISP StepChange (N-1)	501	-	662	1	-177	99%	98%
ISP 2040 Central (N-1)	615	-	662	35	-98	74%	49%