NEED/OPPORTUNITY STATEMENT (NOS)

Reinforcement of Northern Network

NOS- 000000001529 revision 1.0

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Project reason: Market benefit - To realise market benefits
Project category: Contingent Prescribed - Augmentation

Approvals

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1 Background

This Need/Opportunity statement documents the triggers, limitations, needs and potential options for the TransGrid's Northern NSW network.

The existing transmission network in Northern NSW area is shown in Figure 1. The Northern NSW network includes the Queensland – NSW interconnector (QNI) which was commissioned in February 2001 and has been operated under a joint operating agreement between TransGrid and Powerlink to date. It is a high voltage alternating current (HVAC) system connecting the NSW and Queensland power systems, which comprise a double circuit 330 kV line from Armidale in NSW to Tarong Power Station in Queensland.

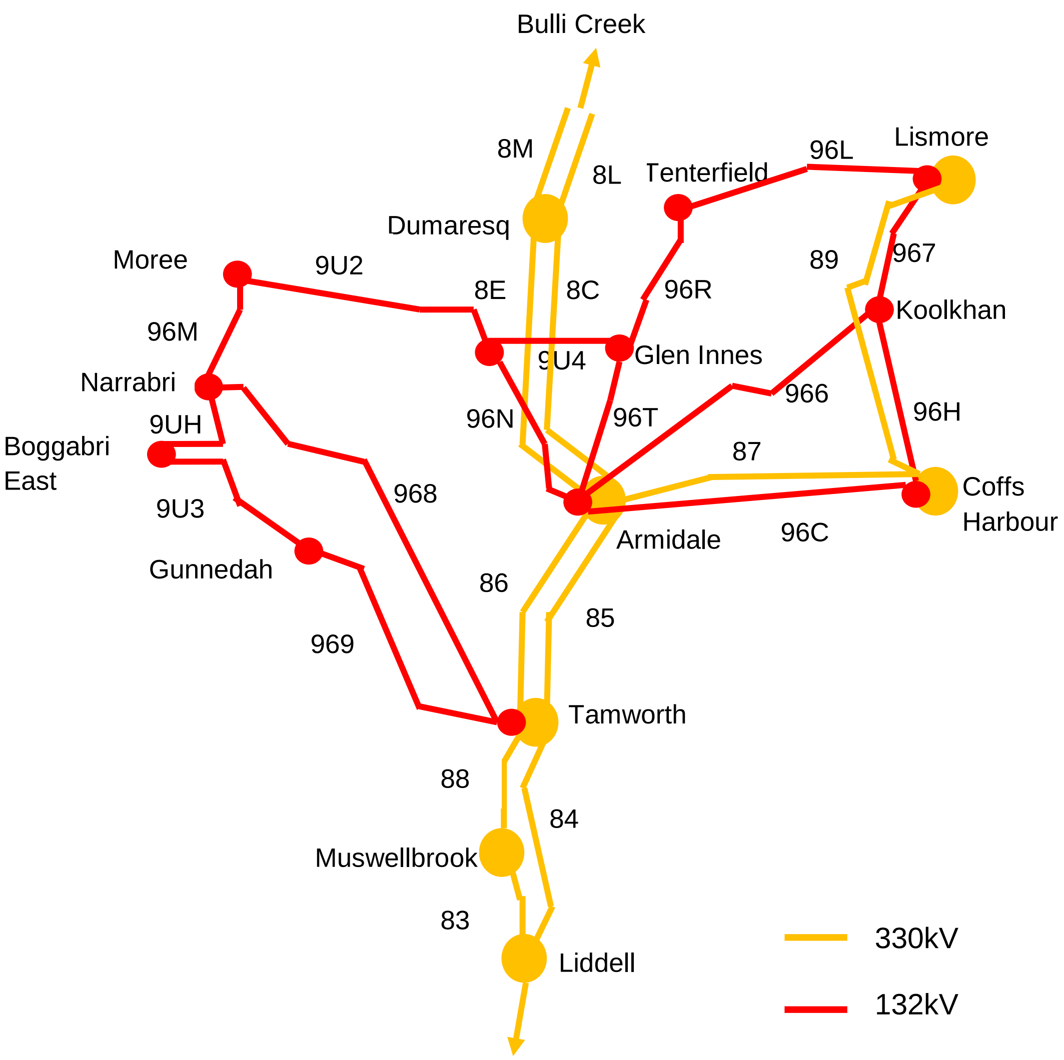

Figure 1: Existing System in Northern NSW area

The 330 kV transmission lines and their rating information in Northern NSW area are shown in Table 1.

Line No.	Line Name	Normal Rating (MVA)	Contingency Rating (MVA)	Design Temp (°C)
8M	Bulli Creek – Dumaresq	1237	1406	85
8L	Bulli Creek – Dumaresq	1237	1406	85
8E	Armidale - Dumaresq	1269	1406	85
8C	Armidale - Dumaresq	1269	1406	85
86	Tamworth - Armidale	840	989	100
85	Tamworth - Armidale	892	983	85
84	Liddell - Tamworth	892	983	85
83	Liddell - Muswellbrook	892	983	85
88	Muswellbrook - Tamworth	892	983	85

Table 1: Line List of Northern NSW network

2 Need/Opportunity

2.1 Assessment of Generation Capacity

AEMO's generation information reports were a key input to select the generation retirement options. In particular, both Liddell and Smithfield are noted by AEMO to be "committed" to retirement. AEMO states that Smithfield Power Partnership advised them that the Smithfield energy facility would be retired in 2017 and AGL advised that Liddell power station would be shut down in 2022.

The reserve plant margins and energy balances within NSW are heavily impacted by the retirement of Liddell, to the point that it is unlikely that renewable projects can fulfil the need for energy and capacity (especially if wind generation cannot contribute significantly at peak demand times). This is particular the case for Medium and especially High demand growth outlooks, where substantial open cycle and combined cycle capacity will almost certain be required.

The ability of NSW existing generation to meet demand was assessed based on the following assumptions:

- NSW 10% POE medium demand growth forecast[1]
- The full capacity of all existing coal, gas and hydro generations is available for dispatch
- Maximum interconnector import capacity (1200 MW import from Queensland, 600 MW import from Victoria)
- Network losses are assumed to be 4% of the maximum demand level

The generator retirements are assumed:

- Smithfield generator with total capacity 162 MW will retire in 2017
- Liddell power station with total capacity 2000 MW will retire in 2022.

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[1] AEMO National Electricity Forecasting Report 2015

The NSW demand, available generation and potential surplus / shortfall is summarised in Table 2. A shortfall in generation is observed in 2022 as a result of the retirement of Liddell power station.

Year	Medium Growth Demand (MW)	Generation (MW)	Interconnector Flow (MW)	Network Losses (MW)	Surplus / Shortfall (MW)
2019/20	14666	15079.8	1800	600	1613.8
2020/21	14887	15079.8	1800	600	1392.8
2021/22	15086	15079.8	1800	600	1193.8
2022/23	15219	13079.8	1800	600	-939.2
2023/24	15457	13079.8	1800	600	-1177.2
2026/27	16168	13079.8	1800	600	-1888.2
2028/29	16591	13079.8	1800	600	-2311.2

Table 2: NSW Generation Surplus / Shortfall Based on Existing Generations for the Medium Growth Demand Scenario

Based on the assessment, it can be concluded that after the retirement of Liddell power station, NSW existing local generation with full interconnector support from other state will not able to meet NSW demand. To meet network reliability new generation or interconnector upgrade will be required.

AEMO also suggests in their 2015 Electricity Statement of Opportunities (ESOO) report that the unserved energy (USE) level in NSW could exceed the Reliability Standard from 2021 under the high scenario and from 2022 under the medium scenario as shown in Figure 2. The increase in USE is primarily driven by the capacity withdrawal from NSW and an increase in maximum demand.

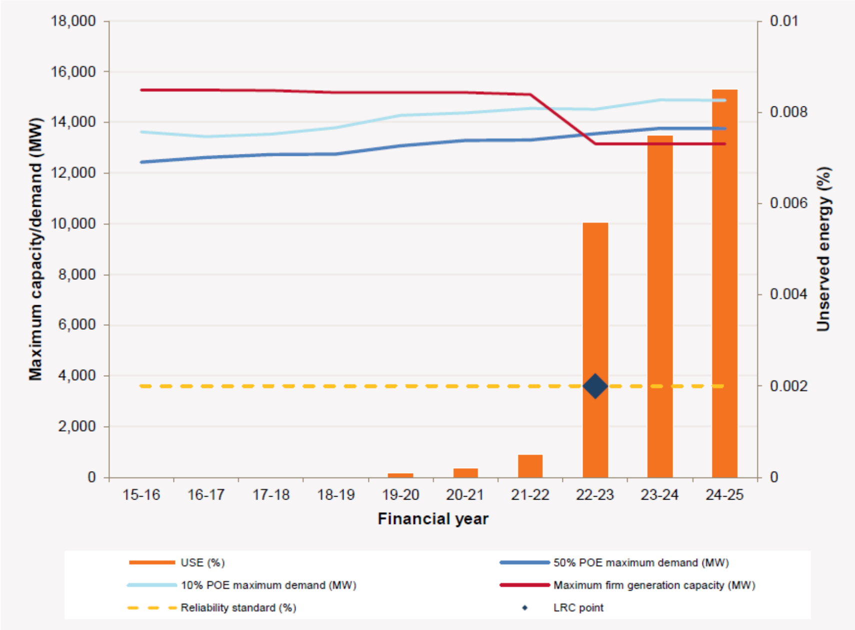

Figure 2: NSW Supply Adequacy (Medium Scenario)[2]

2.2 Generation Development Scenarios

Ernst & Young (EY) developed the generation development scenarios for TransGrid's 2018/19 to 2023/24 revenue proposal. EY identified key influencing factors likely impact on generator developments over the period of interest. The factors adopted in the analysis are:

- Demand Growth
- Renewables penetration and emission response
- Interconnector augmentation
- Small-scale, distributed energy resource (DER) uptake, including consideration of storage

Combining these factors leads to a set of future "worlds" which are called outlooks that EY believe are possible ways in which the electricity system may evolve over the coming years. The drivers for new capacity and the retirement of existing capacity are different and should be examined individually. This leads to a range of different plausible future planting scenarios, which TransGrid selected 5 "most likely" scenarios and based on which will draw transmission requirements in the future. The top 5 generating planting scenarios include three medium demand growth outlooks 38, 29 and 39; one low demand growth outlook 65 and one high demand growth outlook 11 as shown in Table 3.

[2] 2015 Electricity Statement of Opportunities Version 2.0

Outlook Number	Outlook Name	Demand	NSW Renewables and Emissions Response	Interconnector Augmentation	Small Scale Distributed Energy Resource Uptake
38	Medium 1	Medium	Medium Penetration	None	Medium
29	Medium 2	Medium	High Penetration	None	Medium
39	Medium 3	Medium	Medium Penetration	None	Low
65	Low	Low	High Penetration	None	Medium
11	High	High	Medium Penetration	None	Medium

Table 3: Top 5 Selected Scenarios

Three wind farms and one solar farm have recently been completed and are in full commercial operation.

Wind Farm	Capacity (MW)	Commissioning Date
Gullen Range WF	165.5	November 2014
Boco Rock WF	113	March 2015
Taralga WF	106.7	May 2015
Broken Hill Solar	53	October 2015
Moree Solar Farm	56	Early 2016

Table 4: Recently Connected Wind Farms

Generation investment interest in NSW is focused on wind generation projects, mainly through the Marulan – Yass – Bannaby network and New England areas. Solar generation investment remains strong in NSW.

2.2.1 Medium 1 scenario

Under medium 1 scenario, the new generation injections in Northern NSW network are shown in Figure 3. For the network adequacy assessment, it is assumed the renewable cluster in northern NSW is dispatched at 100% while all other wind generators are dispatched at 1.2% of rated capacity and solar generators are dispatched at 25% of rated capacity. The total wind and solar generation dispatched in this cluster is shown in Table 5. Only transitions in renewable generation dispatch are shown, with right pointing arrows indicating that renewable generation dispatch within the cluster is unchanged from the previous year.

Scenario	2019/20	2020/21	2021/22	2022/23	2023/24	2026/27	2028/29
Medium 1	863	→	963	→	1023	1123	→

Table 5: Northern NSW Cluster Dispatch under Medium 1 scenario (MW)

[redacted]

Figure 3: New Generation Injection Points (Medium1)

2.2.2 Medium 2 scenario

Under medium 2 scenario, the new generation injections in Northern NSW network are shown in Table 5Figure 4. The total wind and solar generation dispatch in this cluster is shown in Table 6.

Scenario	2019/20	2020/21	2021/22	2022/23	2023/24	2026/27	2028/29
Medium 2	863	→	→	988	→	1158	→

Table 6: Northern NSW Cluster Dispatch under Medium 2 scenario (MW)

[redacted]

Figure 4: New Generation Injection Points (Medium2)

2.2.3 Medium 3 scenario

Under medium 3 scenario, the new generation injections in Northern NSW network are shown in Figure 5Table 5. The total wind and solar generation dispatch in this cluster is shown in Table 7.

Scenario	2019/20	2020/21	2021/22	2022/23	2023/24	2026/27	2028/29
Medium 3	628	→	→	→	→	653	→

Table 7: Northern NSW Cluster Dispatch under Medium 3 scenario (MW)

[redacted]

Figure 5: New Generation Injection Points (Medium 3)

2.2.4 Low scenario

Under low scenario, the new generation injections in Northern NSW network are shown in Figure 6Table 5. The total wind and solar generation dispatch in this cluster is shown in Table 8.

Scenario	2019/20	2020/21	2021/22	2022/23	2023/24	2026/27	2028/29
Low	698	→	→	→	728	→	853

Table 8: Northern NSW Cluster Dispatch under Low scenario (MW)

[redacted]

Figure 6: New Generation Injection Points (Low)

2.2.5 High scenario

Under high scenario, the new generation injections in Northern NSW network are shown in Figure 7Table 5. The total wind and solar generation dispatch in this cluster is shown in Table 9.

Scenario	2019/20	2020/21	2021/22	2022/23	2023/24	2026/27	2028/29
High	698	→	798	→	858	958	→

Table 9: Northern NSW Cluster Dispatch under High scenario (MW)

[redacted]

Figure 7: New Generation Injection Points (High)

2.3 Description of Need

2.3.1 Need Contingent to the New Generator Connections to provide market benefits

The most critical lines based on line adequacy studies are:

- Line 85: Armidale – Tamworth
- Line 86: Armidale – Tamworth

These two lines will reach their contingency limit when QNI import is high and new generators in the region are at their maximum installed capacity.

Constrained Line	Critical Contingency	Scenarios	New Connection Capacity to reach 100% thermal capability (MW)	Date to reach 100% thermal capacity[3]	Overloading
Line 85	Line 86	Medium1	1123	2025/26	101%
		Medium2	1123	2024/25	101%
		Medium3	N/A	>2027/28	N/A
		Low	N/A	>2027/28	N/A
		High	N/A	>2027/28	N/A
Line 86	Line 85	Medium1	1123	2025/26	100%
		Medium2	1123	2024/25	101%
		Medium3	N/A	>2027/28	N/A
		Low	N/A	>2027/28	N/A
		High	N/A	>2027/28	N/A

This shows that there is possibility that Line 85 and 86 could constrain the power can be imported from QLD and the potential new renewable connections in New England area during time the cost of generations is low in these areas.

2.3.2 Need to Remove Existing QNI Transfer Limitations to provide market benefits

At present QNI transfer is constrained most often by voltage stability, transient stability or thermal constraints by lines in northern NSW. The upgrading of the power transfer capability across QNI by allowing it to operate at its full thermal capacity could provide market benefits. Three specific potential market benefits have been identified:

- Reduced energy costs by the dispatch of lower cost generating plant to meet the energy needs of the NEM.
- Increased sharing of generation sources across the interconnector, thereby reducing the overall need for new generation.

[3] Based on the assumed generation scenarios

- Increased benefits to the NEM participants due to increased competition of generators.

The most recent assessment was carried out as part of the joint Powerlink and TransGrid regulatory consultation process commencing in late 2012. The formal RIT-T consultation process was finalised in December 2014 following the publication of the QNI upgrade Project Assessment Conclusions Report (PACR) and completion of the mandatory consultation period. The PACR described the outcomes of a detailed technical and economic assessment into the upgrade of QNI.

The technical and economic benefits of potential QNI upgrade options were assessed across a range of market development scenarios broadly aligned with scenarios developed by AEMO for its 2012 National Transmission Network Development Plant (NTNDP). As a result, the assessment concluded that while there were market benefits arising from an upgrade of the interconnector, the optimal timing and ranking of the QNI upgrade options varied considerably across different market development scenarios and that there were was no upgrade option which was consistently and robustly ranked above the “do nothing” option for the majority of the scenarios. Therefore, in light of uncertainties surrounding these factors, TransGrid and Powerlink considered that it was prudent not to recommend a preferred upgrade option at that stage and to continue monitoring market developments to determine if any material changes could warrant reassessment of an upgrade to QNI.

TransGrid and Powerlink have conducted studies for a number of years to assess market benefits from uprating the QNI. Each assessment has been made in accordance with the relevant Regulatory Investment Test of the time. If a technical and economic case can be made to upgrade the QNI capacity in the future, then the option selected will be the credible option that maximises the present value of net economic benefit to all those who produce, consume and transport electricity in the market. The scope of credible network options will be developed at the time and may range from incremental upgrades to large scale upgrades. The outcome of the analysis across a broad range of market scenarios will conclude which option maximises the benefit.

2.3.3 Need to Alleviate Non-QNI Thermal Constraints to provide market benefits

QNI northward transfer is currently limited by thermal constraints due to other lines in northern NSW reaching their capacity. Figure 8 presents that under the N-1 contingency condition, the most onerous thermal constraint is the outage of one 330 kV line between Tamworth and Liddell. If work is done to upgrade QNI to address the need in section 2.3.2 these constraints will impose more binding for flow from NSW to Queensland.

The thermal constraints prior Redbank retirement and the Line 83 and 84 de-rate are imposed by the rating of lines between Tamworth and Armidale (line 86 to cater for a contingent trip of the parallel line 85). Post Redbank retirement, the thermal constraints change from the cut-set between Tamworth and Armidale to the cut-set between Liddell and Tamworth (line 83, 84 and 88).

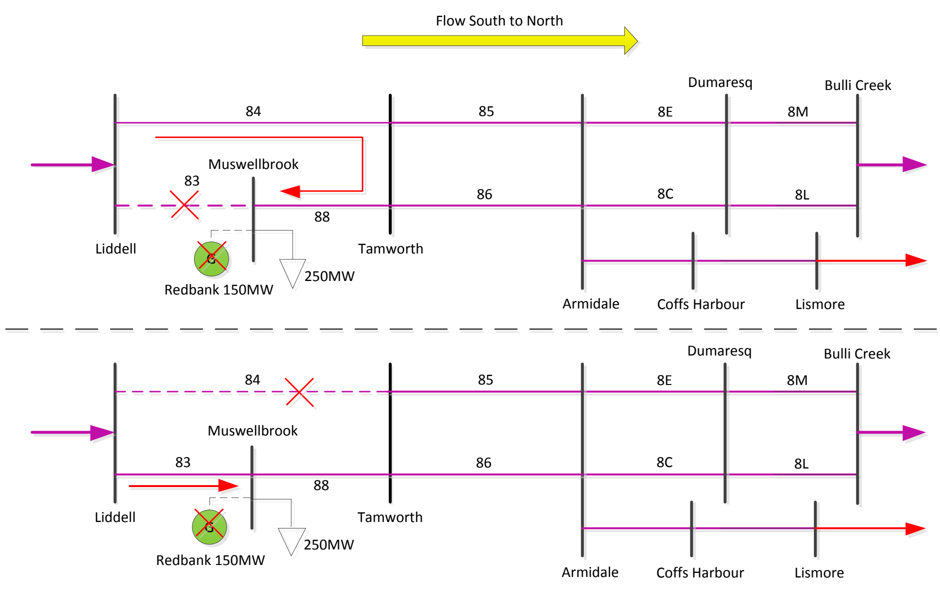

Figure 8: Impact of Redbank Generator Retirement

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Figure 9 shows the thermal limitation on NSW to QLD transfer for the 20 year period based on the Medium Growth Scenario.

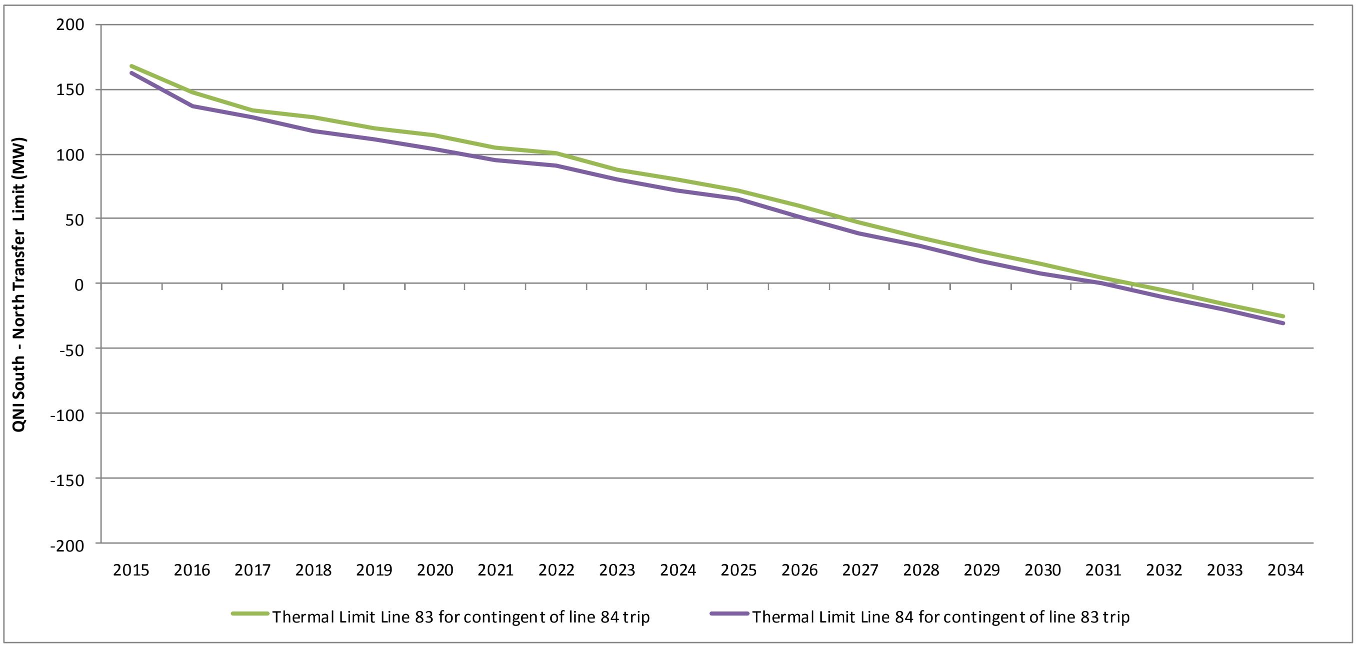

Figure 9: QNI South to North Transfer Limit under Medium Scenario

2.4 TransGrid proposes this project as a contingent project with the following triggers:

- Either:
  - Committed retirement of more than 1100 MW of generation in the Hunter or Central Coast area; and/or
  - AEMO classification of generation developments as being at the ‘committed’ stage of development on the ‘Generator Information’ webpage, exceeding 1100 MW at any current or future connection point(s) north of Armidale; and/or
  - AEMO classification of generation developments as being at the ‘committed’ stage of development on the ‘Generator Information’ webpage, exceeding 350 MW at any current or future connection point(s) south of Liddell and Bayswater.
- Successful completion of the RIT-T which will be initiated in the event of occurrence of any of the above triggers, including a comprehensive assessment of credible options demonstrating positive net market benefits
- Determination by the AER under clause 5.16.6 of the NER that the proposed investment satisfies the Regulatory Investment Test for Transmission.
- TransGrid Board commitment to proceed with the project pursuant to the AER amending the revenue determination pursuant to the Rules.

2.5 Indicative Date to Address Need

The indicative date would be determined by detailed market modelling.

2.6 Type of Service

The system reinforcement would be prescribed service.

3 Related needs/opportunities

Nil

4 Recommendation

It is recommended that options including all feasible network and non-network be considered to address the identified need/opportunity.

Further planning and market modelling studies are to be undertaken to define the market benefit of upgrading the identified circuits.