TransGrid

Capex Forecasting Methodology for QNI Minor Upgrade Project

Contingent Project Application for QNI Minor Upgrade Project

17 January 2020

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1.1 About the QNI Minor Upgrade Project

The Queensland to New South Wales Interconnector (QNI) minor upgrade was included in the Australian Energy Market Operator's (AEMO):

> 2018 Integrated System Plan (ISP)
> 2019 Electricity Statement of Opportunities (ESOO), which reconfirmed the importance of completing the QNI minor upgrade before the forecast closure of Liddell Power Station, and
> draft 2020 ISP released on 12 December 2019, which labelled the QNI minor upgrade a "no regret" action (i.e. it has no downside).

The QNI minor upgrade project (the QNI Project) involves:

> installing static VAR compensators (SVCs) at Dumaresq and Tamworth – this is a critical path task
> installing capacitor banks at Dumaresq, Armidale and Tamworth, and
> uprating existing 330 kV transmission lines between Liddell and Tamworth.

The NSW Government and Energy Security Board (ESB) have requested that we accelerate the completion of the QNI Project by September 2021.

TransGrid and Powerlink prepared a Regulatory Investment Test for Transmission (RIT-T) for the Project. The final stage of the RIT-T involved publishing the Project Assessment Conclusions Report (PACR) on 20 December 2019. In parallel, we have prepared a Contingent Project Application (CPA) for lodgement to the Australian Energy Regulator (AER) in January 2020.

In October 2019, the Federal and NSW Governments and TransGrid executed the QNI Underwriting Agreement (the Underwriting Agreement) to enable early project delivery works, such as equipment procurement, to commence before regulatory approval is obtained.

1.2 Purpose of this document

The purpose of this document is to overview:

> the nature and scope of the capital expenditure (capex) that we require to deliver the QNI Project
> our approaches and processes for procuring external suppliers for the QNI Project
> the outcomes, or status, of the procurement processes for the QNI Project
> how we forecast internal capex for the QNI Project (i.e. where we are not using external suppliers)
> our actual or forecast capex for the QNI Project, by capex category, and
> how we verified and validated our actual and forecast capex for the QNI Project.

1.3 Scope of this document

This document is focussed on explaining and justifying our actual and forecast capex for the QNI Project for the period 1 July 2018 to 30 June 2022, noting that the QNI Project must be completed by September 2021.

Importantly, this document does not do any of the following:

- explain or justify the scope of the QNI Project. This is done in the PACR and CPA, which set out the top-ranked incremental network option, being "Option 1a" – this is the option that we will deliver through the QNI Project. The capex discussed in this document gives effect to this "Option 1a"
- address the requirements in clause 6A.6.7 of the National Electricity Rules (NER) as they relate to the QNI Project. This is done in the separate document prepared by HoustonKemp entitled "Consistency of TransGrid's proposed capital expenditure for the QNI minor upgrade with the NER requirements", and
- explain or justify our operating expenditure for the QNI Project. This is done in a separate document entitled QNI Opex Forecasting Methodology.

Unless otherwise stated, all historical and forecast capex values in this document are presented in real 2017-18 dollars.

1.4 Structure of this document

The remainder of this Capex Forecasting Methodology is structured as follows:

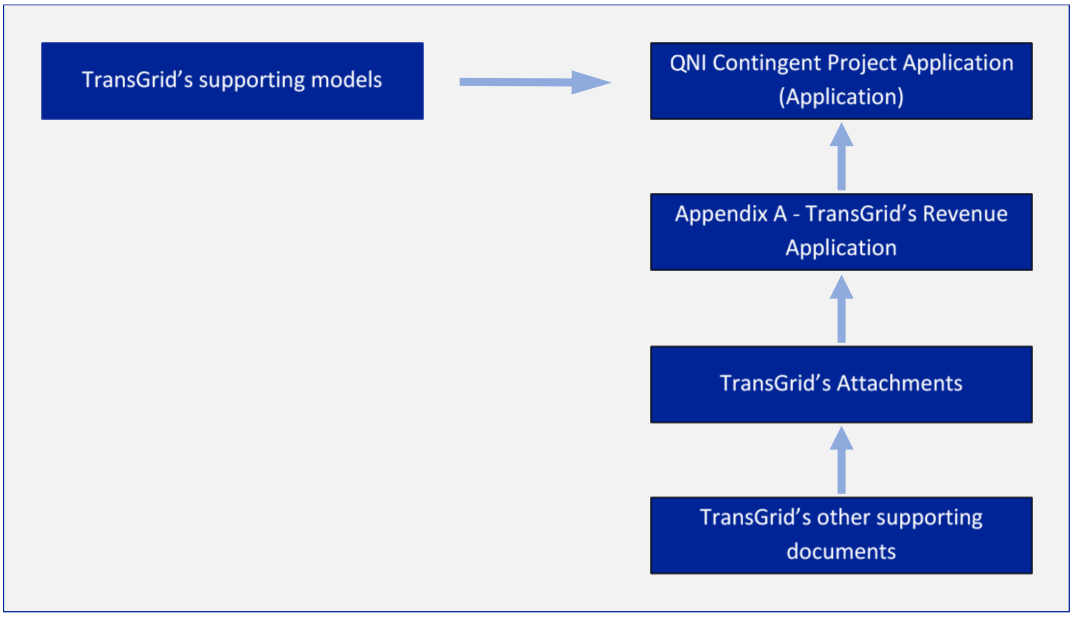
- section 2 overviews our actual and forecast capex for the QNI Project
- section 3 explains the changes in our capex for the QNI Project between the current assessment and the assessment that was included in the RIT-T Project Assessment Draft Report (PADR) that we published on 30 September 2019
- section 4 overviews our investment framework
- section 5 overviews the processes that we used to procure external suppliers for the QNI Project
- section 6 explains our capex on SVCs
- section 7 explains our capex on substations
- section 8 explains our capex on capacitor banks
- section 9 explains our capex on transmission lines
- section 10 explains our capex on high voltage (HV) switchgear
- section 11 explains our capex on transmission line insulators
- section 12 explains our capex on corporate and network overheads (also referred to in this document as indirect capex)
- section 13 explains our connection capex
- section 14 explains our real input cost escalations, and
- section 15 explains our capex for the QNI Project has been verified and validated.

1.5 Structure of QNI Application

There are a number of other attachments and models that support, and form part of, our Application for the QNI Project. This document references these Attachments, models and other supporting documents for further detail and should be read in conjunction with them.

Our Application is structured as illustrated in Figure 1.1 to be as clear and accessible as possible to the AER, customers and other stakeholders.

Figure 1.1: QNI Project Application document structure



2. Overview of QNI Project capex

This section overviews our actual and forecast capex for the QNI Project.

The total forecast capex for the QNI Project is $222.8 million for the period 1 July 2018 to 30 June 2022.

The capex for the QNI Project is incremental to our business-as-usual capex.

Table 2.1 shows the incremental forecast capex for the QNI Project by year and the total capex forecast of $222.8 million.

Table 2.1: Total forecast capex for QNI Project ($M, Real 2017-18, including indirect costs)

	2018-19	2019-20	2020-21	2021-22	Total
Total capex	1.4	74.5	112.1	34.7	**222.8**

There are nine key capex categories for the QNI Project, as detailed in Table 2.2.

We expect that around 87 per cent of the capex for the QNI Project will be based on market prices.

Table 2.2: Total forecast capex for the QNI Project by category ($M, Real 2017-18)

Category of QNI capex	Basis of capex	Status	Capex $M	% of total capex
1.SVCs	Externally tendered - directly procured asset approach	Complete	55.5	24.9
2.Substations	Externally tendered - design and construct approach	Complete	80.6	36.1
3.Capacitor banks	Externally tendered - directly procured asset approach	Complete for Armidale and Dumaresq and in progress for Tamworth. Current Tamworth forecast is an estimate.	14.6	6.5
4.Transmission lines	Externally tendered - design and construct approach	Complete	36.4	16.3
5.HV switchgear	Externally tendered - directly procured asset approach	In progress. Current forecast is an estimate.	6.2	2.8
6.Transmission line insulators	Externally tendered - directly procured asset approach	In progress. Current forecast is an estimate.	0.2	0.1
7.Corporate & network overheads	Actual capex reflects records in Ellipse. Forecast capex internal bottom-up build.	Complete	28.7	12.9

Category of QNI capex	Basis of capex	Status	Capex $M	% of total capex
8.Connections	Externally tendered - directly procured approach	In progress. Current forecast is an estimate.	0.1	0.0
9.Real input costs	Internally bottom-up build using AER's forecast real labour cost escalators	Complete	0.6	0.3
			222.8	**100.0**

Our capex forecast for the QNI Project is prudent and efficient. This is demonstrated by:

> the rigorous, well-defined and transparent capex forecasting methodology set out in this document

> the application of our governance framework and process

> the reliance on market testing and expert reports, and

> external validation of both the capex forecast and deliverability.

The separate document prepared by HoustonKemp entitled "Consistency of TransGrid's proposed capital expenditure for the QNI minor upgrade with the NER requirements" explains and justifies how our capex is prudent and efficient by reference to clause 6A.6.7 of the NER.

3. Changes in capex forecast from RIT-T PADR

This section explains the differences between our final capex forecast for the QNI Project in this Application and the capex forecast published in the RIT-T PADR on 30 September 2019. As discussed in section 2, the final capex forecast is $222.8 million. The capex forecast published in the PADR was $160.2 million[1].

The capex forecast in the PADR was a class four estimate[2], meaning that only 1 to 15 per cent of project specifications were defined, resulting in a likely variation to the final cost of between -30 per cent to +50 per cent. The capex forecast in the PADR was developed internally using historical costs from our "Success" cost estimating database.

The final capex forecast reflects information on the prudent and efficient market-based costs of delivering the QNI Project, which was not available at the time of publishing the PADR. This final forecast reflects the outcomes of competitive procurement processes with multiple bidders that have resulted in fixed price outcomes.

The optimal design for the substation and transmission line components of the QNI Project has also been further developed and refined through the competitive tender process. Our procurement process requires tenderers to determine the optimal design for the QNI Project, subject to our overall design requirements. This is explained in sections 5, 7 and 9.

The increase in the final capex forecast arises from:

> significant demand for infrastructure resources currently in the Australian market, particularly in NSW leading to a shortage in available labour and construction resources

> the accelerated project delivery timeframes, and

> reduced timeframes for tenders.

The $62.5 million increase between the PADR and final capex forecast primarily relates to:

> Substations – The final capex forecast for substations is $79.7 million, an increase of $32.6 million from the PADR forecast of $47.1 million. The final capex forecast is based on competitive market outcome for price and scope as discussed in section 7.

> Transmission lines – The final capex forecast for transmission lines $36.4 million, an increase of $10.6 million from the PADR forecast of $25.8 million. The final capex forecast is based on competitive market outcome for price and scope as discussed in section 9.

> Corporate and network overheads – The final capex forecast for corporate and network overheads is $29.3 million, an increase of $16.2 million from the PADR forecast of $13.1 million. The PADR capex forecast for was derived using a top-down-estimate approach determined by the Success estimating database. This applies a percentage mark-up on the total project capex (i.e. using the design cost factor (DCF) and the network cost factor (NCF)). The DCF and NCF reflect historical projects and are therefore not expected to provide an accurate forecast of indirect costs for QNI given its size. We have now undertaken a detailed bottom-up build of indirect costs. This reflects current available market rates and recent historical data and is explained in section 12.

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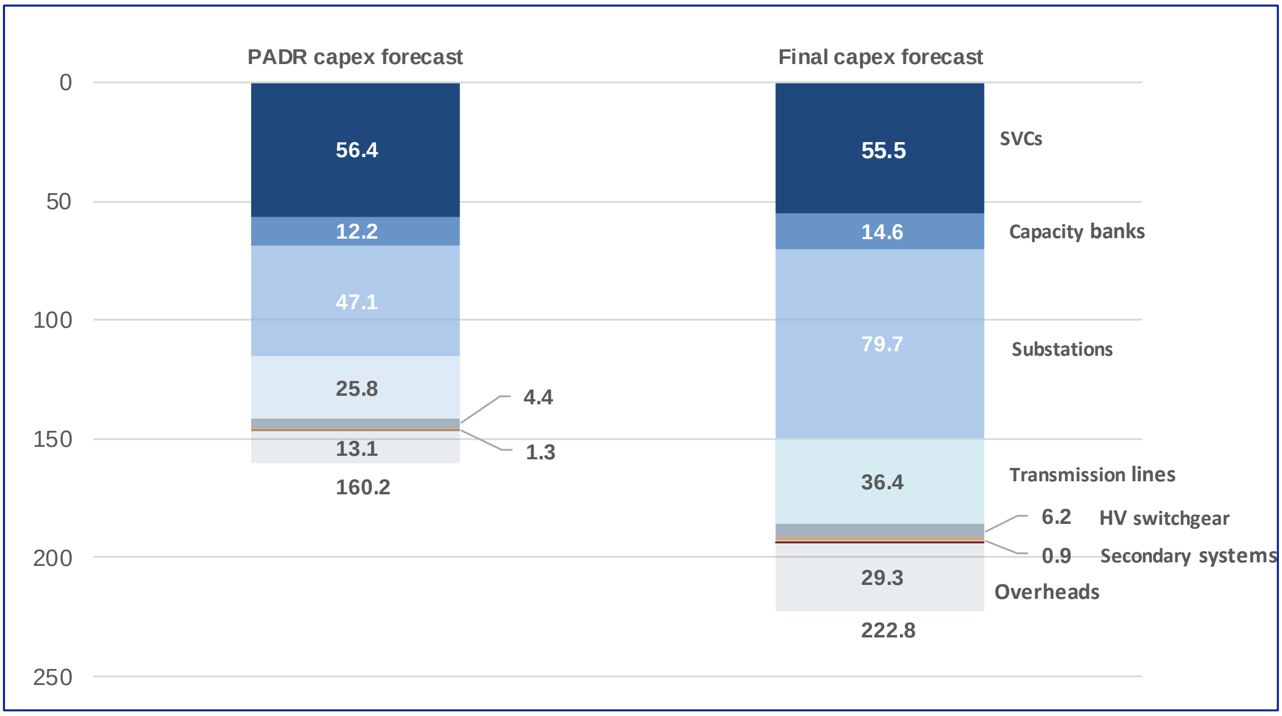
[1] The PADR forecast capex of $175.2 million ($,Real 2021-22) is $160.2 million ($,Real 2017-18).

[2] A "Class 4" under AACE International Recommended Practice and Estimate Classification.

Figure 3.1: Differences between the final capex forecast and the PADR capex forecast ($M, Real 2017-18)



4. Investment framework

This section overviews our investment framework.

We consider the capex for the QNI Project to be prudent and efficient. As discussed in section 3, we undertook further work since the publication of the PADR in September 2019 to refine the key assumptions underpinning the PACR capex forecast in order to reflect more up-to-date and accurate information. Our governance arrangements support optimised investment decisions.

The forecast capex for the QNI Project:

- promotes our corporate objectives – there is a direct line-of-sight between those objectives and the capex forecast
- has been subject to appropriate capital governance
- has been developed from a well-defined capex forecasting process, and
- reflects competitive, market-tested costs that have been obtained from external suppliers.

These matters are discussed in the following sections.

4.1 Aligned with corporate objectives

The capex forecast has been developed in-line with our vision and values to meet the needs of our customers to provide safe, reliable and efficient transmission services.[3] We have the following four overarching objectives for the delivery of the QNI Project:

- deliver value for money
- effectively manage risk to prudently and efficiently deliver the QNI Project
- deliver a fit-for-purpose asset that can be safely and efficiently operated over its design life, and
- continue a strong focus on safety.

Each of these overarching objectives is discussed below.

4.1.1 Value for money

Value for money is achieved by ensuring that the works are no more than is required to meet the need and that project costs are efficient. This is demonstrated by maintaining a rigorous capital governance process (see section 4.2) and ensuring project efficiency.

The optimal design for the substation and transmission line components of the QNI Project is based on the current competitive tender process. Our procurement process requires tenderers to determine the optimal design for the QNI Project, subject to our overall design requirements.

4.1.2 Managing risk

Risk management is a critical aspect of the QNI Project. This is because the nature and complexity of the QNI Project increases construction and delivery risks significantly compared to business-as-usual capex. Our approach to risk management is aligned with our risk appetite. Our Risk Appetite Statement states that we have[4]:

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3 TransGrid, https://www.transgrid.com.au/who-we-are/about-us/mission-vision-values/Pages/default.aspx

4 TransGrid, 2019, TransGrid Risk Appetite Statement, pg. 3 and 4.

- an overall medium risk tolerance across all business areas and functions, which requires the identification of risk treatments for any risk that is rated “High” or “Extreme”, and
- different levels of risk appetite for each key area such as very low risk appetite in relation to safety, moderate risk appetite in relation to prescribed growth activities and low in relation to regulatory compliance.

4.1.3 Delivering a fit-for-purpose asset

QNI is a large capacity interconnector between the Queensland and NSW. As such, it can impact on security of supply in both states. The QNI Project allows for increased capacity between Queensland and Liddell substation. To ensure QNI continues to be a fit-for-purpose asset, we have:

- incorporated the outcomes of planning and engineering studies, allowing the for development of potential QNI Project options
- applied the relevant Australian and international standards in the specification of all materials and equipment required to deliver the QNI Project
- applied our Safety in Design procedure (D2012/14473) to the design of new assets for the QNI Project
- engaged qualified external parties to further develop and verify key aspects of the design and its implementation, and
- included appropriate protection, control and communications in the specification and scope of the QNI Project.

We have undertaken design activities to inform the scope and technical requirements of the QNI Project. The optimal design for the substation and transmission line components of the QNI Project has been further developed and refined through the competitive tender process. Our procurement process requires tenderers to determine the optimal design for the QNI Project, subject to our overall design requirements.

4.1.4 Safe work practices

Safety remains our first and highest priority for customers, the public, staff and contractors. All of our policies and safe work practices apply to the QNI Project. These policies and practices are broad ranging and relate, amongst other things, to design principles (incorporating safety in design practices) and construction safety risk management, especially on existing in-service assets.

4.2 Appropriate governance framework

We have well-defined governance practices, including decision gates, which are documented in the Prescribed Network Capital Investment Process document. These practices are applied to business-as-usual capital projects that form part of the overall portfolio of capital projects in a five-year regulatory reset period (i.e. business-as-usual capital portfolio).

We have a separate capital portfolio for Major Projects (i.e. group 1 and 2 ISP projects).[5] These Major Projects are larger and more complex than business-as-usual capital projects. We have tailored our governance framework for these Major Projects so we are confident that we are making prudent and efficient investment decisions that will deliver satisfactory and sustainable returns on our assets in a compliant, safe and sustainable manner. This governance structure is applied to all Major Projects, including QNI.

The key principles underpinning our Major Project governance framework are to:

- provide consistent and rigorous approach to investment decisions

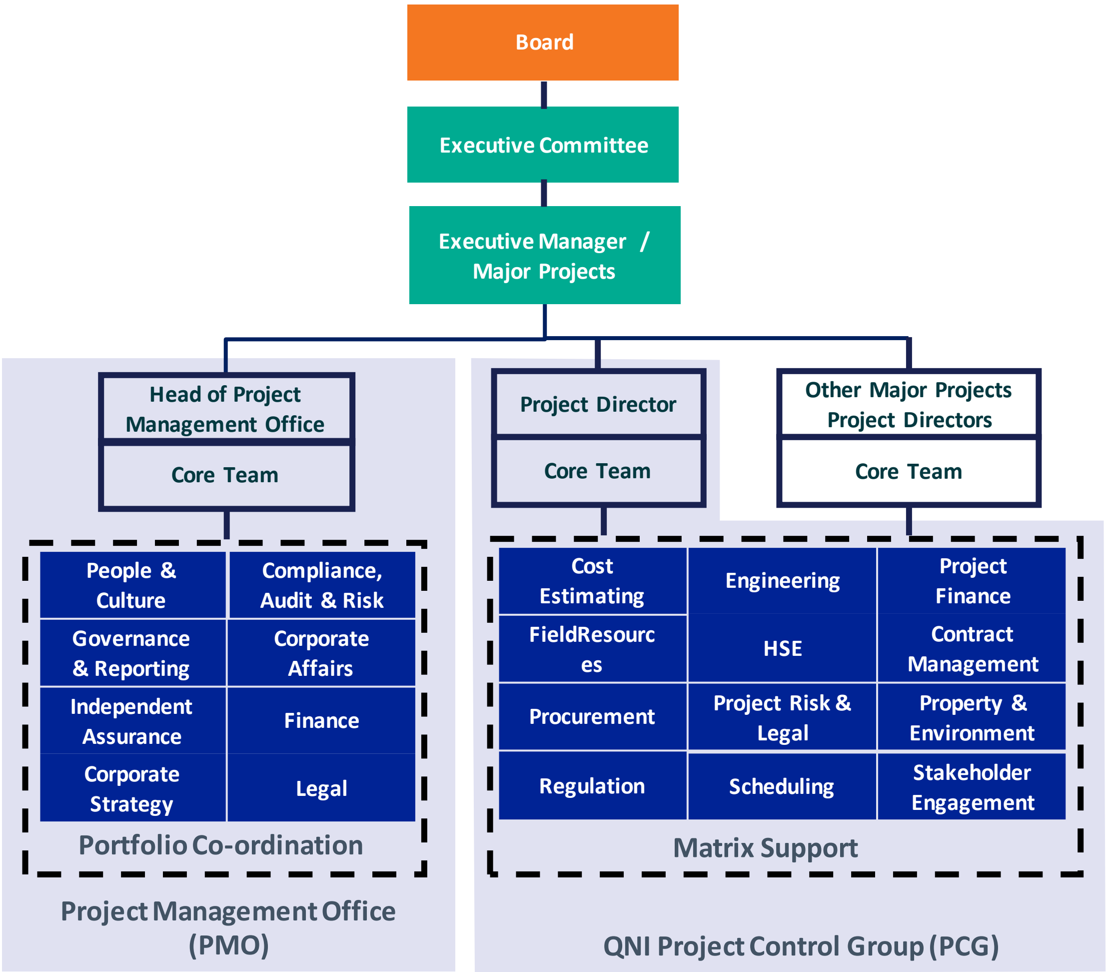
[5] Published by AEMO.

- ensure appropriate level of management scrutiny
- demonstrate to the Board, securityholders and key stakeholders that the forecast capex is efficient and prudent, and
- ensure that all investment accords with our compliance obligations and regulatory requirements.

4.2.1 Governance Framework

QNI is governed in accordance with the Major Projects Governance Framework shown in Figure 4.1, which details the hierarchy of decision making and membership that support the Project.

Figure 4.1: Major Projects Governance Framework



We will periodically review our Major Projects Governance Framework, which is overseen by the Chief Executive Officer (CEO) and the Board.

4.2.2 Executive Committee

The Executive Committee comprises our full Executive Management Team (EMT) and is chaired by the CEO. The Executive Committee meets monthly, is accountable to the Board and is responsible for overall management of TransGrid.

The Executive Committee provides oversight and strategic direction on all Major Projects, including QNI. This oversight and direction ensures that investment in Major Projects is prudent and efficient. Areas of focus include approving the governance structure, reporting cadence and enabling the availability of functional resourcing through matrix support arrangements.

The Executive Manager of Major Projects is a member of the EMT and is the Executive Sponsor for all Major Projects, including QNI. The Executive Manager of Major Projects is accountable for the successful completion of Major Projects, ranging from concept development through to commissioning and handover to the operations group. The position has delegated approval from the Board and Executive Committee to manage the strategic and operational activities required for the Project's completion.

4.2.3 Portfolio Management Office

The Major Projects Portfolio Management Office (PMO) is accountable for governance, reporting and co-ordination across the Major Project capital portfolio. This ensures reporting consistency and that risk and benefits are managed on a whole of portfolio basis. The Head of PMO reports directly to the Executive Manager of Major Projects.

4.2.4 QNI Project Control Group

The Project Control Group (PCG) manages the tactical and day-to-day operational activities required to deliver the QNI Project in accordance with the governance and reporting framework agreed by the Executive Committee. The group meets weekly and is led by the Project Director of QNI, who reports directly to the Executive Manager Major Projects.

The Project Director is supported by a small core team of project-specific technical, commercial, administrative and project management staff. Functional expertise to deliver specific project activities is provided from the wider business, through the matrix support structure.

Functional responsibilities represented within the PCG include:

- project management, which is responsible for managing and co-ordinating project activities to efficiently deliver project tasks to the agreed scope, program and budget. This includes project scheduling, expenditure forecasting and reporting, and analysis of risk to mitigate the likelihood of undesirable outcomes from being realised
- health, safety and environment (HSE), which is responsible for establishing and overseeing HSE process and procedures, as well as auditing the resulting performance
- finance and regulation, which is responsible for managing the financial performance of the QNI Project including cost budgeting and variance reporting, as well as ensuring that TransGrid addresses all regulatory compliance obligations
- engineering, which is responsible for the engineering technical input into the QNI Project including in relation to power systems planning, design, operations and asset management, and cost estimating
- environment and property, which is responsible for managing the environment and land access approvals necessary to enable project construction and future operations and maintenance activities
- corporate affairs, which is responsible for fully understanding and responding to our customers' and other stakeholders' (Governments, market bodies, communities and landowners) needs and expectations and keeping them informed throughout the process
- procurement, which is responsible for supply chain management and contract administration during the delivery phase of works, and
- construction, which is responsible for ensuring site works are appropriately planned and executed in accordance with HSE and operational requirements.

4.3 Well defined capex forecasting process

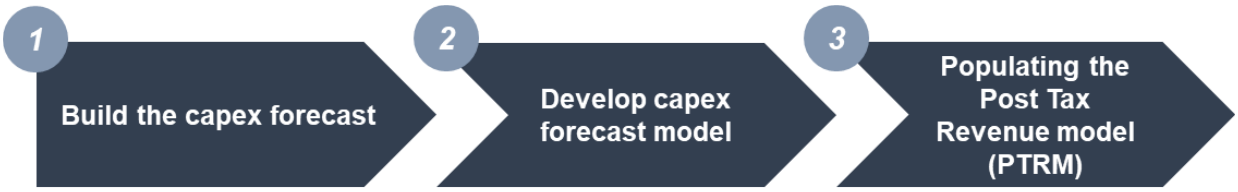
Our forecasting process for QNI involved the three steps as set out in Figure 4.2. These steps are to:

> build the capex forecast

> develop the capex forecasting model, and

> populate the Post Tax Revenue Model (PTRM).

Figure 4.2: QNI capex forecasting process



The QNI capex forecasting process followed a similar process used for business-as-usual capital projects, with certain changes to account for the size and complexity of the QNI Project:

> Step one – Build the capex forecast

  – prices obtained through tender processes have been used instead of historical costs from our cost estimating database, and

  – a bottom-up-build of indirect costs (network and corporate overhead costs) has been developed instead of applying historically derived percentage values from our cost estimating database.

> Step two – Develop capex forecast model

  A QNI Capex Summary and a QNI Capex Forecast Model (linked spreadsheets) have been developed to record the cost inputs, align costs to a common reference year and group the costs into a format suitable for input into the PTRM. This replaces the business-as-usual approach of using the Capital Accumulation Model, which would have required a significant revision to input outcomes from the tender process. The QNI Capex Forecast Model, like the Capital Accumulation Model, allocates capex costs across years and regulatory asset classes and applies real input cost escalation.

  This model adheres to the same principles as the Capital Accumulation Modes used for business-as-usual capital projects. The QNI capex forecast from step one was split by:

  – Financial year (project cash flows)

  – Regulatory asset category, and

  – Commodity type (real input cost escalators was applied to labour only).

  The QNI capex forecast model groups forecast expenditure into the regulatory asset classes approved in the AER's 2018-23 Revenue Determination. The asset classes relevant to QNI are shown in Table 4.1.

Table 4.1: Asset classes relevant to QNI

Asset class	Impacted by QNI
Transmission Lines (2018-23)	Yes
Underground Cables (2018-23)	No
Substations (2018-23)	Yes
Secondary Systems (2018-23)	Yes
Communications (short life) (2018-23)	No
Business IT (2018-23)	No
Minor Plant, Motor Vehicles & Mobile Plant (2018-23)	No
Transmission Line Life Extension (2018-23)	No
Land and Easements	No

The AER approved real materials and labour cost escalators as part of the current 2018-23 Revenue Determination. For labour, this is the simple average of forecasts provided by Deloitte Access Economics and BIS Oxford Economics. The AER approved real material cost escalation rates of zero. Accordingly, materials are only escalated by inflation. The Application applies real input cost escalation as discussed in section 14.

The outputs from the QNI Capex Forecast Model was in a format suitable for input to the PTRM.

> Step three – Populating the PTRM

The PTRM is populated from the QNI Capex Forecast Model, rather than the Capital Accumulation Model.

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5. Overview of our procurement processes

This section overviews the processes that we used to procure external suppliers for the QNI Project.

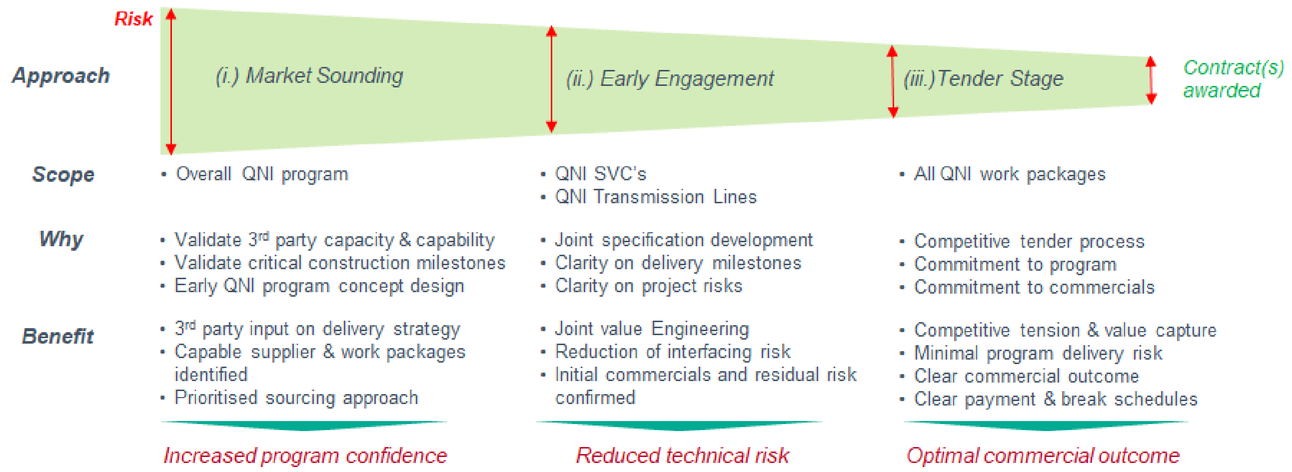
We developed the procurement process for the QNI Project so as to efficiently procure services from external suppliers within the constraints of the expedited timeframes for the Project and a targeted September 2021 commissioning date.

Consistent with the expedited timeframes, we expect to have all environmental approvals for the Project completed by February 2020 so construction can start in March 2020.

Overall, our procurement process is characterised as a 'collaborative third-party procurement approach' to progressively reduce risk and increase confidence by considering an expedited QNI delivery timeframe and a compressed construction program.

The ultimate awarding of contracts for each of the key elements of the QNI Project follows a three-staged approach, involving market sounding, early collaborative pre-tender engagement and a competitive tender and selection stage. Figure 5.1 summarises at a high-level the three key stages to the QNI procurement process, ahead of awarding contracts.

Figure 5.1: Three key stages to the QNI procurement process



The QNI procurement process focuses on six key components that are required for the QNI Project, namely:

1. SVCs
2. substations
3. capacitor banks
4. transmission lines
5. HV switchgear (including associated secondary systems equipment), and
6. transmission line accessories.

We are using two broad models to procure these assets, namely:

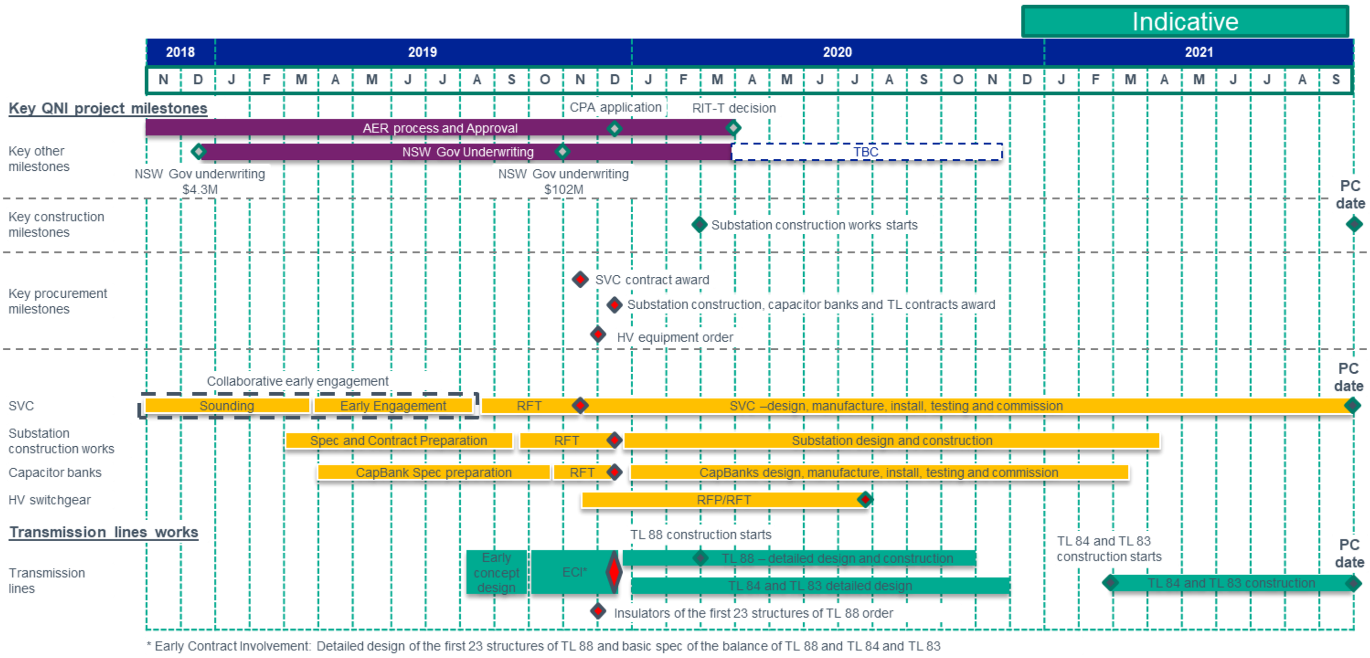
> design and construct contracts – these have been used for transmission lines and substations work, and

> directly procured assets – these relate to SVCs, capacitor banks, HV switchgear and transmission line accessories and have been subject to competitive tenders.

Figure 5.2 gives a step-by-step summary of the procurement process for these investment components, ahead of practical completion from a procurement perspective. While practical completion is shown as September 2021, a further six to nine months is required for inter-regional testing with Powerlink and AEMO. Transfer capacity between NSW and Queensland will only be increased (in both directions) following successful inter-regional testing. This is anticipated by June 2022.

The purple-coloured lines in Figure 5.2 relate to the regulatory and planning steps that are occurring in parallel with the procurement process, consistent with the AER's expedited investment timelines. These steps involve the post-RIT-T regulatory investment approval processes, including this contingent project application, and the Federal and NSW Governments announced underwriting agreements.[6] These parallel steps are necessary for us to deliver the QNI upgrade in the timeframes specified in the AER's expedited process.

Figure 5.2: Key steps and milestones to the QNI procurement process



Note – some timeframes may change from what is represented in this figure.

At the end of each step, the preferred supplier(s) will be selected and we will enter into contracts. Contract execution with the preferred tenderer(s) is expected to occur early 2020 for all steps.

In addition to the key steps summarised above, our procurement process included a number of interactive sessions with potential tenderers to test their proposed delivery plans. These interactive sessions provide opportunities for tenderers to provide feedback on design elements as well as other technical and commercial issues (including risk sharing).

The key objectives of these interactions include:

> enabling tenderers to better understand issues affecting the required design and their responses

> facilitating the transfer of information between us and tenderers

> enabling tenderers to advise their requirements, and

> providing equal opportunity for tenderers to communicate interactively with us.

[6] https://minister.environment.gov.au/taylor/news/2019/ensuring-future-reliable-electricity-supply-nsw

During the evaluation of tender responses stage, interactive sessions are conducted with each tenderer separately. Confidential information provided by a tenderer at, or in connection with, an interactive session between us and a tenderer is treated as confidential and will not be provided to other tenderers, unless we obtain the tenderer's written approval to do so.

All discussions during the interactive process are for the tenderer's information only, meaning that the overriding rule of engagement is that neither party can rely on anything said in the interactive sessions.

It is important to note the following in relation to the capex forecasts arising from the procurement processes:

> We did not consider engaging a single party to deliver all elements of the QNI Project because:
  – a single supplier does not have the capacity to meet the required timeframes
  – the QNI Project involves complex, brownfield sites that require us to manage key risks, especially in relation to health and safety and safe access to HV equipment, and
  – our involvement can help to deliver an efficient, more cost-effective outcome by taking advantage of better supplier rates that we can access and by utilising business-as-usual processes.

> The capex forecasts:
  – do not include any contingencies
  – reflect the outcome of competitive procurement processes
  – do not include any variation provisions – we will manage any actual variations that arise through efficiencies in other areas
  – the tendered outcomes reflect fixed (i.e. capped) prices by the suppliers
  – do not include the cost of any land or easement acquisitions (as the QNI Project does not require any such acquisitions)
  – reflect our acceptance of the lowest cost compliant offer from the competitive tender processes, and
  – reflect procurement in accordance with our compliance and governance requirements, as discussed in section 4.

> We elected to use the standard terms and conditions stipulated in our panel contracts as part of the procurement processes (i.e. as opposed to developing new, bespoke, terms and conditions).

> We obtained the NSW Government's approval and endorsement for suppliers for each major asset type as part of our procurement process by issuing formal Notices to the NSW Government in accordance with the Underwriting Agreement, before issuing letters of intent to preferred suppliers. The process with NSW Government involved:
  – preparing draft Notices that included the scope of work, preferred supplier, contracted scope, procurement process and contract breakage cost profile
  – reviewing the content of the draft Notices at workshops attended by a NSW Government-appointed independent technical advisor, an ESB representative and key TransGrid staff. These workshops allowed for testing and exploring the veracity of the proposed content of the Notices, and
  – subject to the independent technical advisor and ESB representative being satisfied with the content of the Notices, submitting a report to the NSW Government to approve (or not approve) the respective Notices.

6. SVC capex

This section explains our capex for the QNI Project on SVCs.

6.1 Nature and scope

An SVC is a system of connected network equipment components, including, amongst other things, capacitor banks, transformers, power electronics and cooling systems.

SVCs are used to provide fast-acting reactive power on high-voltage transmission networks.

The footprint of an SVC is significant – potentially up to 100x100 metres.

The QNI Project requires the design and supply of two SVCs – one each at Dumaresq and Tamworth.

Procuring the SVCs is the critical path task in the delivery program for the QNI Project.

The ultimate scope of works for the two SVCs that have been agreed between us and the preferred SVC supplier are detailed in the SVC supplier contract portions in section 6.3 below.

6.2 Procurement approach and process

We deployed a directly procured asset approach for the SVC assets.

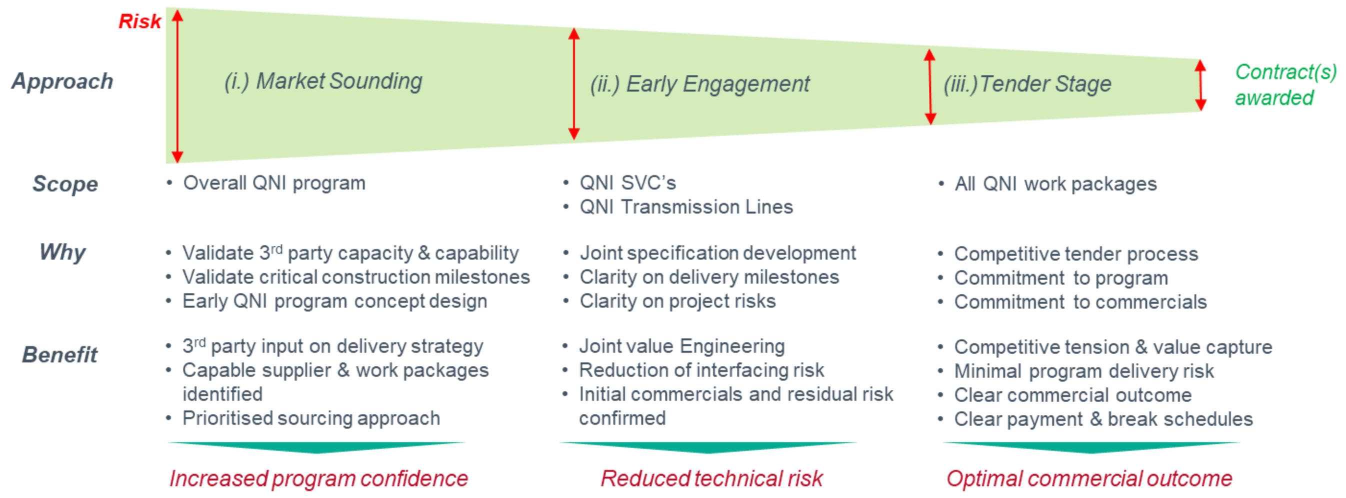
We devised a procurement strategy to deliver the QNI program efficiently and cost effectively, whilst ensuring a "constructible" delivery program.

The expedited timeframes for the QNI Project required us to use a compressed sourcing program. This involved having over-lapping processes for market sounding, early engagement and tendering. We typically undertake these sequentially, where time permits.

We minimised technical and commercial risks of the SVC procurement by following an early engagement approach and by working collaboratively with suppliers throughout the procurement process. This gave the potential for the suppliers to submit competitive and efficient tenders through collaborative engagement.

Figure 6.1 overviews our SVC procurement strategy.

Figure 6.1: SVC procurement strategy



In late 2018, we commenced an initial market engagement and sounding exercise for the procurement of the SVCs. The primary purpose of this early engagement was to:

- identify capable suppliers of the SVCs, and
- develop preliminary specifications, a work program and cost estimates.

We identified three business-as-usual network equipment suppliers who could potentially provide the SVCs within the expedited QNI Project timelines.

The bidder pool was limited to three SVC suppliers due to the lead times required to identify, visit and communicate with parties, as well as to conduct appropriate quality assurance measures and establish robust contractual terms.

We assessed that the three identified SVC suppliers would enable a competitive process.

Early engagement allowed us to offer the three SVC suppliers the opportunity to support the development of detailed specifications, and, importantly, provided sufficient time for the SVC suppliers to recommend the most efficient and effective solution.

We worked with the three SVC suppliers to determine the most cost effective and efficient SVC solution. Our bespoke, high-level functional performance parameter requirements were also informed by the last SVC that we installed in 2003.

We held initial face-to-face meetings with each SVC supplier to discuss the technical parameters required from each SVC and the timeframes for delivery.

A key to the QNI Project's success was defining the scope, especially the civil works required at site – these are predominantly building works as well as the SVC foundations.

As part of the early engagement stage, multiple options were discussed and evaluated between us and the three SVC suppliers in relation to the interfaces between the successful SVC supplier and other suppliers.

The SVC foundations will be delivered by our preferred substations supplier(s), as discussed in section 7. To alleviate risks of delay and interfacing issues on our side, a detailed interfacing document was established and agreed with the SVC suppliers to mitigate misalignment and delays with the substations supplier(s). SVC suppliers were encouraged to provide a commitment on their delivery dates to enable the substation supplier(s) to provide the foundations on time. During the best and final offer stage, detailed negotiations on liquidated damages were also undertaken to address this concern.

We sought tenders based on two SVC options involving different types of technology:

- a classic SVC product, and
- a hybrid SVC product (Statcom plus SVC)[7] – we have not previously adopted this, although it is well established in other networks domestically.

We wanted to leave it to the market to identify the most efficient solution.

We established a tender evaluation committee and evaluation criteria to evaluate supplier responses. The evaluation criteria are detailed in Table 6.1.

7 A hybrid unit replaces the thyristor controlled reactor (TCR) portion of a standard SVC design with a pulse width modulated (PWM) voltage source converter (VSC) portion that uses only insulated gate bipolar transistors (IGBTs) and a capacitor to provide reactive power. This removes the large reactor and reduces the associated harmonic issues. The TSC portion of a standard SVC design is retained.

Table 6.1: SVC evaluation criteria

Mandatory Selection Criteria *If Tenderers do not meet any mandatory criterion the tenderer may not be considered for award*	**Pass / Fail**
Compliance with the Conditions of Tendering Identify any potential conflicts of interest and proposed methodology for managing any such conflicts.	Mandatory
Written commitment from the Tenderer and major subcontractors confirming their intent to work together	Mandatory
Management Systems – Quality Management and Environmental Management Systems including HSE	Mandatory
Insurances & Licences	Mandatory
Technical quality assurance compliant to TransGrid requirements	Mandatory
Standard of documents compliant to TransGrid requirements	Mandatory
WH&S requirements fulfilled and compliant with TransGrid's standards	Mandatory
Environmental requirements fulfilled and compliant with TransGrid's standards	Mandatory
Interfacing / integration requirements compliant with interfacing document	Mandatory
Weighted Selection Criteria – Technical and Commercial	**Weighting (100%)**
Technical appraisal	20%
Technical and other benefits	5%
Delivery & Construction program (including tenderer capability and capacity)	15%
Equipment availability and upgrades	5%
Training and inventory	5%
Commercial offer – Price with losses factored Price of the supplier's compliant offer with commercial losses added from technical appraisal	40%
Commercial offer – Payment Schedule TEC will consult the Project Sponsor on minimum payment schedule requirements. Should a supplier not be able to meet the minimum, the offer may be disqualified. If the offer is acceptable, suppliers will be scored on basis of offering later payments to TransGrid.	5%
Commercial offer – Cancelation schedule	5%
Sum total	100%

In December 2018, we received indicative supplier budgetary and program offers.

In early to mid-2019, we undertook a collaborative engagement exercise with each supplier individually. This involved:

> collaborative value engineering to develop joint specification and program development

> validation of a 'hybrid' SVC option

> development of the preferred interfacing option to reduce delivery risk, and

> commercial requirements (i.e., payments and break costs) articulated to suppliers within pre-negotiated terms and conditions (as mentioned above).

In August 2019, we issued the final specification for both SVCs to all three suppliers, as part of a formal design and supply request for tender (RFT) process. We reserved the right to reduce the number of tenders from three to two, but opted not to do this in order to encourage competitive bids from all suppliers.

We initially scheduled for tender responses to close in September 2019. This process was designed to:

> elicit binding supplier offers with full terms and conditions

> obtain commitment to delivery program and cost, and

> enable a 'best and final offer' process, followed by a recommendation in November 2019 for contract award.

We initially planned for a contract to be awarded in November 2019, for practical completion no later than September 2021.

However, we extended the RFT period to mid-October 2019 to enable tenderers to refine their responses technically and commercially, including to address the transfer of key risks[8] from ourselves to the tenderers. This extension was allowed as the SVC suppliers both indicated they could still meet the September 2021 practical completion date.

We received compliant tender submissions from the three SVC suppliers on a not-to-exceed pricing offer basis. Two suppliers offered "classic" SVC products and the third supplier offered a hybrid SVC product.

The SVC suppliers offered significant improvements between the original tender stage submissions and a subsequent best and final offer process. A key contributor to this was that we provided targeted feedback to each supplier about their individual tender submissions.

On 15 November 2019, we presented our preferred supplier to the NSW Government, as part of the requirements of the Underwriting Agreement.

6.3 Outcome and forecast

The outcome of the SVC tender process was that we engaged a single supplier to provide the two SVCs. The preferred supplier offered to provide a hybrid SVC solution.

TransGrid and the NSW Government jointly agreed to proceed with the preferred supplier.

We have issued a Letter of Agreement to the preferred supplier, which has the effect of placing an order to enable the works to commence.

We will execute a contract with the supplier and issue a Letter of Award in early 2020.

The total expected value of the contract will be $55.5 million.

The associated contract portions to be provided by the preferred SVC provider are detailed in Table 6.2.

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8 'Interface risks' are the key risks for SVCs and relate to the SVC supplier providing detailed civil designs by a certain date to the substation supplier.

Table 6.2: SVC supplier contract separable portions

Separable portions	Details of Portion
1	The provision to the Principal of the full SVC design including design, detailed, design, design review meetings and final "as issued for manufacturing / construction" drawings. The milestone will also comprise provision to the Principal of completed and approved performance requirements for the civil work and the associated footing and foundation layouts (building, equipment, trenches, drainage, structures etc). Once provided in its entirety, this activates the civil design process (conversion of the performance requirements into a delivered civil design) on the part of the Principal.
2	Manufacturing, testing, delivery, installation and commissioning of all SVC equipment. This portion shall include all requirements of this specification not considered in other separable portions (e.g. documentations, training, supplied spares).
3	SVC building construction and supply along with fit out of all associated building services.

7. Substation capex

This section explains our capex for the QNI Project on substations.

7.1 Nature and scope

The QNI Project requires four packages of substation work at the following sites:

> Armidale – this site involves the installation of capacitor banks,

> Dumaresq – this site involves the installation of capacitor banks and an SVC – these assets need to interface for the successful delivery of the QNI Project,

> Tamworth – this site involves the installation of capacitor banks and an SVC – these assets need to interface for the successful delivery of the QNI Project, and

> Liddell & Muswellbrook – this site involves minor works to replace switchgear in the substations and to change over conductors. These works will be undertaken by our internal Works Delivery team and are therefore not subject to a tender process. The associated costs are included in our "Corporate and network overhead" capex, which is discussed in section 12.

The substation suppliers at Armidale, Dumaresq and Tamworth are responsible for below ground and above ground works:

> Design works comprise detailed electrical, civil and structural technical development activities to connect the new SVCs and capacitor banks, and

> Constructions works comprise:

  – procuring and delivering substation materials, including concrete and steel for HV equipment footings and structures, and

  – site construction activities, including civil and electrical works.

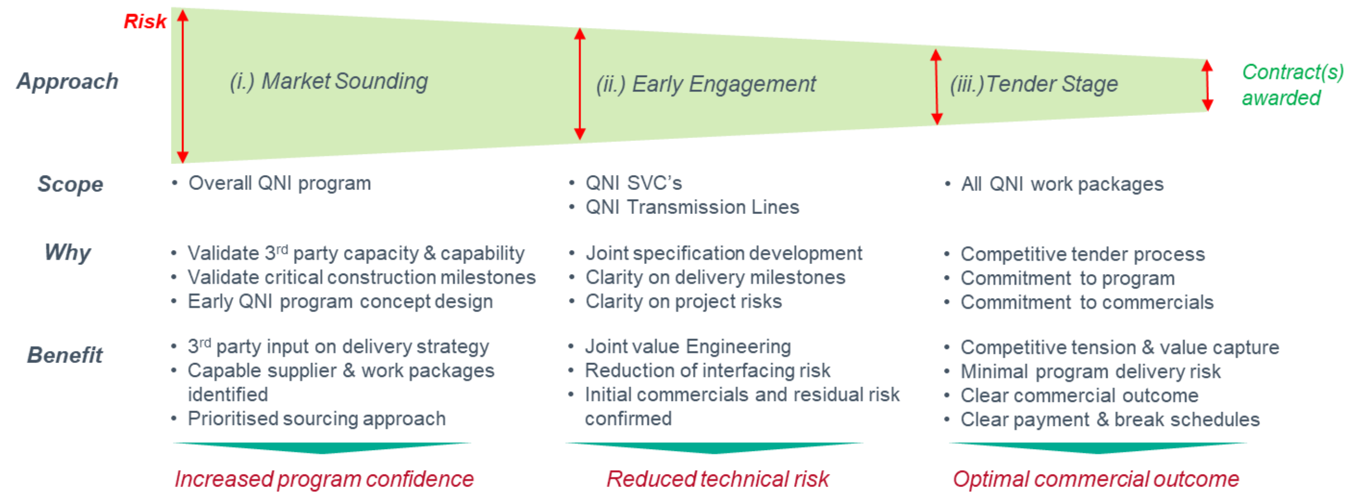
All substation works for the QNI Project are within our existing property boundaries. There is no need to acquire any new or additional land or easements. We ensured this was the case given the tight Project timeframes.

7.2 Procurement approach and process

We deployed a design and construct approach for the substation works at Armidale, Dumaresq and Tamworth.

Figure 7.1 details the overall procurement strategy for the design and supply of equipment, substation and transmission line works for the QNI Project. This strategy is in line with our standard process for procuring these types of services.

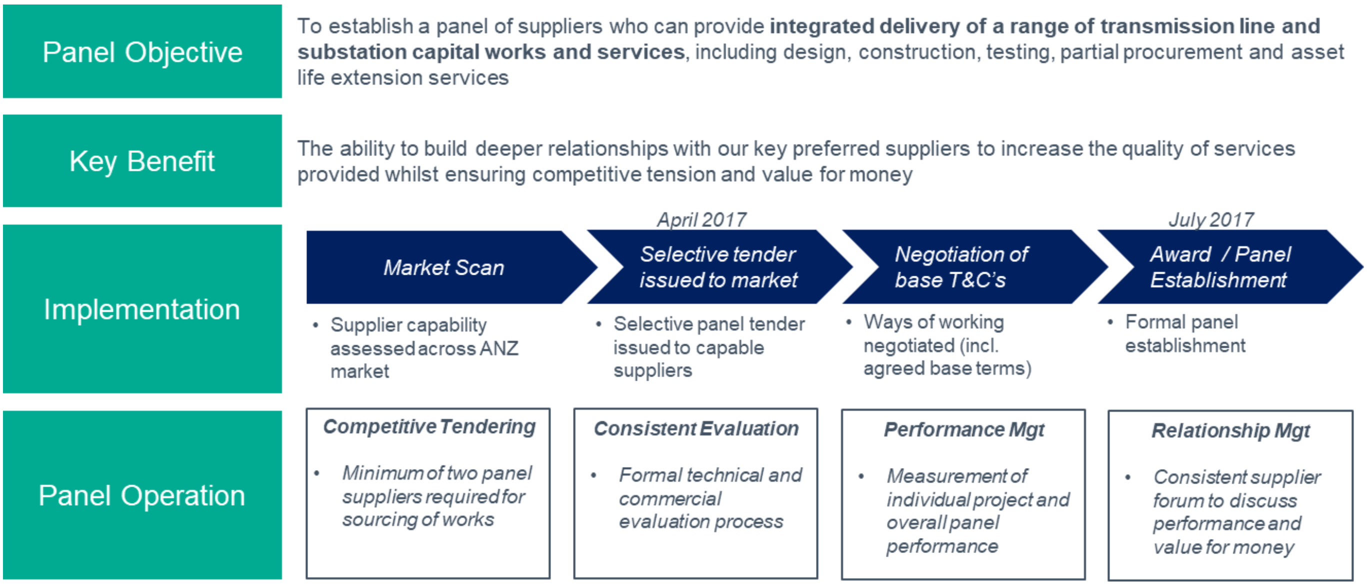
Figure 7.1: Substation Procurement Strategy



Our approach for substations was to:

> use market sounding to develop our panel, as detailed in Figure 7.2:

Figure 7.2: Substation panel establishment process



> work with our panel suppliers to ensure they understood the QNI Project requirements and specifically the process to be followed to ensure the required program delivery milestones would be achieved.

We used a competitive tender process to procure the substation works utilising our existing panel. This panel had previously been established using a competitive process in accordance with our business-as-usual procurement policies.

We approached all four members of the panel, who are each well-established suppliers of substation works.

Following initial approaches to the substation suppliers, we assessed that:

> no supplier had the capacity to undertake the required works at all three sites concurrently. This was due to the requirement to achieve a September 2021 in service date

> a supplier could only undertake work at two sites concurrently in the available timeframe, and

> having a single substation supplier dealing with a single SVC supplier at Dumaresq and Tamworth would provide significant logistical benefits.

We did not undertake an early engagement process for the substation works on account of:

> there being significantly less uncertainty associated with the works and supplier capabilities than was the case for the SVCs, and

> the panel had already undergone an evaluation process when we established it.

Between early May and mid-September 2019, we undertook a detailed specification exercise for each substation and prepared contracts to be released as part of the RFT process.

The tenders were based on concept designs we prepared, which were supported by our Standard Design Manual and Standard Construction Manual. This level of specification was used because of timeframe constraints. We nevertheless consider that it provided a stable platform for the suppliers' bids.

The formal RFT process commenced with the release of the Armidale RFT on 13 September 2019. The Dumaresq and Tamworth RFTs were subsequently released on 20 September 2019 and 27 September 2019, respectively. We released the tenders sequentially in order to allow the suppliers time to digest the structure, form and requirements of each RFT. The specification documents contained mandatory and evaluation criteria.

During September and November 2019, we:

> held separate face-to-face workshops with the four suppliers

> held three site visits with all supplier jointly, one at each of the three substations, over two days. It was a mandatory criterion for the supplier to attend these site visits. We considered this important so that the suppliers adequately understood the conditions at each site, and

> provided opportunities for suppliers to ask clarifying questions and for us to provide answers.

We received RFT responses on 8 November 2019. We received three tender submissions for the Armidale and Dumaresq substations and four tender submissions for the Tamworth substation.

We undertook a tender evaluation process to determine the preferred suppliers. This involved:

> a technical assessment for non-compliance, and

> a commercial assessment for any commercial departures.

The final offers from the preferred suppliers were ranked highest both technically and commercially for their respective substation offers. The evaluation process determined that both their technical and commercial offers, combined, were superior to other suppliers. The other suppliers' offers were either only budgetary non-binding submissions or had excessive commercial departures for us to evaluate.

We undertook separate value engineering workshops with the preferred suppliers with a view to reducing cost by further refining the design. This collaborative approach was aimed at optimising the cost and design of the substation works so that the final expenditure is both prudent and efficient.

The best and final offer prices received from the preferred suppliers were lower than the prices in their original Tender responses.

On 13 December 2019, we presented our preferred suppliers to the NSW Government, as part of the requirements of the Underwriting Agreement.

7.3 Outcome and forecast

The outcomes of the tender processes for the substation works were that we engage:

> a single supplier to provide the substation works at Dumaresq and Tamworth, and

> a single (different) supplier to provide the substation works at Armidale.

TransGrid and the NSW Government jointly agreed to proceed with the preferred suppliers.

We have issued Letters of Agreement to the suppliers, which have the effect of placing orders to enable the works to commence.

We will execute contracts with the suppliers and issue Letters of Award.

The total value of the contracts for the substation works by the preferred suppliers at Armidale, Dumaresq and Tamworth is $80.6 million, comprising:

> $15.9 million for the Armidale substation
> $29.6 million for the Dumaresq substation
> $34.2 million for the Tamworth substation, and
> $0.9 million for secondary systems.

8. Capacitor bank capex

This section explains our capex for the QNI Project on capacitor banks.

8.1 Nature and scope

A capacitor bank is a group of connected capacitors that stores electrical energy. It is used to counteract or correct a power factor lag or phase shift in an alternating current power supply.

The QNI Project requires three packages of capacitor banks at the following sites:

- Armidale, one 120MVAr and two 50MVAr units
- Dumaresq, two 120MVAr units, and
- Tamworth, one 120MVAr and two 60MVAr units.

The scope of work required from the capacitor bank suppliers involves the design and supply of capacitor banks.

The design work comprises:

- detailed electrical, civil and structural technical development activities, and
- the use of our transmission network technical requirements as an input to this task.

The supply work comprises:

- ordering main equipment, including individual capacitor bank components such as cans and reactors
- manufacturing and testing of the capacitor banks, and
- delivering to site, all installation and pre-commissioning works, and commissioning support to us for connection to the transmission network.

The capacitor bank suppliers are responsible for above the ground works at the sites and we are responsible for the below ground works.

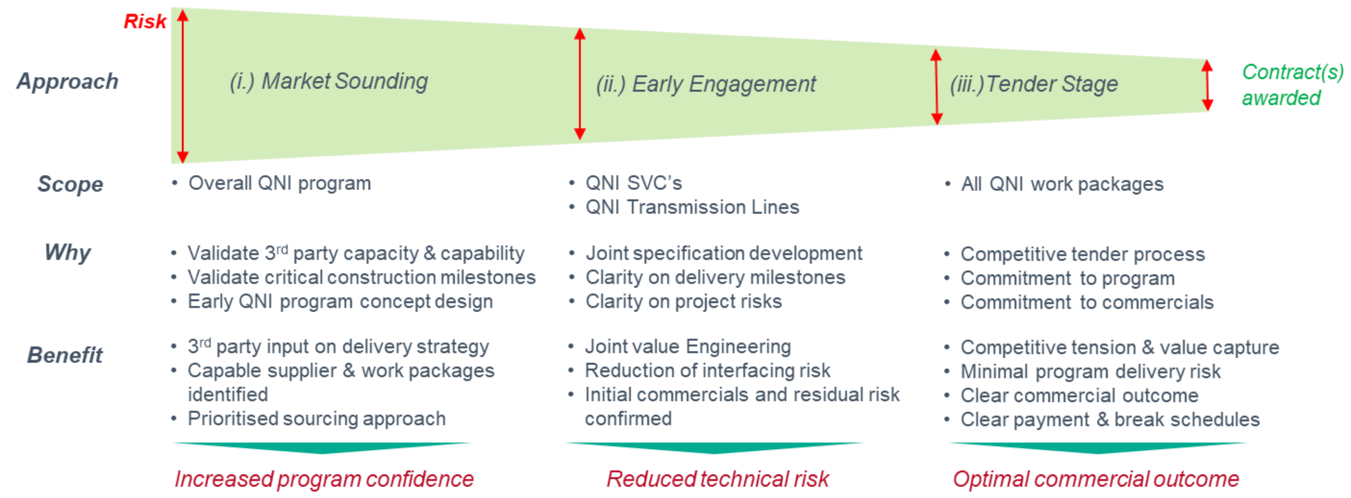
8.2 Procurement approach and process

We deployed a directly procured asset approach for the capacitor banks.

We used a competitive tender process to procure the capacitor banks utilising our existing panel. This panel had previously been established using a competitive process in accordance with our business-as-usual procurement policies. We established that there are two potential suppliers of capacitor banks for the QNI Project on the panel that could achieve the in-service completion date of September 2021.

Figure 8.1 details the overall procurement strategy for the design and supply of equipment, substation and transmission line works for the QNI Project. This strategy is in line with our standard process for the procurement of these types of services.

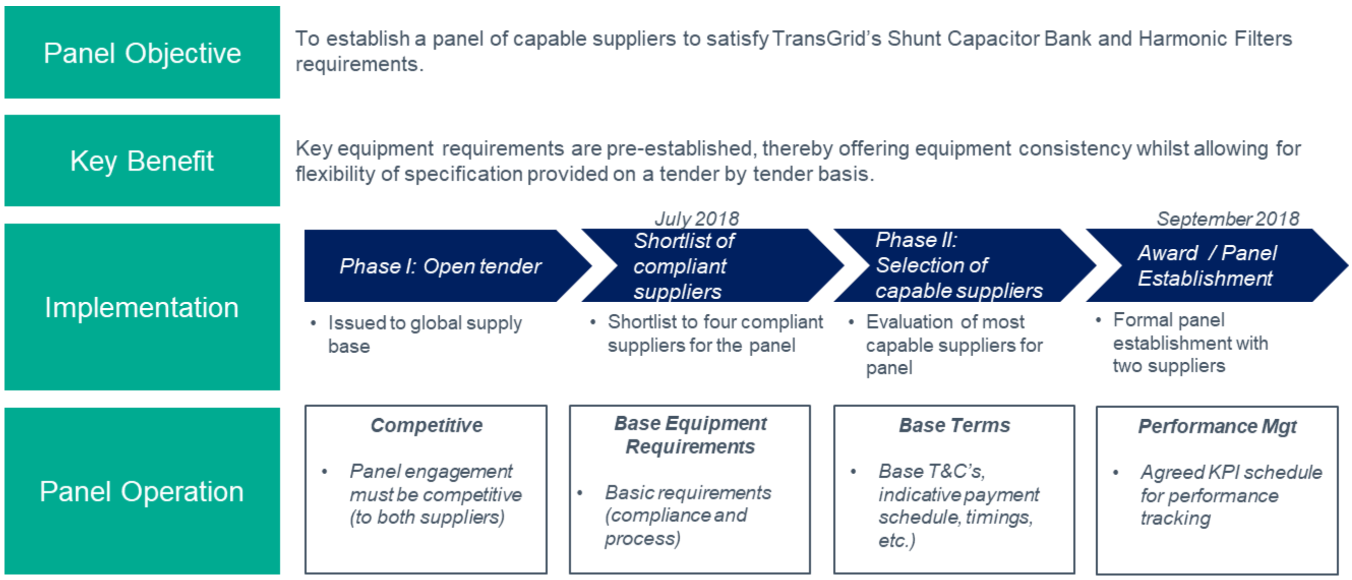
Figure 8.1: QNI Procurement Strategy



Our approach for procuring the capacitor banks was to:

i. use market sounding to develop our panel, as detailed in Figure 8.2

Figure 8.2: Capacitor bank panel establishment process



ii. work with the two panel suppliers to ensure they understood the QNI Project requirements and specifically the required program delivery milestones, and

iii. undertake the following tender stage activities:

a. develop a project-specific evaluation plan, including an evaluation process, technical and commercial criteria (inclusive of weightings), and identify the evaluation team members comprising technical and commercial representatives

b. complete an RFT process with the two panel suppliers

c. evaluate the two RFT responses received from suppliers (i.e. technical and commercial). The evaluation included our internal assessment of the responses, clarification of responses with individual suppliers, individual workshops with each supplier (inclusive of suppliers providing overseas specialists) and scoring of the responses

d. complete a best and final offer process with both suppliers to elicit the best price, and

e. recommend the preferred supplier to enable the Contract to be placed with this supplier.

The RFTs that we issued to the two suppliers required their bids to be subject to the standard terms and conditions of the panel. Given this, the evaluation criteria for the tender related to the suppliers':

> technical capacity and capability to deliver the capacitor banks to achieve the in-service date, and
> price.

Two separate tenders, one each for Armidale and Dumaresq, were issued to the two existing capacitor bank suppliers on 11 October 2019. The two suppliers provided their best and final offers for both sites on 15 November 2019.

We completed our tender evaluation process to determine the preferred supplier. The tender evaluation process found that the same supplier's final offers for Armidale and Dumaresq ranked first technically and commercially. This meant the evaluation process determined that this supplier's technical offer was superior to the other offer, and its offered price was lower than the other offer.

On 13 December 2019, we presented our preferred supplier for the Armidale and Dumaresq capacitor banks to the NSW Government, as part of the requirements of the Underwriting Agreement.

We issued our tender for the Tamworth capacitor banks on 6 December 2019. This allowed the two suppliers sufficient time to respond to the Armidale and Dumaresq tenders, noting that the Tamworth capacitor banks are not on the critical path for the QNI Project. We expect to obtain best and final offers from the two suppliers for the Tamworth capacitor banks in mid-January 2020.

We therefore do not have tendered prices for the Tamworth capacitor banks at the time of preparing this document.

The specifications for the capacitor banks at Tamworth are very similar to those at Armidale and Dumaresq.

We have therefore based our expenditure forecast for Tamworth, for the purposes of this document, on the tendered prices that have been received for Armidale and Dumaresq.

8.3 Outcome and forecast

The outcome of the tender processes for the Armidale and Dumaresq was for us to engage a single supplier to design and supply capacitor banks at both sites.

TransGrid and the NSW Government jointly agreed to proceed with the preferred supplier.

We issued Letters of Agreement to the preferred supplier, which have the effect of placing orders to enable the works to commence.

We will execute contracts with the preferred supplier and issue Letters of Award.

The total value of the contract for the design and supply at Armidale and Dumaresq by the preferred supplier is $8.6 million, comprising:

> $4.8 million for the Armidale capacitor banks, and
> $3.8 million for the Dumaresq capacitor banks.

We estimate, on the basis of the costs for the Armidale and Dumaresq capacitor banks, that the Tamworth capacitor banks will cost about $5.9 million.

We will provide the AER with updated details of the Tamworth capacitor banks once we have completed our procurement process in early 2020.

We therefore estimate that the total cost of the capacitor banks for the QNI Project will be $14.6 million. This reflects best and final offers for Armidale and Dumaresq and a budget estimate for Tamworth.

9. Transmission line capex

This section explains our capex for the QNI Project on transmission lines.

9.1 Nature and scope

The QNI Project requires works to uprate (i.e. increase the capacity) on three existing transmission lines at the following sites to a design temperature of 120°C:

> L88 – the transmission line number 88 from Muswellbrook to Tamworth
> L83 – the transmission line number 83 from Liddell to Muswellbrook, and
> L84 – the transmission line number 84 from Liddell to Tamworth.

Uprating is required so that we can maintain at least the statutory clearances on our transmission lines.

The transmission line uprating works involve:

> replacing transmission structures, including by installing 60 new poles
> replacing insulators, and
> strengthening existing transmission structures.

The three packages of work on the existing transmission lines require different levels of work, which will each take different durations of time to complete:

> L88 requires the most work and will take the longest time to complete,
> L83 requires the second most amount of work and will take the next most time to complete, and
> L84 requires the least amount of work and will be completed quickest.

The three transmission lines cannot be taken out of work during the summer peak demand period between December and February of each year. This means that the works program can only be undertaken between March and November of each year. Further, we need to avoid taking more than one transmission line out at any time. These factors constrain the order and timing of the transmission line works.

As a result of the nature and size of the required works, and the availability of the transmission lines, we need to implement the following schedule in order to meet the September 2021 timeframe:

> work on L88 must be undertaken first between March and November 2020, and
> work on L83 and L84 must be undertaken in 2021.

The scope of work for the transmission line uprating works is for the design and construction of transmission line uprating works for L88, L84 and L83:

> the design works comprise detailed electrical, civil and structural technical development activities to replace transmission line structures and retrofitting existing structures with a combination of inverted V-strings and D-strings (insulator arrangements), and
> the construction works comprise:
  – procuring and delivering transmission line structures and fittings,
  – delivering to site all equipment and components and components enabling construction works, and
  – erecting, installing and pre-commissioning, and commissioning support to us for connection to the existing transmission network.

We require dedicated switching personnel to take our transmission lines out of, and put into, service to support the uprating works. The costs of these personnel are separately included under “Works Delivery” in the “Corporate and network overhead” capex forecast, which is discussed in section 12.

9.2 Procurement approach and process

We deployed a design and construct approach for the transmission lines’ component of the QNI Project.

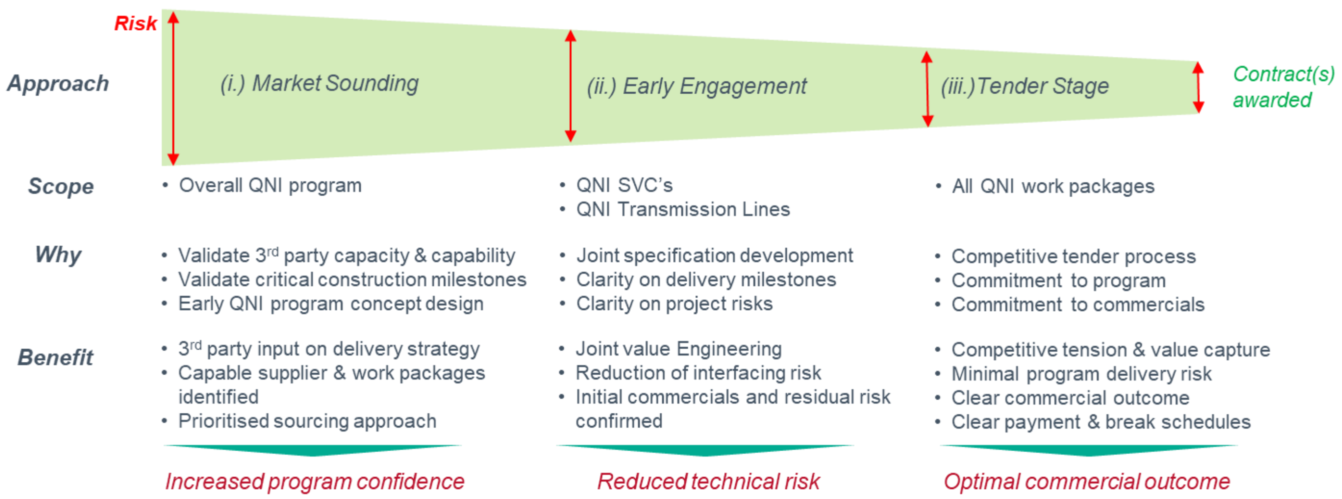
We used a competitive tender process to procure the transmission line works utilising our existing panel. This panel had previously been established using a competitive process, in accordance with our business-as-usual procurement policies.

We initially approached the four members of the panel, who are each well-established suppliers of transmission line works. We short-listed two panel suppliers during August and September 2019 based on assessments of:

- past and present service performance in delivering transmission line projects for us
- general capability and capacity in delivering transmission lines, including having regard for the suppliers’ availability given their existing projects for us and other clients, and
- the risks of not meeting the September 2021 deadline.

Figure 9.1 details the overall procurement strategy for the design and supply of equipment, substation and transmission line works for the QNI Project. This strategy is in line with our standard process for the procurement of these types of services.

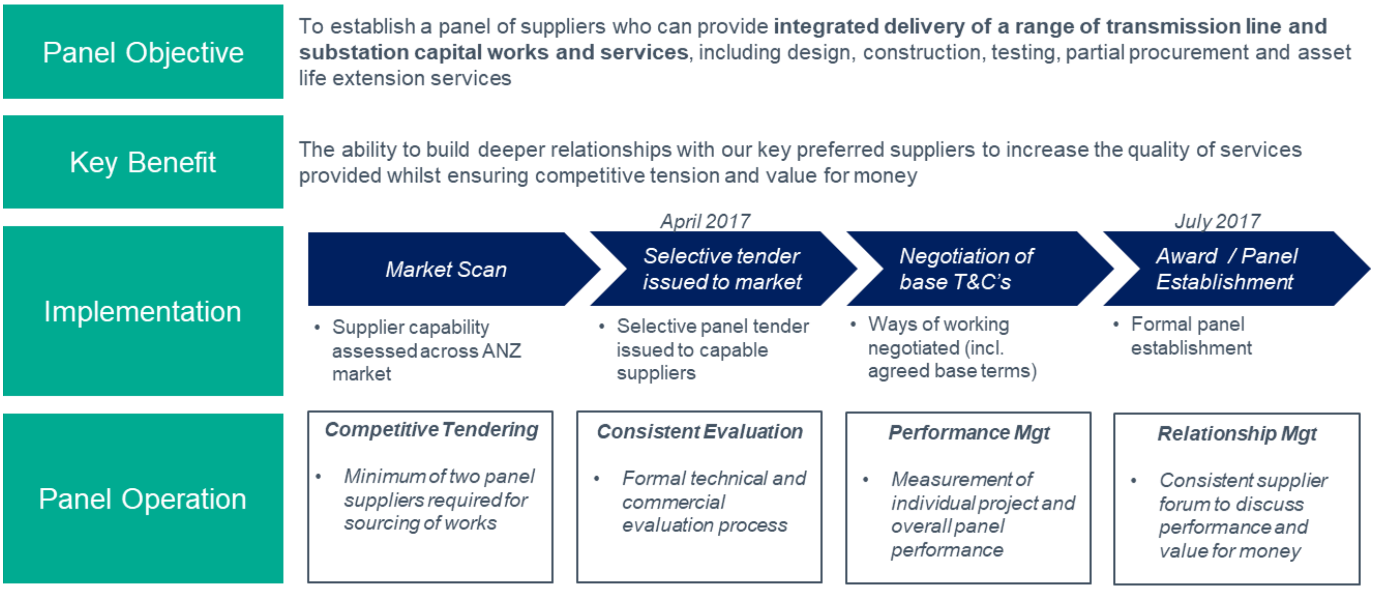
Figure 9.1: Transmission Line Procurement Strategy



Our approach for transmission lines was to:

i. use market sounding to develop our panel, as detailed in Figure 9.2:

Figure 9.2: Transmission line panel establishment process



ii. undertake early engagement and tender stage activities, including working with panel suppliers to ensure they understood the QNI Project requirements and specifically the process to be followed to ensure the required program delivery milestones would be achieved.

The RFTs that we issued to the two suppliers required their bids to be subject to the standard terms and conditions of the panel. Given this, the evaluation criteria for the tender related to the suppliers':

> technical capacity and capability to deliver the transmission lines to achieve the in-service date of September 2021, and

> price.

We issued RFTs for the transmission lines' work to the two transmission line suppliers on 18 October 2019. The scope included:

> a competitive early contractor involvement process. This required design works only to be completed for the first 23 structures for the L88 works

> basic specification of the balance of the L88 works and for the works for L83 and L84, and

> all construction works for L88, L83 and L84.

Each supplier was provided a high-level concept design for the first 23 structures of the L88 works. They were asked to undertake their own detailed designs to achieve technical compliance and to specify how they would most efficiently deliver the works. The design works were required so that the successful supplier could commence the relevant pole procurement as soon as possible after being awarded the contract, given the tight timeframes. The successful supplier will undertake detailed design works for the remaining structures following the award of the contract.

We undertook the following process:

> we held separate workshops with the two suppliers to provide detailed information on the works

> we held compulsory site visits with the two suppliers

> the two suppliers separately prepared designs for the installation of the first 23 structures of L88 so that, if successful, they could start work in March / April 2020 (i.e. to "Issued for Construction" stage). As noted, the successful supplier will prepare designs for the remaining structures following contract commencement, and

- the two suppliers submitted contractual binding offers for all three lines so that, if successful, they could start work on L88 at the earliest outage availability (i.e. from March 2020).

We received the responses from the two transmission line suppliers on 28 November 2019.

We then completed our evaluation to determine the preferred supplier who offered the lowest cost and a compliant design and offer.

The preferred supplier was ranked first technically and first commercially. This means the evaluation process determined that the preferred supplier's:

- technical offer was superior to the other offer, and
- commercial offer was superior to the other offer. This was due to the other offer being a budgetary offer only which was not revised further to become a binding offer during the evaluation and best and final offer stages.

We undertook a value engineering workshop with the preferred supplier with a view to reducing cost by further refining the design. This collaborative approach was aimed at optimising the cost and design of the transmission line works so that the final expenditure is prudent and efficient.

On 13 December 2019, we presented our preferred supplier to the NSW Government for the transmission lines, as part of the requirements of the Underwriting Agreement.

9.3 Outcome and forecast

The outcome of the tender process for the transmission lines was for us to engage a single supplier to provide the transmission works on the three lines.

TransGrid and the NSW Government jointly agreed to proceed with the preferred supplier.

We have issued Letters of Agreement to the preferred supplier, which have the effect of placing orders to enable the works to commence.

We will execute contracts with the preferred supplier and issue Letters of Award.

The total value of the contract for the design and construction of L88, L84 and L83 by the preferred supplier is $36.4 million.

10. HV switchgear capex

This section explains our capex for the QNI Project on HV switchgear.

10.1 Nature and scope

The QNI Project requires new HV switchgear at the Armidale, Dumaresq, Tamworth, Liddell and Muswellbrook substations.

HV switchgear is the combination of electrical disconnect switches, fuses or circuit breakers used to control, protect and isolate electrical equipment. HV switchgear also requires associated secondary system equipment (i.e. cables, panels, relays, etc) in order to control and operate the HV switchgear. HV switchgear is used to de-energize equipment to allow work to be undertaken and to clear downstream faults.

We will provide the HV switchgear and the associated secondary system equipment as free issue items to the suppliers who are undertaking the associated works at the relevant substations.

10.2 Procurement approach and process

We are deploying a directly procured asset approach for the HV switchgear.

We are using a competitive tender process to procure the HV switchgear utilising our existing panel. This panel was established using a competitive process, in accordance with our business-as-usual procurement policies. There are multiple suppliers of HV switchgear on this panel.

We expect to acquire the various required HV switchgear components from multiple panel members.

We commenced the procurement process for the HV switchgear in November 2019. This is later than for the other major components of the QNI Project, given that the HV switchgear:

> is relatively simple to procure, and

> involves relatively low levels of capex.

10.3 Status and forecast

At the time of preparing this document, we are liaising with panel suppliers of each HV switchgear component to enable the September 2021 equipment in-service date to be achieved.

We estimate that the total value of the contracts for the HV switchgear and the associated secondary system equipment will be approximately $6.2 million.

We will provide the AER with updated details of the total value of the actual contracts for HV switchgear once we have completed our procurement process in early 2020.

TransGrid

11. Transmission line insulator capex

This section explains our capex for the QNI Project on transmission line insulators.

11.1 Nature and scope

The QNI Project requires new transmission line insulators on L88, L83 and L84.

Insulators are used to support and separate electrical conductors without allowing current through themselves. Insulating supports are attached to transmission lines and transmission structures. They support the weight of the suspended wires without allowing the current to flow through the structure to the ground.

We will provide the transmission line insulators as a free issue item to the supplier that is undertaking the transmission line works discussed in section 9.

11.2 Procurement approach and process

We are deploying a directly procured asset approach for the transmission line insulators.

We are using a competitive tender process to procure the transmission line insulators utilising our existing panel. This panel was established using a competitive process, in accordance with our business-as-usual procurement policies. We have multiple suppliers of transmission line insulators on our panel.

We commenced the procurement process for the transmission line insulators in November 2019. This is later than for other major components of the QNI Project, given that the transmission line insulators:

> are relatively simple to procure, and

> involve relatively low levels of capex.

11.3 Status and forecast

At the time of preparing this document, we were liaising with panel suppliers of each HV switchgear component to enable the September 2021 equipment in-service date to be achieved.

We estimate the total value of the contracts for the HV switchgear will be approximately $0.2 million.

We will provide the AER with updated details of the total value of the actual contracts for transmission line insulators once we have completed our procurement process in early 2020.

12. Corporate and network overhead capex

This section explains our capex for the QNI Project on corporate and network overheads.

12.1 Nature and scope

We will incur ‘Corporate and Network Overhead’ capex in the delivery of the QNI Project – we also refer to this as ‘indirect capex’. These costs are incremental to the capex approved in the AER’s 2018-23 Revenue Determination, as they relate to activities that are additional to our normal business activities and would not be incurred if we did not proceed with the QNI Project[9].

We have four categories of indirect capex:

> historical indirect capex – this is capex that we incurred on the QNI Project from 1 July 2018 to 30 November 2019

> forecast indirect capex – we have grouped this capex into three sub-categories:

- Works delivery capex – this is capex associated with the design and construction of those components of the QNI Project that we will undertake internally. This relates to work on the Armidale, Tamworth, Dumaresq, Liddell and Muswellbrook substations, as well as transmission lines L88, L83 and L84
- Project development capex – this capex relates to setting up and project managing the QNI Project. Most of the project development costs relate to incremental labour. There will also be some non-labour costs for consultant and professional fees, and
- Other indirect capex – this capex comprises two sub-components:
  - insurance to cover the risks associated with “construction” activities during the substation and transmission line uprating works – this is incremental to our existing insurance cover, and
  - bidder payments made to suppliers where they are asked to prepare detailed designs during the bidding phase of tenders.

We have submitted a separate document to the AER entitled “Corporate and Network Overhead Costs” that provides further detail about the nature of these indirect capex categories.

12.2 Approach to determining capex

This sub-section overviews the approach we have taken to determine our actual and forecast indirect capex. The document entitled “Corporate and Network Overhead Costs” provides further details about this approach.

12.2.1 Historical indirect capex

The value of our historical indirect capex reflects transactions recorded in Ellipse, which is our enterprise resource planning (ERP) system. We have allocated and attributed these costs to the QNI Project in accordance with our cost allocation methodology. We have treated these costs in accordance with our capitalisation policy.

[9] Corporate and network overhead costs are capitalised if they are sufficiently connected with the delivery of capital works – this is consistent with our capitalisation policy.

12.2.2 Works delivery capex forecast

We have forecast our works delivery capex based on the additional resources we require for project delivery, having regard for the timing of when FTEs are required and our standard labour rates. There are no non-labour costs included in the works delivery capex forecast. We have:

> estimated that 24.7 additional FTEs are required for this capex. This has regard for our current practices, the complexity and timeframes of the QNI Project and relevant legislative requirements

> phased the commencement of FTEs over the duration of the QNI Project

> applied standard labour rates, effective from 30 June 2018. Real labour cost escalations have not been included in this part of the forecast – they are instead detailed in section 14, and

> included labour-related costs in the forecast, such as for sustenance allowance, training, recruitment, travel and IT.

12.2.3 Project development capex

We have forecast our project development capex based on the additional resources required for the set-up and ongoing management of the QNI Project. We have:

> estimated that 43 additional FTEs are required for this capex

> phased the commencement of FTEs over the duration of the QNI Project

> applied standard labour rates, effective from 30 June 2018. Real labour cost escalations have not been included in this part of the forecast – they are instead detailed in section 14, and

> included labour-related costs in the forecast, such as for travel and sustenance, training, recruitment, travel, office leases and IT.

In addition, we have estimated that capex is also required for:

> Consultant and professional fees, and

> Design and equipment engineering.

12.2.4 Other indirect capex

We have obtained estimates [redacted] for additional insurance to cover the risks associated with construction activities during the substation works and transmission line uprating works. [redacted]

We will pay relatively small amounts to suppliers where they are asked to prepare detailed design during the bidding phase of tenders. These include the production of the transmission line design works to enable the requisite scheduling and outage planning for site works to commence during March 2020.

12.3 Outcome and forecast

Our total indirect capex is $28.7 million, comprising:

> $3.3 million for historical indirect capex from 1 July 2018 until 30 November 2019

> $17.9 million for Works Delivery

> $6.0 million for Project Development, and

> $1.5 million for Other indirect capex, comprising $0.9 million for insurance and $0.2 million for bidder payments.

13. Connection capex

This section explains our capex for the QNI Project on connections.

13.1 Nature and scope

Our transmission network also relies on the interconnection to Essential Energy's distribution network.

The QNI Project requires the existing Essential Energy connection to be upgraded from 200MVA to 500MVA.

The connection design works will be undertaken by a level 3 accredited service provider.

Essential Energy will undertake the required connection works as a quoted service.

13.2 Procurement approach and process

At the time of preparing this document, we were liaising with a level 3 accredited service provider and with a provider of connection works about providing the connection services.

13.3 Status and forecast

We estimate the total value of the contracts for these connection works will be approximately $0.1 million.

We will provide the AER with updated details of the total value of the connection works once we have completed our procurement process in early 2020.

14. Real input cost escalations

This section explains our real input cost escalations for the QNI Project.

14.1 Nature and scope

Labour costs make-up a large component of our forecast capex for the QNI Project. These labour costs tend to increase over time by more than the rate of inflation. We have included the forecast impact of these real labour input escalation increases in our capex forecasts.

14.2 Approach to determining capex

Forecast real input cost escalation is calculated by multiplying the labour cost components of the tendered expenditure, property costs, and indirect expenditure by the forecast real labour cost escalators allowed by the AER in its revenue determination for the 2018-23 regulatory period.[10] Consistent with that determination, no real input cost escalation was included for non-labour components of the expenditure.

The real labour input cost escalators for 2018-19 to 2021-22 are set out in Table 14.1. These are converted into a cumulative index from the 2017-18 year.

Table 14.1: Real labour input cost escalator and cumulative index

	2017-18	2018-19	2019-20	2020-21	2021-22
Real labour input cost escalator	N/A	0.81%	0.95%	1.21%	1.46%
Cumulative index	1.000	1.008	1.018	1.030	1.045

Note: Values are rounded for presentational purposes. Unrounded values have been used in the calculations.

The approach is applied in our capex model.

14.3 Forecast

Applying this approach gives forecast real input cost escalation of $0.6 million over the 2018-23 regulatory period, as set out in Table 14.2.

Table 14.2: Forecast real input cost escalation ($M, Real 2017-18)

	2018-19	2019-20	2020-21	2021-22	Total
Real input cost escalation	0.0	0.1	0.4	0.1	**0.6**

[10] See, AER, May 2018, *AER - Final decision TransGrid transmission determination - Capex model - May 2018*. The labour escalators adopted by the AER are at cells H23:H27 of the 'Input_Fixed' sheet.

15. Forecast verification and validation

This section explains how our actual and forecast capex for the QNI Project have verified and validated by independent experts.

15.1 GHD's engineering assessment

We engaged GHD to undertake an independent engineering verification and assessment of our capex forecast.

GHD verified that the scope of the QNI Project is reasonable and realistic to meet the investment needs.

GHD developed comparative estimates, or estimated costs using historical project costs and publicly available data. A comparative estimate was developed for each of the forecast capex categories.

GHD considered our capex forecast to be reasonable if it was within ± 20 per cent of its comparative estimate. For forecast capex categories that were not within ± 20 per cent, GHD then undertook a further review to explore if there were any know project specific reasons that resulted in this variation.

Overall, GHD concluded that our forecast capex for the QNI Project is within a reasonable margin of GHD's comparative estimate.

GHD's independent review therefore supports the consistency of our forecast capex with that which would be incurred by a prudent and efficient business.

GHD's report is provided as an attachment to this Application.

15.2 HoustonKemp's economic assessment

We engaged HoustonKemp to assess the consistency of our proposed capex for the QNI Project with the NER requirements. HoustonKemp relied on GHD's engineering assessment in undertaking its economic assessment.

HoustonKemp found:

> the QNI Project has been subject to a RIT-T and is expected to deliver benefits that exceed costs. The project therefore meets the capex objectives

> the RIT-T has considered multiple demand and cost scenarios and has identified that the QNI Project is the preferred option

> the RIT-T has confirmed that the QNI Project will provide net market benefits from 2021-22, taking into account the higher costs associated with the fast-track process

> the likely commencement and completion dates for the QNI Project are reasonable and have been market tested through the procurement process, and

> for the most material capex categories, the competitive procurement process (which has resulted in a fixed price) and GHD's verification provides confidence that the forecast is prudent and efficient.

HoustonKemp's report is provided as an attachment to this Application.

TransGrid