HOUSTONKEMP
Economists

Consistency of TransGrid's proposed capital expenditure for the QNI minor upgrade with the NER requirements

Final Report

17 January 2020

Report authors

Ann Whitfield

Martin Chow

Contact Us

Sydney
Level 40
161 Castlereagh Street
Sydney NSW 2000

Phone: +61 2 8880 4800

Singapore
8 Marina View
#15-10 Asia Square Tower 1
Singapore 018960

Phone: +65 6817 5010

Disclaimer

Contents

Tables

1. Introduction and key conclusions

The minor QNI upgrade[1] refers to transmission works in NSW that will increase the existing capacity of the existing interconnector between NSW and Queensland.

These works were identified by Australian Energy Market Operator (AEMO) in its inaugural 2018 Integrated System Plan (ISP) as a 'Group 1' investment that would provide substantive benefits to the National Electricity Market as soon as they could be completed.[2] The draft 2020 ISP results released by AEMO on 12 December 2019 reconfirms the proposed network upgrade by 2021-22 as part of the optimal network development path and labels it a 'no regret' action.[3]

TransGrid and Powerlink have subsequently completed the formal Regulatory Investment Test - Transmission (RIT-T) process, which has confirmed that the minor QNI upgrade option identified in the ISP is the preferred option and would provide a positive net market benefit based on an assumed completion date of 2021-22. The Project Assessment Conclusions Report (PACR) for the RIT-T was published on 20 December 2019.

1.1 TransGrid's contingent project application

The minor QNI upgrade works were accepted by the Australian Energy Regulator (AER) as a contingent project in its final revenue determination for the current regulatory control period TransGrid (specifically the 'reinforcement of Northern Network (QNI upgrade)').[4]

This project is also now defined in the National Electricity Rules (NER) as a one of the two 'QNI projects' and has been identified as a priority project for early implementation under the NER, consistent with the AER's proposed expedited regulatory investment approval process.[5]

TransGrid is now lodging a contingent project application to the AER, to vary its current regulatory determination by an amount that reflects the prudent and efficient costs of the minor QNI upgrade.

TransGrid's contingent project application puts forward an estimated capital cost for the minor QNI upgrade of $222.8 million ($2017/18). The cost profile for the minor QNI upgrade over the 3 years proposed for construction, plus the early works already committed, is set out in Table 1.[6]

Table 1: Forecast capex for the minor QNI upgrade 2018-23 ($m, 2017-18, including overheads)

2018-19	2019-20	2020-21	2021-22	2022-23	Total
$1.4m	$74.5m	$112.1m	$34.7m	-	$222.8m

Note: Capex includes equity raising costs.

[1] In the remainder of this report we use the term 'QNI upgrade' to refer to the minor QNI upgrade which is the subject of TransGrid's contingent project application. We note that a later, more substantive upgrade to QNI transfer capacity was also identified by AEMO in its 2018 ISP (as a Group 2 project) and is also included in the draft 2020 ISP (as 'QNI medium) with a recommended timing of 2028-29.

[2] AEMO, Integrated System Plan, July 2018, p. 94.

[3] AEMO, *Draft 2020 Integrated System Plan*, 12 December 2019, p. 50.

[4] AER, *Final Decision, TransGrid transmission determination 2018 to 2023, Attachment 6 – Capital expenditure*, May 2018, p. 6-137.

[5] AER, *Guidance Note QNI Regulatory Investment Test*, July 2019.

[6] TransGrid, *Capex Forecasting Methodology for QNI Minor Upgrade Project*, 17 January 2020, Table 2.1 p. 4.

TransGrid's contingent project application also includes its estimate of the incremental opex over the current regulatory period associated with the minor QNI upgrade.

1.2 Scope of this report

We have been asked by TransGrid to assess the consistency of its proposed capex costs for the minor QNI upgrade with the National Electricity Rules (NER) requirements against which the AER will assess TransGrid's application. Our assessment comprises an assessment of:

- project scope – specifically whether the proposed project is justified and whether it represents the efficient approach to meeting the objectives of the project;
- the capex estimate - including how the capex estimate has been prepared and the assumptions adopted.

This report does not cover TransGrid's estimate of incremental opex.

In preparing this report we have had regard to:

- the capital expenditure forecasting methodology report prepared by TransGrid;
- the forecast indirect capex report prepared by TransGrid;
- the underlying models relating to each of the above capex forecasts; and
- the independent review by GHD of TransGrid's forecasting methodology and the reasonableness of the overall total capex and timing of the cost estimates.

We note that TransGrid is submitting all the above documentation as part of its contingent project application.

We have also held several discussions with TransGrid staff in the course the preparation of this report, in particular to clarify our understanding of the procurement process TransGrid has undertaken for key elements of the project and aspects of how the capex forecasts have been derived.

The remainder of this report is structured as follows:

- section 2 sets out the NER requirements relating to the AER's determination on the minor QNI upgrade contingent project application;
- section 3 presents our assessment of the justification for the project and associated timing, in light of the NER requirements;
- section 4 presents our assessment of each of the key elements of TransGrid's capex forecasts, in light of the NER requirements; and
- section 5 brings together our conclusions.

1.3 Summary of conclusions

Our conclusions are set out in the following table.

Table 2: Consistency of TransGrid's proposed expenditure on QNI minor upgrade with the NER

Assessment criteria	Assessment
How does the project meet the capital and operating expenditure objectives?	The project has been subject to a RIT-T and is expected to deliver benefits that exceed costs. The project therefore meets the capital and operating expenditure objectives. GHD has verified that the project scope is reasonable and realistic to meet the investment needs.
Does the proposed expenditure reflect the efficient and prudent costs of achieving the expenditure objectives?	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 TransGrid's capex forecast for overhead and corporate costs is within a reasonable margin of the higher end of what GHD considers to be a reasonable range. GHD has verified that this is due to the specific nature and risks associated with the project.
Does the proposed expenditure reflect a realistic expectation of the demand forecasts and cost inputs to achieve the capital expenditure objectives?	The RIT-T has considered multiple demand and cost scenarios and has identified that the QNI minor upgrade as the preferred option.
Is the amount of capital required each remaining regulatory year reasonable?	We have no information on which to separately verify that the proposed timing in each year of the regulatory period is prudent and efficient.
Is the likely commencement and completion dates reasonable?	The likely commencement and completion dates are reasonable and have been market tested through the procurement process. The RIT-T has confirmed that the project will provide net market benefits from 2021/22, taking into account the higher costs associated with the fast-track process.

2. The regulatory framework applying to the AER's contingent project determination

This section sets out the regulatory framework that applies to the AER's consideration and determination of TransGrid's contingent project application for the minor QNI upgrade.

2.1 Requirements under the NER

2.1.1 The basis for the AER's assessment of a contingent project application

When considering the appropriate amendment to a revenue determination in response to a contingent project application, the AER is required to determine the following:[7]

- the amount of capital expenditure (capex) and incremental operating expenditure (opex) that is reasonably required for each remaining regulatory year to undertake the contingent project;
- the total capex reasonably required for undertaking the contingent project;
- the likely commencement and completion dates for the contingent project; and
- the incremental revenue likely to be required by the TNSP for each remaining regulatory year of the current regulatory period as a result of undertaking the contingent project.[8]

In making the assessment above, the AER is required to accept the amounts and dates put forward by the TNSP if it is satisfied that the amounts of forecast capital expenditure and incremental operating expenditure:

- reasonably reflect the *capital expenditure criteria* and the *operating expenditure criteria* (as defined by the NER), taking into account
- the *capital expenditure factors* and the *operating expenditure factors* respectively (as defined by the NER), in the context of the contingent project.[9]

2.1.2 Proposed expenditure needs to be prudent and efficient

The capital expenditure criteria and the operating expenditure criteria are defined in the NER.[10]

In making a determination on a contingent project application, the AER must be satisfied that the expenditure reflects:

- the efficient costs of achieving the capital (operating) expenditure objectives;
- the costs that a prudent operator would require to achieve the *capital (operating) expenditure objectives*; and
- a realistic expectation of the demand forecast and cost inputs required to achieve the *capital (operating) expenditure objectives*.

These criteria are the same that apply to the AER when approving TransGrid's capex and opex allowances as part of its full regulatory determination.

[7] NER Ch 6A.8.2(e)(1).

[8] This amount will differ from that implied from the total expenditure for the contingent project where the expenditure for the contingent project spans more than one regulatory period. This is not expected to be the case for the near term QNI upgrade.

[9] NER Ch 6A.8.2 (f)

[10] NER Ch 6A.6.7(c) and Ch 6A.6.6(c).

Assessment is against the capital (operating) expenditure objectives

The AER is required to consider a contingent project application on the basis of achieving the capital and operating expenditure objectives.

These objectives are defined in the NER as being to:

- meet or manage the expected demand for prescribed transmission services over that period;
- comply with regulatory obligations or requirements;
- maintain the quality, reliability and security of the network; and
- maintain the safety of the transmission network.

Assessment of compliance against the capital expenditure objective essentially requires an assessment of the reason why TransGrid is undertaking the project.

In the case of the minor QNI upgrade this requires an assessment of the rationale for the project, as demonstrated by the application of the RIT-T.

Assessment of prudent and efficient costs

The AER is required to consider:

- the efficient costs of achieving the capital (operating) expenditure objectives;
- the costs that a prudent operator would require to achieve the capital (operating) expenditure objectives; and
- a realistic expectation of the [..] cost inputs required to achieve the capital (operating) expenditure objectives.

All of these requirements go to the question of whether the proposed expenditure is prudent and efficient

This requires an assessment of:

- whether the proposed scope of the minor QNI upgrade represents the efficient approach to meeting the objectives of the project; and
- whether the costs TransGrid is proposing to meet this scope represent a realistic expectation of efficient costs.

Moreover, the AER is required to determine not only whether the total proposed costs are prudent and efficient, but also whether the costs proposed in each year of the current regulatory period are prudent and efficient. This requires consideration of the whether the proposed works schedule for delivering the minor QNI upgrade is consistent with that which would be adopted by a prudent and efficient TNSP.

Assessment against the relevant expenditure factors

In assessing whether the proposed costs are prudent and efficient, the AER is required to consider the relevant *expenditure factors*, as set in the NER.[11]

For the minor QNI upgrade the following expenditure factors appear the most relevant:

- the relative prices of operating and capital inputs;
- the substitution possibilities between opex and capex in relation to the contingent project; and

[11] NER Ch 6A.6.7(e) and Ch 6A.6.6(e).

- any relevant Project Assessment Conclusions Report (under the RIT-T).

3. Project justification and timing

3.1 The rationale for the minor QNI upgrade

The minor QNI upgrade was identified by AEMO in its inaugural 2018 Integrated System Plan as a 'Group 1' investment that would provide substantive benefits to the National Electricity Market (NEM) as soon as it could be completed.[12]

The 2019 AEMO Electricity Statement of Opportunities (ESOO) reconfirmed the importance of completing an incremental upgrade to QNI ahead of the forecast closure of Liddell Power Station, which it states will improve the supply-demand balance in New South Wales and reduce the likelihood of unserved energy.[13]

The draft 2020 ISP results released by AEMO on 12 December 2019 reconfirms the proposed network upgrade and labels it a 'no regret' action.[14]

The formal RIT-T process required under the NER has now been completed by TransGrid and Powerlink for the minor QNI upgrade. The RIT-T is an economic cost benefit test that is overseen by the AER and applies to all major network investments in the National Electricity Market. The Project Assessment Conclusions Report (PACR) was published on 20 December 2019 and is the final step in the RIT-T process.[15]

The findings from the RIT-T process for the minor QNI upgrade is that:

- the preferred option (option 1A) is to uprate the Liddell to Tamworth lines and install new dynamic reactive support at Tamworth and Dumaresq and shunt capacitor banks, with the investment being completed by 2021/22.

The RIT-T found that this option is expected to deliver net benefits to the NEM of approximately $170 million over the assessment period to 2044/45 (on a weighted basis in present value terms, $2019/20) through:

- reducing the need for new generation and large-scale storage in New South Wales to meet demand following Liddell Power Station's forecast retirement over 2022 and 2023;
- lowering the aggregate generator fuel costs required to meet demand in the NEM going forward; and
- avoiding capital costs associated with enabling greater integration of renewables in the NEM.

Moreover, the investment is expected to generate sufficient benefits to recover the project capital costs seven years after the option is commissioned.[16]

Relevantly, the estimate of capital costs for option 1A used in the PACR is the same as the forecast capex costs put forward in TransGrid's contingent project application for the minor QNI upgrade

The PACR considered different demand and policy scenarios. Specifically, four scenarios were considered, which covered a wide range of possible futures and are generally aligned with the AEMO's 2020 ISP 'slow change', 'neutral' and 'fast change' scenarios. The four scenarios differ in relation to key variables expected to affect the market benefits of the options considered, including demand outlook, assumed generator fuel

[12] AEMO, Integrated System Plan, July 2018, p. 94.

[13] AEMO, 2019 Electricity Statement of Opportunities, August 2019, pp.4 & 93.

[14] AEMO, *Draft 2020 Integrated System Plan*, 12 December 2019, p. 50.

[15] TransGrid and Powerlink, *Expanding NSW-QLD transmission transfer capacity, Project Assessment Consultations Report*, 20 December 2019.

[16] TransGrid and Powerlink, *Expanding NSW-QLD transmission transfer capacity, Project Assessment Consultations Report*, 20 December 2019, p.4.

prices, assumed emissions targets, retirement profiles for coal-fired power stations, and generator and storage capital costs. Under the scenario assessment:

- option 1A is expected to provide materially higher benefits than the next alternative option (Option 1B) in the neutral scenario, and equivalent benefits in the fast change scenario;
- the only scenario where Option 1B is expected to deliver materially higher net benefits than Option 1A is the 'neutral + low emissions' scenario, which is a bespoke scenario developed to further stress test the RIT-T assessment following feedback from TransGrid's NSW & ACT Transmission Planning forum in November 2018 (ie, before the 2020 ISP scenarios were finalised);
- on a weighted basis, Option 1A and Option 1B provided equal net market benefits; and
- option 1A provides more transmission capacity at times of peak demand in NSW (Option 1B on its own does not increase southerly capacity in NSW at time of peak demand).

Consistent with the expedited process that is being applied to the minor QNI upgrade,[17] TransGrid and Powerlink have now sought confirmation from the AER under NER 5.16.6 that the RIT-T has been applied correctly for the minor QNI upgrade, which is one of the triggers for the contingent project application. Under the expedited process, the AER will consider the question of whether the RIT-T has been applied correctly for the QNI upgrade and TransGrid's contingent project application concurrently.

3.1.1 Our assessment

As discussed in section 2.1.2 the AER is required to assess the proposed expenditure in the contingent project application by reference to achieving the capital expenditure objectives set out in the NER. This essentially requires an assessment of whether TransGrid's rationale for undertaking the project is justified.

Our assessment is that the QNI minor upgrade is justified because it reflects the preferred option under the RIT-T and is expected to deliver benefits that exceed costs.

The RIT-T is the standard process under the NER for assessing transmission investments. Where a project is justified under the RIT-T, it can be assumed to be consistent with the capital expenditure objectives in the NER. The RIT-T assessment for the minor QNI upgrade has considered a reasonable range of different demand and cost scenarios (consistent with the NER requirements) as well as different future development paths for the NEM.

Further we note that the costs in the PACR reflect the cost estimates that are being proposed in TransGrid's contingent project application. These are above the costs that were included in the earlier Project Assessment Draft Report (PADR), and reflect the outcomes of the competitive procurement process TransGrid has conducted for major elements of the project. The PACR analysis demonstrates that the minor QNI upgrade continues to be justified under the RIT-T on the basis of the capex estimate put forward in the contingent project application.

Finally, we note that GHD has verified that the project scope is reasonable and realistic to meet the investment need. More specifically, GHD states that:[18]

> The CPA QNI scope has remained consistent, except for refinement in detail, since the PADR. GHD is able to verify that the refinements in the scope detail have resulted in a scope of work commensurate with the CPA and that the scope is reasonable and realistic to meet the investment need.

[17] AER, *Guidance Note, QNI Regulatory Investment Test*, July 2019.

[18] GHD, *QNI – Independent Verification and Assessment*, 10 January 2020, p. 4.

3.2 Efficient timing

The minor QNI upgrade is scheduled to commence construction in 2019/20 and be completed by 2021/22.

As noted earlier, in its 2018 ISP, AEMO identified that the minor upgrade of QNI would provide benefits as soon as it could be constructed and recommended that the investment proceed as a priority. AEMO confirmed this finding in the draft 2020 ISP released in December 2019, and has made clear the importance of completing the upgrade ahead of the closure of the Liddell Power Station in NSW which is forecast to occur over 2022 and 2023.

This assumed timing for the minor QNI upgrade is consistent with that assumed in the RIT-T assessment released by TransGrid and Powerlink in December 2019. The RIT-T assessment shows that the minor QNI upgrade delivers substantial benefits from as soon as it can be put in place (2021/22).

The assumed timing is also consistent with the expectations of the Energy Security Board (ESB) and the AER, as well as those of the Commonwealth and NSW governments who have jointly provided underwriting for early works to enable TransGrid to meet this 'fast track' timetable for the minor QNI upgrade.[19]

There are necessarily additional costs associated with fast-tracking the project to meet the required timeframe, and TransGrid has needed to adapt its procurement processes in order to be able to complete contracts for key elements of the project which are on the critical path to meeting the 2021/22 timing.[20]

3.2.1 Our assessment

The proposed project timing for the QNI minor upgrade is 'fast tracked' when compared to what would be a business as usual (BAU) process. We understand from discussions with TransGrid that this will result in additional costs and risks associated with the QNI upgrade, compared to those associated with a later project completion date.

Given the expectations from the ESB, AEMO, the AER and the Commonwealth and NSW governments that the minor QNI project be in place by 2021/22, ahead of the start of the closure of the Liddell power station, we have not separately assessed whether the decision to fast-track the project is prudent and efficient.

Rather, we have assessed whether the project is expected to provide a net benefit to the NEM based on the additional costs and risks associated with delivering the project by 2021/22.

Our assessment, based on the RIT-T outcome for the QNI minor upgrade, is that this is the case.

The costs for the QNI minor upgrade used in the RIT-T assessment and reflected in TransGrid's contingent project application take into account the additional costs required to meet the 2021/22 delivery date, either as a consequence of the costs being based on tender outcomes that specify the required timing or through the build-up of the cost estimates reflecting the resources estimated to be required to meet the project timeframe. The RIT-T assessment has confirmed that even with these higher costs, the QNI minor upgrade will start delivering net benefits from 2021/22.

We also consider that there appears to be a high degree of confidence that the additional costs incurred will enable the accelerated project timeframe to be met. Specifically, we note that the deliverability of the project within this timeframe has been validated via TransGrid's market procurement process for key elements of the project:

- Tenderers were only included in the process where TransGrid had a high degree of confidence from discussions with the parties that they would be able to meet the required timeframes. Although this resulted in some potential tenderers being excluded for some elements, all of the procurement processes

[19] Prime Minister, Premier of New South Wales, Minister for Energy and Emissions Reduction, Minister for Energy and Environment, *Media Release*, 28 October 2019.

[20] TransGrid, Capex Forecasting Methodology for QNI Minor Upgrade Project, January 2020, p. 36.

still involved multiple bidders, all of whom were assessed as having the capability to meet the required timeframes;

- Further, where TransGrid determined from initial discussions with potential tenderers that no single firm would be capable of providing all aspects of the services required for a particular element (most notably substation works across the four substation sites), it scoped the coverage of the tenders accordingly;[21]
- The procurement process for the transmission line works has been phased to enable uprating on L88 which requires the most work and will take the longest to complete to be started ahead of the finalisation of the design for the works required on the other two lines (L83 and L84); and
- TransGrid has now entered into in-principle contracts for the majority of the competitively procured elements of the QNI upgrade works with timings that are consistent with completion by 2021/22.

Notwithstanding that there remain challenges with meeting the fast track QNI upgrade timetable,[22] we consider that the above factors provide positive support for the proposed timetable.

Finally, we understand that there are additional risks associated with the accelerated timeframe. For example, a BAU process is likely to have allowed for more time for sample survey of ground conditions and for site inspections by bidders, as well as more early design work for the uprating works ahead of the market procurement process. In the absence of these activities, we understand from discussions with TransGrid that the basis for the procurement contracts for generally with respect to a baseline estimate, with variations (both positive and negative) agreed for specific circumstances where actual conditions differ from those assumed. We understand that at this stage there is no basis on which to determine whether there is a greater likelihood of costs increasing as a result of these variations or decreasing, with the baseline estimate reflecting the best current view of likely outcomes and therefore the current expected cost.

We note that TransGrid has not included any contingency amount as part of its capex forecast[23] and has also not incorporated a 'risk allowance' as part of the contingent project application. To the extent that the risks to project cost are symmetric (which actual costs having an equal likelihood of being potentially higher or lower than the forecast), then the exclusion of a risk allowance is appropriate. Further, to the extent that the fact-track timetable presents a greater likelihood of costs increasing compared with the forecast, we note that TransGrid would bear these costs in the first instance, as there is no allowance in the contingent project application.

[21] TransGrid, Capex Forecasting Methodology for QNI Minor Upgrade Project, January 2020, p. 28.

[22] As discussed by GHD in its report, chapter 6.

[23] The exception is the estimate provided for the Tamworth capacitor bank, which we understand will be superseded by the actual contract value when the procurement process is completed in mid-January.

4. Consistency of capex forecasts with NER requirements

In this section, we consider the consistency of TransGrid's capex forecasts for the QNI minor upgrade with the NER requirements. To inform our assessment, we have relied on:

- reports and models prepared by TransGrid, namely:
  - capex forecasting methodology for QNI minor upgrade project report;
  - forecast indirect capex report;
  - the summary of the outcome of the tender process contained in: *12_QNI Capex forecast inputs*; and
  - models setting out the capex forecast calculations.
- GHD's independent verification and assessment of QNI's capex forecast; and
- discussions with TransGrid staff to clarify and augment our understanding of matters covered in the TransGrid reports.

On the basis of the material above, we have assessed whether the capex forecast provided by TransGrid reflects the expected average costs of completing the project that would be forecast by a prudent and efficient business.

All costs in this section are expressed in 2017/18 dollars.

4.1 TransGrid's approach to deriving its capex forecast draws heavily on the outcomes of competitive procurement processes

The capex forecast for the QNI minor upgrade is $222.8 million ($2017-8).

TransGrid's approach to deriving its capex forecast varies depending on the information that is available to inform the estimate for each key component of capex. However, 87% of the capex forecast has been derived on the basis of costs determined through competitive procurement processes for major packages of works.

The circumstances of TransGrid's contingent project application, with many of the major procurement contracts for the QNI minor upgrade already having been concluded, is unusual compared to the circumstances in which the AER is typically evaluating the prudency and efficiency of capex forecasts at the time of a regulatory determination.

Specifically, TransGrid has already undertaken a competitive tendering process and has received, or expects to shortly receive, 'best and final' offers for many of the components of the project. TransGrid's general approach to procurement for the QNI upgrade is summarised in Box 1. The elements of the project that are being competitively tendered are:

- SVCs;
- the substation works;
- capacitor banks;
- uprating of transmission lines;
- high voltage switchgear; and
- other minor components and works.

The outcomes of the tendering process and the bids from the preferred tenderer have been used as the basis for the associated elements of the capex forecast. As a consequence, these costs have been validated by the market. Moreover, all of the suppliers participating in the tenders are unconnected with TransGrid, and so represent suppliers who are operating on independent terms.[24]

Further, we understand that the agreed prices in the contracts that have been entered into are fixed lump sum payments (rather than a cap on total costs) by reference to certain baseline assumptions. For example, the tenderers for substation works and transmission line uprating works were provided with relevant desktop geotechnical research to inform their tender submissions. The agreed fixed price reflects specific (and limited) variations in case actual outcomes vary from the assumed baseline assumptions. From our discussions with TransGrid, we understand that these variations may potentially giving rise to both higher and lower actual outturn costs.

The agreed fixed lump sum payment therefore currently reflects TransGrid's expected cost, in the absence of any further information as to whether variation payments may be more likely to be positive or negative. We note that TransGrid has not incorporated any contingency amount or risk cost into its capex forecast.[25] This is consistent with the key costs being known with a high degree of certainty (following near-completion of the procurement process), and with the major variation risks at this point being considered by TransGrid to be largely symmetric.

Given the above, there is a high degree of certainty and confidence associated with these elements of TransGrid's capex forecasts.

4.1.1 Overview of procurement approach

TransGrid's general approach to procuring services from external suppliers for the QNI upgrade project is as follows:

- identify list of suitable tenderers, using existing panel contract arrangements where possible;
- consider list of tenderers that could complete project within required timeframe and meet project requirements;
- package work programs to manage risks, eg:
  - awarding substation works to separate tenderers manage risks of insufficient capacity of a single tenderer to complete the work; and
  - manage interface risks between different contractors by having a single substation supplier dealing with a single SVC supplier.
- select preferred tenderer based on commercial and technical considerations – in most cases the preferred tenderer was considered to offer the best technical solution and was also the lowest cost bid; and
- undertake value engineering sessions to refine scope and design to achieve a better value for money outcome.

[24] NER 6A.6.7(e)(9).

[25] GHD, *QNI – Independent Verification and Assessment*, 10 January 2020, p. 1.

4.2 Independent verification of the capex forecast based on comparative unit cost estimates

TransGrid engaged GHD to undertake an independent verification and assessment of TransGrid's capex forecast. To assess the reasonableness of TransGrid's capex forecast, GHD developed comparative estimates, or estimated costs using historical project costs and publicly available data.[26] A comparative estimate was developed for each of the forecast capex categories.

GHD considered TransGrid's 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.

GHD's independent review provides further support for the consistency of TransGrid's forecast capex with that which would be incurred by a prudent and efficient business. We refer to the findings of the GHD review in our detailed assessment below.

4.3 Assessment of each category of TransGrid's capex estimate

This section discusses each category of capex for the QNI minor upgrade in turn and presents our assessment. Table 2 below summarises our observations.

Table 3: Assessment of capex categories – summary (all costs $2017-18)

	Scope of work	Estimated cost and basis for estimate	GHD comparative estimate and assessment	Our observations
SVCs	Two SVCs, one at Dumaresq and one at Tamworth	$55.5 million based on outcomes from competitive tender process	$60 million. GHD concludes TransGrid's estimate is reasonable	Competitive procurement (fixed price) and GHD verification provide confidence that forecast is prudent and efficient
Substation	Work at Armidale, Dumaresq and Tamworth substations	$79.7 million based on outcomes from competitive tendering process	$56.6 million. GHD concludes that TransGrid's estimate is higher due to additional civil works, and that the difference is therefore reasonable.	We understand that the pipeline of near term transmission investment is significantly above BAU activity, leading to higher than normal prices Competitive procurement (fixed price) and GHD verification provide confidence that forecast is prudent and efficient.
Capacitor banks	Capacitor banks at three substations (Armidale, Dumaresq and Tamworth)	$14.5 million in total. $4.8 million for Armidale and $3.8 million for Dumaresq based on outcomes from competitive tender. $5.9 million for Tamworth estimated using tender submission for Armidale and Dumaresq.	$4.6 million for Armidale, $3.6 million for Dumaresq and $4.6 million for Tamworth. GHD considers estimates for Armidale and Dumaresq to be reasonable. GHD was unable to verify higher costs for Tamworth.	Competitive procurement (fixed price) and GHD verification provide confidence that forecast is prudent and efficient for Armidale and Dumaresq). Estimate for Tamworth is not well justified. However, this is a placeholder and we understand that TransGrid will provide updated costings to the AER once the Tamworth tender process is completed.

[26] GHD, *QNI – Independent Verification and Assessment*, 10 January 2020, p. 2.

			$31.5 million. GHD considers TransGrid's estimate to be reasonable as GHD's estimate excludes some minor other works and TransGrid estimate is within ±20 per cent of GHD's estimate	
Transmission lines	Uprating of three existing transmission lines	$36.4 million based on outcomes from competitive tendering process		Competitive procurement (fixed price) and GHD verification provide confidence that forecast is prudent and efficient.
HV switchgears	Provision of HV switchgears at five substations	$6.2 million based on pricing schedules previously provided by existing suppliers on TransGrid's panel	$6.2 million. GHD considers TransGrid's estimate to be reasonable	Competitive panel pricing and GHD verification provide confidence that forecast is prudent and efficient
Other minor components and works	Provision of minor additional components and works to enable QNI	$1.2 million based on quotes TransGrid has received and TransGrid's understanding of market prices.	TransGrid's estimate more than 20 per cent higher than GHD's estimate. GHD did provide potential reasons for the differences.	These costs represent an insignificant proportion of total project capex.
Corporate and overheads costs	Incremental internal costs that TransGrid has incurred or expects to incur as a result of the QNI upgrade.	$28.7 million based on historical transaction records and a bottom up costing approach	GHD considers TransGrid's estimate to be within an acceptable range of project margins. GHD has verified that these costs are due to the specific nature and risks associates with the project.	GHD's verification provides confidence that forecast is prudent and efficient.

4.3.1 SVCs

TransGrid's forecasting approach

Two SVCs are required for the QNI minor upgrade, one at Dumaresq and one at Tamworth. We understand that procurement of the SVCs is a critical path task for the project. Given this, finding a provider that could deliver the SVCs on time and to the required capabilities is key for the successful on time completion of the project.

TransGrid identified three existing suppliers that could provide the SVCs within the required timeframe. All three identified suppliers participated in the tendering process and submitted final offers. The preferred tender offered a hybrid SVC whereas the two other tenders offered a classic SVC product. TransGrid considered that the hybrid SVC was the most effective solution for the project.

The forecast capex for SVCs is $55.5 million ($2017-18) based on the final bid of the preferred tenderer.

GHD's assessment

GHD used a comparative estimate approach which indicated a cost for the SVCs of $60 million. On this basis, GHD considers that TransGrid's capex forecast of $55.5 million is reasonable as it is within the ± 20 per cent margin.[27]

GHD indicates that the early engagement approach used by TransGrid to procure the SVCs is a standard approach for a product of this type, ie, where there are a wide range of technology solutions may achieve superior performance and cost outcomes, and supplier knowledge is crucial in developing solutions.

[27] GHD, *QNI – Independent Verification and Assessment*, 10 January 2020, Table 10 p. 33.

Our assessment

TransGrid's capex forecast methodology report refers to the offer from the preferred tenderer as being on a 'not-to-exceed price' basis.[28] Further discussions with TransGrid staff has confirmed that the contract is a lump sum payment, with specified variations that could result in the price of the SVCs either increasing or decreasing if the variant events occur . We note that the $55.5 million estimate does not include any allowance for expected variations or contingencies. Given that the potential variations could be positive or negative, at this stage, the $55.5 million capex forecast therefore reflects the expected cost TransGrid is likely to incur.

Further discussions with TransGrid staff also confirmed that the preferred bidder offered the lowest price as well as being judged as offering a superior technical solution.

We therefore consider the capex forecast of $55.5 million for the SVCs to be prudent and efficient for the following reasons:

- it reflects the outcome of a competitive tendering process with several bidders – a competitive tender process was undertaken, which identified a preferred tenderer that offered a superior solution and the lowest price;
- it reflects the expected costs TransGrid is expected to incur – the contract is a lump-sum payment for the SVCs and variations could both increase or decrease the final price paid by TransGrid; and
- it is within a reasonable margin of GHD's comparative estimate (-7.5%).[29]

4.3.2 Substation works

TransGrid's approach

TransGrid has procured three packages of substation work externally for the following sites:

- Armidale, which involves the installation of capacitor banks;
- Dumaresq, which involves the installation of capacitor banks and an SVC; and
- Tamworth, which involves the installation of capacitor banks and an SVC.

The successful tenderers will be responsible for undertaking works to connect the new SVCs and capacitor banks to TransGrid's network, as well as onsite construction works.

TransGrid used its existing supplier panel to procure the substation works. All four members on the panel were invited to submit a tender. Following discussions with each potential supplier, TransGrid concluded that no supplier had the capacity to complete all three work packages within the required timeframe. TransGrid also identified the desirability of awarding the substation works for Dumaresq and Tamworth to the same tenderer so that there was one substation supplier interacting with the SVC supplier to manage potential interface risks.

The three packages of substation work were released as separate request for tenders. TransGrid received three responses for the Armidale and Dumaresq substations and four responses for the Tamworth substation.

TransGrid undertook an evaluation process to determine the preferred supplier for each tender. This involved:

- a technical assessment for non-compliance; and

[28] GHD, *QNI – Independent Verification and Assessment*, 10 January 2020, p. 37.

[29] GHD, *QNI – Independent Verification and Assessment*, 10 January 2020, Table 10 p. 33.

- a commercial assessment for any commercial departures.

The preferred suppliers ranked highest on both the technical and commercial assessments. Follow-up value engineering workshops were undertaken with the preferred suppliers to further reduce costs and refine the design. Best and final prices were then received from the preferred suppliers and were lower than the prices in their original tender response.

The capex forecasts are based on the best and final prices received. The estimated value of substation works is $79.7 million, comprising:

- $15.9 million for works at the Armidale;
- $29.6 million for works at Dumaresq; and
- $34.2 million for works at Tamworth.

GHD's assessment

GHD used a comparative estimate approach which indicated a total cost for the substation works of $56.6 million. This comprises:

- $12.3 million for works at the Armidale, compared with $15.9 million estimated by TransGrid;
- $21.7 million for works at the Dumaresq, compared with $29.6 million estimated by TransGrid; and
- $22.6 million for works at the Tamworth, compared with $34.2 million estimated by TransGrid;

Overall, TransGrid's estimate for the substation works was around 40 per cent higher than GHD's comparative estimate, and so is beyond what GHD considers to be a reasonable margin. The significant differences between the comparative estimate and TransGrid's capex forecast prompted GHD to investigate potential drivers of the differences.

GHD concludes that TransGrid's capex forecast is higher due to the following factors: [30]

- increase in bulk civil works required for the switchyard extension works;
- additional allowance for excavation in hard rock; and
- the requirement for excavation and disposal of contaminated soil.

GHD further states that TransGrid's procurement approach:[31]

> … is standard practice for brownfield projects to identify and minimise associated project costs and risks, and GHD accepts that these prices are the current market rates.

Our assessment

Our discussions with TransGrid staff have confirmed that the preferred tenderers for the substation works reflected those who offered the lowest price.

We have also confirmed that the tender price is a fixed price subject to specified variations. A key risk associated with the substation site is the potential for ground conditions to vary from what has been assumed in the desk-top study that was provided to tenderers as the base line for their bid. We understand that this risk may be more limited given the brownfields nature of the work, however it remains a factor that may lead to contract variations. We further understand that differences in ground conditions (including the

[30] GHD, *QNI – Independent Verification and Assessment*, 10 January 2020, p. 44.

[31] GHD, *QNI – Independent Verification and Assessment*, 10 January 2020, p. 44.

amount of contaminated soil identified) compared to the base line estimate may lead to either positive or negative cost variations.

We conclude that TransGrid's capex forecast for the substation works are prudent and efficient. We have reached this view on the following basis:

- TransGrid's capex estimate reflects the outcomes of a competitive tendering process with multiple tenderers – a competitive tender process was undertaken (using suppliers that has already been through a competitive process to be appointed to TransGrid's panel), with the preferred tenderers offering the lowest price;
- It also reflects the expected costs TransGrid is expected to incur – the contract is a lump-sum payment and variations or uncertainties, such as ground conditions, could either increase or decrease the overall costs; and
- GHD considers TransGrid's cost to be reasonable and realistic – TransGrid's costs are higher than GHD's estimate but GHD has verified that this is due to additional civil works required**.**

4.3.3 Capacitor banks

TransGrid's approach

The QNI minor upgrade project requires three work packages of capacitor banks, namely:

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

TransGrid used its existing panel to procure the capacitor banks. It identified two panel members that could deliver the capacitor banks within the required timeframe and both firms have participated in the tendering process. The request for tenders for capacitor banks at Armidale and Dumaresq were released prior to that for Tamworth, as these two sites are on the critical path for delivery of the QNI minor upgrade by 2021/22.

TransGrid's tender evaluation process found that the same supplier was assessed to offer a better technical offer and lower price at both Armidale and Dumaresq. The capex forecast for capacitor banks for these two sites are reflect best and final offer TransGrid has received. Overall, the estimated value of capacitor banks at the two sites is $8.6 million, comprising of:

- $4.8 million for capacitor banks at Armidale; and
- $3.8 million for capacitor banks at Dumaresq.

TransGrid has released a request for tender for capacitor banks at Tamworth and we understand from discussion with TransGrid staff that tender submissions are due in mid-January 2020. TransGrid has estimated that the price for capacitor banks at Tamworth will be $5.9 million based on the submissions received for Armidale and Dumaresq.

In total, the total forecast capex for capacitor banks at the three sites is $14.5 million.

GHD's assessment

GHD used a comparative estimate approach which resulted in the following indicative estimates of the costs of the three capacitor banks:

- $4.6 million for capacitor banks at Armidale;
- $3.6 million for capacitor banks at Dumaresq; and
- $4.6 million for capacitor banks at Tamworth.

On this basis, GHD considers that TransGrid's capex forecast for capacitor banks at Armidale and Dumaresq to be reasonable as it is within the ± 20 per cent margin. However, TransGrid's capex forecast of $5.9 million for capacitor banks at Tamworth is around 30 per cent higher than the capex forecast put forward by TransGrid. GHD notes that it expects the price of capacitor banks at Tamworth to be similar to those at Armidale given the similarities in specification and was unable to verify why TransGrid's capex forecasts for capacitor banks were higher at Tamworth.

Our assessment

Discussions with TransGrid staff have indicated that lump-sum payments associated with purchasing capacitors are unlikely to be subject to change as these are off-the-shelf products, and so there is limited scope for variations.

TransGrid staff have also indicated that they expect to receive the tender submissions for the Tamworth capacitor banks in min-January and intend to provide the AER with an updated capex forecast for these capacitor banks at Tamworth soon thereafter. The revised forecast will reflect the competitive market outcome, replacing the placeholder estimates currently put forward by TransGrid.

We consider the capex forecast of $8.6 million for the capacitor banks at Armidale and Dumaresq to be prudent and efficient for the following reasons:

- it reflects the outcomes of a competitive tendering process – a competitive tender process was undertaken (using suppliers that has already been through a competitive process to be appointed to TransGrid's panel), which identified a preferred tenderer that offered the lowest price;
- it reflects the expected costs TransGrid is expected to incur – the contract is a lump-sum payment and is unlikely to change; and
- it is within a reasonable margin of GHD's comparative estimate.

We do not consider that the current forecast estimate for the capacitor bank at Tamworth has been demonstrated to be prudent and efficient, and note that the forecast currently includes a 'contingency' which has not been explained as drives the higher cost forecast compared with the Armidale capacitor bank. We note that GHD has also not been able to verify this higher cost estimate.

Notwithstanding, we note that the forecast for the Tamworth capacitor bank is currently a placeholder, and that TransGrid will shortly have available a comparable competitive market price for the substation. We would consider the revised capex forecast for Tamworth to be prudent and efficient if is reasonably close to the comparative estimates calculated by GHD.

4.3.4 Transmission lines

TransGrid's approach

The QNI project requires the uprating on three existing transmission lines, which are:

- Transmission line number 88 from Muswellbrook to Tamworth;
- Transmission line number 83 from Liddell to Muswellbrook; and
- Transmission line number 84 from Liddell to Tamworth

The upgrade work includes replacing and strengthening existing structures, replacing insulators and installing 60 new polls. The successful provider will be responsible for the design and construction of the upgrades.

TransGrid used its existing panel to procure the uprating of the relevant transmission lines. TransGrid approached four members on the panel. Each member was assessed on the following criteria:

- past and present performance in delivering transmission line uprating for TransGrid;

- general capacity and capability of delivering the transmission line uprating within the required timeframes, including considerations of the suppliers' existing workload; and
- the risks that the suppliers would not be able to meet the required timeframe.

Two suppliers were shortlisted on this basis and invited to submit a response to a tender to complete the required transmission line uprating works. TransGrid evaluated the bids based on:

- the suppliers' capacity and capability to complete the work within the required time frame; and
- price.

The preferred supplier's bid was considered to be superior both from a technical and commercial perspective. TransGrid then undertook a value engineering workshop with the preferred supplier to reduce costs and refine the design.

TransGrid's capex forecast for transmission line uprating work is based on the outcomes of this competitive tendering process. The estimated value for the transmission line uprating works is $36.4 million.

GHD's assessment

GHD used a comparative estimate approach which resulted in an indicative estimate for the uprating works of $31.5 million (ie, a difference of 15.5%). GHD also notes that the:[32]

> variance in the estimated total costs for the five transmission lines is within our nominal range of ±20%, and given there are additional costs for other minor other works that GHD cannot independently verify (such as individual tower steel member replacement and landscaping), we consider the TransGrid estimated costs for the transmission line work scopes to be reasonable and realistic.

Our assessment

Our discussions with TransGrid indicated that it expected the tender submission to include a significant amount of detailed design work from the tenderers. TransGrid provided the two shortlisted tenderers with bidder payments to encourage them to participate in the tender process and put the required effort into the submission.

We understand from TransGrid that one of the tender submissions did not provide the necessary technical detail and did not offer a firm quote for undertaking the work. Given this, the submission was considered inadequate and was not considered further. Notwithstanding this, we expect that the preferred tenderer was still subject to the appropriate competitive tension as they would have prepared their submission on the basis of there being a potential competing bidder.

We understand from TransGrid that there could be variations associated with the uprating contract, which could lead to either a higher or lower overall cost for TransGrid. In particular, there is a risk that ground conditions will differ from those assumed in the baseline desktop study provided to bidders, which could require a different mix of bored pier footings (normal ground conditions) and rock anchors (medium, high and extreme strength rock).

That said, the contract with the preferred tenderer is a lump-sum contract and reflects the costs TransGrid currently expects to incur.

We consider the capex forecast of $36.4 million for the transmission line uprating works to be prudent and efficient for the following reasons:

[32] GHD, *QNI – Independent Verification and Assessment*, 10 January 2020, A.3 in "Appendix – Review of initial QNI estimate."

- it reflects the outcomes of a competitive tendering process – competitive tender process was undertaken and the selected tenderer provided a response consistent with the tender requirements;
- it reflects the expected costs TransGrid is expected to incur – the contract is a lump-sum payment and reflects the expected costs TransGrid will incur; and
- it is within a reasonable margin of GHD's comparative estimate.

4.3.5 HV switchgear

TransGrid's approach

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

TransGrid is using a competitive tender process to procure the HV switchgear using its existing panel. There are multiple suppliers of HV switchgear on the panel and TransGrid expects that it would procure various components from different panel members. The procurement of HV switchgear is expected to be completed in early 2020 and we understand that TransGrid intends to provide the AER with updated details on contracted values when they become available.

Currently TransGrid estimates that the total price to purchase the required HV switchgear will be around $6.2 million. There is no basis given in the TransGrid document for this estimate.

GHD's assessment

GHD used a comparative estimate approach which resulted in an indicative estimate for the costs of the HV switchgear of $6.2 million. TransGrid's estimate is 0.3 per cent lower than GHD's comparative costs.

Our assessment

TransGrid has advised us the forecast capex for HV switchgear is based on pricing schedules that the panel members have previously provided and assumptions around the type and number of switchgear required. TransGrid has indicated that the final price may vary from the capex forecast if, say, different types of switchgear is purchased, however the current capex forecast reflects their 'most likely' estimate at present.

Overall, we consider the capex forecast of $6.2 million for the HV switchgear to be prudent and efficient for the following reasons:

- it uses existing supplier panel arrangements and pricing, which have been established on a competitive tender basis;
- it reflects the expected costs TransGrid is expected to incur; and
- it is very close to GHD's comparative estimate.

We also note that the outcome of the tender process for HV switchgear are expected to be available early in 2020 and could be taken into account by the AER at that time.

4.3.6 Other minor components and works

TransGrid's approach

There are several additional minor components and works required for the QNI minor upgrade that TransGrid intends to procure from external suppliers. The forecast capex for the minor components and additional work is estimated to be $1.2 million. This comprises of:

- $0.2 million for new transmission line insulators based on internal TransGrid estimates,
- $0.9 million for secondary systems equipment; and

- $0.1 million to connect to Essential Energy's network, based on quotes received from Essential Energy.

GHD's assessment

GHD used a comparative estimate approach which resulted in an indicative estimate of:

- $0.1 million for new transmission line insulators, significantly lower than TransGrid's estimate of $0.2 million; and
- $1.4 million for secondary systems equipment, significantly higher than TransGrid's estimate of $0.9 million.

GHD did not provide a comparative estimate for connection costs to Essential Energy's network.

Our assessment

We do not have enough information to develop an informed opinion about whether the capex forecasts for other minor components and works is prudent and efficient. However, we note that these costs represent a very minor proportion of the capex forecasts, and so will not have a material effect on the overall project costs.

4.4 Corporate and network overhead capex (indirect capex)

TransGrid will incur corporate and network overhead capex in the delivery of the QNI minor upgrade project, ie, indirect capex. Indirect capex can be grouped into the following key categories:

- historical indirect capex
- forecast indirect capex, to cover:
  - works delivery;
  - project development; and
  - other indirect capex.

TransGrid has estimated total forecast indirect capex using a bottom-up approach. For example, labour cost has been estimated based on the number of additional full time equivalent (FTE) staff required and TransGrid's standard rates per FTE.

TransGrid's forecast for corporate and network overhead capex is $28.7 million in total.

4.4.1 Historical indirect capex

Historical capex relates to expenditure that TransGrid has incurred between July 2018 and November 2019 to progress the QNI upgrade project. TransGrid's enterprise resource planning system (Ellipse) records transactions and staff time that TransGrid has incurred. TransGrid has followed its cost allocation methodology and capitalisation policy when allocating and attributing costs to the QNI upgrade project as capex.[33]

TransGrid estimates the historical capex is $3.3 million for the QNI upgrade.

4.4.2 Forecast indirect capex – works delivery

TransGrid will need to hire additional staff to undertake work delivery activities, eg, undertake project and contract management and inspect work completed by suppliers and contractors.

[33] GHD, *QNI – Independent Verification and Assessment*, 10 January 2020, p. 45.

TransGrid has identified the need for additional 43 FTE, comprising of:

- 10 FTE for project management;
- 21 FTE for substation works delivery; and
- 12 FTE for transmission lines work delivery.

The estimated costs of works delivery capex are $17.9 million, where around $16 million is labour costs. Work delivery costs have been calculated based on the need for an additional 43 FTEs, TransGrid's standard rates and costs for these FTEs, and TransGrid's estimate of the likely duration required for each role.

4.4.3 Forecast indirect capex – project development

The estimated costs of project development $6 million.

Labour related costs

TransGrid is scheduled to construct several major capex projects over the coming years. For example, in addition to the QNI minor upgrade, TransGrid will also be constructing Project EnergyConnect, HumeLink and the NSW portion of the VNI interconnector.

To help coordinate these projects and integrate these upgrades into the existing network, TransGrid has established a major projects division.

Some of these FTEs will be working specifically on the QNI upgrade project whereas sone will be working across the different major projects. TransGrid estimated that the costs that are attributed to the QNI upgrade are around $5 million for labour and labour related costs. This cost has been estimated based on the expectation that:

- there would be 17 FTEs dedicated specifically to the QNI upgrade project – all of these costs have been allocated to the QNI upgrade project; and
- 24 FTEs would be in roles that are not specific to an individual major project, and so are common costs across all major projects – these costs have been allocated to the QNI upgrade project based on the expected proportion of capex for the QNI upgrade compared to the total capex for all major projects.

Non-labour related costs

TransGrid estimates that it will incur around $1 million of non-labour project development capex. This is to cover the hiring of specialist consultants to help prepare the contingent project application and supporting documents for the QNI minor upgrade. TransGrid has based its estimate on recent historical costs and considers it to be consistent with TransGrid's procurement and governance processes.

4.4.4 Forecast indirect capex – other costs

TransGrid will incur other indirect capex as a result of the QNI minor upgrade. TransGrid estimates that it will incur $1.55 million, comprising of:

- $0.3 million to cover the incremental role for an environment officer;
- $0.2 million to cover incremental tasks of undertaking stakeholder and community engagement;
- $0.9 million for incremental insurance costs during construction – [redacted]; and
- $0.2 million for bidder payments to encourage participation of multiple bidders and improve the quality of tender submissions – these payments are in-line with common industry practice and NSW government guidelines.

4.4.5 GHD's assessment of indirect capex forecasts

To develop a comparative estimate of the indirect capex costs for the QNI minor upgrade, GHD used benchmarks from other comparable major civil and electrical industry projects as a guide. GHD noted that the comparison needed to incorporate the brownfield nature of the QNI upgrade and the overheads involved in managing access and outages on the transmission lines for the uprating works.[34]

GHD noted that project management costs are generally between nine to 15 per cent of total project costs. In particular, GHD's report points to work undertaken by Ernst and Young, which examined data from eight road and rail authorities in Australia for projects with a total cost above $50 million. When outliers are excluded, Ernst and Young found that owner costs (excluding design costs) were:

- on average 11 per cent for road projects, ranging from eight to 14 per cent; and
- on average 16 per cent for rail projects.

GHD considered that road projects were a more comparable benchmark given the brownfield nature of the QNI upgrade. GHD also noted that most of the design work (85 per cent) has been outsourced to contractors, and so already incorporated in the lump sum payments to contractors.

GHD estimated that an 11 per cent allowance for project management and overhead costs was appropriate for the QNI upgrade, which results in a comparable estimate of $20.9 million for total indirect capex costs, assuming that TransGrid's direct capex forecast is accepted.

GHD notes that TransGrid's capex forecast for corporate and overhead costs equates to 12.9 per cent of total project costs. GHD noted that: [35]

> …the increased allocation is due to the specific nature and risk profile for the project. GHD has verified that only TransGrid staff have the authority (under the Power System Safety Rules) to undertake works within energised HV substations so as to make safe areas of work for contractors. Also, only TransGrid staff are permitted to apply earths to transmission lines to allow for safe working for contractors.

GHD concludes that:[36]

> GHD is of the view that the project overheads in the CPA estimate representing 12.9% of the total project costs are within an acceptable range of project margins.

4.4.6 Our assessment

We do not have the relevant expertise to independently validate the reasonableness of TransGrid's bottom-up approach to calculating corporate and overhead costs. However, we consider TransGrid's capex forecast for corporate and network overheads to be prudent and efficient on the basis of GHD's assessment.

4.5 Overall assessment of TransGrid's capex forecast compared with GHD's comparative estimates

4.5.1 Summary of key findings of GHD's report

GHD considers TransGrid's overall forecast capex of $222.8 million to be within a reasonable margin of GHD's comparative estimate.[37]

[34] GHD, *QNI – Independent Verification and Assessment*, 10 January 2020, p. 49.
[35] GHD, *QNI – Independent Verification and Assessment*, 10 January 2020, p. 53.
[36] GH, *QNI – Independent Verification and Assessment*, 10 January 2020, p. 53.
[37] GHD, *QNI – Independent Verification and Assessment*, 10 January 2020, p. 2.

> a reasonable estimate of costs would be approximately $194 million which indicates the CPA capex forecast is within a reasonable margin (+/- 20%) above this estimate.

Further, GHD considers that the: [38]

> difference is due to our reliance on adjusted historical project costs rather than market-tested tender costs that support the CPA.

On an individual category basis, GHD finds that:

- TransGrid's direct capex forecast is within a reasonable margin for many of the cost categories, which together represents $215.4 million (75 per cent) of the total forecast capex. ie,
  - SVCs;
  - HV switchgear;
  - Capacitor banks at Armidale and Dumaresq; and
  - The uprating of transmission lines;
- there were some costs where TransGrid's forecast capex was 20 per cent higher than GHD's comparative estimate, most notably:
  - capacitor banks at Tamworth, which GHD were unable to verify reasons for the higher costs;
  - substation works, due to additional civil works; and
- TransGrid's estimate of overhead and corporate costs are 12.9 per cent of the total capex cost, which GHD considers to be reasonable given the specific nature and risks associated with the project.

In conclusion, GHD noted that TransGrid CPA forecasts were higher than GHD's estimate in total and in general on a work package basis. However, GHD also considered that: [39]

- TransGrid's estimates are more likely to be accurate – GHD's comparative estimate is a Class 4 estimate with an accuracy of ±30% whereas the TransGrid CPA forecast is based on tender outcomes, representing firm offers from tenderers;
- TransGrid has accepted lump-sum arrangements for separate work packages, which are based on most accurate information available and may also include allowances for contingency risks; and
- GHD's comparative estimates have relied upon costs for similar historic projects, and so may not have included provision for accelerated construction timelines or any cost pressures due to market conditions or delivery constraints.

4.5.2 Our overall assessment

On the basis of the discussion above, we consider TransGrid's capex forecast for QNI to be prudent and efficient. We also note that TransGrid's estimate is likely to be a more accurate estimate of the expected costs of completing the QNI upgrade project when compared with GHD's comparative estimate.

[38] GHD, *QNI – Independent Verification and Assessment*, 10 January 2020, p. 5.

[39] GHD, *QNI – Independent Verification and Assessment*, 10 January 2020, p. 5.

5. Conclusions on the consistency of TransGrid's proposed capex for the QNI upgrade with the NER

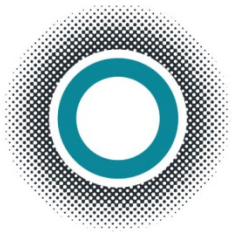
We have considering the following:

- consistency of the QNI minor upgrade with the capital expenditure objectives in the NER;
- whether the proposed capex amounts proposed by TransGrid reasonably reflects (both in total, and on an annual basis):
  - the efficient costs of achieving the expenditure objectives;
  - the costs that a prudent operator would require to achieve the expenditure objectives; and
  - a realistic expectation of the demand forecast and cost inputs required to achieve the expenditure objectives;

We have reviewed TransGrid's capex forecast and considered the findings of GHD's independent verification and assessment of the QNI upgrade. We conclude that:

- the project meets the capital and operating expenditure objectives:
  - the project has undergone a RIT-T and is expected to deliver benefits that exceed costs; and
  - GHD has verified that the project scope is consistent with the preferred option identified in the RIT-T and is reasonable and realistic to meet the investment need;
- the proposed expenditure reflects the efficient and prudent costs of achieving the expenditure objectives:
  - the vast majority of direct capex forecast has been based on the outcomes of competitive procurement processes with multiple bidders, that have resulted in fixed price outcomes which represent the current expected cost to TransGrid. There is therefore a higher degree of certainty and confidence associated with these elements of the TransGrid's forecast;
  - the forecasts for the majority of expenditure items are within a reasonable margin of GHD's comparative estimates, which have been developed independently based on historic unit cost outcomes.
  - the key exception is the substation works, where TransGrid's estimates exceed GHD's comparative estimates. However, GHD's conclusion is that this difference is due additional civil works;
  - the estimated cost for the Tamworth capacitor banks is also currently not substantiated, but we understand is a placeholder and that the outcome from the current tender process will be provided to the AER once it is available later in January;
  - corporate and overhead costs are within what GHD considers to be an acceptable range of project margins. GHD concludes that these costs are due to the specific nature and risks associated with QNI;
- the proposed expenditure reflects realistic expectations of demand forecasts and cost inputs to achieve the capex objectives – the RIT-T considered different demand and cost scenarios and the option put forward in the contingent project application was identified as the preferred option; and
- the commencement and completion dates are reasonable:
  - the timing for the QNI minor upgrade has been fast tracked compared with BAU. The RIT-T has confirmed that the project will provide net market benefits from 2021/22, taking into account the higher costs associated with the fast-track process.
  - the reasonableness of the project timing has been market tested through the procurement process

- we have no information on which to separately verify that the proposed timing in each year of the regulatory period is prudent and efficient but note that this timing should be expected to align with the timing of milestone payments in the competitive contracts.



HOUSTONKEMP
Economists

Sydney
Level 40
161 Castlereagh Street
Sydney NSW 2000

Phone: +61 2 8880 4800

Singapore
8 Marina View
#15-10 Asia Square Tower 1
Singapore 018960

Phone: +65 6817 5010