Powerlink Revenue Determination: Technical Review

Forecast Capital Expenditure and Service Targets

Report to

Australian Energy Regulator

Public Version

Energy Market Consulting associates
Strata Energy Consulting

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Energy Market Consulting associates
PO Box 542,
St Leonards, NSW 2065
Australia

Phone: 0412 559 138 / Phone (intl): 61 412 559 138
Email: psell@emca.com.au
Web: www.emca.com.au

About EMCa

Energy Market Consulting associates (EMCa) is a niche firm, established in 2002 and specialising in the policy, strategy, implementation and operation of energy markets and related access and regulatory arrangements. Its Director, Paul Sell, is an energy economist and previous Partner in Ernst & Young and Vice President of Cap Gemini Ernst & Young (now Capgemini). Paul has advised on the establishment and operation of energy markets and on matters such as electricity network open access, pricing and regulation and forecasts for over 30 years.

About Strata

Strata Energy Consulting Limited specialises in providing services relating to the energy industry and energy utilisation. The Company, which was established in 2003, provides advice to clients through its own resources and through a network of Associate organisations. Strata Energy Consulting has completed work on a wide range of topics for clients in the energy sector both in New Zealand and overseas.

Authorship

Prepared by:	Bill Heaps, Paul Sell, David Frow, Stephen Lewis, Dave Allen
Quality approved by:	Paul Sell and Bill Heaps
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1 Introduction and background

1.1 Purpose of this review

1. The Australian Energy Regulator (AER), in accordance with its responsibilities under the National Electricity Rules (NER), is required to conduct an assessment into the appropriate revenue to be obtained from provision of prescribed transmission services provided by Powerlink from 2012/13 to 2016/17 (the next regulatory control period, or RCP). The process that the AER is required to follow is described in chapter 6A of the NER.

2. Powerlink provided its Revenue Proposal for the period 2013-17 to the AER on 31 May 2011[1].

3. The AER engaged EMCa and Strata Energy Consulting (Strata) as a Technical Consultant to review and provide advice on specific areas of Powerlink's Revenue Proposal. The focus of the review is on Powerlink's past and forecast capital expenditure (capex), associated policies and procedures, and its service standard proposals.

1.1.1 The Powerlink Proposal

4. Powerlink's Revenue Proposal submitted to the AER includes a prescribed transmission services capex forecast of $3.484 billion (real $2011) for the 5 years of the next RCP. The Revenue Proposal includes Powerlink's capex estimate for the current RCP (i.e. from 1 July 2007 to 30 June 2012) of $2.904 billion (nominal).

5. Powerlink identifies the main drivers of the capex forecast as being:

[1] 2013-17 Powerlink Queensland Revenue Proposal (to AER), and including associated supporting information

Load Driven	Based on continuing underlying economic growth in South East Queensland and a resources driven economic rebound with major load increases in: • Surat Basin – many upstream processing and compression plants, and some new coal mines, water treatment and service towns • Bowen Basin (CQ) – new and expanded coal mines, increased electric rail haul capacity, new and existing port expansions (Gladstone, Mackay ports) • North Bowen Basin / Galilee Basin (NQ) – new and expanded coal mines, rail haul capacity increases, port expansions (Abbot Point)[2]
Non-load driven	The need to replace assets based on age and condition and anticipated limitations in land access for new transmission line routes.

1.1.2 The NER requirements

6. The main relevant chapter of the NER for our assessment of transmission capex is Chapter 6A which deals with the rules for economic regulation of transmission services including such services provided by Powerlink.

7. The Revenue Proposal must establish how forecast capex meets Powerlink's regulatory obligations. To do this the forecast capex must meet the submission guidelines, be for prescribed transmission services, and be provided as a total and for each year of the regulatory control period. In addition, the revenue proposal must identify whether forecast capex is for reliability augmentation (i.e. to meet the reliability standards in the NER or State legislation) or has met the regulatory test or regulatory investment test for transmission.

8. Under the NER, the AER must accept Powerlink's proposed capex if the costs are considered efficient, prudent, and realistic in relation to forecast demand and anticipated input costs (cl 6A.6.7(c)).

9. The NER requires the AER to evaluate the proposed capex against thirteen "capital expenditure factors" (clause 6A.6.7(e)). If the AER is not satisfied with the proposed capex, it must substitute its own proposed capex. In this case, the AER must give reasons (clause 6A.13.2 (b) and clause 6A.14.1(2)(ii)).

10. Powerlink can propose contingent projects as part of its revenue proposal. These are subject to the same capex and opex tests as non-contingent expenditure. A trigger must be set to determine if and when the capex and opex associated with contingent projects will be added to the aggregate annual revenue requirement (AARR). When the

[2] Overview of Revenue Proposal and challenges – presentation by Gordon Jardine Powerlink CEO June 2011

trigger event occurs, Powerlink must make an application to the AER for inclusion of the contingent capex and opex in a revised revenue allowance.

1.2 Scope and approach

1.2.1 Scope

11. The scope for this review covers the requirements for the technical consultant as set out in the AER's "Terms of Reference for Technical Consultant and Demand Forecast Consultant" (the TOR). Our interpretation of the TOR was also informed by direct reference to the NER, as described above. The terms of reference for the technical consultant were subject to a number of clarifications and some changes of emphasis as the review progressed.

12. This review is primarily focused on Powerlink's proposed capital expenditure. EMCa, in association with NZIER, was engaged separately by the AER to undertake an assessment of Powerlink's demand forecast. The findings from the demand forecasting review have been considered as an input assumption for the purposes of this technical review.

13. A previous review has taken place for the current RCP which included the setting of a revenue cap. This technical review considers Powerlink's actual expenditures for the current RCP and considers the reasons for any significant variances. This assessment also takes into account material variations between historical expenditures (planned and actual) and the proposal.

14. The scope of this review can be summarised as comprising the following components:

Capital governance structure	Described and reviewed Powerlink's capital governance framework under which capex programmes and projects are established
Capex forecast methodologies and assumptions	Provided a description of the methodologies and assumptions used by Powerlink when determining the capex forecast
Cost estimation methodologies	Reviewed and described the cost estimation methodologies used by Powerlink for capex projects
Contingent projects review	Reviewed, in order to establish their reasonableness and compliance with the requirements of the NER.
Capex projects review	Reviewed a sample of projects that are included in the development of the prescribed transmission services capex forecast
Probabilistic capex planning methodology	Provided a description of the methodology and assessed the reasonableness of the outcomes.
Service target incentive scheme	Reviewed the accuracy of inputs and the appropriateness of the methodology used and targets proposed by Powerlink

1.2.2 Approach taken

15. Powerlink's capex proposal is developed on what can be considered to be a bottom-up basis where input assumptions are set into a number of scenarios that are in turn used to generate load driven capex projects. Replacement projects, projects that have reached an advanced stage of commitment and non-network projects are added to this list. This detailed list of several hundred individual projects is the foundation on which Powerlink makes its capex forecast is made.

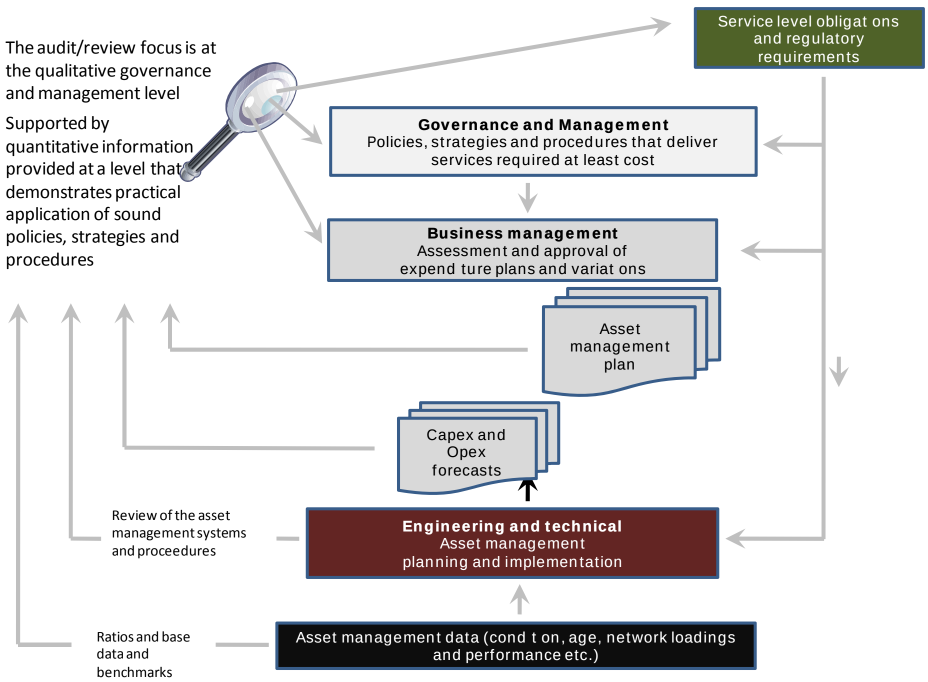
16. We have taken a senior management / governance-based approach to this review, supported by analysis. We commenced our review by undertaking a "top down" assessment of Powerlink's capital governance structure. This approach enabled us to establish a view on the extent to which Powerlink's capital governance structure could be considered to be aligned with asset management standards and good industry practice.

17. We then undertook a review of a sample of projects to gain a view of the extent to which Powerlink applies its capital governance framework in practice.

18. We used an on-site review to inform us on Powerlink's asset management practices and the impact of the organisational culture on the development of capex plans and how there are implemented.

19. The following diagram sets out the conceptual structure for the approach we adopted for this review.

Figure 1: *Overall approach to our review*



Source: Strata Energy Consulting Limited

1.2.3 Data sources

20. In the course of this review we have examined a large quantity of documents. This includes documents that Powerlink provided to the AER with its Revenue Proposal and

a number of other significant documents that were provided in the course of the on-site meetings or in response to our requests for information.

21. We wish to acknowledge here the considerable assistance that Powerlink provided with this review. This assistance was of a highly professional nature, as evidenced in the course of on-site meetings and by Powerlink's prompt and open provision to us of supporting information and responses to queries.

1.3 Our qualifications

22. To support our management-level approach, our review team was comprised solely of people with senior management, governance board and senior advisory experience with electricity network businesses. The review team was comprised as follows:

Reviewer	Experience summary
Paul Sell	Paul is the Director of Energy Market Consulting associates Pty Ltd, based in Sydney. Paul is an energy economist with 30 years' experience, specialising in electricity and gas markets, with major experience advising on structural reforms and resulting regulatory regimes and markets in the Australian electricity sector, commencing in the early 1990s. His experience includes producing demand and expenditure forecasts, network pricing and access development, policy advice, regulatory analyses and business analyses in relation to electricity transmission and/or distribution networks in jurisdictions including Victoria, Western Australia, Queensland, New Zealand, Ontario and in the Philippines. Paul was previously a Vice President in the global professional firm Capgemini and a Partner in Ernst & Young consulting. Paul holds an honours degree in economics, specialising in Operations Research.
Bill Heaps	Bill is Managing Director of Strata Energy Consulting Limited. He is an electrical engineer with senior management experience in energy utilisation, distribution, retail, transmission and power generation. Bill was previously Geothermal Manager for ECNZ and Contact Energy responsible for the Wairakei and Ohaaki geothermal power stations. He was Commercial Services manager for Transpower New Zealand and a director of dCypha Limited, the company that undertook data reconciliation for the New Zealand electricity market and electricity futures development in Australia. He is a past director of Orion Network and Commercial Manager for CentralPower, both electricity distribution businesses, and was General Manager of Energy Brokers NZ Limited. Bill's industry governance roles include that of Chair of the Transmission advisory Group, Wholesale Market Advisory Group, Retail Advisory Group and the Investment Advisory Group for the New Zealand Electricity Commission, and Chair of the Locational Price Risk Technical Group for the New Zealand Electricity Authority.

Reviewer	Experience summary
Dave Frow	Dave is a former Chief Executive Officer of the Electricity Corporation of New Zealand (ECNZ), with seven years' experience in this role which included responsibility for electricity transmission. Dave steered the company through the period of industry structural and market reform, to the creation of the separate transmission company and competitive electricity generation companies. Dave is former Chairman of Transpower (New Zealand's national electricity transmission company), a former Director of Unison Networks Ltd (an electricity distribution company) and former Director of ETEL Ltd (providing electrical transformers). Dave has provided international strategic management consulting advice in a range of industries, including postal, harbours, electricity and manufacturing. Dave holds a degree in engineering from the University of Natal South Africa and is a graduate of the Harvard Business School Advanced Management Programme. He is a fellow of the Institute of Professional Engineers (IPENZ).
Stephen Lewis	Stephen is an electrical engineer with over 30 years' electricity supply industry experience. His previous career with National Grid plc spanned the UK, the USA, Australia and South America. Stephen is currently a Director of MainPower New Zealand Ltd., a Trustee and Chair of Community Energy Action and a Trustee of Dance and Physical Theatre Trust. Stephen was the Commercial Director for National Grid Australia during the final stages of the Basslink HVDC interconnector project between Tasmania and Victoria. Prior to this, he was a Vice President of National Grid USA and headed the transmission business covering the New England and New York states. While in the UK, Stephen held senior management positions in the transmission business for National Grid in the fields of: maintenance delivery, maintenance and construction planning, network outage management, rights of way management, logistics, network safety management and marketing, sales and customer relations for unlicensed activities.
Dave Allen	Dave has a corporate and commercial banking background with experience in infrastructure, property, primary industry and investment companies. This includes a role as Head of Credit for the New Zealand branch of Credit Agricole, one of the world's largest banks. Dave is a director and shareholder of Vantage Consulting Group. Since joining Vantage in 1999 Dave has provided feasibility studies, financial modelling, strategic reviews, asset reviews and advice on business process improvement, disputes and debtor management to a

Reviewer	Experience summary
	wide range of clients including Telecom NZ, Transpower, Commerce Commission, Electricity Commission, Meridian, Powerco and Port Marlborough. This work includes (as an associate of Strata Energy Consulting) four reviews of Transpower New Zealand's Non Part F Capex for the Commerce Commission.

1.4 Structure of this report

23. The structure of this report is, to the extent possible, aligned with the structure of the AER TOR and with the above scope for the review.

Section	Title	Content
1	Introduction and background	Sets out the purpose and background for the review
2	Findings and recommendations	Provides our key findings and recommended capex adjustments
3	Capex in the current Revenue Control Period	Reviews capex expenditure for the current RCP and its implications for capex in the next RCP
4	Powerlink's proposed capex for next Revenue Control Period	Covers the main parts of our review and provides the analysis and basis for our findings. The section includes: • An outline of Powerlink's capex forecast for the next RCP • Review of capital governance framework • Review of capex forecasting methodologies and assumptions • Review of cost estimation methodologies • Review of probabilistic planning methodology • Sample project review
5	Alternative capex proposal	Provides an alternative level of capex for the AER to consider as a substitute for Powerlink's proposed capex
6	Other requested advice	Provides our analysis and recommendations on the AER's questions on Powerlink's STPIS proposal, on contingent projects and on connection assets.

24. In order to present a focused main report we have taken out much of the background and descriptive text and included this in a series of annexures to the report. The annexures also contain responses to a number of areas on which the AER asked us to provide specific advice that is not covered elsewhere in the report.

25. This public version of the report has been redacted in accordance with advice from AER.

2 Findings and recommendations

2.1 Headline findings

27. From our review of Powerlink's capital governance structure and its capital expenditure forecasting processes, we find that Powerlink presents as a well-structured and professional organisation that meets industry good practice standards in many regards. In line with the objectives of this review, our findings are focused on those technical aspects of Powerlink's 2013-17 Revenue Proposal that we consider not to meet the requirements of the NER.

28. For this purpose, our headline findings in relation to forecast capex for prescribed services are as follows:

   a. A proportionate reduction in allowable capex should be made consistent with EMCa/NZIER's recommendation that AER should not accept Powerlink's demand forecast and should substitute a lower demand forecast.

   b. Capex should be disallowed within the current RCP for the proposed 275kV projects with future 500kV capability represented by project numbers CP01470 and CP02477.3, together with a component of the capex proposed for project numbers CP01477.2 and CP01875 and which represents the "option" value of later 500kV upgradeability as this expenditure is not adequately justified by Powerlink.

   c. The higher carbon reduction scenarios proposed by Powerlink in its probabilistic analysis, should be excluded based on recent Federal Government decisions.

   d. Powerlink's proposed Cost Estimation Risk Factor ("CERF") of 3% applied to uncommitted project costs is not justified, given Powerlink's self-correcting costing methodology, and should be disallowed.

   e. An efficiency reduction factor should be applied to uncommitted project estimates, comprising 1% of forecast expenditure in the second year of the RCP and 2% in subsequent years, to reflect reasonably expected cost reduction and solution optimisation gains as these projects progress towards commitment.

29. Our headline findings in relation to other matters within the requested scope are:

a. The following contingent projects proposed by Powerlink should not be accepted as contingent projects: CP02542, CP02850, CP01125, CP02382, CP02537, CP02600, CP0219, CP04152, CP01527 and CP02359. These projects are not considered to pass the "probability" test under the NER.

b. The adjustments proposed by Powerlink to the transmission line and transformer availability target, cap and collar parameters in the Service Target Performance Incentive Scheme (STPIS) should be disallowed, and we propose amending STPIS parameter weightings along with the collar and cap parameters for loss of supply events.

c. We consider that Powerlink's application of clause 11.6.11 relating to classification of connection asset expenditure is consistent with its interpretation of this clause.

2.2 Headline recommendations

30. EMCa recommends that the AER not accept Powerlink's forecast of required capital expenditure because, in our opinion, the Revenue Proposal does not (in accordance with the NER clause 6A.6.7(c)) reasonably reflect:

- the efficient costs of achieving the capital expenditure objectives;
- the costs that a prudent operator in the circumstances of the relevant Transmission Network Service Provider would require to achieve the capital expenditure objectives; and
- a realistic expectation of the demand forecast and cost inputs required to achieve the capital expenditure objectives.

31. EMCa recommends that the AER adopt a substitute forecast of capital expenditure that is in aggregate over the RCP $1,015m less than that proposed by Powerlink. This represents a reduction of 29% of the capex proposed by Powerlink and is based on acceptance of all of the findings in section 2.1 above. In the event that AER accepts some but not all findings, then adjustments specific to those findings are recommended, as described in section 5.3.

2.3 Summary of findings

2.3.1 Findings from review of current RCP expenditure

32. Powerlink's profile of expenditure in the current RCP has been opposite to the profile that it proposed in 2005, in that it has been less than proposed for the first four years and Powerlink forecasts it to be considerably greater in the final year.

33. We consider that, in aggregate, Powerlink's capex in the current RCP may have been higher than was necessary, given that actual demand in this period is just below the low demand estimate that Powerlink proposed for this RCP. This approximates a peak summer demand of 800MW (10%) less than the medium demand forecast by the end of this period (i.e. by 2011/12). Notwithstanding this considerably lower demand, Powerlink estimates that its capex for this period will be close to that which was included in its revenue allowance as being required to meet a medium demand scenario. Whilst this variation can in part be explained by the inertia of the planned

capex that prevents swift responses to the changing intra RCP demand trends, we consider that it has not been fully explained in Powerlink's proposal.

34. Powerlink's estimated 2011/12 expenditure represents a considerable step increase compared with the previous four years of the current RCP. Our assessment is that Powerlink has the capability to deliver this, but we consider that it is likely that it will not be fully achieved and, in any case, is not fully required. We consider that some projects could have been prudently deferred for consideration in the next RCP and that this smoothing would also provide a more efficient cost outcome for Powerlink (see below at paragraph 47).

2.3.2 Findings from review of proposed expenditure for next RCP

Capital Governance Framework

35. Whilst we have observed that Powerlink's capital governance framework generally aligns with good asset management standards and practices, we consider the following improvements would lead to better outcomes:

    a. Greater emphasis on the strategic nature of programs of proposed work, at the Asset Manager / Asset Owner level, would lead to better-informed strategic decision making;

    b. An executive-led formal cost reduction program is likely to realise material capex efficiency gains;

    c. Inclusion of an executive-led formal continuous improvement program in the capital governance structure would help to ensure that Powerlink is "driving the network" as efficiently and effectively as possible;

    d. A more proactive process for identifying and assisting with the scoping of non-network alternatives is likely to lead to further reductions in network investment requirements.

36. These findings have implications for the inclusion of certain projects in the forecast capex, and for the costing of all uncommitted projects, as covered below.

Probabilistic approach

37. We consider that the probabilistic approach developed and applied by Powerlink is basically sound and we note that it has been improved in each of the RCPs for which it has been used. We have noted that the capex resulting from the range of 20 scenarios included in this assessment is similar to that which results from considering the "medium" scenarios only.

38. The accuracy of outputs from this approach is determined by the input assumptions used to construct the various scenarios. We have assessed these and we consider that it is appropriate to adjust Powerlink's proposal to reflect updated information and a separate assessment for the following inputs:

    - Lower demand forecasts; and
    - Carbon reduction targets set by the Federal Government which would lead us to exclude the medium and high carbon reduction scenarios included by Powerlink in its forecast.

39. EMCa estimates that incorporating a lower forecast demand, as recommended by EMCa in association with NZIER, leads to a proposed capex reduction of $554m.

40. Excluding the medium and high carbon reduction scenarios in Powerlink's probabilistic model leads to a proposed capex reduction of $135m, based on Powerlink's own scenarios.

Forecast capex project reviews

41. For most projects we have found that Powerlink has applied its capital governance framework consistently and that most projects have been classified correctly for inclusion in the Prescribed Transmission Service component of the capex forecast. We found the projects sampled to have been appropriately classified as non-contingent projects.

42. We have reached the view that four 275kV (500kV capable) augmentation projects have not been assessed appropriately by Powerlink in accordance with its capital governance framework and/or the requirements of the NER because:

    a. Powerlink has not provided (and appears not to have undertaken) a study which demonstrates a limitation in continuing to augment its 275kV system;

    b. The proposed 500kV capability will not be required within the next RCP;

    c. The strategic implications of a "move to 500kV" have not been articulated in accordance with the level of capital governance that would be expected of a proposed program with such significance and with implications for future expenditure that are well in excess of the projects proposed thus far;

    d. Rigorous and pro-active evaluation of non-transmission options that may obviate the eventual need for 500kV, has not been undertaken; and

    e. The supporting documentation provided by Powerlink suggests the costs of 500kV-capable construction are uncertain and the cost uncertainty and associated risks have not been sufficiently articulated in accordance with good capital governance.

43. We consider that two projects are both unlikely to be required within the RCP, particularly given the reduced demand forecast recommended by EMCa/NZIER. These are:

    - CP01470 (Halys - Greenbank) which Powerlink proposes to be commenced in the last years of the next RCP, under medium and high demand scenarios only (for commissioning subsequent to the RCP), and
    - CP 02477.3 (Western Downs to Halys second line) which Powerlink proposes to be commenced only in the final years of the RCP and only under its "high" demand scenario.

44. We therefore recommend that this capex is considered to be deferred beyond the current RCP.

45. For two other projects we accept the need for these lines to be constructed and to operate at 275kV (as Powerlink proposes). These are:

    - CP 01875 Halys-Blackwell, construction of which is about to commence, for commissioning in 2014, and
    - CP 01477.2 Western Downs to Halys first line, which (in Powerlink's medium demand) is proposed for commissioning in 2015.

46. However we consider that Powerlink has not justified the need for the considerable incremental spend that would provide "500 kV capability" for a notional future upgrade that Powerlink estimates may be required by around 2023 and which we would expect

would be further deferred by lower demand forecasts. We propose accepting capex for these projects consistent with the proposed 275kV operational voltage and disallowing the proposed incremental spend to provide future 500kV capability.

47. These adjustments lead to a proposed capex reduction of $549m.

Expenditure smoothing and its impact

48. Significantly front-loaded capex profiles that are evident in the current and the next RCPs could be smoothed to achieve a reduction in actual costs per project which would flow through to a reduced total capex. Our experience is that a component of capex can be smoothed without detriment to the business, over periods of a few years. In particular, we consider that the replacement capex profile could be improved to more efficiently manage both internal and external resources.

49. Smoothing will lead to a more efficient and more effective use of resources and this is likely to reduce costs. The cost reduction impact of such smoothing is a factor in proposing an efficiency adjustment (see below).

50. To assist with the efficient use of resources, particularly given the high level of proposed augmentation expenditure in the first years of the next RCP, the front loaded replacement capex profile across the 5 years of the next RCP should be smoothed by applying an average annual value for the non-scenario replacement capex projects.

Capex forecasting and cost estimation processes

51. Methodologies used by Powerlink for forecasting capex are considered to be for the most part fit for purpose and in alignment with good industry practice. The processes used contain the components that are required to ensure that capital expenditure forecasts are developed to meet service requirements and/or are based on the age and condition of assets.

52. We consider that opportunities to improve efficiency and reduce costs exist and these can and should be incorporated in its forecasting process. Accordingly, we consider that an efficiency adjustment should be applied to the uncommitted expenditure in Powerlink's forecasts comprising:

- A 1% reduction in forecast expenditure in the second year of the RCP; and
- A 2% reduction in subsequent years.

53. This would reflect realisation of the plan refinement process and project synergies, together with gains that could be achieved from a range of measures including more pro-active assessment of non-network options, resource smoothing, and gains from ongoing cost reduction and performance improvement programs within Powerlink's capital governance framework.

54. This efficiency adjustment leads to a proposed capex reduction of $45m.

55. The Cost Estimation Risk Factor ("CERF") of 3% that Powerlink has applied on top of the estimated cost of uncommitted projects is not appropriate because the continuous cycle of updating the BPO's that Powerlink undertakes provides a feedback loop that should progressively refine the accuracy of its estimates. EMCa does not accept that the need for this additional factor is evident from the report that Powerlink quotes as justification.

56. Excluding the CERF leads to a proposed capex reduction of $70m.

2.3.3 Conclusions on specific focus areas

Contingent project review

57. We consider that seven of the contingent projects meet the NER requirements. We consider that the following projects do not meet the requirements for contingent projects under the NER:

a. CP02542 (Columboola – Western Downs and Columboola – Wandoan 3rd circuit) does not meet the "probability" test under the NER, as it is required only with net loads well in excess of those assumed in the high scenario and only if that high LNG-related load cannot be sufficiently met by local generation;

b. CP02850 (NEMLink) does not meet the "probability" test, and we note that AEMO assumes that it would proceed only from around 2020/21;.

c. CP01125 (QNI upgrade) is unlikely to proceed unless the possibility of NEMLink was ruled out in NEM planning. Further, the justification for both this and the preceding project CP02850 relate to market benefits and we consider that neither project meets the capital expenditure objectives required under the NER;

d. CP02382, CP02537 and CP02600 (N-2 security to essential loads) does not meet the probability test within the RCP, noting that this is a conceptual proposal only that would require NEM consideration, decision, change to defined security requirements and then (assuming a positive decision) a staged implementation;

e. CP0219, CP04152, CP01527 and CP02359 (FNQ 275kV energisation) do not meet the probability test under the NER as they are predicated on an assumed N-2 requirement to FNQ that does not currently exist and Powerlink has not made clear under what mandate such a requirement may be imposed within the RCP.

58. Accordingly, we propose that the contingent projects identified above are not accepted.

Service target performance incentive scheme (STPIS)

59. Powerlink's processes for data capture and analysis appears to be generally sound with the exception of the following three areas.

a. Powerlink has not adequately justified its proposed adjustments to the performance targets for transmission circuit availability, transmission lines and transformers within STPIS and EMCa recommends that the AER not accept the proposed adjustments.

b. For the two Loss of Supply (LOS) parameters derived from the 'curve of best fit' an improved methodology would set the collar for 'large' LOS events and the cap for 'moderate' LOS events at 2 and not 3.

c. The weightings for 'large' and 'moderate' LOS events will provide improved and more meaningful incentives if they are reversed.

Classification of connection asset expenditure

60. We consider that Powerlink's application of clause 11.6.11 relating to classification of connection asset expenditure is consistent with its interpretation of this clause. Therefore, provided that the AER considers the stated interpretation to be acceptable, then it follows that the allocation of grandfathered connection assets should also be considered acceptable.

2.4 Summary of recommended adjustments

Proposed alternative proposal

61. The NER requires that:

If, in its final decision on the Revenue Proposal made under rule 6A.13, the AER does not accept the total of the forecast of required capital expenditure for the regulatory control period then the AER must, in accordance with clause 6A.13.2(b), use a substitute forecast of required capital expenditure.

62. EMCa proposes an alternative capex forecast that we consider would address each of the findings that we have identified and which we consider to be a more appropriate forecast for the purposes of revenue determination. Table 1 summarises the adjustments that would result from each of our headline findings on forecast capex.

Table 1: *Alternative capex proposal - individual impact of proposed adjustments*

$million (real 2011/12)

Adjustment	
Demand Forecast Reduction	- 554
500kV Adjustments	- 549
Carbon Reduction Target 5%	- 135
Cost Estimation Risk Factor	- 70
Efficiency	- 45

Note the overall adjustment is not cumulative because these adjustments are interdependent

Source: EMCa Strata

63. Table 2 sets out the impact of the adjustments calculated in combination. In aggregate the proposed reduction is $1,015m, resulting in total capex of $2,474m (before disposals). The time-profile of this alternative capex forecast is provided in section 5.4

Table 2 : *Alternative capex proposal – incremental and aggregate impact*

$million (real 2011/12)

	Incremental Adjustment	Cumulative Aggregate Adjustment	Adjusted Total Capex
Powerlink Forecast Capex			**3,488**
Demand Forecast Reduction	- 554	- 554	2,934
500kV Adjustments	- 301	- 854	2,634
Carbon Reduction Target 5%	- 78	- 933	2,556
Cost Estimation Risk Factor	- 48	- 981	2,508
Efficiency	- 34	- 1,015	2,474
Adjusted Capex		**- 1,015**	**2,474**
Less Disposals	- 4	- 1,019	2,469
Total net of Disposals		**- 1,019**	**2,469**

Source: EMCa Strata

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3 Capex in the current Revenue Control Period

3.1 Introduction

64. In order to make an informed assessment of the proposed capex programme for the next RCP, we carried out an analysis of the capex programme for the current RCP. We focused on the spread of expenditure and work across each year of the period and the efficiency of resource use. We compared the actual expenditure for 2007/08, 08/09 and 09/10 plus Powerlink's latest estimated expenditure for 10/11 and 11/12, with the annual regulatory allowances approved for the current RCP[3].

65. We considered the profile of expenditure over the current RCP and the impact of the irregularity of this on the proposals for the next RCP. We then focussed on the work estimated to be done in the 2011/12 year and considered the probability of this ambitious programme being achievable. We were particularly interested in this to provide some confidence that the extensive capex programmed for the first two years of the next RCP could actually be delivered.

66. We carried out an analysis of the demand forecast used for the current RCP (as provided in Powerlink's 2005 Annual Planning Report) and compared this with the actual/estimated demand for this same period, as provided in the 2011 Annual Planning Report. This was to assess the extent to which actual capex spend during the period reflects actual system demand growth.

[3] We note that it is not within the scope of the NER for the AER to make a determination on capital expenditure in the current RCP. Accordingly we have not assessed the prudency or efficiency of expenditure within this period.

67. We analysed the actual/estimated expenditure figures from the next RCP compared with the expenditure proposed in the current RCP for major projects with more than $25m spend. The intention was to provide some confidence in the reliability of the data from the probabilistic planning method.

3.2 Our review scope, approach and assumptions

3.2.1 Scope

68. Under our Terms of Reference we were required to undertake a high level review of the actual and estimated capex in the current RCP (2007/8 to 2011/12) and compare this with:

- The forecast expenditures allowed in the 2007 AER revenue cap decision.
- The proposed capex for the next regulatory control period.

69. We were also required to indicate whether our review of past capital expenditure raises any issues for consideration in evaluating the proposed forecast expenditure for the next RCP.

3.2.2 Approach

70. In considering the capex programme for the current RCP we first carried out an analysis of the profile of expenditure over the five years. We made a comparison between the profile of actual/estimated expenditure for the current period with the expenditure proposed for the next RCP.

71. We considered the nature of the projects completed and proposed for the current period and made a number of adjustments for transfers and contingent projects in order to make the comparison between regulatory periods more relevant.

72. We considered the profile of actual/estimated expenditure for the current RCP combined with the proposal for the next RCP and noted the significant variability of workload from year to year. We were concerned about Powerlink's ability to deliver such a variable workload and carried out a more detailed review of progress towards the 2011/12 programme. We consider that if Powerlink is able to deliver the 11/12 programme then we would have greater confidence in its ability to deliver the programmes for the following years, to 2014/15, after which proposed capex reduces in any case.

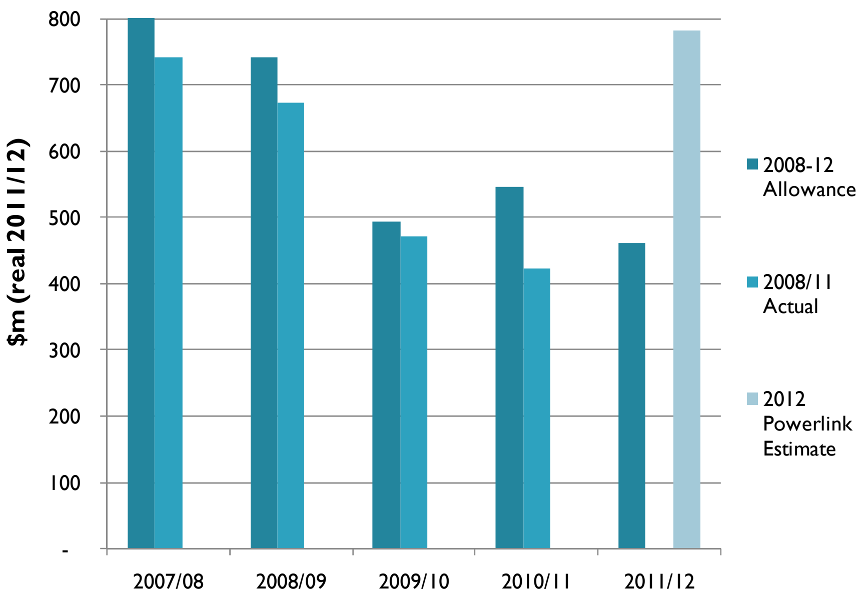
73. We also considered the variability of the expenditure with respect to the efficiency of resource use and the effect of that on staffing and contract costs.

74. In considering the current RCP capex actual/estimate performance to evaluate the implications for the next RCP we analysed all large projects proposed in the current RCP and reviewed the level of actual expenditure for all high probability projects.

3.2.3 Current RCP capex and initial observations

75. Powerlink's actual / currently estimated expenditure is shown in the figure and associated table below.

Figure 2: *Current RCP - allowance vs actual / estimated CAPEX*



Source: EMCa Strata (from Powerlink Data)

Table 3: *Current RCP - allowance vs actual / estimated CAPEX*

$million (real 2011/12)

	2007/08 Actual	2008/09 Actual	2009/10 Actual	2010/11 Actual / Estimate	2011/12 Forecast	Total
2008-12 Allowance	816	741	493	546	462	**3,058**
2008-12 Actual / Estimate	741	673	470	424	781	**3,089**
Variance ($)	- 75	- 68	- 23	- 123	319	**31**
Variance (%)	-9%	-9%	-5%	-22%	69%	**1%**

Source: EMCa Strata (from Powerlink Data)

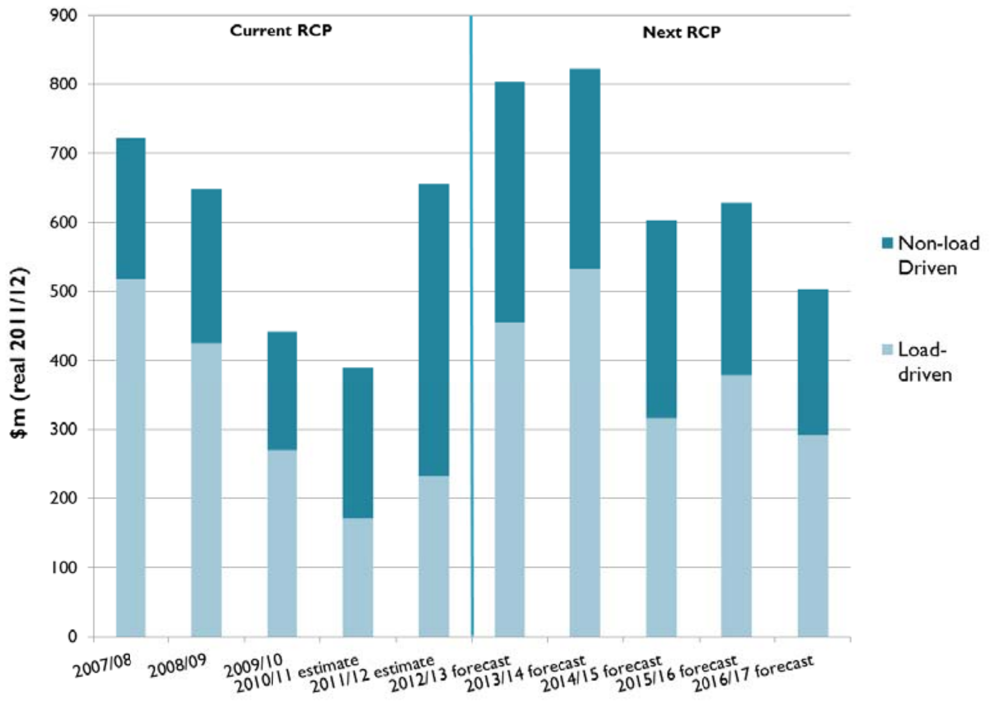
76. It can be seen that there is a significant difference between the actual/estimated expenditure profile over the five years compared with the profile originally submitted for the current RCP, with a substantial under expenditure in the first three years, which becomes more severe in year four. In year five Powerlink has forecast an 84% increase over the previous year, which would bring the total capex expenditure for the five years to $3,089m, and very close to the regulatory cap of $3,058m (in real $ 2011/12).

77. We also found that the profile of expenditure across the current RCP, when combined with the proposed capex for the next RCP, displays an unusually high peak over the next three years, before dropping off substantially again. It should be noted that Figure 3 below excludes the already constructed Kogan Creek and Surat Basin assets which total $100m and are to be transferred in to the RAB in the current RCP.

78. We are concerned about the ability of the organisation and its contractors to efficiently deliver the substantially increased amount of capex in the final year of the current RCP,

and in the first two years of the next RCP and we report later in this section on further investigations on this matter.

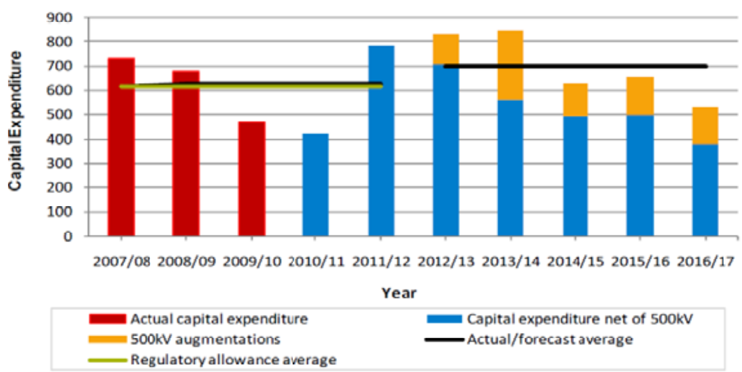
Figure 3: *Comparison of load-driven vs. non load-driven network projects*



Source: EMCa Strata (from Powerlink Data)

79. Powerlink presented the following graph showing only a slight increase in capex spend trend between the current and next RCP, as below. We consider this misleading since the average for the current RCP is pulled up by the very high forecast expenditure in 2011/12 which (a) has yet to be incurred, (b) may not all be deliverable and (c) includes "transfers" of existing assets into the RAB mentioned above and some contingent project expenditure, as against forecast non-contingent expenditure for the next RCP.

Figure 4: *Powerlink current and next RCP capital expenditure comparison ($m, 2011/12)*

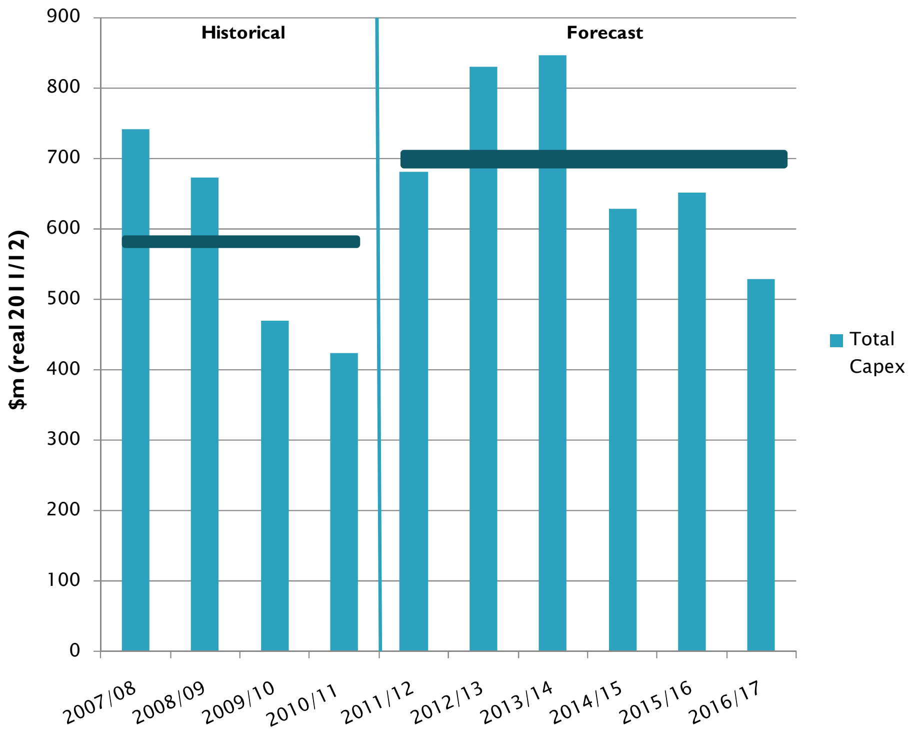


Source: Powerlink

80. We have made some adjustments for these factors, and present our interpretation of historical versus future forecast expenditure in the graph below. We consider that this

provides a more useful reference point as it compares "historical" actual expenditure with the forecast expenditure and which includes the uncompleted final year of the current RCP. This indicates that the Powerlink proposal represents 20% increase in average spend (in real terms), from the historical average.

Figure 5: *Historical and forecast capital expenditure comparison*



Source: EMCa analysis (from Powerlink Data, adjusted to exclude "asset transfers" as these are not expenditure)

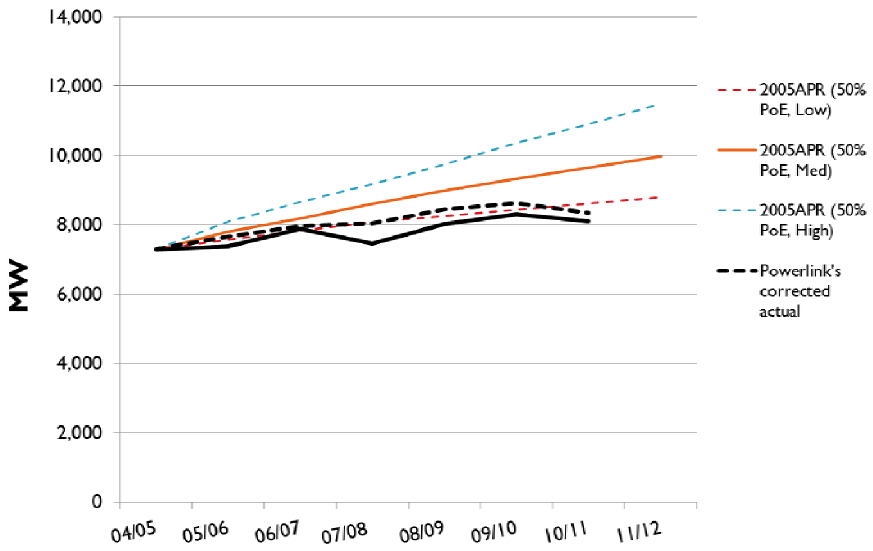
81. In view of our concern about Powerlink's ability to achieve the high levels of proposed capex in 2011/112, 12/13 and 13/14, we reviewed progress to date on contract commitments for the 2011/12 year. This analysis is discussed further in the next section.

3.3 Review of current capex

3.3.1 Demand analysis and its implications

82. We carried out a comparison of the latest demand growth figures from the 2011 Annual Planning Review (APR), with the figures provided in the 2005 APR (which we understand was the basis for Powerlink's 2007-12 revenue proposal) to establish what this signalled about changes in capex requirements for the current period. As can be seen from the graph below, the actual demand was below the low demand forecast from the 2005 APR and, after Powerlink's (upwards) correction for temperature in this period, this temperature-corrected demand was approximately equivalent to the 2005 low demand forecast.

Figure 6: *Actual demand versus demand forecast for current RCP*



Source: EMCa .NZIER (from Powerlink Data)

83. It is clear from this that Powerlink would have realised that demand was below the low scenario level from the beginning of the regulatory period, and would have had the opportunity to reflect this into an adjusted capex programme. This may have happened to an extent, as actual capex in the first four years of the RCP was approximately 11% below Powerlink's forecast. However, Powerlink has scheduled a major (84%) increase in the level of capex in year 5, which will bring the total capex for the regulatory period up to the level approved in the RCP. Powerlink's forecast peak summer demand for 2011/12 is now estimated to be 9,112MW, compared with the forecast of 9,974MW given in the 2005 APR for the medium scenario, a reduction of 862MW.

84. From Powerlink's revenue proposal for the current RCP, we note the following relationship between capex requirement and demand:

Table 4 : *Powerlink 2008-12 RCP – originally proposed capex and demand forecast*

2007/08 - 2011/12	Cost ($m)	MW
Med	2,894	9,937
Low	2,061	9,110
Delta	833	827

Source: EMCa Strata (from Powerlink Data)

85. This indicates that the capex requirement to meet demand approximating that which has eventuated would have been approximately $830m (real $2011/12) less than the capex that Powerlink proposed (and expects to spend).

3.3.2 Expenditure profile

86. We discussed with Powerlink the reasons for the low expenditure over the first 4 years of the current RCP, which are then followed by the 84% increase in network expenditure planned for year five. Powerlink expressed a view that the reduction in early years was driven by a reduction of demand owing to the global financial crisis, and

the big increase in the last year is due to the gearing up for the mining expansion, the LNG developments and in preparation for the proposed "500kV" developments.

87. We believe that the low expenditure over earlier years could possibly have been affected by all or some of the following factors:

a. Actual demand being substantially below the levels underpinning the capex programme assumed in setting the RCP cap;

b. An inability to deliver the work planned due to resource shortage of internal staff and external contractors;

c. The actual work plans varying significantly from the work programme assumed in the probabilistic planning model, as a result of year-on-year refinement;

d. Efficiency improvements achieved;

e. An original over estimate of the capex requirements.

88. It would be concerning if the 84% increase in expenditure in year five was driven by an effort to boost the total capex spend up to the level approved in the current RCP. Circumstantially, the big increase in capex is not matched by a convincing demand increase and we observe that Powerlink is planning large increases in non-load driven capex at the same time as it forecasts large increases in load-driven capex.

3.3.3 Comparison of works undertaken

89. We have examined the level of capex for the current period for two purposes. Firstly to assess a total value of work carried out, for use as a benchmark for evaluating the deliverability of the 2012/13 and 13/14 capex programmes. Secondly to assess how much of that work was included in the approved revenue cap. This figure is used to evaluate how much of the capex included in the revenue cap was used as intended.

90. In considering the first of these we have made adjustments for two projects which did not require the expenditure of new money, or the use of additional resources, to be completed. These projects involved transfer of existing assets from customer specific assets into the prescribed asset base. They were not included in the current RCP forecast capex, yet have been recorded in the proposal for the next RCP as capex to be rolled into the RAB in the current period.

- CP02100: Surat Basin ($74.7m)
- Kogan Creek: ($25.43m) (No CP number assigned).

91. Hence, for deliverability comparison we use a five year capex figure of $3,089m - $100m =$2,989m.

92. In considering the second issue, we carried out an additional adjustment by deducting expenditure on the following projects that were classified as "contingent projects" in the current RCP:

- CP: 01327 South Pine – Sandgate 275kV Transmission Line approximately $21m nominal dollars
- CP02030: Columboola to Wandoan Network Augmentation $46.98m nominal dollars
- CP02031: Columboola to Western Downs Network Augmentation $4.6m nominal dollars

93. Hence for comparison with the next RCP proposals, we use a figure of $2,989m - $76m (approximate conversion to real $2011/12) = $2,913m.

94. The Probabilistic Planning approach makes monitoring of Powerlink's performance difficult as there is no accountability for which projects are done, or for the accuracy of individual budget figures. We analysed the latest actual/estimated project costs from the pro forma statements and compared these with costs from the 2006 Proposal, converting data to real $2011/12 to enable comparison. We considered only projects over $25m and looked at those projects which were considered 100% certain and those with over 70% certainty to see how the actual expenditure compared with the 2006 probabilistic assessment. The results of this analysis are provided in Annex 1.

95. The results showed that of the 19 projects shown as 100% certain, four had no expenditure and three were more than 25% below the revenue submission forecast. Of the 14 projects with significant expenditure, the actual / forecast capex (as per Powerlink's 2011 submission) for six projects is more than 25% above the forecast in Powerlink's 2006 submission. The total spent on these 14 projects was $924m compared with the $750m budgeted for those projects.

96. There were a further six projects with greater than 70% certainty and of these only two had any expenditure recorded.

97. The total budget for the greater than 70% probability, high value projects was $1,288m and those with no expenditure against them totalled $389m. However, there were an additional 12 major projects, either not included, or included at less than $25m, with an aggregate spend of $647m, while the budgeted amount for these was $125m. One of these projects not included in the budget was CP01429 South West Queensland Augmentation, which has expenditure of $162m against it.

98. In summary, the correlation between the programme and the budget produced by the probabilistic planning model does not bear much similarity to the actual work done according to the later Annual Planning Reports. Whilst we are sympathetic to the view that a business should adapt its programme to changes in circumstances, we consider that there is also merit in having a greater degree of transparency to the programmes of work that form the basis of regulatory determinations, the programmes proposed in the APRs and the year-by-year changes to those programmes.

3.3.4 Transitioning from current to proposed levels of expenditure

99. In order to provide some confidence of Powerlink's ability to achieve the high levels of proposed capex in 2011/112, 12/13 and 13/14, we reviewed progress to date on contract commitments for the 2011/12 year. We considered the progress for the 28 largest projects (10% by number, 75% by value) to establish whether the projects were approved, whether major contracts had been awarded and whether site work had been started. The results of this analysis are presented in Annex 1. In this analysis we have made an estimate of the probability of completing each project to produce a probability-based figure for the whole programme. This provided an aggregate figure of 88%, which provides a guide as to how much of Powerlink's forecast 2011/12 capex we consider likely to be spent. Hence we estimate that the amount of the 2011/12 programme likely to be spent is $688m (as shown in the table below).

Table 5 : *Actual, estimated and forecast capex for transition from current to next RCP*

$million (real 2011/12)

Year	CAPEX ($m)	Increase ($m)	Increase (%)
2010/11	424		
2011/12	688	264	62%
2012/13	830	142	21%
2013/14	846	16	2%

Source: EMCa Strata (from Powerlink data, adjusted by EMCa Strata for deliverability and to remove 'transfers')

100. We are concerned that Powerlink's staff and external contacting staff will be heavily stretched to achieve the additional increase in work in the 2012/13 year, and that this will not only endanger the completion of the programme, but will also increase the cost of work done.

3.4 Our findings and observations

3.4.1 Findings

101. Powerlink's profile of expenditure in the current RCP has been opposite to the profile of the allowance assumed for revenue determination purposes in 2005/06, in that it has been less than proposed for the first four years and Powerlink forecasts that it will be considerably greater in the final year.

102. We consider that, in aggregate, Powerlink's capex in the current RCP may have been higher than was necessary, given that actual demand in this period is just below the low demand estimate that Powerlink proposed for this RCP. This approximates a peak summer demand of over 800MW (10%) less than the medium demand forecast by the end of this period (i.e. by 2011/12).

103. Notwithstanding this considerably lower demand, Powerlink estimates that its capex for this period will be close to that which was included in its revenue allowance as being required to meet a medium demand scenario. Whilst this variation can in part be explained by the inertia of the planned capex that prevents swift responses to the changing intra RCP demand trends, we consider that it has not been fully explained in Powerlink's proposal.

104. Powerlink's estimated 2011/12 expenditure represents a considerable step increase compared with the previous four years of the current RCP. Our assessment is that Powerlink has the capability to deliver this, but we consider that it is likely that it will not be achieved and may not be fully required in any case. We consider that some projects could have been prudently deferred for consideration in the next RCP and that this smoothing would also provide a more efficient cost outcome for Powerlink (see comments in the observations section below).

3.4.2 Observations

On deliverability

105. In considering the deliverability of the proposed capex programme, we estimate that the 2011/12 year programmed spend of $781m is likely to be underachieved by 12%

($94m). This still represents an increased spend over the previous year of $264m (62%). For the 2012/13 year a further increase of $142m (21%) is proposed, which we think is possible, but at risk. We are also concerned about the 2013/14 year with a further increase in spend, although in the years after that spend drops off and causes no concern from a deliverability perspective.

On actual capex in relation to actual versus forecast demand growth

106. The actual demand for the period is just below the low scenario figures, which approximates to a reduction in Peak Summer Demand of at least 827MW by the end of 2011/12. On Powerlink's estimates (from the previous RCP process) this should have allowed the deferral of at least $700m of capex over the current RCP. After correcting for asset transfers (which do not represent actual capex within the period) and for contingent projects that were not in the original forecast, we estimate that Powerlink will have spent approximately $170m less than was forecast, implying that it already has the capacity to absorb some future growth.

107. This "under-spend" is also, in our view a more valid representation than Powerlink's claim to have essentially incurred capex to the levels that it had previously forecast.

On resource smoothing and its implications for efficiency

108. We consider that Powerlink should give serious consideration to smoothing out the capex workload across years and between RCPs to improve the efficiency of use of its own staff and that of external contractors. In short, if Powerlink has enough staff to cope with the peak workloads, then they have too many for the lean times. Also if its contractors have to shift staff out of state or source them internationally, then this must incur additional costs which inevitably flow into contract pricing. [C-I [redacted] We believe that smoothing resources will produce long term cost savings, and this is one of several factors that we have taken into account in our assessment of Powerlink's proposed capex for the next RCP.

109. Powerlink appears to make little effort to smooth the capex expenditure from year to year and this results in substantial peaks and troughs of work for its own staff and for its contractors. The view is that contractors can pull in extra resources from other states and from overseas.

On transparency

We are concerned that the probabilistic approach does not allow the AER to clearly identify which projects are expected to be completed in which years. This makes monitoring of Powerlink's performance difficult as there is no accountability for which projects are done, or the accuracy of individual budget figures. Our analysis of the actual work done does not provide confidence that the outcomes from the probabilistic planning approach as it was applied in 2006 were as proposed and we do not see evidence of ex-post review by Powerlink or of data that would facilitate such review by the AER.

4 Powerlink's proposed capex for next Revenue Control Period

4.1 Introduction

110. In this section we provide our assessment of Powerlink's proposed capex for the next RCP. We first summarise Powerlink's capex proposal. In subsequent sub-sections we describe specific focus areas of our review, covering, in turn:

- Powerlink's capital governance structure;
- Powerlink's methodologies and assumptions for forecasting capex;
- Powerlink's cost estimation methodologies;
- Powerlink's probabilistic methodology for determining its proposed capex; and
- Our review of a sample of specific projects.

111. We summarise our findings on Powerlink's proposed capex in section 4.8. Proposed capex adjustments resulting from this review are described in section 5.

4.2 Powerlink's proposed capex

112. Powerlink's capex proposal for the next RCP is set out in table 6, below:

Table 6: *Powerlink capex proposal for next RCP*

$million (real 2011/12)

	2012/13	2013/14	2014/15	2015/16	2016/17	Total RCP	% of Total
Network Capex							
Committed	529	356	60	12	3	**958**	27.5%
Uncommitted	275	468	544	617	501	**2,405**	69.0%
Total Network Capex	804	823	604	629	504	**3,364**	96.4%
Non-Network Capex	26	24	25	24	25	**125**	3.6%
Total Capex	830	847	629	653	529	**3,488**	
Less Disposals	1	1	1	1	1	**4**	
Total Net Capex	**830**	**846**	**628**	**652**	**528**	**3,484**	

Source: EMCa Strata (from Powerlink Data)

113. The capex proposal is comprised of:

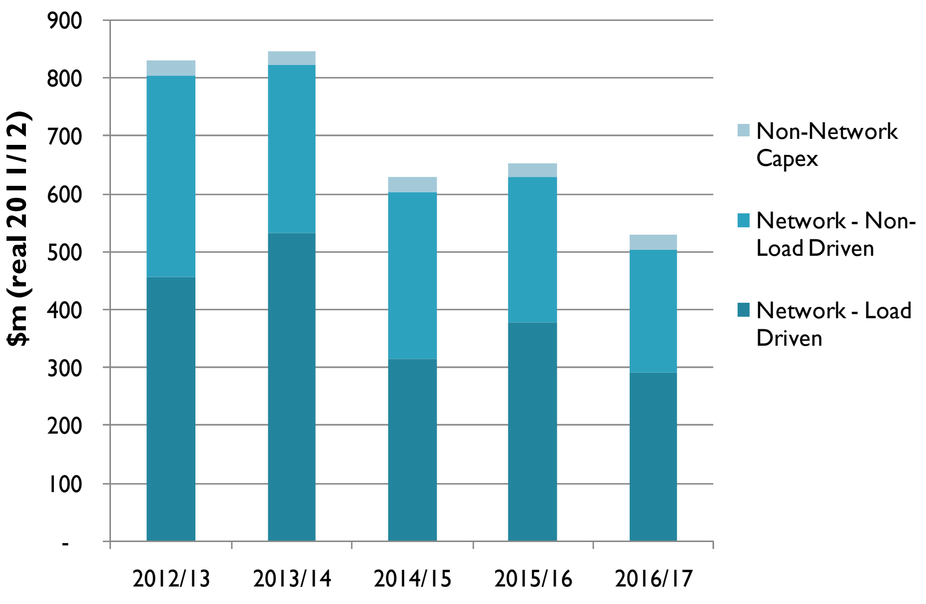
a. **Uncommitted network projects -** projects which have not yet been approved. At $2,405 million these represent 69% of the total RCP capex proposal of $3,488 million. These projects are further disaggregated into "scenario" projects, meaning that their need, cost or timing is in some way dependent on the demand, generation or other scenario parameter, and non-scenario projects, such as replacements, refurbishments or physical security-related projects that are unaffected by scenario parameters.

b. **Committed projects** - approved network projects which, at $958 million, represent 28% of total capex.

c. **Non-network projects -** these are comprised of Information Technology, Commercial Buildings, Motor Vehicles and Tools and represent 3.6% of total capex.

114. The distribution of capex across each year reflects a significant loading of projects in the first two years (48% of total capex across the RCP). The graph below shows Powerlink's proposed expenditure, categorised as load-driven projects, non load-driven projects and non-network projects.

Figure 7: *Powerlink capex proposal for next RCP*



Source: EMCa Strata (from Powerlink Data)

115. Load driven and non load-driven capex (which is driven by asset condition) make up 59% and 41% of total forecast capex respectively.

116. The following table sets out network capex by project category:

Table 7: *Powerlink capex proposal by project category*

$million (real 2011/12)

		2012/13 forecast	2013/14 forecast	2014/15 forecast	2015/16 forecast	2016/17 forecast	Total
LOAD DRIVEN	Augmentation	415	489	261	316	248	**1,730**
	Easements	25	31	46	54	33	**189**
	Connections	15	12	8	8	11	**55**
	Total Load Driven	**455**	**533**	**316**	**379**	**292**	**1,974**
NON-LOAD DRIVEN	Replacements	300	241	260	227	200	**1,229**
	Security/Compliance	19	19	9	3	2	**51**
	Other	30	30	20	20	10	**110**
	Total Non-Load Driven	**349**	**290**	**288**	**250**	**212**	**1,390**
NETWORK TOTAL		**804**	**823**	**604**	**629**	**504**	**3,364**

Source: EMCa Strata (from Powerlink Data)

117. Table 7 above reflects the predominance of Augmentation (51%) and Replacement (37%) projects in the composition of overall network capex. This expenditure represents a significant increase on historical expenditure (i.e. to 2010/11), as was shown in section 3.

118. The average annual capex spend is set out in table 8.

Table 8: *Average annual capex – comparisons between periods*

$million (real 2011/12)

Comparison across RCP's	Average annual spend	Increase
RCP2008-12	598	99
RCP2013-17	697	17%

$million (real 2011/12)

Comparison Actual vs Forecast	Average annual spend	Increase
Actuals (2008-11)	577	117
Forecast (2012-17)	694	20%

Current RCP capex is restated to exclude transferred assets comprised of CP02100 Surat Basin ($74.7m) and Kogan Creek ($25.43m, no CP number assigned)

Source: EMCa Strata (from Powerlink Data)

119. This compares: the current RCP spend (excluding transfers) with the next RCP; and, 'actual' capex to June 2011 (4 years) with forecast capex July 2011 to June 2017 (6 years). Note that the data for the 2010/11 year has been treated as actual on the basis

of Powerlink's advice during our June on-site visit that actual capex was tracking very closely to the estimate.

4.3 Review of Powerlink's capital governance framework

4.3.1 Introduction

120. We were asked to review Powerlink's capital governance framework including its capex strategies, policies and procedures. Specifically, we were asked to assess whether Powerlink's capital governance framework:

a. reasonably reflects the capex objectives and criteria under clause 6A.6.7 of the NER;

b. is based on sound principles that are in accordance with its capex strategies, policies and procedures;

c. provides a reasonable basis for developing Powerlink's forecast capex; and

d. is effectively coordinated across the organisation.

121. The following sub-sections provide a summary of the approach we have taken and set out our key findings. It is not our intention to provide a detailed description of Powerlink's capital governance framework, however we do provide a high level summary of its structure and components.

4.3.2 Assessment approach and assumptions

122. Our top down review of Powerlink's capital governance framework is central to the approach we have taken to this review. As the capex expenditure forecasts and Powerlink's actual capex are determined from the application of the capital governance framework, a fit-for-purpose, quality framework is necessary to ensure appropriate and efficient capex outcomes.

123. A key proposition implicit in our approach is that, if the asset management systems are consistent with good industry practice and have been properly applied, then the output asset management plans, projects and expenditure forecasts are likely to be reasonable, appropriate and efficient.

124. For the above proposition to be correct reliance is placed on the application of sound and accurate input assumptions such as demand forecasts, unit cost rates, asset condition information etc. It also relies on Powerlink appropriately applying its capital governance framework in practice. A key objective of our on-site and sample project review was to test the extent of Powerlink's application of its capital governance framework.

125. For the top down assessment of Powerlink's capital governance framework we established assessment criteria that included the requirements of the NER (6A.6.7) and

also took into account the requirements of the ToR and some additional criteria we considered to provide good industry practice benchmarks[4].

126. As information was obtained from Powerlink our review was expanded to ensure the assessment of the capital governance framework included all asset management systems and processes used by Powerlink to establish its capital expenditure plans. In addition, we sought to include any good industry practice standards or benchmarks used by Powerlink as criteria in our assessment framework. From the outset, our review has focused on asset management policies, strategies, systems and processes. This approach established a view of the quality of Powerlink's capital governance structures, its asset management systems and expenditure planning procedures.

127. Throughout the review we questioned, sought further information and assessed how Powerlink ensured that it was delivering least cost outcomes (taking into account full asset life cycle costs). We also sought information on the methodologies used by Powerlink to ensure this was occurring.

128. A primary focus of our assessment of the capital governance framework was Powerlink's monitoring, review and improvements systems including how the resulting benefits were measured and taken into account when developing capex forecasts.

4.3.3 Our assessment

129. The core of Powerlink's capital governance framework is the Asset Management System that encompasses the policies, strategies, methodologies and procedures used to manage the company's assets.

130. Two key management concepts used to drive the asset management system are Asset Management and the Asset Life Cycle. The combination of these concepts provides the basis for Powerlink's approach to asset management and the establishment of projects and subsequent capital expenditure.

131. A description of our understanding of the structure and components of Powerlink's capital governance framework is provided in Annex 4. In this section we highlight some key areas of the capital governance framework that have led to our key findings.

Asset Management System structure

132. Powerlink has an Asset Owner/Asset Manager/Service Provider structure which provides focus on specific aspects of infrastructure management and allows a concentration of skills and disciplines in related areas. From a capital governance perspective, the structure is designed to allow Powerlink's Board to focus on key strategic and larger value items.

[4] Good industry practice benchmark criteria were developed with reference to PAS 55 Asset Management Standard, AS/NZS ISO 31000:2009 Risk Management/Principles and Guidelines and the New Zealand Asset Management Support Group (NAMS) International Infrastructure Management Manual. See in particular PAS 55 – 2008 4.2

133. Powerlink's Asset Manager organisational structure includes all the core areas and functions necessary to undertake the asset management and capital governance functions. Powerlink's data acquisition, management and assessment processes and procedures for operational asset management and maintenance appear to be well organised and managed.

134. The combined use of Asset Management and Asset Life Cycles in the capital governance structure is aligned with current industry standards for infrastructure industries. The cycles are given prominence in Powerlink's asset management documentation and our desk top and on-site investigations gave confidence that they are being implemented in practice

135. Successful operation of the Asset Owner / Asset Manager / Service Provider (AO/AM/SP) model requires that information flows between the functions occur at an appropriate level of detail and relevance. The Asset Owner must be provided by the Asset Manager with information and guidance sufficient to ensure sound strategic decisions can be made. Conversely, the Asset Owner must provide clear guidance and direction to the Asset Manager and this is usually provided through approval of strategies and polices.

136. Our assessment is that information flows across the Powerlink AO/AM boundary do not always seem to meet the standard that we would expect to find. We consider that this has implications particularly for significant strategic groups of related capital projects, such as the suite of 500kV-capable investments. We discuss this issue further in section 4.7.

137. Good industry practice[5] allows for an organisation to choose the option of using a minimal Asset Management Policy combined with more detailed asset specific policies. However, we consider that for the AO/AM/SP structure, the Asset Management Policy should be a significant guiding reference document that provides direction for the asset manager. We take this view because high capital value infrastructure assets require a broader strategic view to be taken that cannot be provided at the specific asset policy level alone. We consider that Powerlink's documented Asset Management Policy, which comprises less than one page, is not adequate for this purpose.

138. At the asset management level, in the majority of cases Powerlink's specific asset policies are well documented and are structured in a manner that allows them to be used consistently for asset management practice.

139. However, the Investment Decision Making process is a key component of the capital governance framework. This process is not a documented and approved process but rather an implied process derived from the application of Asset Management Strategy, Joint Planning Process, Capital Project Approval Procedure and Project Implementation Process. This is not necessarily a problem given that Powerlink has clearly documented capital investment management procedures and strategies in place. However, providing a documented end to end map of the process through which capital

[5] PAS 55 – 2008 4.2

investment decisions are made would provide a useful reference for those involved in that process.

Implementation of the Capital Governance Framework

140. The top down review of the capital governance framework provides a view of the mechanism through which Powerlink develops, approves and implements its capital investment program. The capital governance framework governs the production of cost estimates on which the capex forecasts in the Proposal are based. The capital governance framework will only deliver efficient outcomes if it has been consistently applied in practice.

141. In our review we investigated the implementation of the capital governance framework through the on-site review and through our review of a selection of individual projects. A summary of our project reviews is provided in section 4.7 with more detail on the process for this review in Annex 3.

142. In general, we consider that Powerlink is implementing its capital governance structure in practice when developing, approving and implementing individual capital projects. However, we have identified a number of systemic implementation areas that we consider may have led to suboptimal capital investment outcomes. These areas are:

   a. Informed strategic decision making:

      i. Strategy appears not to be consistently driven at a governance level;

      ii. The full extent of some significant strategic developments does not appear to have been addressed at Board level to the extent that we would expect;

      iii. A governance approach focused around individual projects rather than a strategic program focus;

   b. Level of monitoring, measuring and reporting may be leading to foregone opportunities for capital governance framework improvements and cost efficiency gains.

143. Each of the above areas is discussed in the following sections.

Informed strategic decision making

144. In the preceding sub-section we discussed the importance of adequate and accurate information flows across the Asset Owner/Asset Management interface of Powerlink's AO/AM/SP structural model. If this does not occur, the Asset Owner (Powerlink's Board) may make sub-optimal strategic decisions relating to network development and consequently capital project investments.

145. We were informed by Powerlink management that whilst the Asset Owner is made aware of strategic network development issues there is no requirement for formal approval of the strategies. Approval of the strategy is considered to be implicit in the approval of individual projects that are submitted in accordance with the strategy.

146. The omission of Asset Owner approval of key strategic capital investment programs is unlikely to reflect good industry practice since it does not recognise that the Asset Owner will be in a better position to take a broader strategic perspective than the Asset Manager. The potential impact of this issue can be highlighted by reference to a key strategic capital investment program; namely, the decision to move to a 500kV capable network in Queensland.

147. Documentation and discussion with Powerlink[6] demonstrated that the Asset Manager had presented the need for and potential development of a 500kV network but that Asset Owner approval for the resulting strategy was not required. We consider that the information provided did not include a sufficiently broad assessment of the long term cost implications and strategic options as they developed over time, or of the counterfactual to the 500kV-capable development project(s), to the extent that they have been presented to the Board. The implications of this are discussed further in the Sample Project review (section 4.7 of this report).

148. Given that strategies for network development impact on the value and risk faced by the Asset Owner we find it surprising that we did not see evidence of a formal approval process for the assumed 500 kV network development strategy. A formal process would require comprehensive information flow across from the Asset Manager to the Asset Owner providing the information base that the Board would require to make significant strategic network development decisions.

Individual project rather than strategic program focus

149. An important feature of the AO/AM/SP model adopted by Powerlink is the focus on individual projects rather than program or expenditure category. As discussed previously, at the Asset Owner level the Powerlink Board is provided with total capex performance against budget and, in addition, monitors projects that are above $20m in total value.

150. The project based approach adopted at the Asset Owner level has been cascaded through the Asset Management function. The development of Powerlink's capex planning and forecasting demonstrates how this building block approach works in practice.

151. The augmentation component of the capex forecast is developed from the triggering of individual projects and each project is treated primarily as a stand-alone investment. Initially asset replacement projects are considered differently, being driven from the asset life cycle management and condition assessment. However, once identified, the asset augmentation projects are approved, managed, monitored and reported on an individual project basis

152. It is acknowledged that Powerlink is deriving considerable benefit from the AO/AM/SP model and that focus on the performance of individual projects has produced gains in the effectiveness of cross functional project management. The introduction of the Network Investment Steering Committee (NISC) as a standing cross functional committee overseeing network investments as been recognised as producing significant improvements in the management of capital projects. The NISC represents a major

[6] To gain a better understanding of the 500kV network strategy and the capital governance aspects with regard to the formulation, content and agreement of this strategy; further information was obtained from Powerlink. The following material was provided: response from Powerlink detailing the history and providing supporting material or references of: decision making and strategic plan development, strategic easement and land acquisition, notification and consultation, information provided to Powerlink's Board and Board decisions relating to the development of the 500 kV.

improvement that has brought cross functional review and challenge to capital project development. However we consider it to be a weakness that this Committee's role does not flow on to implementation.

153. Despite the benefits being derived from the project centric approach opportunities for process improvement and efficiency gains are likely to be missed as a result of not monitoring, measuring and reporting performance against a broader set of categorisations.

Level of monitoring, measuring and reporting

154. The monitoring of capex expenditure at the Asset Owner level is limited to overall actual capex against budget and individual project reporting for projects above $20m. The Asset Manager function monitors at a project level with no reporting of expenditure in aggregated categories, asset categories or on a program basis.

155. Many of the capital investment projects can be considered to be part of programs. For example the 132kV replacement program contains several individual projects and the 500kV capable projects combined form a major strategic program. It is also possible to consider programs based on specific regional demand growth such as in the Surat Basin.

156. The objective of undertaking monitoring on an aggregated level is that it can reveal issues that viewing expenditure at granular level may not. For example, viewing expenditure on an aggregated level can highlight areas where optimisation of resources can occur.

157. Viewing Powerlink's capex profile for the next RCP[7] we see that the initial two years are forecast to have a much higher expenditure than the later three years. The current RCP forecast capex profile (i.e. 2008-12) followed a similar profile, yet actual expenditure has followed the reverse trend. From a resource perspective these variable profiles can add significant costs as manpower has to be more actively managed and this is likely to lead to higher costs.

158. Monitoring capex at an expenditure category level may reveal opportunities for spreading work more evenly across the years.

Continuous improvement, efficiency and cost reduction gains

159. The AER has asked[8] that we identify and take into account changes made to the capital governance framework during the current RCP. We have also sought to identify the improvements that Powerlink expect to make during the next RCP.

160. The approach we took to address this question was to ask Powerlink to identify the changes and improvements that it has undertaken in the current RCP and expects to make in the next RCP. We asked Powerlink to quantify the realised and expected benefits arising from the changes and improvements. In addition we asked Powerlink to

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[7] See section 4.2

[8] AER Terms of Reference B3 paragraph 21

demonstrate how the expected benefits have been taken into account when developing the forecast capex.

161. The improvement initiatives identified by Powerlink together with our views on improvements that have been made are provided in Annex 12.

162. Whilst the initiatives identified demonstrate that Powerlink has and will continue to identify improvement opportunities, we observed that Powerlink found it difficult to identify and describe improvements and efficiency gains and quantify the net benefits derived from their introduction.

163. Standard quality management frameworks and good industry practice suggest that continuous improvement requires structure and visibility within an organisation. In particular the use of measurement and targeting is seen as an essential component of quality and cost management.

164. We have found it notable that Powerlink does not have a formally managed focus on continuous improvement and cost management. During our on-site review Powerlink management informed us that continuous improvement and cost management are implicit in every manager's approach – "we just do it". Whilst we found evidence to support this view, we also found that learnings were not sufficiently shared across the organisation. Most importantly, we found that Powerlink does not quantify and target potential benefits from improvement initiatives and that the improvement initiatives were not driven and monitored at a senior management level.

165. When we questioned Powerlink on where it considered the next big efficiency gains would be made, Powerlink responded as follows:

> *"Powerlink is at the efficiency frontier and all the big gains in efficiency and productivity such as:*
>
> - *Moving offices from the city to the suburbs saving in rental costs; and*
> - *Consolidating the control centre function in one location,*
>
> *have been realised."*

166. From our observations we agree with Powerlink's management that the talented individual managers have, and will continue to, introduce improvements and be conscious of the need to manage costs. However, we consider that the introduction of a formal continuous improvement and cost management program which includes cross functional teams and targets is likely to produce a big efficiency gain for Powerlink.

167. One improvement initiative that we consider has the potential to produce significant economic gains and reduce the capex spend is the development of a more proactive approach to transmission alternatives. Our reasons for taking this view are set out in Annex 10. We have also identified areas that we consider may realise gains from improvement programmes in Annex 12.

168. Many organisations have introduced quality and cost management programs and we consider that such a program would lead to efficiency gains in regards Powerlink's capex expenditure. In section 4.4.3 we report our assessment of the measures that could be addressed and the gains that could be achieved from such a program.

4.3.4 Findings on Powerlink's capital governance framework

Summary of findings

169. Whilst we have observed that Powerlink's capital governance framework generally aligns with asset management standards and good asset management practices, we consider the following improvements would lead to better outcomes:

a. Greater emphasis on the strategic nature of programs of proposed work, at the Asset Manager / Asset Owner level, would lead to better-informed strategic decision making;

b. An executive-led formal cost reduction program may realise material capex efficiency gains;

c. Inclusion of an executive-led formal continuous improvement program in the capital governance structure would help to ensure that Powerlink is "driving the network" as efficiently and effectively as possible;

d. A more pro-active process for identifying and assisting with the scoping of non-network alternatives is likely to lead to further reductions in network investment requirements.

170. These findings have implications for the inclusion of certain projects in the forecast capex, and for the costing of all uncommitted projects, as covered in subsequent sections.

Key observations

171. Powerlink's organisational structure demonstrates a 'fit for purpose' design and includes all the required features to undertake the asset management and capital governance functions. Recent improvements made through the establishment of the Projects and Portfolio Management Team within the Network Strategy and Performance business Unit demonstrate that the structure is still evolving and can be responsive to improvement opportunities.

172. Had Powerlink been identifying opportunities to drive the network harder we would have expected to see strong and proactive consideration of smart grid technology and non-network solutions being undertaken and that these would have a strategic prominence within the organisation. Non-network or transmission alternatives may have potential to realise significant economic benefit. A discussion of non-network solutions is provided in Appendix 7.

173. We identified a potential issue relating to the categorisation of expenditure between capex and opex. Opex on towers (i.e. maintenance) has been deferred up to the point where refurbishment/replacement is required towards the end of the asset's life (classified by Powerlink as capex).

174. From a benchmarking perspective this will have a positive effect on Powerlink's ITOMS position relative to other transmission network providers that have a different strategy and categorise life extending refurbishment as maintenance, or that undertake higher levels of preventative maintenance. Also past maintenance strategies may have led to the need for higher forecast capex and this may be sub-optimal on an asset maintenance lifecycle basis. Whilst we found no evidence to suggest the Powerlink was not optimising the capex/opex expenditure, we do consider that, given the substantial

132kV replacement programme, Powerlink's claimed high performance in ITOMS needs to be considered in this overall expenditure context[9].

175. Whilst we agree with Powerlink that the team based, project centric structure will assist to "ensure the efficient implementation of projects" we observed that the individual project focus may be delivering sub-optimal outcomes and providing a single dimensional view of the capital governance framework's overall performance.

Implications for the proposed capex for the next RCP

176. The opportunities that we believe exist for Powerlink to gain material benefits from the introduction of formal efficiency and cost reduction programs are considered in section 4.4.3.

177. Our findings regarding the information flow from Asset Manager to Asset Owner contribute to our concerns and issues regarding the 500kV network. The implications of this are discussed in section 4.7.4.

178. Both factors have led us to suggest adjustments to capex, and our assessment of these adjustments is presented in section 5.

4.4 Review of Powerlink's methodologies and assumptions for forecasting capex

4.4.1 Introduction

179. In this section we report our review of Powerlink's overall forecasting process, including Powerlink's Capital Accumulation Model (CAM). In section 4.5 which follows, we review the methods used for costing these projects, which includes the use of "Base Planning Object" (BPO) unit costs, the application of a "risk factor" on top of those project costs and the application of differential cost escalators. In section 4.6 we report on our review of the "probabilistic planning" methodology that is an integral part of Powerlink's approach.

4.4.2 Assessment approach

180. Powerlink's Revenue Proposal identified the methodologies and assumptions on which the capex forecast had been based. Powerlink also provided additional information and documentation during the course of our review. We formed our views on the reasonableness and application of Powerlink's methodologies and assumptions based on this information and documentation and through more detailed investigation undertaken during our on-site review.

[9] Another factor that we expect significantly advantages Powerlink in its ITOMS ranking, without necessarily indicating good performance, is high capex-led growth in the asset value denominator of opex/asset value ratios

181. Our assessment of Powerlink's capital governance framework identified policies under which the methodologies and assumptions had been developed. Given the presence of appropriate policies, our review largely focused on the compliance of the methodologies and assumptions with these policies and their application in formulating the capex forecast. It should also be noted that much of the forecast capex proposed by Powerlink for revenue determination purposes is at an early stage only in its capital governance process. We therefore focused particular attention on forecasting of expenditures for such projects, including project "need" and costing.

182. Powerlink has developed a process based methodology for forecasting capex. These processes differ depending on project status and type, and Powerlink adopts the following nomenclature:

Project Category	Description
Uncommitted	Uncommitted projects are network projects that have not been progressed through formal business case development and approval
Committed	Committed projects are network projects which have been approved
Non-Network	IT and Business Support projects
Contingent	As per definition in Chapter 6A of the NER

183. A description of the key components of the capex forecasting processes for the above project categories is provided in Annex 5. In brief, Powerlink forecasts capex for uncommitted projects using its Capital Accumulation Model (CAM). This model takes costed projects along with their timings for a number of scenarios, applies a risk factor, applies cost escalation and produces a weighted probabilistic capex forecast for uncommitted projects. This is then combined with the forecast for committed projects and non-network projects, to produce an aggregate capex forecast.

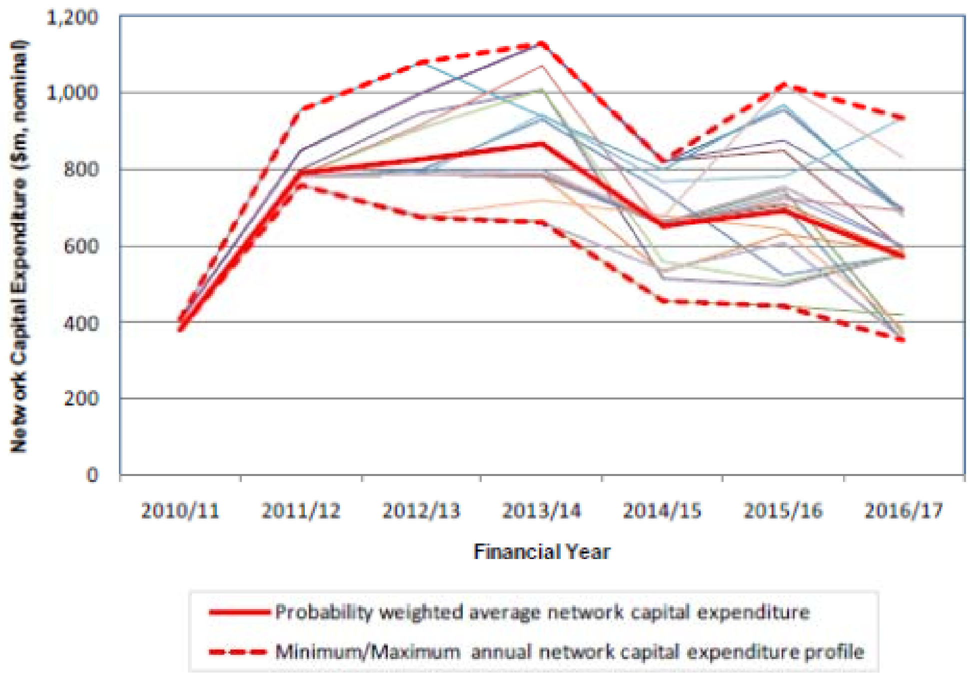
4.4.3 Our assessment

Uncommitted projects and the CAM model

184. The CAM is an Excel based model used by Powerlink to produce a forecast capital expenditure for uncommitted network projects. The CAM applies a range of factors to adjust the costs and timing of capex on projects contained in each of 20 probability weighted scenarios. The sum of adjusted project costs for each scenario is multiplied by the probability each scenario will occur, and the overall forecast arrived at by summing this value across all scenarios. This is then converted from escalated values to real ($2011/12 mid-year) for inclusion in Powerlink's capex proposal.

185. Figure 8 shows the expenditure profiles for the 20 scenarios used by Powerlink in its scenario modelling. The wide spread of expenditure possibilities from this process is evident.

Figure 8: *Network capital expenditure profile (probabilistic scenarios)*



Source: Powerlink (Revenue Proposal, figure 8.5)

186. The forecast for uncommitted project capex is comprised of:

- the full estimated cost of projects which appear in all 20 scenarios
- the probability weighted proportion of the cost of projects which appear in less than 20 scenarios.

187. The resultant capex forecast (in solid red in Powerlink's diagram above) does not directly represent specific projects but is a composite figure arrived at by summing the probability weighted portions of the cost of each such project.

188. Projects in each scenario include non-load driven projects (such as the replacement of assets) and load-driven requirements (such as network augmentation). Non-load driven projects appear in all 20 scenarios, as their requirement is based on condition. Load-driven projects may appear in any number of scenarios, including all 20 scenarios, depending on the assessment of the probability it will be required.

189. We note that Powerlink separates uncommitted projects into "scenario" and "non-scenario" categories. Confusingly, non-scenario projects are included in the scenarios input into the CAM, however they are all included at 100% probability i.e. they figure in all 20 scenarios. Scenario projects however are not, as might be expected, all at less than 100% probability. $312m out of $1,239m of scenario projects are at 100% probability. Almost all scenario projects are load-driven while non-scenario projects are a mix of load- and non-load-driven projects.

190. Further information on the CAM model is provided in Annex 5.

CAM stress-testing

191. We have tested the validity of the application of escalators and other variables in the model by applying different values and assessing the results. Specifically we have:

a. applied different values across the model to test the validity of the formulas and linkages;

b. assessed forecast capex outcomes across specific categories of scenarios, project and asset types. We noted that forecast capex for the aggressive LNG scenario (with medium demand and medium Carbon Price Trajectory) was $146.8m lower than for the moderate scenario. This was unexpected but has now been satisfactorily explained by Powerlink;

c. modelled a 10% increment in a single year across all escalators. We are satisfied that the mathematical application of escalators and other variable factors (the CERF, S-curves, completion dates under each scenario, scenario weightings) within the CAM is accurate.

192. Our stress testing produced the results that we expected and in the course of our review we have not found any unexplainable anomalies. As a capex forecasting tool given Powerlink's probabilistic forecasting methodology, we consider that this model is fit for purpose.

S-curve review

193. The CAM model is also used to spread project expenditure according to an "S" curve, for a given commissioning date, to represent the project investment expenditure profile. Powerlink has advised that the curves are established from the average of historical trends of capital expenditure in the 2008-11 period for each project type and we can observe this calculation in the model. We accept that this is likely to be representative of future project cashflows.

Capex forecasting processes as precursors to the CAM

194. We note that while the factors applied in the CAM materially impact on the projected level of capex, the base assumptions input into the CAM are more significant determinants of the CAM calculated component of Powerlink's proposed capex envelope for the next RCP. The key pre-CAM determined assumptions include the outputs of processes which:

a. establish the need for the project, particularly demand forecasting;

b. identify the appropriate technical solution;

c. determine nominal project costs;

d. determine the projects which comprise each scenario; and

e. establish the completion date for each project within each scenario.

195. Demand forecasting is covered in the separate advice from EMCa/NZIER and the assessment of project costing follows in the next sub-section. The other aspects of the process have been described to us, and also to an extent overlap with the capital governance processes. These processes appear to be consistent with good industry practice.

Efficiency gains

196. As discussed in previous subsections, we find that the capex forecasting methodology does not factor in ex ante gains from efficiency and cost reduction initiatives because it is backwards looking and does not assume any cost reduction or continuous improvement programs are in place. Specifically, the capex forecasting methodology does not factor in ex ante estimates of gains from:

a. the refinement of network options;

b. synergies involving "optimisation" between projects as related projects are committed;

c. new non-network options that may be identified during the 2013-17 RCP;

d. resource smoothing; and

e. other potential efficiency gains and cost savings, which would be realised from implementation of a cost reduction and continuous improvement programs, as proposed in section 4.3.3.

197. With regards to non-network solutions, the capex forecasting process does not take into account the options for non-network solutions or the capacity for "optimisation" between projects (where one project, once committed, may enable the deferral or de-scoping of others). This is because these opportunities are not pursued until the detailed design and planning phase in the lead-up to approval. While specific project opportunities will only be identified over the course of the next RCP, it is our view that such opportunities will arise and that consequent savings can be achieved across the portfolio of projects in the CAM.

198. In aggregate, we are confident that actual expenditure (for given performance outcomes) would be less than a capex forecast that does not take these opportunities into account. Based on our team's experience and involvement in the implementation of efficiency programmes, we consider it reasonable to expect that Powerlink would be able to achieve capex efficiency gains of at least 1% by the second year of the RCP and 2% thereafter, by implementing such programs. No such gains are currently allowed for in Powerlink's capex forecasting process.

4.4.4 Findings on Powerlink's methodologies and assumptions for forecasting capex

199. Methodologies used by Powerlink for forecasting capex are considered to be for the most part fit for purpose and in alignment with good industry practice. The processes used contain the components that are required to ensure that capital expenditure forecasts are developed to meet service requirements and/or are based on the age and condition of assets.

200. We consider that opportunities to improve efficiency and reduce costs exist and these can and should be incorporated in its forecasting process. Accordingly, we consider that an efficiency adjustment should be applied to the uncommitted expenditure in Powerlink's forecasts comprising:

- A 1% reduction in forecast expenditure in the second year of the RCP; and
- A 2% reduction in subsequent years.

201. This would reflect realisation of the plan refinement process and project synergies, together with gains that could be achieved from a range of measures including more

pro-active assessment of non-network options, resource smoothing, and gains from ongoing cost reduction and performance improvement programs within Powerlink's capital governance framework.

202. In section 5, we have estimated that this efficiency adjustment leads to a proposed capex reduction of $45m.

203. In reviewing the capital cost forecasting methodologies we also considered how efficiency and cost reduction initiatives could be applied. In our opinion, the structured and well managed capital cost forecasting methodologies would provide an excellent framework on which to evaluate, implement and monitor such initiatives.

4.5 Review of Powerlink's cost estimation methodologies

4.5.1 Assessment approach and assumptions

204. In our assessment we have reviewed the methods by which Powerlink determines costs for the projects included in its forecast capex. This includes:

a. Powerlink's methodology for costing its committed projects;

b. Powerlink's methodology for costing uncommitted network projects, which comprises the following elements:

   i. Unit costs which are maintained in a "costing book" (the Base Planning Objects or BPOs);

   ii. Determination of base costs for such projects;

   iii. Powerlink's proposed application of a cost estimation risk factor (CERF) on top of its cost estimation for uncommitted projects;

   iv. Allowance for escalation of such costs.

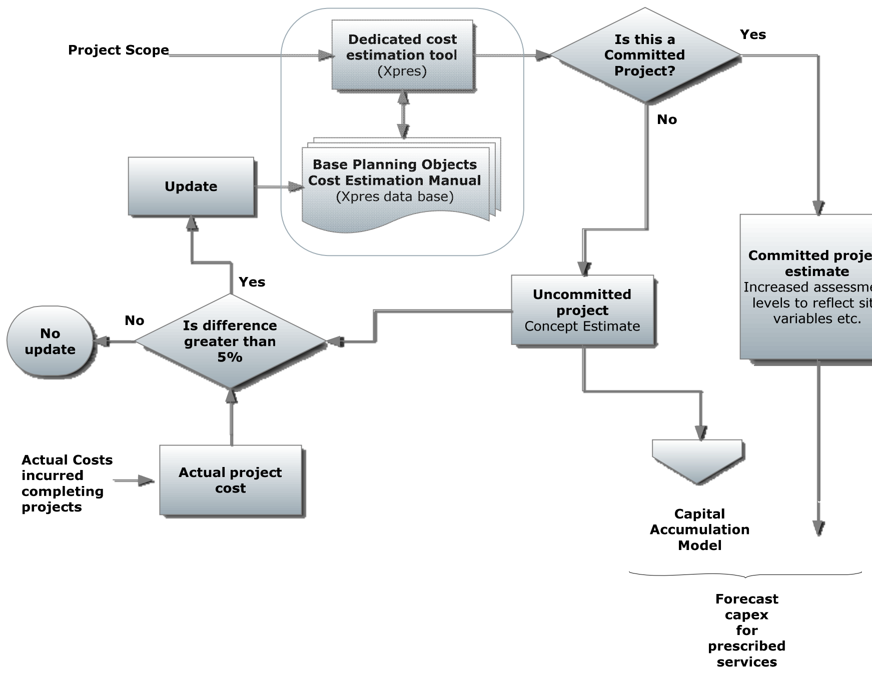
4.5.2 Our assessment

Cost estimation for uncommitted projects

205. At the core of Powerlink's capital project cost estimation is a dedicated cost estimation tool which includes a Base Planning Objects (BPO) Cost Estimation Manual. The BPO is used to produce cost estimates for uncommitted capital projects. As uncommitted projects progress through business case to approvals, the BPO estimates are replaced or adjusted to reflect the more detailed analysis of quantities, costs and other variables.

206. The cost estimates for uncommitted projects are inputs into the CAM. The accuracy of the BPO is therefore critical to the reasonableness of the capex forecast.

Figure 9: *Powerlink's cost estimation process*



Source: EMCa Strata(from description by Powerlink)

Base Planning Objects review

207. On the grounds of extreme commercial sensitivity Powerlink has declined to release a copy of its BPO estimating manual and so we have not been in a position to independently verify the cost estimation processes followed. Powerlink has advised that:

- the BPOs model the amount of steel, aluminium, copper, labour and individual plant items required to establish the unit at costs based on independent expert input;
- the BPOs also take into account the expected impact on capex costs of location-specific aspects of each project. We understand this includes soil, rock, water crossings, climatic conditions, environmental and managing cultural issues. We note however, in the case of capex in new geographic regions, that these conditions are not always fully known;
- while internal Powerlink project approvals routinely include a 10% contingency, the BPOs (and hence the project costs input into the CAM) contain no contingencies;
- the BPOs are routinely updated once each year based on the forecast exchange rate, commodity spot prices, current labour costs and current equipment costs. Also, where an input cost moves significantly between reviews, the BPO's are updated;
- the project costs modelled in the CAM for the next RCP were calculated on the basis of the BPOs set out in the 2010/11 Powerlink Estimating Manual, July 2010.

208. Powerlink has indicated that a number of improvements in strategies and processes have recently been made. Powerlink has advised that the improvements identified and/or implemented have already been incorporated into the capex forecast for the 2013-17 RCP. Given the mechanism through which the BPOs are updated we have concerns that not all improvements will be reflected in the cost estimates. Certainly the further efficiencies we consider can are achievable within the next RCP (see previous subsection) will not be reflected in the BPO process as described by Powerlink.

Cost Estimation Risk Factor review

209. Powerlink applies a Cost Estimation Risk Factor (CERF) which adds this additional factor to the costings for uncommitted projects, after applying the BPOs. The purpose of the CERF was described to us as being to offset unforeseen capex costs which arise as a result of factors such as delays to site access, changes to technology, legislative and compliance requirements, community management matters, unforeseen site conditions and extreme weather patterns. For the next RCP Powerlink has applied a 3% CERF.

210. Powerlink engaged Evans & Peck to provide an independent estimate of the cost estimation risk factors to apply to the next RCP. In its May 2011 report 'Capital Program Estimating Risk Analysis' Evans & Peck noted[10] significant levels of exceedance of cost estimates for 50 projects completed in the first 3.75 years of the current RCP:

- a 30 – 35% cost overrun on easements
- a 15 – 19% cost overrun on line projects
- an 8% cost overrun on substation projects.

211. Evan's & Peck also noted[11] that:

> *"our strong expectation is that a range of factors other than those envisaged in the cost estimation risk factor analysis are at play. These could include:*
>
> - *Optimistic estimation underpinning original estimates;*
> - *The use of P50 estimates, which by commercial standards, is an optimistic approach;*
> - *Variation between AER approved escalation factors and actual escalation, including changes in market conditions particularly in the area of easements;*
> - *Project scope creep, or incomplete scope application in high level estimate."*

212. Evans & Peck noted its expectation that Powerlink would address many of these issues. Our view is that the majority of adjustments to the BPO's arising from these projects will already have been incorporated into the capex forecast for the next RCP because:

a. the current RCP commenced 1 July 2007 and Powerlink's Estimating Manual was revised three years later in July 2010; and

b. based on Powerlink's advice that:

> *"Where an input cost moves significantly between reviews, the input is updated and the estimating manual is updated accordingly"*

213. In our view the CERF is effectively an 'accuracy factor' and as such is not appropriate to the process of calculating a capex forecast for the RCP. The continuous cycle of

[10] Ibid page 7

[11] Ibid page 7

updating the BPO's that has been described to us and that we have recorded in Figure 9 should ensure the accuracy of the cost estimation tool without the need for the CERF.

214. Given that the BPO is effectively self-adjusting, over time against actual project costs, we consider that Powerlink has not established justification to support this additional adjustment factor.

Escalator review

215. Real escalators are applied in the CAM to take account of movements leading up to and during the course of the RCP in the key components of capex. Powerlink has consulted independent experts and used independent datasets to establish the escalators.

216. Powerlink advises that escalation factors in the CAM can be summarised as follows:

a. steel, aluminium, and copper escalations are established from the SKM commodity prices and indices using Econtech USD foreign exchange rates to calculate the real escalations, and adding CPI to arrive at the nominal escalation factors. Actual CPI of 3.33% is applied to the 2010/11 year and CPI of 2.5% thereafter;

b. plant and equipment escalations are a composite of Australian and overseas procured items. The escalations are based on the actual and forecast CPI. The Econtech forecast exchange rate is applied to the overseas component of plant and equipment. Historically the percentage of overseas plant and equipment is 76%;

c. labour escalations adopt the BIS Shrapnel escalation factors for external labour prices. The Powerlink internal labour escalator is a composite of the general (17%) and skilled (83%) internal BIS Shrapnel rates;

d. land escalation factors are adopted from the Urbis consultant's report;

e. actual and forecast CPI is used as the escalation factor for all other components.

217. We have tested the CAM model and we consider that Powerlink's application of its escalator assumptions is correct.

218. We have modelled the sensitivity of uncommitted capex costs to changes in the escalator factors. As an illustration of their relative impact, the table below sets out the impact that each of the escalators proposed by Powerlink contributes to the forecast cost, relative to "baseline" escalation at assumed CPI (2.5%).

Table 9 *: Sensitivity analysis - impact of Powerlink escalator assumptions in forecast cost estimation (relative to CPI*

$million (real 2011/12)

	2012-13	2013-14	2014-15	2015-16	2016-17	Total Reg. Period
Steel	5.2	11.0	9.6	10.5	8.2	**44.6**
Aluminium	2.6	5.6	5.5	8.1	7.1	**28.9**
Copper	0.1	0.3	- 0.0	- 0.2	- 0.4	**- 0.3**
Plant & Equipment	3.1	9.3	11.1	12.5	11.6	**47.6**
Labour Internal & External	4.5	14.0	21.7	27.5	26.9	**94.7**
Compensation - Urban & Non-Urban	0.5	2.4	6.7	12.8	8.3	**30.6**
Total	16.0	42.5	54.6	71.2	61.7	**246.0**
Reduction	6%	9%	10%	12%	12%	10%

Source: EMCa Strata

219. The table indicates that the combined effect of the escalation applied (relative to a counterfactual of CPI) is to increase capex on uncommitted projects for the next RCP by $246m. Labour escalators have the greatest impact. This level of escalation is built in to the forecast capex that Powerlink has proposed.

220. Our Terms of Reference for this work did not ask us to form a view on the quantum of the escalators used by Powerlink in preparing its capex forecast, therefore we have made no adjustment in relation to Powerlink's assumptions and these sensitivities are reported for information only.

Committed projects costing review

221. Committed projects are projects which have been approved at the requisite level within Powerlink and, where necessary, sanctioned by the Queensland State Government. As such these projects have, at a minimum, been through a detailed design and planning phase.

222. In costing committed projects, BPO's are utilised where appropriate, albeit it on a more accurate basis compared with uncommitted projects, as costs are calculated on the basis of a more detailed and accurate breakdown of requirements. Our review of four committed projects with total capex of $541m, indicates that this process has been appropriately applied. In some instances the projects are sufficiently progressed that tender processes and actual contracts are used to provide project cost figures.

223. We have confirmed with Powerlink that contingencies, which have been applied to internal budgets, are not included in the forecast capex for committed projects. In our view, this is appropriate.

Non-load driven projects costing review

224. Non–load driven projects include replacement capex which is proposed by Powerlink to require a total spend over the next RCP of $1.2 billion. This category of expenditure is driven by the age and condition of specific assets and is governed by Powerlink's Asset Management Strategy and the Asset Replacement and Refurbishment Policies, as discussed in section 4.3.

225. In Annex 5 we discuss our understanding of the key components of Powerlink's capital cost estimation and capex forecasting processes. We have found that the methodologies used are sound and can be considered to be in alignment with good industry practice standards and guidelines. The combination of the project development methodology and the BPO based cost estimation can be seen as objectively driven with the actual age and condition of assets leading to project identification and then project cost estimates based on the application of the BPO.

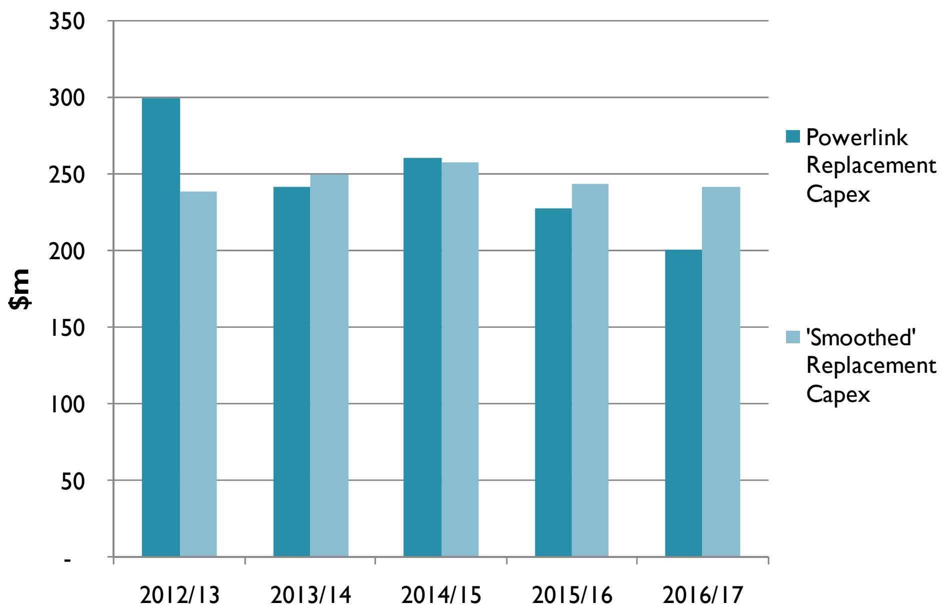
226. In our sample of individual projects we reviewed nine replacement capex projects that accounted for 20% of the forecast replacement capex for the next RCP. We found that, in each case Powerlink had followed the requirements of the components of its capital governance framework. In particular we considered that the condition assessments that had been undertaken to support business cases were comprehensive.

227. Given the above review we found no reason to reduce the replacement capex forecast for the next RCP other than for the risk factor and efficiency gain adjustments described elsewhere.

228. We do consider that the replacement capex profile over the 5 years of the RCP is front loaded and that this could be smoothed. The smoothing of the expenditure profile will assist in the efficient use of Powerlink and contractor resources and, through this, reduce costs and this is one of several factors already contributing to the efficiency adjustment that we propose in section 4.5.3. The smoothing would also affect the capex allowance timing that is used by the AER in its revenue determination.

229. The impact of proposed smoothing is reflected in figure 10 below.

Figure 10: *Impact of potential smoothing on replacement capex*



Source: EMCa Strata. N.B.: The smoothed replacement capex is not entirely level because $37m of capex on two 'scenario' replacement projects has not been smoothed.

Non-Network Projects Costing Review

230. The two non-network projects reviewed were uncommitted projects with total capex of $2.6m. As concept level projects the project documentation assessed requirements at a high level. Both project cost estimates were prepared using Powerlink's IT estimating methodology. The forecasts are difficult to independently assess as they relate to one-off IT applications however the project review did not indicate any areas of potential concern.

4.5.3 Findings on Powerlink's cost estimation methodologies

231. For the most part, we found that the methodologies and processes used in cost estimating for capital projects represents good practice and appear to meet the requirements of the NER.

232. The Cost Estimation Risk Factor ("CERF") of 3% that Powerlink has applied on top of the estimated cost of uncommitted projects is not appropriate because the continuous cycle of updating the BPO's that Powerlink undertakes provides a feedback loop that should progressively refine the accuracy of its estimates. EMCa does not accept that

the need for this additional factor is evident from the report that Powerlink quotes as justification.

233. In section 5, we have estimated that excluding the CERF leads to a proposed capex reduction of $70m.

234. To improve the efficient use of resources, the front loaded replacement capex profile across the 5 years of the next RCP should be smoothed by applying an average annual value for the non-scenario replacement capex projects.

235. The application in the CAM of escalators and other variable factors (CERF, S-curves, completion dates under each scenario, scenario weightings) within the CAM appears to be mathematically accurate.

236. No costing adjustments are proposed to Powerlink's capex forecast for committed projects or for non-network projects in the next RCP.

4.6 Review of Powerlink's probabilistic planning methodology and scenario assumptions

4.6.1 Introduction

237. The TOR requires that we assess whether the methodology and outcomes of Powerlink's probabilistic approach for determining its proposed forecast capex is reasonable.

238. In addition we have been asked to:

- describe the probabilistic approach in detail;
- determine the reasonableness of the assumptions and inputs used within the model (for example, economic growth expectations, load growth forecasts, generation scenarios and expected customer connections); and
- describe the scenarios and probabilities of the model and assess whether they are reasonable.

4.6.2 Powerlink's probabilistic planning methodology

239. A full probabilistic planning methodology has been applied by Powerlink at 5 yearly intervals, as part of its capex forecast methodology in preparation for regulatory submission revenue resets. Outputs from the probabilistic planning approach are also used during the current RCP, as part Powerlink's on-going network planning processes.

240. The probabilistic methodology appears to have remained fundamentally the same since it was first adopted in 2001. The most significant change has been the reduction in the number of demand forecasts, which in turn, has led to a significant reduction in the generation scenarios studied in the overall probabilistic planning methodology. In

addition, ROAM[12] has introduced some refinements in its methodology for developing the generation scenarios, based upon its experience with Powerlink and, we understand, with other transmission network operators in Australia.

241. The overall objective of the probabilistic planning approach applied by Powerlink, is to develop a probability weighted average expenditure profile for the load driven capex, as an input to developing its total forecast capex for the next RCP within its submission.

242. A more detailed description of the probabilistic approach is provided in Annex 9.

4.6.3 Assessment approach and assumptions

243. Our approach to this part of the review involved first confirming our understanding of the methodology applied by Powerlink. We then considered how the approach aligned to Powerlink's objectives and examined the inputs to the methodology to asses if they were applicable and comprehensive. Using Powerlink's CAM model, we examined the methodology to determine which input(s) had most influence on the end results and examined the reasonableness of those assumptions and inputs.

244. We then considered the market development scenarios and probabilities used within the methodology, as reported by Powerlink's consultant (ROAM) and (at on-site meetings) we confirmed our understanding of the process by which Powerlink develops transmission plans consistent with the probabilistic market scenarios.

245. Finally, we tested model outputs to determine whether the probabilistic methodology appeared to provide an undue bias in comparison to a more deterministic planning approach and to consider whether any adjustment to the approach would offer an improved outcome or other benefits.

246. We made the following assumptions in forming views:

a. That the ROAM methodology for determining the generation scenarios is robust and sound and we limited our review to the reasonableness of the inputs, assumptions and assigned probabilities used for the forthcoming RCP period;

b. That the network modelling and augmentation options analysis undertaken by Powerlink was robust and sound, based upon assumptions that:

   i. The software and tools used to undertake the analysis are consistent with those employed by other service providers;

   ii. The integrity and validity of Powerlink's modelling has been subject to review by the AER and its consultants in previous revenue resets;

247. In our review of sample projects, we considered whether Powerlink's review of sample projects identified a robust and consistent approach to network planning and option analysis with reasonable outcomes;

248. Descriptions provided to us by Powerlink at our on-site review meetings.

[12] ROAM Consulting has undertaken probabilistic modeling and analysis for Powerlink for each of its Revenue Proposals since 2001

4.6.4 Our general assessment of Powerlink's methodology

249. Our review showed that the methodology has the advantage of showing a range of outcomes and the sensitivity of those outcomes to themed assumptions, and facilitates adjustment as assumptions are considered to change. The analysis undertaken is a major improvement over 'best guess' approaches to estimating.

250. A disadvantage of the probabilistic approach is that it does not provide a list of projects against which actual outcomes can be assessed. This means that variations between forecast and actual capex forecast are difficult to explain and justify.

251. In our view, increased value from the methodology could be gained by undertaking a more focused examination of a limited range of the most probable scenarios. This would allow intuitive cause-and-effect conclusions to be drawn from the scenarios used. It is of note that within the ROAM report the following comment was made when ascribing probabilities to the load demand forecasts:

> *"ROAM considers that it is unlikely that a trend of many years of consistently high or consistently low growth will occur, with the long term average tending to be in line with the medium forecast'*

252. From the more focused analysis discussed above, a more accurate assessment of forecast expenditure for load driven network projects could be derived, without any significant increased risk due to uncertainty. This would be achieved by taking a more deterministic view on most probable scenarios within the methodology with the advantage of providing a clearer picture for the purpose of ex post regulatory comparison and for Powerlink's own performance assessment.

253. We reviewed the ROAM report to understand the methodology, asses the inputs and assumptions for both completeness and reasonableness and assessed the basis on which the probabilities had been assigned. Our examination of the Grid Plan, CAM and Pro Forma showed that there was consistency of projects within the scenarios.

254. We were informed by Powerlink that network planning studies of market development scenarios are used to identify potential trigger points for projects within the RCP. Although this is a reasonable and useful tool for that purpose, it is unclear to us how updated knowledge for the load demand forecasts or other changes in assumptions are fed into, or taken account of, within the deterministic planning process (i.e as represented by the APRs). We consider that this process should be more transparent and better communicated.

4.6.5 Our assessment of Powerlink's demand forecast assumptions

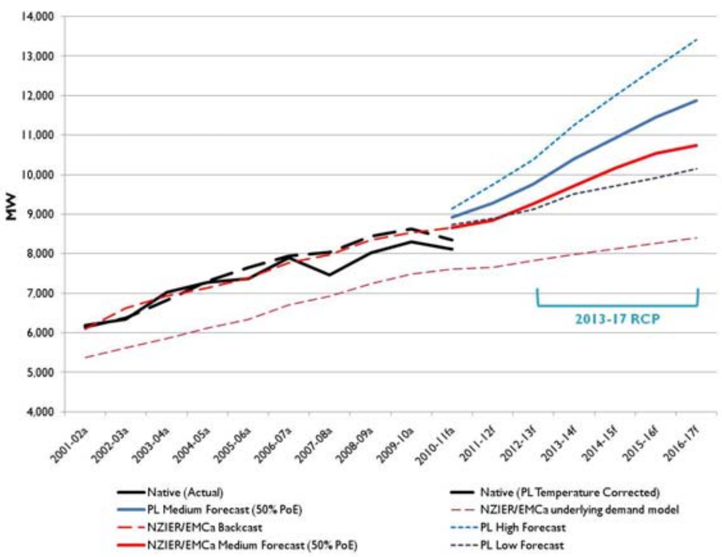
Alternative demand forecast

255. The most significant factor that influences the outcome is the load demand forecasts[13]. The Demand Forecast Consultancy has led to the following recommendations as part of its review[14]:

> *"We recommend that the AER not accept the use of Powerlink's proposed demand forecast as a basis for determining a capex allowance in Powerlink's revenue determination.*
>
> *We recommend that the AER adopts the alternative forecast that we have proposed [as below]. Specifically we recommend that our alternative forecast for a medium scenario, at 10% PoE temperature, should be used in place of Powerlink's medium forecast at 10%PoE, and that any other forecasts used for planning purposes should be similarly adjusted."*

256. Figure 11shows the alternative forecast recommended by the demand consultant by comparison with the forecast proposed by Powerlink as the basis for the load-driven component of its capex forecast. For the next RCP (2012/13 – 2016/17) the alternative forecast lies between Powerlink's medium and low forecasts, and is closer to Powerlink's low forecast.

Figure 11*: Actual demand and comparison of EMCa/NZIER and Powerlink peak demand forecasts*



Source: EMCa.NZIER

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[13] This was also identified by PB Associated in their 2006 revenue reset review report.

[14] *Demand Forecast Review*, *Report to Australian Energy Regulator.* (Section 2.3) (EMCa in association with NZIER, September 2011)

257. For capex planning purposes, Powerlink plans to be able to meet load at the higher summer temperatures that are expected to occur on an incidence of once every ten years, that is with a "probability of exceedance" (PoE) of 10%. Deriving these from the median (PoE 50%) forecasts involves determining a relationship between temperature and demand. Based on the above forecast and the demand forecast consultants' assessment of the demand/temperature relationship, the demand forecast consultant has recommended an alternative 10% PoE forecast to use in determining a corresponding adjustment to load-driven capex.

258. The following tables set out Powerlink's medium scenario forecasts and the alternative forecasts proposed by EMCa/NZIER, at 10%, 50% and 90% PoE levels. The 10% PoE forecast is the most relevant for capex planning purposes and this is 1,291 MW (or 10%) below Powerlink's proposed forecast (in 2016/17).

Table 10*: Powerlink peak demand forecasts*

MW

	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
Med Scenario 90% PoE	8,992	9,467	10,090	10,613	11,120	11,537
Med Scenario 50% PoE	**9,280**	**9,765**	**10,400**	**10,930**	**11,447**	**11,877**
Med Scenario 10% PoE	9,753	10,252	10,907	11,450	11,984	12,437

Source: EMCa NZIER (from Powerlink Data)

Table 11*: EMCa / NZIER alternative peak demand forecasts*

MW

	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
Med Scenario 90% PoE	8,674	9,089	9,536	9,983	10,357	10,563
Med Scenario 50% PoE	**8,841**	**9,259**	**9,710**	**10,161**	**10,537**	**10,746**
Med Scenario 10% PoE	9,205	9,632	10,090	10,547	10,931	11,146

Source: EMCa NZIER

Table 12*: Differences between alternative forecast and Powerlink demand forecast*

MW

	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
Med Scenario 90% PoE	- 318	- 378	- 554	- 630	- 763	- 974
Med Scenario 50% PoE	**- 439**	**- 506**	**- 690**	**- 769**	**- 910**	**- 1,131**
Med Scenario 10% PoE	- 548	- 620	- 817	- 903	- 1,053	- 1,291

Source: EMCa NZIER

Resulting alternative capex forecast

259. The lower demand forecasts advised by the Demand Forecast Consultant mean that trigger points for uncommitted augmentations in all scenarios would come later in the RCP than in Powerlink's proposal. Also, later projects appearing in each scenario would not be required until the following RCP.

260. We have used the probabilistic planning scenario outputs provided by Powerlink to calculate a capex forecast based on the lower demand forecast, and using Powerlink's capex forecast scenarios. Our methodology for doing this is as follows:

a. Powerlink provided twenty scenarios in its probabilistic planning model, in which it had determined capex project requirements for "uncommitted" projects, for low, medium and high demand scenarios. We understand that these scenarios are designed by Powerlink (and its consultants, ROAM) to be internally consistent, in that they are based on detailed analysis of loads by connection point and specific generation scenarios to meet those loads, analysis of the resulting projected load flows over the transmission network and the need for augmentation projects to address limits and constraints arising from that analysis.

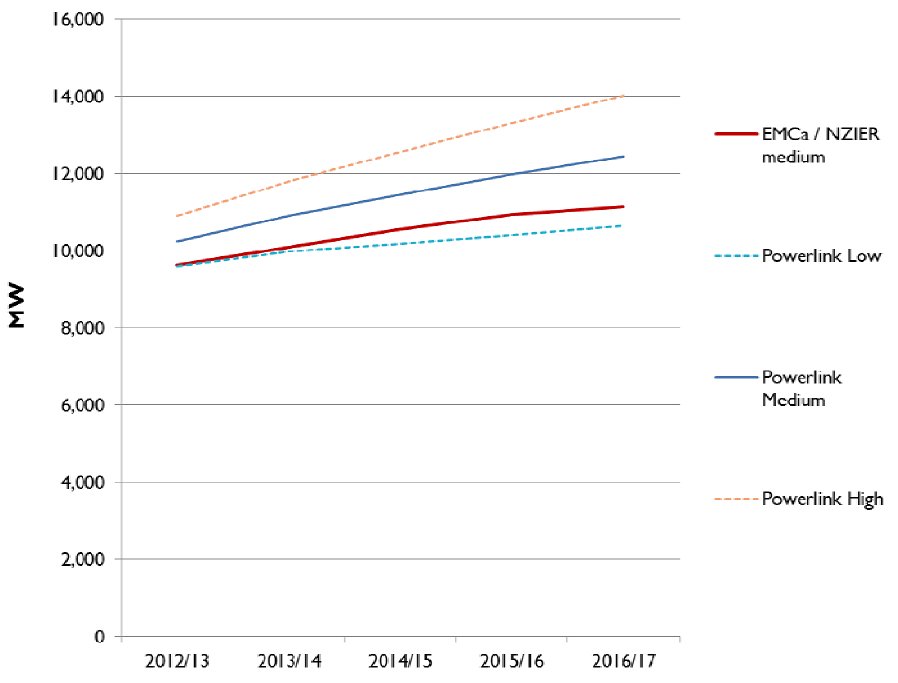
b. We have observed from the output files from these scenarios that, in moving from high to medium to low demand forecasts, Powerlink has assessed that many load-driven projects are deferred, some beyond the next RCP. This is as we would expect.

c. We adjusted the weightings applied to the scenarios, consistent with the Demand Forecast consultancy's alternative demand forecast, which lies between Powerlink's medium and low demand forecasts. The revised weightings that we used are directly based on the relationship between the medium alternative demand forecast and Powerlink's medium and low demand forecasts. This therefore resulted in higher weighting being applied to Powerlink's low forecast and lower weighting being applied to Powerlink's medium forecast.

d. We did not adjust the weighting relativities in other respects, in other words, for the different LNG and carbon reduction scenarios and for the different generation "planting" scenarios.

261. Figure 12 shows the relativity between the alternative demand forecast and Powerlink's low, medium and high demand forecasts (at 10% PoE).

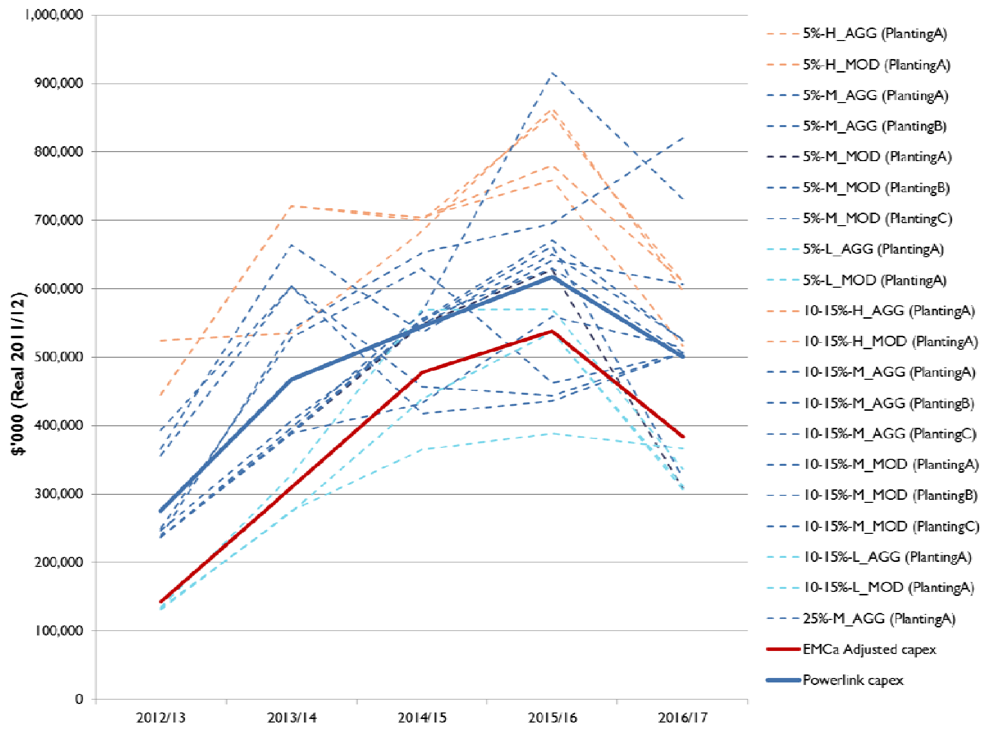
Figure 12*: Comparison of EMCa/NZIER and Powerlink forecasts for next RCP (at 10% PoE)*



Source: EMCa NZIER

262. Figure 13 shows the uncommitted expenditure profiles from each of Powerlink's twenty scenarios. We have colour coded these to distinguish between the low, medium and high demand scenarios. Super-imposed on this graph, we show Powerlink's probability-weighted capex forecast that results from these scenarios (solid blue) and the probability-weighted capex that follows from the EMCa/NZIER alternative demand forecast (solid red), by applying the methodology described above.

Figure 13*: Uncommitted component of capex forecast - Powerlink's expenditure scenarios and probability weighted forecasts*



Source: EMCa (with data from Powerlink)

263. In section 5, we propose that the resulting demand-driven adjustment to Powerlink's uncommitted expenditure forecast should be used in determining an alternative capex forecast. To do this, we added back the capex forecasts for committed network projects and non-network projects, neither of which is adjusted as a result of the alternative demand forecast, to determine an aggregate alternative capex forecast.

264. As with Powerlink's probabilistic methodology, this alternative capex forecast does not provide a deterministic set of proposed projects; rather, it provides a capex path that is considered to be a reasonable assessment on a probabilistic basis of the required level of "uncommitted projects" capex, for a given set of input assumptions. We have derived our alternative capex forecast using weighted outcomes from low and high carbon

reduction[15] and moderate and aggressive LNG scenarios, in the same way as Powerlink has in its probabilistic planning methodology.

265. The lower demand forecast would also seem to have implications for augmentation projects that Powerlink plans to commence in the current year. Particularly given our observation in section 3 that delivering these projects may be challenging and may drive up costs, we consider there would be merit in Powerlink undertaking a re-assessment of the timing of such projects. However we note that a finding on this matter is outside of the scope of our terms of reference.

4.6.6 Our assessment of carbon reduction target assumptions

266. Greater certainty regarding the lower carbon reduction targets (which assumes a 5% reduction target) due to recent Federal Government announcements on emissions taxes and other measures mean that a greater probability would now be ascribed to these in the CAM modelling. In terms of materiality, we consider that the pragmatic assumption is to simplify the modelling permutations by discarding the medium and high carbon reduction scenarios, which respectively involved 10-15% and 25% carbon reductions.

4.6.7 Findings on probabilistic planning and scenario assumptions

267. We consider that the probabilistic approach developed and applied by Powerlink is basically sound and we note that it has been improved in each of the RCPs for which it has been used. We have noted that the capex resulting from the range of 20 scenarios included in this assessment is similar to that which results from considering the “medium” scenarios only.

268. The accuracy of the output will be set by the input assumptions used to construct the various scenarios. We have assessed these and we consider that it is appropriate to adjust Powerlink’s proposal to reflect updated information for the following inputs:

- Lower demand forecasts
- Carbon reduction targets set by the Federal Government which would lead us to exclude the medium and high carbon reduction scenarios included by Powerlink in its forecast.

269. In section 5, we report our estimate that incorporating a lower forecast demand, as recommended by EMCa in association with NZIER, results in a proposed capex reduction of $554m.

270. In section 5, we report our estimate that excluding the medium and high carbon reduction scenarios in Powerlink’s probabilistic model results in a forecast capex reduction of $135m.

271. The demand forecast is the most significant driver of the load driven capex forecast. Under these uncertain conditions we consider that there may be a tendency to forecast

[15] Though we have separately proposed using a sub-set of carbon reduction scenarios, as described below

high as this reduces risk to the network business. However Powerlink's probabilistic planning methodology already provides Powerlink with a useful tool to assess the implications of higher levels of demand and to be able to consider risk mitigation against the possibility that these occur. The PoE10% planning criterion also provides a measure of upside demand risk hedging. We do not consider that any further demand risk "contingency" is warranted.

272. In summary, we consider that probabilistic planning is a useful tool for establishing a view on Powerlink's risk exposure across the range of scenarios and this is demonstrated by the ability to readily re-assess capex forecasts based on changed assumptions, as above.

4.7 Review of sample projects

4.7.1 Introduction

273. This section summarises the results of our review of a sample of specific projects. More detail on the sampling methodology and on the assessment of each of these projects is contained in Annex 3.

4.7.2 Assessment approach and assumptions

274. The projects considered for review were contained in both the Committed and Uncommitted project lists provided by Powerlink. The projects in the lists totalled 454 from which a workable sample had to be derived. The project sample for review was selected by:

a. Selecting the high value (e.g. above $50m) projects;

b. From the remainder producing a random sample that was generally representative of the range of expenditure categories; and

c. Adjusting the random projects sampled to ensure that the focus was on the high cost expenditure categories.

275. The sample list of projects that we reviewed is contained in Annex 3.

276. A main focus of the project reviews was to identify the extent to which Powerlink had applied its capital governance framework in practice. In particular, we reviewed each project's development through the stages of the Investment Decision Making and Project Approval procedures.

277. In order to achieve consistency in our reviews we developed assessment criteria against which each project in our sample was reviewed. The assessment criteria are provided in Annex 2.

4.7.3 Our assessment - overview

278. A summary of our project assessments is provided in table 13. The ratings (and associated colours) indicate:

- score of 3 (green) - we identified no concerns with the project;
- score of 2 (yellow) - we identified a potential issue, that may warrant further consideration;

- score of 1 (red) - we identified an issue to be resolved.

279. It can be seen from the assessment table that in general we found a good level of compliance with Powerlink's capital governance framework. Key areas of concern that we identified in the project review concern the suite of 500kV-capable network augmentations. The issues with this important and significant network development expenditure are discussed in the section 4.7.4.

280. We found that two projects had the potential to be misclassified as their need was dependent on an easily identifiable load development in a geographic region. From information initially provided, we considered that these projects could have been better classified as contingent, namely:

- CP02030 and CP02031 Columboola to Western Downs Network Augmentation;
- CP01781 – Northern Bowen Basin Augmentation – 275kV new line (operating at 132kV).

281. Subsequent to submitting its Revenue Proposal, Powerlink has provided additional information that the required triggers for these projects have been met. In both cases we are informed that Connection Access Applications for major loads (LNG compression and coal mining and associated transportation) have now been obtained by Powerlink. The projects were therefore accepted for inclusion in the capex forecast for Prescribed Transmission Services.

282. The remaining issues that were identified in our project reviews relate to the 500kV network development program. These issues are discussed in the following section.

Table 13: *Assessment ratings for sampled projects*

Project ID	Description	Needs assessment	Options analysis	Scope assessment	Cost estimation	Timing	CGF alignment	Accuracy	Project classification	Trigger event	Forecast value and timing
CP.01546	Callide A Switchyard Replacement	3	3	3	2	3	3	3	3	3	2
CP.01477.2	Western Downs to Halys 1st 500kV DCST Operating at 275kV	2	2	3	2	3	2	3	1	1	2
CP.01470	Halys to Greenbank 500kV DCST Operating at 275kV	2	2	3	2	3	2	3	1	1	2
CP.01423.2	Western Downs to Halys 500kV Easement Compensation	3	3	3	3	2	3	3	3	3	3
CP.02039	Collinsville 132kV Substation Replacement	3	3	3	3	3	3	3	3	3	3
CP.02030	Columboola to Wandoan South Network Augmentation	3	3	3	3	3	3	3	3	3	3
CP.02031	Columboola to Western Downs Network Augmentation	3	3	3	3	3	3	3	3	3	3
CP.01875	Halys-Blackwall 500kV	2	2	3	2	3	2	3	3	3	2
CP.01710	Gin Gin Substation Replacement	3	3	3	2	3	3	3	3	3	3
CP.01957	Calvale to Larcom Creek 275kV DCST	3	3	3	3	3	3	3	3	3	3
CP.01781	Northern Bowen Basin Augmentation	3	3	3	3	3	3	3	3	3	3
CP.01748	Ashgrove West 2 x 100MVA 110/33kV Transformers	3	3	3	3	3	3	3	3	3	3
CP.02583	OHEW Fault Rating Upgrade Stage 1	3	3	3	3	3	3	3	3	3	3
CP.02534	West Darra to Upper Kedron 110kV T/L Life Extension	3	3	3	3	3	3	3	3	3	3
CP.02507	Collinsville to Proserpine T/L Life Extension	3	3	3	3	3	3	3	3	3	3
CP.01762	Calvale 2nd 275/132kV Transformer	3	3	3	3	3	3	3	3	3	3
CP.02599	Calvale to Wandoan South Easement Acquisition	2	2	3	3	2	2	3	3	3	2
CP.02585	Belmont Substation Transformer Upgrade Options	3	3	3	3	3	3	3	3	3	3
CP.02520	Tarong PS 66kV Cable Replacement	3	3	3	3	3	3	3	3	3	3
CP.01924	System Spare 330/275kV Transformer	3	3	3	3	3	3	3	3	3	3
CP.96958	Extended Web Based Integration of Power Systems Information	3	3	3	2	3	3	3	3	3	3
CP.96945	Improved Access to Operational and Event	3	3	3	3	3	3	3	3	3	3
CP.01156.2	Stanwell to Broadsound Stringing 2nd 275kV Circuit	3	3	3	3	3	3	3	3	3	3
CP.02363	Dynamic Line Ratings	3	3	3	3	3	3	3	3	3	3
CP.00882	Cardwell - Ingham South 132kV Line Replacement	3	3	3	3	3	3	3	3	3	3

Source: EMCa Strata

4.7.4 Consideration of the 500kV capable network development

283. We reviewed four major network development projects that combined, represent a step change development in Queensland's transmission network. These projects are:

CP 01875	Halys to Blackwall 500kV DCST
CP 01477.2	Western Downs to Halys 500kV DCST
CP 02477.3	Western Downs to Halys 500kV DCST circuits 5 and 6
CP 01470	Halys to Greenbank 500kV DCST

284. The combined estimated total capital cost of these projects is $ 1,680m with $1,209m falling within the next RCP. A probability-weighted forecast capex of $931m is included in Powerlink's capex projections for the next RCP.

285. A significant proportion of the capital cost of these projects is the inclusion of the capability for the assets to operate at 500kV but, for an undefined period, to be run at 275kV. This means that the capital cost, included within the prescribed services forecast capex for the next RCP, is almost double that which would be required in the absence of the option for the future development of a 500kV network.

286. Importantly, expenditure proposed on the four projects in the next RCP will not in itself enable a 500kV network to be established. Further investment would be required at some point in the future before the network can be operated at 500kV.

287. The need for an increase in network capacity has been determined through routine planning studies that identified a series of network limitations forecast to occur within Southern Queensland from the summer of 2011/12 through to the summer 2013/14. These predicted limitations are as a result of forecast growth of load demand in South East Queensland. Under the increased demand the predicted limitations would require network investments to cover a number of the planning criteria in order to maintain reliability. In addition, fault level issues are predicted to occur at the Braemar substation.

288. Powerlink's planning studies have identified a need for investment; however, we consider the need has only been demonstrated for a 275kV capability double circuit line to address the network limitations. This is demonstrated by the fact that Powerlink will operate the new assets at 275kV for at least the next two RCPs.

289. In reviewing the options identified and studied for each project, we could find no indication that Powerlink has identified a practical or practicable limit to further

augmentation to the 275kV network. In the supporting documentation provided with each project, the only references to the 'strategic' need or justification for building the double circuit transmission lines at 500kV capability is based on Powerlink's assumption that future land easements for multiple 275kV transmission lines will be difficult to obtain[16]. The future 500kV network option is presented as mitigating this issue by providing increased transmission capacity on fewer line easements. This assumption appears to have led Powerlink not to consider a 275kV counterfactual option.

290. In our opinion the strategic case or need for building at 500kV capability has not been presented effectively or to a reasonable depth to justify continued 275kV option not to be developed and considered. And in the absence of the development of a 275kV counterfactual it would be impossible to know the extent of additional easement routes that would be required.

291. To meet the requirements of the NER, good industry practice and Powerlink's capital governance framework, we consider that Powerlink should have evaluated all reasonable options. If no technical limitation on meeting the future network capacity requirements at 275kV could be identified, Powerlink should have developed and evaluated the 275kV option. If this had been done, the need for the incremental 'strategic' element of building at 500kV capacity would have been clearly separated, illustrated and justified above the need and requirement for the 275kV capability augmentation to address the forecast network limitations.

292. Options for meeting the expected increasing load demands within South East Queensland are not limited to electricity transmission. For example, gas may be piped or otherwise transported to locations closer to load centres and used for electricity generation and, as a general rule, transporting gas tends to be cheaper than electricity transmission (per unit of energy transported). Identification and pro-active communication of the incremental cost of building 500kV capability may also lead to the identification of alternative lower cost non-network options.

293. Our review of Powerlink's Request for Information consultation procedure to identify non-network solutions found that it is not a proactive process that identifies what non-network options are possible and what the cost of making them viable would be. Given the availability of primary energy resources in the state, it is likely that non-network options are possible, yet none have been evaluated to establish if the costs would be lower than the very significant cost of the electricity network option.

Timing for later two of the projects

294. The timing for two of the 500 kV capable lines is such that they appear unlikely to be required even as 275 kV lines within the next RCP. These lines are:

- CP01470 (Halys - Greenbank); and
- CP 02477.3 (Western Downs to Halys second line).

16 [C-I-C] [redacted]

295. Except under high demand scenarios, Powerlink's forecasts would not see CP01470 commissioned (even as a 275kV line) until October 2018 or 2019. With deferrals from the lower demand forecast, we consider that this project is unlikely to be required within the RCP.

296. CP02477.3 is assumed by Powerlink not to be required (again, even as a 275kV line) except under high demand scenarios or limited other planting scenarios (when it enters the forecast at the end of the RCP).

297. In the unlikely event that these projects were required, it would appear to involve limited expenditure at the very end of the next RCP. Under the NER Powerlink would then obtain cost recovery for this expenditure under RAB roll-forward provisions in the subsequent RCP. On the balance of probabilities, we consider that a more accurate capex forecast arises from excluding these projects for the purposes of revenue determination for the next RCP, than from including them such that a carrying cost is incurred on behalf of consumers in the current RCP for expenditure that is more likely to be required in the subsequent RCP.

Project cost allowance

298. Given that we have reached the view that the need for the 500kV network expenditure has not been proven and that an appropriate 275kV counterfactual has not been established, we consider that the allowance for the incremental carrying cost of the option for later 500kV upgrade should not be included in Powerlink's capex forecast for revenue determination purposes. We consider that the appropriate cost to include in capex forecasts is the cost of building the lines to operate, as Powerlink plans to do, at 275kV.

299. This finding applies to any of the 500 kV capable lines that are not already excluded, as above.

Easement costs

300. For clarity, we do not consider that any adjustment is required to the costs proposed by Powerlink for acquiring easements. As a strategic move, and given the need proposed by Powerlink for at least 275kV lines to be built over these routes, we consider that the purchase of strategic easements is justified.

4.7.5 Findings from our review of sample projects

301. For most projects we have found that Powerlink has applied its capital governance framework consistently and that most projects have been classified correctly for inclusion in the Prescribed Transmission Service component of the capex forecast. We found the projects sampled to have been appropriately classified as non-contingent projects.

302. We have reached the view that four 275kV (500kV capable) augmentation projects have not been assessed appropriately by Powerlink in accordance with its capital governance framework and/or the requirements of the NER because:

a. Powerlink has not provided (and appears not to have undertaken) a study which demonstrates a limitation in continuing to augment its 275kV system;

b. The proposed 500kV capability will not be required within the next RCP;

c. The strategic implications of a “move to 500kV” have not been articulated in accordance with the level of capital governance that would be expected of a proposed program with such significance and with implications for future expenditure that are well in excess of the projects proposed thus far;

d. Rigorous and pro-active evaluation of non-transmission options that may obviate the eventual need for 500kV, has not been undertaken;

e. The supporting documentation provided by Powerlink suggests the costs of 500kV-capable construction are uncertain and the cost uncertainty and associated risks have not been sufficiently articulated in accordance with good capital governance.

303. We consider that two projects:

- CP01470 (Halys - Greenbank) which was proposed to be commenced in the last years of the next RCP for commissioning subsequent to the RCP; and
- CP 02477.3 (Western Downs to Halys second line) which Powerlink proposes to be commenced only in the final years of the RCP and only under its “high” demand scenario;

are both unlikely to be required within the RCP, particularly given the reduced demand forecast recommended by EMCa/NZIER. We therefore recommend that this capex is excluded from the allowance for the next RCP.

304. For two other projects:

- CP 01875 Halys-Blackwell, construction of which is about to commence, for commissioning in 2014; and
- CP 01477.2 Western Downs to Halys first line, which (in Powerlink’s medium demand) is proposed for commissioning in 2015;

we accept the need for these lines to be constructed and to operate at 275kV (as Powerlink proposes). However we consider that Powerlink has not justified the need for the considerable incremental spend that would provide “500 kV capability” for a notional future upgrade that Powerlink estimates may be required by around 2023 and which we expect would be further deferred by lower demand forecasts.

305. We propose accepting capex for these projects consistent with the proposed 275kV operational voltage and disallowing the proposed incremental spend to provide future 500kV capability.

306. Given the alternative demand forecast, we also consider it appropriate for assume a one-year deferral of the Halys-Blackwell line. This does not affect the capex allowance (in real terms) in the next RCP, but shifts the profile of such expenditure.

307. In section 5, we report our assessment that these adjustments leads to a capex forecast reduction of $549m.

4.8 Findings on Powerlink's proposed capex

4.8.1 Headline findings on Powerlink's proposed capex

308. From our review of Powerlink's capital governance structure and its capital expenditure forecasting processes, we find that Powerlink presents as a well-structured and professional organisation that meets industry good practice standards in many regards. In line with the objectives of this review, our findings are focused on those technical aspects of Powerlink's 2013-17 Revenue Proposal that we consider not to meet the requirements of the NER.

309. Our headline findings in relation to forecast capex for prescribed services are as follows:

  a. A proportionate reduction in allowable capex should be made consistent with EMCa/NZIER's recommendation that AER should not accept Powerlink's demand forecast and should substitute a lower demand forecast.

  b. Capex should be disallowed within the current RCP for the proposed 275kV projects with future 500kV capability represented by project numbers CP01470 and CP02477.3, together with a component of the capex proposed for project numbers CP01477.2 and CP01875 which represents the "option" value of later 500kV upgradeability as this expenditure is not adequately justified by Powerlink.

  c. The higher carbon reduction scenarios proposed by Powerlink in its probabilistic analysis, should be excluded based on recent Federal Government decisions.

  d. Powerlink's proposed Cost Estimation Risk Factor ("CERF") of 3% applied to uncommitted project costs is not justified, given Powerlink's self-correcting costing methodology, and should be disallowed.

  e. An efficiency cost reduction factor should be applied to uncommitted project estimates, comprising 1% of forecast expenditure in the second year of the RCP and 2% in subsequent years, to reflect reasonably expected cost reduction and solution optimisation gains as these projects progress towards commitment.

310. Significantly front-loaded capex profiles that are evident in the current and the next RCPs could be smoothed to achieve a reduction in actual costs per project which would flow through to a reduced total capex. Our experience is that a component of capex can be smoothed without detriment to the business, over periods of a few years.

311. Smoothing will lead to a more efficient and effective use of resources and, through this, is likely to reduce costs. The cost reduction impact of such smoothing is a component in our consideration of the proposed efficiency adjustment above. In section 5, we also specifically propose smoothing of replacement capex in determining the alternative capex.

4.8.2 Headline recommendations on Powerlink's proposed capex

312. EMCa recommends that the AER not accept Powerlink's forecast of required capital expenditure because, in our opinion, the Revenue Proposal does not (in accordance with the NER clause 6A.6.7(c)) reasonably reflect:

  a. the efficient costs of achieving the capital expenditure objectives;

b. the costs that a prudent operator in the circumstances of the relevant Transmission Network Service Provider would require to achieve the capital expenditure objectives; and

c. a realistic expectation of the demand forecast and cost inputs required to achieve the capital expenditure objectives.

313. An alternative capex forecast is proposed in section 5.

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5 Alternative capex proposal

5.1 Introduction

314. The NER requires that:

> *If, in its final decision on the Revenue Proposal made under rule 6A.13, the AER does not accept the total of the forecast of required capital expenditure for the regulatory control period then the AER must, in accordance with clause 6A.13.2(b), use a substitute forecast of required capital expenditure.*

315. AER's TOR require that:

> *"In the event that the technical consultant is not satisfied that Powerlink's proposed forecast capex reflects criteria under clause 6A.6.7 of the NER, the technical consultant is required to outline why the proposal is not in accordance with the NER, and provide the AER with an alternative proposal that satisfies the relevant criteria in the NER, outlining an alternative cost and timing for relevant projects"[17].*

316. As is described in section 4, EMCa considers that Powerlink's proposed forecast does not meet the criteria of the NER and should not be accepted by the AER as the basis for determining Powerlink's revenue. In accordance with our TOR, we have therefore prepared an alternative capex forecast. This alternative forecast is intended to provide the basis for the AER to meet the above requirements of the NER.

5.2 Approach to determining alternative capex

317. Our approach to determining an alternative capex proposal has been to:

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[17] TOR clause 46

a. assess the extent (if any) to which the Revenue Proposal does not comply with the objectives and criteria set out under clause 6A.6.7 of the NER;

b. determine, to the extent non-compliance would consequently be addressed, a basis for the calculation of adjustments to the Revenue Proposal; and

c. calculate those adjustments.

318. In the previous section we have described five aspects of Powerlink's proposed capex that we consider are material in not meeting the requirements of the NER. These aspects of the capex forecasts comprise:

a. Powerlink's demand forecast (as assessed by the Demand Forecast Consultants);

b. carbon reduction scenarios, for which we consider assumptions have changed since Powerlink prepared its forecasts;

c. the proposed 500kV-capable projects;

d. Powerlink's proposed "cost estimation risk factor";

e. allowing for efficiency gains in cost forecasting.

5.3 Alternative capex forecast – specific adjustments

319. The calculation of the amount and basis for each proposed adjustment is described below on the basis each is independent of the other. However these adjustments will interact with each other and therefore the aggregate adjustment is not simply an accumulation of the individual adjustments. Our assessment of an aggregate adjustment, assuming all of the component adjustments, is set out in section 5.4.

5.3.1 Changed demand forecast assumption

320. As discussed in section 4.6, the Demand Forecast Review has proposed a reduction in peak demands used for planning purposes and which results in a medium growth forecast which aligns more closely with Powerlink's low growth forecast.

321. The potential impact of this has been calculated based on the correlation between levels of demand growth and the levels of capex as described in that section. Using Powerlink's low and medium growth scenarios we have used Powerlink's probabilistic planning model to assign revised weightings to its low and medium capex scenarios, to determine a probability-weighted capex forecast akin to that proposed by Powerlink.

322. On the basis of the proposed reduction of demand we recommend a reduction in the level of capex of $554m. The methodology also results in some shifting of the profile of this expenditure, which is taken into account in the year-by-year alternative capex proposed (in section 5.4).

5.3.2 Reduced carbon reduction assumption

323. Subsequent to the preparation of the generation scenarios by ROAM the Federal Government has committed to a carbon reduction target in line with a 5% reduction scenario:

> *"The Government has committed to responsible targets to reduce carbon pollution and to play our part in the global effort to avoid dangerous climate change. The Government has committed to reduce carbon pollution by 5 per cent from 2000 levels by 2020 irrespective of what other countries do, and by up to 15 or 25 per cent depending on the scale of global action"* [18]

324. Given the Government's commitment it is appropriate to review the relevance of the high carbon reduction scenarios for the next RCP. We consider that the Government's commitment is unlikely to incentivise investment in technologies which would deliver scenarios above the 5% level. It is therefore recommended that capex is recalculated using only those scenarios which reflect the current Government Climate Change Plan.

325. Based on the outputs from the CAM for the 5% Carbon Price Trajectory, total capex on uncommitted projects is $2,271m. This is a reduction of $135m.

5.3.3 Consideration of proposed 500kV costs

326. The "500kV" projects have been examined in terms of business justification, need, timing and cost estimation. As discussed at section 4.7.4 we have come to the view that the incremental spend on the 500kV, over and above a build to 275kV, should be disallowed for revenue determination purposes.

327. We have calculated the impact of disallowing the incremental costs of building to 500kV. For the next RCP these projects contribute $931m (including 500kV easements) to Powerlink's forecast for capex in the RCP. The effect of this adjustment is to reduce the probability-weighted 500kV spend in the period to $617m, a difference of $315m.

328. We consider that two projects are both unlikely to be required within the RCP, particularly given the reduced demand forecast recommended by EMCa/NZIER. These are:

- CP01470 (Halys - Greenbank) which was proposed to be commenced in the last years of the next RCP for commissioning subsequent to the RCP, and
- CP 02477.3 (Western Downs to Halys second line) which Powerlink proposes to be commenced only in the final years of the RCP and only under its "high" demand scenario.

329. We therefore recommend that this capex is disallowed. This reduces the capex allowance for revenue determination purposes in the next RCP by a further $234m.

330. The impacts of these adjustments are shown in the table below.

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[18] *Securing a clean energy future The Australian Government's Climate Change Plan 2011* Section 2.2.1 page 14

Table 14*: Impact of proposed 500kV adjustments*

$million (real 2011/12)

	Total
Powerlink "500 kV" Project Forecast (Weighted) Capex	931
Less Easements	52
Forecast construction Capex during RCP	**879**
Less	
Disallow CP01470 Halys to Greenbank & CP02477.3 Western Downs to Halys	234
500/275kV Cost adjustment calculated in CAM for Uncommitted CP01477.2	141
500/275kV Cost adjustment for Committed CP01875	174
Total Reduction on Construction Costs	**549**
Residual Construction Capex on '500'kV Projects	330
Total Adjusted capex including Easements	**383**

Source: EMCa Strata

331. The overall reduction proposed of $549m reduces the proposed allowance for these projects to $383m.

5.3.4 Cost estimation risk factor

332. As discussed at section 4.5.2 the Cost Estimation Risk Factor ("CERF") is in essence an accuracy factor. This is not considered to be appropriate because the continuous cycle of updating the BPO's progressively refines the accuracy of the costing methodology.

333. Powerlink has applied a factor of 3% via the CAM as a proposed "uplift" to the costs of all uncommitted projects which comprise approximately $2.4bn of forecast capex during the next RCP. Rerunning the CAM with the CERF reduced to zero reduces forecast capex by $70m.

5.3.5 Efficiency

334. We have observed considerable opportunity for Powerlink to improve the efficiency of its capex through a range of initiatives that could be harnessed through a formally instituted cost reduction / performance improvement program. This would include measures such as gains from resource smoothing, proactive facilitation of viable non network solutions, smart grid initiatives and focused identification of synergies between projects. Powerlink does not appear to have such a program and does not yet appear to be realising these potential gains.

335. We also observe that Powerlink achieved a reduction in historical expenditure by comparison with its allowance, in the current RCP.

336. Based on senior transmission business management experience in our team and supported by evidence of savings from such programs elsewhere, we consider that an efficiency adjustment should be applied to the expenditure as otherwise estimated by Powerlink using its forecasting methodology and costing assumptions, comprising:

- A 1% reduction in forecast expenditure in the second year of the RCP; and
- A 2% reduction in subsequent years.

337. Applying these efficiency factors to forecast capex in the next RCP results in a reduction in capex of approximately $45m.

338. In addition, to assist in the efficient use of resources, the front loaded replacement capex profile across the 5 years of the next RCP should be smoothed to an average annual level for non-scenario replacement capex projects.

5.3.6 Sensitivity to cost escalators

339. The AER has asked us to examine the sensitivity of the forecast for labour and materials cost escalators and these results are reported in section 4.5. No adjustment to the capex forecast based on alternative escalator values has been made in our alternative capex proposal.

5.3.7 Summary of specific adjustments to forecast capex

340. Table 15 below summarises the proposed adjustments to Powerlink's capex proposal, if applied individually.

Table 15: *Alternative capex proposal – individual impact of proposed adjustments*

$million (real 2011/12)

	Adjustment
Demand Forecast Reduction	- 554
"500kV" Project Adjustments	- 549
Carbon Reduction Target 5%	- 135
Cost Estimation Risk Factor	- 70
Efficiency	- 45

Note the overall adjustment is not cumulative because these adjustments are interdependent

Source: EMCa Strata

5.4 Aggregate adjustment to proposed capex

5.4.1 Incremental adjustments

341. The impact of the aggregated calculation of the proposed adjustments is less than the sum of applying specific adjustments independently, because of interdependencies. For example, Powerlink's uncommitted 500kV-capable projects are either deferred or not included in Powerlink's low demand scenarios. So as not to double-count, we have allowed for this interaction in the proposed aggregate adjustment such that, if the low demand forecast adjustment is considered, then there is a considerably smaller further adjustment required to account for our findings on the 500 kV projects. Further, "proportionate" adjustments such as removal of the 3% CERF and incorporating assumed efficiency improvements proportionately reduces other adjustments.

342. We have taken these interactions into account in our assessment of an aggregate alternative capex forecast.

343. In the table below, we show the effect of making each of the adjustments incrementally, that is, with each adjustment assuming that the preceding adjustments have been made. These could be presented in any order; however the final adjusted total capex, which reflects the simultaneous application of all adjustments, is not altered by the sequence in which the adjustments are presented.

344. The adjusted capex forecast (before disposals) is $2,474m as against Powerlink's proposed forecast of $3,488m (in $2011/12 real terms), a reduction of $1,015m.

Table 16: *Alternative capex proposal - incremental adjustments and aggregate impact*

$million (real 2011/12)

	Incremental Adjustment	Cumulative Aggregate Adjustment	Adjusted Total Capex
Powerlink Forecast Capex			**3,488**
Demand Forecast Reduction	- 554	- 554	2,934
500kV Adjustments	- 301	- 854	2,634
Carbon Reduction Target 5%	- 78	- 933	2,556
Cost Estimation Risk Factor	- 48	- 981	2,508
Efficiency	- 34	- 1,015	2,474
Adjusted Capex		**- 1,015**	**2,474**
Less Disposals	- 4	- 1,019	2,469
Total net of Disposals		**- 1,019**	**2,469**

Source: EMCa Strata

5.4.2 Annual adjustments

345. The impact of these adjustments on the uncommitted project component of capex has been calculated using adjusted inputs to Powerlink's CAM and by applying adjustments to the outputs from the model. This has involved:

a. Calculation of the impact of the demand forecast adjustments, as previous described;

b. Adjustment of the 500kV project cost inputs to the CAM to reflect the deferral (beyond the next RCP) of two 500kV projects and the reduction in the cost of the others to 275kV levels;

c. Use of the medium and low growth 5% Carbon Price Reduction scenarios as a basis for calculating a revised capex forecast on a year by year basis by means of re-weighting / interpolation;

d. reducing the CERF cost uplift from 3% to zero and applying the efficiency factor of 1% in year 2 and 2% in each subsequent year of the RCP.

346. Adjusted committed project capex has been calculated by:

- Reducing the cost of CP01875 Halys – Blackwall 500kV project to 275kV level;
- Deferring capex on this project by one year, but not adjusting the overall spend within the next RCP;
- the application of the efficiency factor (as above).

347. Adjusted non-network capex has been calculated by applying the efficiency factor to Powerlink's proposed capex.

348. The adjusted capex forecast is set out on a year by year basis in the table below.

Table 17: *Alternative capex proposal – adjustments on an annual basis*

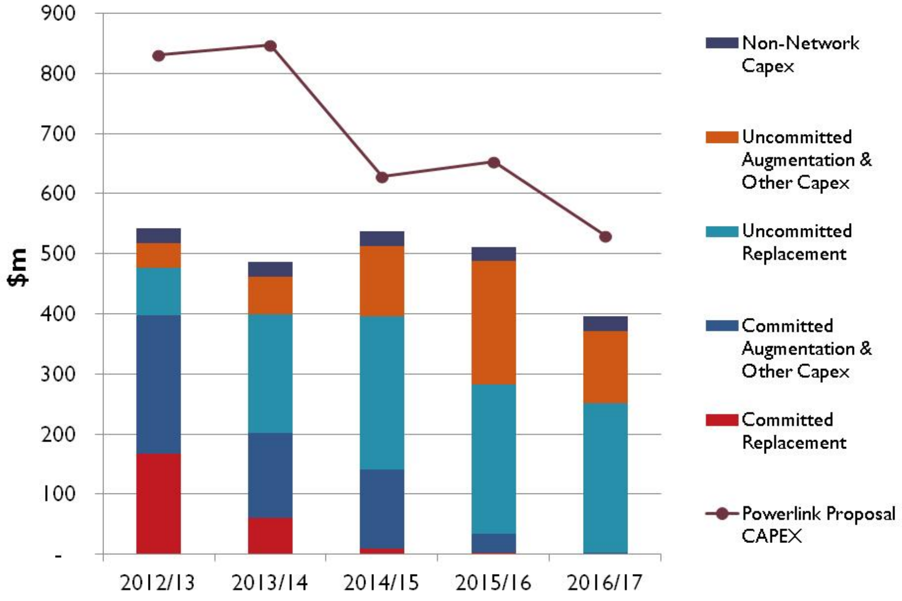
$million (real 2011/12)

	Uncommitted Network	Committed Network	Non-Network	Total Capex
2012/13				
Powerlink Forecast	275	529	26	830
Adjustment	- 157	- 130	- 0	- 287
Adjusted Capex	**119**	**398**	**26**	**543**
2013/14				
Powerlink Forecast	468	356	24	847
Adjustment	- 208	- 153	- 0	- 361
Adjusted Capex	**260**	**202**	**24**	**486**
2014/15				
Powerlink Forecast	544	60	25	629
Adjustment	- 172	81	- 0	- 92
Adjusted Capex	**372**	**141**	**25**	**538**
2015/16				
Powerlink Forecast	617	12	24	653
Adjustment	- 163	22	- 0	- 141
Adjusted Capex	**455**	**34**	**23**	**512**
2016/17				
Powerlink Forecast	501	3	25	529
Adjustment	- 134	0	- 0	- 134
Adjusted Capex	**367**	**3**	**25**	**395**
Total RCP				
Powerlink Forecast	**2,405**	**958**	**125**	**3,488**
Adjustment	- 833	- 180	- 2	- 1 015
Adjusted Capex	**1,572**	**778**	**123**	**2,473**
Less Disposals				4
Total Adjusted Capex				**2,469**

Source: EMCa Strata

349. In figure 14, the alternative capex proposal is shown, by component, and compared with the Powerlink proposal.

Figure 14*: Alternative capex proposal – comparison with Powerlink's proposal*



Source: EMCa Strata

5.5 Recommended alternative capex forecast

350. We recommend that AER adopts the forecast capex described in section 5.4 above as its alternative capex forecast. In summary, the proposed adjustments applied in combination result in an overall reduction of $1,015 million on Powerlink's proposed capex of $3,488 million. The resulting alternative capex forecast is $2,474 million ($2011/12 real terms).

351. In the event that AER accepts some but not all findings, then adjustments specific to those findings are recommended, as described in section 5.3.

352. The proposed forecast has a smoother profile than that proposed by Powerlink. We consider that it better reflects need, in terms of meeting NER objectives. It would also have lower risk in terms of deliverability, potential asset stranding and under-utilisation and, through better resource utilisation and the opportunity to further examine alternatives, would have lower unit delivery costs than the capex proposal proposed by Powerlink.

6 Other requested advice

6.1 Introduction

353. In this section we describe our review and findings in relation to:

- Powerlink's proposal regarding the service target performance incentive scheme (STPIS);
- Powerlink's proposal regarding contingent projects; and
- Classification of connection asset expenditure.

6.2 Service target performance incentive scheme (STPIS) parameters

6.2.1 Introduction

354. This section provides our assessment of the values proposed for the next RCP by Powerlink for the Service Component of the Service Target Performance Incentive Scheme (STPIS). Our assessment addresses the questions posed within the original TOR for the Technical Consultant and some specific questions posed by AER in the course of our review.

355. We also provide an assessment of Powerlink's methodologies and procedures for monitoring and reporting against STPIS parameters.

6.2.2 Powerlink's proposal with regards the (STPIS)

356. Within its Revenue Proposal, Powerlink has submitted proposed targets in respect of its STPIS approved on the 31st March 2011. The scheme provides Powerlink with an incentive or penalty of 1% of MAR under the Service Component. For the Service Component, the scheme measures performance against seven parameters, as follows:

- Transmission Lines Availability;
- Transformer Availability;

- Reactive Plant Availability;
- Peak Transmission Availability;
- Frequency of Large Loss of Supply Events greater than 0.75 system minutes;
- Frequency of Moderate Loss of Supply Events greater than 0.1 system minutes;
- Average Outage Duration.

357. Chapter 13 of the Revenue Proposal contains Powerlink's proposed targets, caps, collars and weightings for the above parameters.

6.2.3 Review scope, approach and assumptions

Scope

358. AER's TOR required the following (in summary) :

a. an opinion on the values and weightings proposed and detailed reasons on whether the proposed performance targets, caps, collars and weighting are consistent with the principles in clause 6A.7.4 of the NER and the AER's STPIS[19].

b. Advice on any aspects of the proposed values and weightings that EMCa disagree with and, where appropriate, propose substitute values that are considered to be consistent with the requirements of the NER and STPIS including reasons, methodologies and assumptions.

359. In accordance with the requirements of the TOR, a review and assessment of the recording, reporting systems and processes used to record performance against the STPIS is provided. The aim of this review and assessment is to identify:

a. The accuracy and reliability of the performance data;

b. The appropriateness of the recording processes in terms of collecting service standards performance data;

c. Any systemic weakness in these processes or systems.

Approach

360. For the proposed performance targets, caps and collars, we examined each parameter, the calculations behind the proposal, the reasonableness of the proposed target, cap and collar, and any proposed offset, and assessed it for reasonableness against the STPIS and NER principles and requirements. In doing so, we considered the proposed weightings for each parameter and the relationships between them.

361. To review the recording and reporting systems and processes, we held an onsite meeting with Powerlink staff to have these explained and to discuss the methods of

[19] *Electricity transmission network service providers; Service target performance incentive scheme* (AER, March 2011)

audit, verification and monitoring. A subsequent review of data capture and processing verification was undertaken.

Assumptions

362. The following assumptions were made in forming views:

a. That the data recorded and used by Powerlink for the purposes of calculating previous years' performance statistics was accurate and complete; and

b. That the additional information and data with regard to developing proposals for offsets was as accurate and complete as Powerlink could estimate with regard to planned and expected outage durations to undertake works.

6.2.4 Our assessment of Transmission Circuit Availability parameters

Powerlink calculations

363. The AER-approved STPIS has three transmission circuit availability plant parameters:

- transmission lines;
- transformers and reactive plant; and
- a peak circuit parameter.

364. For each of the parameters, the methodology for determining the proposed target, collar and cap is estimated by taking the mean of the past five years' availability data. The cap and collar is calculated as plus or minus two standard deviations around the mean.

365. Our review identified that Powerlink's calculations are correct for the initial targets, collars and caps for each of these parameters using the above methodology.

Powerlink methodology

366. In calculating the caps and collars in the manner described above, Powerlink appear to be applying some form of statistical process control (SPC) technique, although from the information provided it is unclear which exact one is being utilised.

367. The use of SPC is considered valid and reasonable to the parameters for availability. Although complex, the overall process for managing availability of each parameter within the total network does consist of a number of managed sub processes such as; outage management, maintenance, construction, plant and equipment selection etc. As such it is reasonable to assume the overall process is managed and controlled and will produce a controlled output within a defined range. However, in our opinion, it is unlikely the overall process can be described empirically with defined relationships between each of the sub processes.

368. The setting of the cap and collar at two standard deviations for each parameter effectively means that 95% of expected outcomes for each overall process would fall within the cap and collar, if each sub process is continued to be managed in the same way as in the previous RCP.

369. The STPIS provides an incentive element for the improvement of the management of each sub process, so as to achieve an improvement in the total process, and seeking outcomes that lie between the mean target performance and cap. The result of this, at the end of an RCP, should incentivise improvements leading to an improved mean performance and/ or reduced variability (range) in outcomes.

370. For reactive plant, the recalculated performance target, after excluding capacitor bank in the winter off peak period, has led to a lower performance target. In our opinion this exclusion has been calculated correctly. We would not see the performance target calculated as being an illogical result because of the large range in the data and because there is significant variance (for a transmission network asset) in the availability, or unavailability, of the capacitor banks, year by year and throughout each year. This range of variance, consistent with the concepts of SPC, suggests either, that there is a managed process with a very wide range of variability or, it is a process that is out of managed control.

371. The above point is discussed further later in this section when discussing weightings.

372. As a result of the wide variance in data from month to month within each year, the exclusion of the data for a part year has resulted in a performance target mean at a reduced level. For a process that is exhibiting low management control on process and as a result large variance in the outcomes, this is not an unexpected result. A process in such a state of control will not generally provide a mean from five data points that is the same as the true long term mean

373. In this availability parameter there is considerable scope, within the managed sub processes, for improved control leading to a tighter range in variability around the long term mean.

374. We consider the methodology used for determining the caps and collars for the availability parameters is reasonable and consistent with the requirements and principles of the STPIS and NER.

Offset methodology proposed by Powerlink

375. Due to a combination of capital and operational refurbishment works during the next RCP, Powerlink has proposed offsets for both the Transmission Line and Transformer parameters. Powerlink has proposed that works such as these have not been undertaken before and will require substantial outages in addition to those in the current RCP for construction and maintenance requirements.

376. Powerlink has calculated the proposed offsets for each parameter by taking the total number of hours that are expected to be added to unavailability by the works over the next five years and dividing that by five. The number of hours is then divided by the projected availability and subtracted from the performance target. Projected availability is forecast by taking the average growth rate of availability for each parameter over the last five years.

377. It is notable that Powerlink proposes the adjusted performance target but uses the original standard deviations for the collars and caps from the unadjusted data. Also, it does not include any variability that is likely to exist in the estimates of the unavailability due to the works. By doing so, it is keeping the cap and collar narrower than could be expected.

378. The following questions were raised with Powerlink regarding the data used to calculate the offset.

a. When forecasting availability to calculate the availability offsets for lines and transformers, a constant growth rate of availability for these plant items is used based on historical growth. How does Powerlink justify the assumption that, over the next five year period, these two plant items will undergo the same rate of growth as the previous five year period?

b. How does Powerlink justify that the ‘base’ line and transformer capital and operational works will be the same as the previous 5 year period; such that the ‘additional’ works are an addition to be considered for an offset?

c. When calculating the availability offsets, why has Powerlink not estimated the variance around the mean time to complete the ‘additional’ works?

379. In responding to the first two questions, Powerlink stated that it expected the same rate of capital expenditure as had occurred over the past five years, and there was some uncertainty to the actual timing of all work. The forecast capital expenditure provides an indication of the number of network elements to be placed into service in the next regulatory period. Of these network elements, some will be replacements for existing network elements and not increase the total number. As the total capex for the next period is broadly similar to that for the current period, and replacement capex accounts for a similar proportion of total capex as for the current period, the number of additional network elements brought into service is expected to be similar to the current period. In these circumstances, Powerlink considers it reasonable to extrapolate the count of transmission line and transformer elements from the 2008–12 periods.

380. We consider that this answer provides a reasonable basis for the assumption of a constant and ‘smoothed’ growth in availability for lines and transformers and for the assumption that the ‘base’ line and transformer capital and operational works will be the same as the previous 5 year period (based on the capex forecast within the submission). However, this would need to be reviewed in the light of any adjustment determined to the capex proposals contained in the submission.

381. In responding to the third question, Powerlink informed us that the majority of transmission line and transformer unavailability in the previous five year period is attributed to planned outages required to support project works, such as replacement of substation equipment. Much of the project work in this period may seem to have a degree of repeatability; however, the individual requirements of specific sites and network topologies result in a degree of variability.

382. The transmission line tower painting and transformer refurbishment works in the next regulatory control period will be of a similar project based nature. As a result, these projects will have similar outages to the works that have driven most unavailability in the previous five year period. Hence, the ‘additional’ work for the next five year period, while assessed on the basis of standard durations for packages of work, is expected to show a similar amount of variability of outage duration. For this reason, after allowing for offsets, Powerlink has chosen not to adjust the variance around the mean for the availability targets.

383. Powerlink’s explanation suggests that it has a reasonable ability to forecast what the likely variation in outage duration will be. However, by deciding not to allow for this,

Powerlink has effectively kept the cap and collar to narrower limits than would otherwise be the case.

384. On the basis of our review, we consider that Powerlink's methodology for calculating proposed offsets is reasonable and appropriate. We address below whether we consider the offsets to be justifiable.

Application of offsets

385. We were asked in the AER's supplementary questions whether the offsets could be calculated and applied on a year by year basis in the years refurbishment works took place. We consider that it would be possible and reasonable to do this. However, because the growth of availability is assumed to be linear, due to the uncertainty of timing of capex projects and the fact that the 'additional' work timing is questionable, we question whether bringing 'accuracy' to one element would give any significant advantage or improvement to the application of the offsets on this basis. This approach would only bring some level of increased accuracy if works were applicable to definite years and not spread over the entire RCP.

Justification for applying proposed offset due to "extra works"

386. We then examined the reasonableness of the extra works for Transmission Lines and Transformers to consider whether they represented a justifiable increase in the volume of works as identified in 3.3 (k) (2) of the STPIS.

387. For transmission lines, we see the works as either ensuring that end of asset financial life is met through maintenance (opex) or providing an extension of asset life (capex). We consider that the need for all the works, whether capex or opex has arisen as a result of the RCM regime that Powerlink has applied to the transmission towers. We hold the view that earlier condition monitoring and application of necessary maintenance strategies in the form of tower painting is likely to have avoided the need for much, if not all, of this work and avoided the compressed timescale it is to be done in.

388. Based on experience and knowledge in the field of transmission tower maintenance, our review team considered that with the application of best practice maintenance techniques the physical life of the transmission towers would exceed the financial asset life assigned by Powerlink by many years.

389. The decision not to maintain the transmission towers in this manner can be considered to be a decision based on a capex vs. opex 'trade-off' strategy in that at, or towards the end of, the financial asset life it is to be expected that the towers will require replacement (physical replacement or life extension as defined in the Powerlink AMS) as part of a capex programme. On that basis we would expect that such replacement works would be integrated and smoothed within the 'normal' capex programme, the timing taking into account the outage requirements balanced with those of other capex requirements and the overall impact on the parameter availability.

390. We consider the inability to integrate and smooth the impact of the proposed capex work for towers on availability is, to a significant extent, due to the late understanding of the condition of these towers and the required urgency of the work as a result of this. On that basis, we do not consider an offset, as proposed for the capex works

transmission line works represents a justifiable increase in the volume of works as identified in 3.3 (k) (2) of the STPIS.

391. As Powerlink has identified in its submission that only additional capital works represent a justifiable increase in the volume of works as identified in 3.3 (k) (2) of the STPIS, we have assumed that none of the 'operational refurbishment' works have been included in the calculation of the proposed offset for transmission line works. However, this is not entirely clear within the submission or in the calculations provided by Powerlink. In line with our conclusion for capital works, we also consider that the offset is not justified for 'catch up' opex maintenance.

6.2.5 Our assessment of Transformer Availability parameters

392. For transformers, the 'additional' work is described as transformer refurbishment projects. Powerlink's AMS defines refurbishment work as an operational expense above normal routine maintenance to maintain the capability of the asset for its normal expected life. As such this is not capital works and no provision for justifiable increase in the volume of works as identified in 3.3 (k) (2) of the STPIS exists.

6.2.6 Our assessment of Frequency of Loss of Supply parameters

Review of calculations and of "curve of best fit" approach

393. For the two Loss of Supply (LOS) parameters, Powerlink has calculated a performance target based on the average performance history over the most recent five years. Our review of the calculations shows these to be correct.

394. For the collars and caps, Powerlink adopts a 'curve of best fit' approach for the data available over a 10 year period. The total process for network supply, and in effect LOS, would be complex to model as a relationship of "sub processes". Although these are well understood as sub processes, they would be difficult to empirically define. Therefore we consider that the use of the 'curve of best fit' method for the frequency data is a valid and reasonable approach.

395. Powerlink's Proposal was unclear to us on the methodology and tool used to develop the 'curves of best fit'. We therefore requested further information and explanation. In response Powerlink identified they have used the @ Risk plug-in for Microsoft Excel and had selected the Gamma distribution for the "large' (>0.75 system minute) events and the Pearson distribution for the 'moderate' (>0.1 system minute) events.

396. The response from Powerlink identifies it has sought to fit the best distribution to each set of data. Although we would accept that it is complex to model the process for LOS, we consider that the causes of all LOS can be viewed as common. In addition, 'large' events are also classified as 'moderate' events. Therefore, we consider that the common best fit distribution across both sets of data would have been a more appropriate selection.

397. We also note that the best fit Gamma and Pearson distributions selected are for continuous distributions yet the frequency data for LOS is clearly discrete. There is either a LOS event or not a LOS event. It is not clear to us that Powerlink has sought to fit discrete distributions to the data sets.

398. The use of a continuous distribution to approximate discrete data is not necessarily incorrect. There are many situations in which the distinction between discrete and continuous data is rather unclear. However, Powerlink has attempted to fit a continuous distribution and has then determined the caps and collars by rounding to the nearest integer. Essentially, it has fitted a continuous distribution to discrete data and then rounded the fitted values to make the distribution discrete. The problem with this method is that the rounding has involved moving a sizeable amount of probability mass, which severely distorts the curve that was initially fit.

399. In our opinion a better solution to the problem would be to fit a discrete distribution in the first place. We[20] calculated the LOS parameters under this method using the @Risk plug-in to fit discrete distributions, which are also more theoretically suitable for such situations, to the frequency data supplied by Powerlink. Doing this provided the following comparisons:

	LOS >0.75 system minutes		LOS >0.1 System Minutes	
Percentile %	**Powerlink Distribution (rounded)**	**Discrete Distribution**	**Powerlink Distribution (rounded)**	**Discrete Distribution**
5	0	0	2	1
10	1	0	3	2
90	3	2	10	10
95	3	3	12	12

Consideration of exclusion of data for 2002-03

400. We have considered the question as to whether it is reasonable to use ten years of data for determining the collar and caps for the 'curve of best fit' methodology and we have considered the statistical issues associated with data size and whether there is a case for excluding data from 2002-03, for which the data indicates a different pattern from other years.

[20] We were assisted by NZIER in undertaking the assessment and calculation of LOS parameters and @Risk analysis.

401. The sample is already small, at only ten observations. We consider that there is no cause to exclude data unless there is a clear reason as to why it is invalid to include it. It may be that 2002-03 saw some extreme conditions that would not be expected in future, or it may be that the other years were particularly good for Powerlink and it is the zeros and ones which are overrepresented in the sample. Powerlink has indicated that it considers the latter factor to be the case in section 5.5.2 of its submission, in identifying that the reduced intensive storm, lightning and high winds in the current RCP has been a factor in its improved performance in LOS parameters over the period.

402. In a functioning power network, we would expect to see few failures on average with a larger number on rare occasions. That is also approximately the prediction of the gamma functions that Powerlink appears to have fitted to the data. The implication is that we would expect to see a large number of small values and a small number of large values, exactly as we see in the frequencies provided by Powerlink. This underlines the importance of keeping the full sample of data.

403. We asked Powerlink for further information regarding the LOS events in 2002 and 2003 and received the following response:-

> *"The years 2002 and 2003 have a higher number of Loss of Supply events greater than 0.1 system minutes than other years in the performance history. This was attributable to a number of factors, internal and external, for example: natural hazards such as lightning and other environmental factors. Powerlink can confirm that these events were all unrelated, random and unforeseeable and are not the result of any common cause of failure".*

404. If the data was valid to be included as an extreme event and not excluded as a *force majeure* within the STPIS at the time, it is relevant to question why the data from these years should be excluded. It is difficult to identify a reason why, if the principle of using 10 years of data (to provide a more accurate 'curve of best fit' methodology than with 5 data points) has been established with other TNSP's, the data from these years should be excluded as statistical outliers for Powerlink.

405. Finally, we considered the effect of retaining the full data set, relative to sub-sampling the values excluding 2002-03. The relatively large number of high frequencies in the full sample will cause the cap and collar to be relatively high compared to the mean, which gives Powerlink some more leeway on the collar. However, it also means that the performance target, which averages only five years of data, is low compared to the likely true, population mean.

406. The small number of LOS events in the past five years, relative to the full samples, means that the targets may be biased downwards. Indeed, the median of the past five years for LOS >0.75 system minutes events is only 1, compared to a fiftieth percentile of 1.4 and, for LOS greater than 0.10 system minutes, is only 4 events compared to a 50th percentile target of 4.7 for Powerlink's fitted data.

407. In summary, we recommend retaining the full sample. However, we caution that it does imply that the performance targets, caps and collars are estimated on different data sets and are thus inconsistent, in a sense. For the current estimations, the performance targets are a low number of LOS events, relative to the caps and collars. We presume this was also the case for other TNSPs where AER has accepted the use of 10 years of history. If it has previously been agreed that the use of 10 years of data provides a more reliable data set for the 'curve of best fit' methodology; it would seem logical to use the

same data set for the calculation of the performance target as allowed for in 3.3 (h) of the STPIS.

408. For information and comparison we provide the following table developed from fitting discrete distributions to the most recent 5 year data sets:

	LOS >0.75 system minutes	LOS >0.1 System Minutes
Percentile %	Discrete Distribution (5 years data)	Discrete Distribution (5 years data)
5	0	1
10	0	2
90	2	6
95	2	6

Consideration of parameter values

409. We consider that the proposed performance targets for the' large' and 'moderate' LOS parameters have been calculated correctly on the previous 5 years' data. The caps and collars proposed are correct as the 10th and 90th percentiles for the 'curves of best fit' using 10 years of data selected by Powerlink. We accept Powerlink's logic in rounding "down" the large LOS cap to "zero events" rather than using the statistical value of "1 event" (and which would make it otherwise the same as the target parameter) .

410. Taking into account our observations above, with regard to the use and selection of 'curves of best fit' for discrete distributions as opposed to continuous distributions; we would propose selection of caps and collars from the 10th and 90th percentiles of the discrete distributions we have developed.

411. It should be noted that the STPIS allows for the proposed cap and collar to result in both symmetric and asymmetric incentives in 3.3 (f). Also that use of 5 years' data to calculate the targets, and 10 years' data to calculate the cap and collar, results in lower (i.e. more onerous) targets compared to the likely true population mean.

6.2.7 Our assessment of Average Outage Duration parameters

412. Similar to the transmission circuit availability parameters, Powerlink has proposed a performance target for this parameter that is an average of the five most recent years of performance data. The cap and collar proposed is calculated as plus or minus two standard deviations around the mean. We would see this as an appropriate and

reasonable approach to proposing the cap and collar for the same reasons outlined above for the parameters of Transmission Circuit Availability.

413. We can confirm that our review identified that Powerlink's calculations are correct for the initial targets, collars and caps for each of these parameters using the above methodology. We can also confirm that the exclusion for the capacitor banks has been calculated correctly.

414. We consider the proposed target, cap and collar for this parameter to be reasonable and appropriate.

6.2.8 Our assessment of weightings

Weightings for plant availability

415. Powerlink has proposed that the three plant parameters (transmission lines, transformers and reactive plant availability) be weighted to reflect the number of plant elements in each particular availability parameter. It is not clear to us how weighting reflecting the number of plant items is consistent with the requirements and principles of the STPIS and NER.

416. It is our expectation that resources within Powerlink are appropriately aligned and organised in proportion to the number of plant items in each plant parameter to provide the necessary asset management to ensure the optimum reliability and availability is achieved. It is, therefore, our expectation that the long term performance objective and target achievement for each would be the same unless specific reasons are provided for other outcomes.

417. In our view, an appropriate starting position is that all plant classes contribute equally to the overall transmission system service to provide reliable supply.

418. The peak availability parameter in effect reflects the overall need to have the highest performance from the three plant sub groups at the critical time. As such, it is a cumulative performance measure of the other three parameters during the critical period and, out of the four availability parameters, is the one significantly aligned to clause 6A.7.4 (b) (1) (i) of the NER. From that point of view, placing an equal weighting on this parameter in effect adds a premium to the weightings on the other measures to the extent that they apply at peak times and, again, we have not been presented with arguments as to why this should differ from the weightings for other availability factors.

419. We have considered the potential for overlap between the peak availability parameter and the market component of the STPIS. Although we recognise that there is an element of overlap between the two, we consider this to be small in total and consider that the drivers and outcomes that each parameter seeks to address have some significant independence that is only addressed by the independent STPIS parameters. The market component is primarily applied to remove constraints to the most effective dispatch of generation at all times to achieve the most effective market outcomes in alignment with NER 6A.7.4 (b) (1) (ii). Whereas, the peak availability is primarily addressed at providing greater reliability of the network when users, and specifically important in this, the load users, place greatest value on the reliability of the network in alignment with NER 6A.7.4 (b) (1) (i). For this reason we consider that the weighting for

peak availability should be set without reference or consideration of any overlap effect with the market component.

420. Any variation from the initial starting position should be justified on the basis of identification of a specific plant item being perceived to be of greater value in contributing to service or reliability or to seek improvement in a lower performing area. Our suggestion would be that reactive plant (with a particular emphasis on capacitor banks), is such a plant item for the following reasons:

a. Powerlink in many of its planning reports and during its onsite presentations emphasises its leading position worldwide in the use of reactive plant to push the transmission network to maximum delivery and the key role it plays in maintaining voltage stability. On the Powerlink network this means reactive plant is playing a far more significant role than on many TNSPs worldwide. We would, therefore, recommend an increased weighting on this plant parameter to reflect that importance.

b. As noted earlier, the unavailability of capacitor banks has a high variability within each year and across each year historically. An incentive to focus solutions to technical problems and managed processes to improve the outcomes for this plant family is desirable.

421. Our advice for availability plant group and peak parameter weightings is as follows:

- Transmission Lines Availability 0.10;
- Transformer Availability 0.10;
- Reactive Plant Availability 0.15;
- Peak Availability 0.10.

422. These availability weightings sum to 0.45, which is as Powerlink proposed for availability as a group.

Weightings for loss of supply

423. Loss of supply, on a transmission system conforming to planning standards in build and operation, is generally due to the failure of the system to respond as designed to an initial event or the network suffering from extreme events, subsequent to an initial event, that does not allow adequate operation time to re-secure the system to planning standards or has damaged the system such that his cannot be achieved. Extended loss of supply beyond the initial event is normally due to poor operator action or unforeseen or unplanned system circumstances.

424. Causes leading to a LOS are common to both the moderate and large LOS events.

425. Powerlink has proposed a weighting of 0.30 for ‘large’ events and 0.15 for ‘moderate’ events. We note that any ‘large’ events will also be counted as ‘moderate’ events, since the definition has a lower threshold but not an upper threshold. Also we note that the target for large events is 1, with a collar of 0, so that there is in effect a binary incentive.

426. For this reason, performance against the parameter for ‘moderate’ events (for which Powerlink’s proposed target is 4) is easier to measure and interpret and is therefore likely to be a more meaningful incentivisation target. In addition, emphasis is placed on reducing the frequency of LOS as a whole. For Powerlink, the incidence of a higher

weighting on 'moderate' events (which will be statistically more stable) will provide a more meaningful and stronger incentive.

427. We consider that the weightings proposed by Powerlink for the LOS parameters would be improved and would provide more meaningful incentives if they were reversed.

6.2.9 Our assessment of recording and reporting systems and processes

428. At our onsite visit we reviewed the STPIS related recording and reporting systems and processes. It appears that data collection systems are 'mechanical' in nature, and have been well explored, described, examined and audited by previous consultants for both a revenue reset and STPIS review (PB 2008 & SKM 2007). We identified that Powerlink has not made any change to its performance data and capture system subsequent to these audits and review. For this reason we considered that replicating the system description in this report was unnecessary.

429. As the wider EMS has recently been upgraded there was an opportunity to use the end to end testing results obtained when commissioning the new EMS to verify STPIS data integrity. To do this we obtained and reviewed results for 10 randomly selected EMS cases and examined:

a. A spreadsheet extract of the circuit breaker operations as recorded by Powerlink's Energy Management System (EMS). (To reduce the number of entries, a filter was applied to include only circuit breaker operation events.);

b. A spreadsheet extract of the Powerlink's Circuit Availability data, which comprises the Forced Outage Database (FOD) and Outage System Transmission Reporting And Coordination (OSTRAC) Database.

430. The above examinations allowed STPIS input data entries to be traced (and verified) from the EMS information to the Circuit Availability records. From this examination we conclude that the Powerlink system for recording, processing and reporting of service standards continues to be a robust and reliable system free from material errors.

431. By providing the relevant minutes, Powerlink demonstrated that it now conducts an AER Services Statistics Monthly Review Meeting at which it examines and seeks to understand the greatest contributing factors to both the Service and Market elements. From this, Powerlink is identifying ways to improve performance. We considered that this provided a good demonstration that the STPIS is driving behaviour consistent with the principles in clause 6A.7.4 (b) of the NER.

6.2.10 Findings and further observations with regards to STPIS parameters

Findings

432. Powerlink's processes for data capture and analysis appear to be generally sound with the exception of the following three areas.

a. Powerlink has not adequately justified its proposed adjustments to the performance targets for transmission circuit availability, transmission lines and transformers within STPIS and EMCa recommends that the AER not accept the proposed adjustments;

b. For the two Loss of Supply (LOS) parameters derived from the 'curve of best fit' an improved methodology would set the collar for 'large' LOS events and the cap for 'moderate' LOS events at 2 and not 3;

c. The weightings for 'large' and 'moderate' LOS events will provide improved and more meaningful incentives if they are reversed.

433. Our recommendations with regard to the targets, caps and collars proposed by Powerlink for STPIS are as follows:

a. For Transmission Lines Availability the offset proposed should not be allowed and the performance target should be set at 98.94% and not 98.67% as proposed by Powerlink;

b. For transformer Availability we do not consider the STPIS specifically provides for allowing the offset proposed by Powerlink and the performance target should be set 98.76% and not 98.59% as proposed by Powerlink.

   In both cases, the caps and collars are to be adjusted accordingly.

c. For the LOS parameters:

   - For 'large' (y) LOS events the collar should be set at 2 and not 3 as proposed by Powerlink;
   - For 'moderate' (x) LOS events the cap should be set at 2 and not 3 as proposed by Powerlink.

d. Weightings for the availability parameters should be set for:

   - Transmission Lines at 0.10 and not 0.175 as proposed by Powerlink;
   - Transformers at 0.10 and not 0.115 as proposed by Powerlink;
   - Reactive Plant at 0.15 and not 0.090 as proposed by Powerlink;
   - Peak Availability at 0.10 and not 0.070 as proposed by Powerlink.

e. Weightings for LOS events should be:

   - Set at 0.15 for large (y) LOS events and not 0.30 as proposed by Powerlink;
   - Set at 0.30 for moderate (x) LOS events and not 0.15 as proposed by Powerlink.

434. The following table sets out our recommendations for the performance targets, caps, collars and weightings for the service component of STPIS[21] (differences between our recommended values and those proposed by Powerlink are shown in red):

Table 18: *Recommended STPIS parameters*

Parameter	Unit	Collar	Target	Cap	Weighting (% of MAR)
Transmission Lines Availability	%	97.77	98.94	100	0.10
Transformer Availability	%	98.27	98.76	99.24	0.10
Reactive Plant Availability	%	94.45	97.15	99.84	0.15
Peak Availability	%	98.31	98.76	99.20	0.10
LoS >0.75 system minutes	Events	2	1	0	0.15
LoS >0.10 system minutes	Events	10	4	2	0.30
Average Outage Duration	Minutes	1,306	859	412	0.10

Source: EMCa Strata (with input from NZIER)

Observations

435. There appears to be a case to support the use of 10 years of data to calculate the performance target for the LOS parameters to align with the use of 10 years of data for the 'best fit curves'. We consider where small data sets of 5 years are used for the calculation of performance targets for parameters that the use of the median rather than the mean should be considered, as this will provide stronger correlation to the true long term mean of a larger data set.

436. For all aspects of the service components there will be a finite performance target that can be achieved. Additionally there is most probably a lower performance target that is the optimum economic target to be achieved. Although monitoring and setting

[21] Subject to our observation and comments with regard to the transformer plant group and the legal advice received by AER with regard to STPIS application for adjustment on the performance targets for changes in the volume of operating works under the STPIS and the NER.

performance targets is likely to have achieved performance improvement through process improvement and management control, there is a definitive service component performance requirement within the planning standards the network is designed and built to, that provides the service standards required and expected. To seek to achieve more may not be cost effective and it is not clear to us how the STPIS or NER objectives currently reflect this cost and service component standard balance.

437. Currently in the parameters, such as LOS, the target performances are focussed on monitoring and recording the adverse outcomes rather than the situations that precede and can eventuate to these adverse outcomes. Improvements in this performance may be achieved through the techniques applied to 'total loss control" where the 'near miss' is monitored, recorded and examined for root causes to improve the performance on outcomes.

6.3 Review of Powerlink's proposed contingent projects

6.3.1 Assessment approach and assumptions

438. The concept of "contingent projects" is defined in the NER, and allows for the TNSP to submit projects, as part of a Revenue Proposal, that can be triggered by an event or circumstances that are pre-defined. Once triggered, there is then a further review and regulatory approval process for the project costs, in which the AER may approve an amendment to the revenue determination.

439. As required under the TOR we undertook a review of all the contingent projects submitted by Powerlink. To do this we established a framework for our review, which covered the following aspects:

a. **Double counting**: to assess whether any aspect of the contingent project is also included in the "forecast capex" submission;

b. **Definitional allocation:** To assess whether the project meets the hurdle criteria for a "contingent project" as defined in the NER (clause 6A.8);

c. **Trigger event**: To assess whether the trigger event is reasonably specific and capable of objective verification, is a single and sole trigger, and relates to a "specific location", not to the "network as a whole".

440. Following clarification with the AER, we did not review the proposed costings for reasonableness as the AER has the responsibility for making a determination on project costs (and other matters) if and when Powerlink seeks to trigger a project. We undertook to report on any manifest errors in costings that we identified.

441. The full list of contingent projects reviewed is listed in detail in Appendix N of Powerlink's submission and summarised in Powerlink's main Revenue Proposal document.

442. In addition to reviewing the contingent projects proposed by Powerlink, we also undertook a contingent project assessment on the sample of "forecast" projects as described in section 4.7. In this assessment, we considered whether each project more

properly meets the criteria for a contingent project and should be so presented, rather than being included in forecast capex. Our reporting on that analysis is contained in section 4.8.

6.3.2 Our assessment

443. The following provides a summary of the review undertaken for each of the contingent projects using the framework identified in in section 6.3.1. It also delivers key findings from our analysis, our view on the classification as contingent and supporting justification for the view we have taken.

CP 02542: Columboola to Western Downs & Columboola to Wandoan South 275kV 3rd Circuits

444. We have considered the first two contingent projects proposed by Powerlink as a single contingent project as they have an identical trigger point and are both linked to the solution of the same network constraints and limitations.

445. The project meets the financial hurdle rate of being >$48m.

446. We would express some doubt on the probability that this project will be needed during the RCP for the following reasons:

a. The trigger is either import to or export from the Surat Basin region exceeding 850MW. The information from Powerlink would suggest that growth in load or generation in the Surat Basin, Columboola – Wandoa area is equally likely; this in turn would suggest that there is likely to be considerable 'netting off' of load and generation in the region.

b. The current 10% PoE high scenario load forecast for the Surat Basin identifies a load at the beginning of the RCP of approximately 100MW and does not identify load of 850MW until the following RCP period. Taking into account the comment made above; we consider that there is more than adequate 'headroom'.

c. There is no suggestion that if generation development requires an export of greater than 850MW that such export is required for reasons of reliability. This, therefore, would constitute a market constraint on the export of generation and export of greater than 850MW should not be considered an allowable trigger.

447. Our view is that this should not be accepted as a contingent project.

CP 02850: NEMLink (Queensland Component)

448. Due to the significant amount of work in refining the current high level study, preparation of the market benefit Regulatory Test, and the time and debate to be expected (across all east coast states) we consider that it is highly improbable that this project will proceed during the next RCP. We would have expected to see a significant commencement of detailed planning to have already commenced for construction to be possible within the RCP.

449. In the high level studies, AEMO has assumed that the NEMLink proceeds from 2020/21. We would consider this to be an optimistic consideration, bearing in mind the rate of progress of similar market benefit proposals in other countries worldwide.

450. We do not consider that, as a pure market benefit project, the project meets the NER requirements for capital expenditure objectives and that being the case, does not meet the NER requirements for a proposed contingent project.

451. Our view is that this should not be accepted as a contingent project.

CP 01125: QNI Upgrade (Queensland Component)

452. As this is a Markets Benefit project, we consider that this project and the benefits that can be ascribed to it are significantly interlinked to the NEMLink proposal.

453. We consider it unlikely that this project would proceed if it was determined to progress with the NEMLink proposal as it would be overtaken or subsumed within that proposal. It is, therefore, our expectation is that any decision on this proposal would be deferred until refinements of the NEMLink study have been completed and a decision to proceed or not has been made.

454. Bearing in mind our comments above on the NEMLink contingent project; we consider it unlikely that this project would commence within the RCP.

455. We do not consider that, as a pure market benefit project, the project meets the NER requirements for *capital expenditure objectives* and that being the case, does not meet the NER requirements for a *proposed contingent project* .

456. Our view is that this should not be accepted as a contingent project.

CP 02382, CP 02537, CP02600: N-2 security to essential loads

457. The series of works and projects for this contingent event revolve around a recommendation of the AEMC that a national framework be established governing the reliability of supply from transmission networks to loads. As part of these reforms, the AEMC has recommended that reliability standards be determined on a jurisdictional basis by a body independent of the transmission asset owner. This appears to be a proposal for a similar structure to the NERC in the USA.

458. As far as we understand, this is currently a highly conceptual proposal and has yet to be fully consulted on; and according to that outcome, a structure will then need to be put in place. We consider it unlikely that a jurisdictional review of reliability will conclude and make a determination in a time frame within the next RCP which would require Powerlink to construct assets to meet an N-2 reliability standard.

459. Our view is that this should not be accepted as a contingent project.

CP 0219, CP04152, CP 01527, CP 02359: FNQ 275kV energisation

460. We note that the contingent project is premised on an increased reliability standard of N-2 for the North Queensland Region.

461. None of the material provided in support of this Contingent Project identifies what body may determine this increased standard of reliability or any information to support the probability of this occurring in the RCP.

462. We consider that there is no evidence to suggest this will be required or is likely during the RCP.

463. Our view is that this should not be accepted as a contingent project.

Acceptance of contingent projects

464. We consider it reasonable that the following projects be accepted as a contingent projects because:

a. The project has a definite trigger point that meets the NER requirements.

b. The contingent project is for the advancement of shared transmission network works that would be required when the trigger was met.

465. Indicative costs are based on the most expensive case founded on the need for all shared transmission works needing to be advanced.

CP 01156.2 CP 02090 CP 02271.2	Mt Isa connection shared network works.
CP 02483	Galilee Basin Connection Shared Network Works
CP 02044 CP 02549.2	Moranbah Area
CP 02539	Bowen Industrial Estate
CP 01762 CP 02464	Callide to Moura transmission line and Calvale transformer
CP 01706.3 CP 01957.3	Gladstone State Development Area (connection shared network works)
CP 02270.2	Ebenezer 330_275_110kV establishment

6.3.3 Findings on proposed contingent projects

466. We consider that seven of the contingent projects meet the NER requirements.

467. We consider that the following projects do not meet the requirements for contingent projects under the NER:

a. CP02542 (Columboola – Western Downs and Columboola – Wandoan 3rd circuit) does not meet the "probability" test under NER, as it is required only with net loads well in excess of those assumed in the high scenario and only if that high LNG-related load cannot be sufficiently met by local generation;

b. CP02850 (NEMLink) does not meet the "probability" test, and we note that AEMO assumes that it would proceed only from around 2020/21.

c. CP01125 (QNI upgrade) is unlikely to proceed unless the possibility of NEMLink was ruled out in NEM planning. Further, the justification for both this and the preceding project CP02850 relate to market benefits and we consider that neither project meets the capital expenditure objectives required under the NER;

d. CP02382, CP02537 and CP02600 (N-2 security to essential loads) does not meet the probability test within the RCP, noting that this is a conceptual proposal only that would require NEM consideration, decision, change to defined security requirements and then (assuming a positive decision) a staged implementation;

e. CP0219, CP04152, CP01527 and CP02359 (FNQ 275kV energisation) do not meet the probability test under the NER as they are predicated on an assumed N-2 requirement to FNQ that does not currently exist and Powerlink has not made clear under what mandate such a requirement may be imposed within the RCP.

468. Accordingly, we propose that the contingent projects identified above are not accepted. The values of these projects are as shown in table 19.

Table 19:*Proposed contingent projects not accepted*

$million (real 2011/12)

Project	Total
CP 02850: NEMLink (Queensland)	768
CP 01125: QNI upgrade (Queensland)	59
CP 02542: Western Downs to Columboola 275kV 3rd circuit	58
CP 02542: Columboola to Wandoan South 275kV 3rd circuit	62
CP 02382, 02537, 02600 N-2 security to essential loads	112
CP 01219, 01452, 01527, 02359: FNQ 275 kV energisation (from 132kV)	86
Total	**1,145**

Source: EMCa Strata

469. After disallowing the above projects, there would be a balance of $514m contingent projects allowed.

470. Because contingent projects are not part of “forecast capex”, the adjustments above are not incorporated in the alternative capex forecast.

471. Throughout our review of the proposed contingent projects we gained the perspective that a tendency may exist for the category to be used as a ‘catch all’ for concept projects that did not find a home under the probabilistic scenarios. As highlighted in our review of these projects a significant proportion, in our opinion, do not meet the NER requirements for contingent projects and/or are unlikely to occur within the next RCP.

472. In other respects, Powerlink’s proposed contingent projects are considered acceptable.

6.4 Classification of connection asset expenditure

6.4.1 Scope

473. We have been asked to confirm that connection assets have been appropriately classified in accordance with the AER's interpretation of clause 11.6.11 of the NER that:

> *"any proposed replacement or reconfiguration of an existing connection asset, grandfathered as providing a prescribed transmission service under clause 11.6.11, should be treated as a negotiated transmission service asset"*

6.4.2 Our assessment

474. We asked Powerlink to provide details of any assets that are included in the projects used to develop the 2013-17 capex forecast that are also grandfathered connection assets. In addition we asked for an explanation, if any instances existed where grandfathered assets are included, as to why they are not part of a negotiated transmission service agreement.

475. Powerlink has advised that its interpretation of the requirement of clause 11.1.11 of the NER is that:

> *"where an existing connection asset, grandfathered as providing a prescribed transmission service, is replaced without the Transmission Network User requesting any amendment to the services provided, and the services are being provided under a pre-existing Connection Agreement, then the resultant replacement assets will be treated as continuing to provide prescribed transmission services".*

476. Powerlink's advice on its interpretation of clause 11.6.11 is provided in Annex 11. EMCa has not undertaken a regulatory legal interpretation of this clause. As Technical Advisers, we have assessed Powerlink's approach based on the provided interpretation.

477. Consistent with Powerlink's interpretation, its Revenue Proposal includes forecast capital expenditure to replace a number of existing connection assets, grandfathered as providing prescribed transmission services under clause 11.6.11.

478. Powerlink has confirmed that, in all instances, the services meet its definition of a grandfathered prescribed connection service under clause 11.6.11 because:

a. the relevant service is provided by using assets that include eligible assets;

b. the whole of the relevant service is being provided under a Connection Agreement which was first entered into before the commencement date (as extended, amended or novated from time to time);

c. the Connection Agreement has not at any time after the 2009 commencement date been amended at the request of the Transmission Network User for the purposes of altering the relevant service; and

d. the relevant service would not otherwise be a prescribed transmission service for the purposes of new Chapter 6A, but for this clause 11.6.11.

6.4.3 Findings on classification of connection asset expenditure

479. We consider that Powerlink's application of clause 11.6.11 relating to classification of connection asset expenditure is consistent with its interpretation of this clause. Therefore, provided that the AER considers the stated interpretation to be acceptable, then it follows that the allocation of grandfathered connection assets should also be considered acceptable.

A. Annexures

Annex 1: Deliverability analysis (current RCP)

Table 20 *: Deliverability assessment for 2011/12 projects*

Project ID	Project Description	Commissioning Date	2007/8-10/11	2011/12	Reg Test / Business Case Cost Estimate	Review Commentary	Project weighted probability of completion	Programme weighted probability of completion	External consultation	Business case prepared	Project approved	Equipment Panel Contracts Let	Construction Panel Contracts Let	Major Contracts committed	Commenced
CP.02100	Surat Basin Assets	Jun-12	-	74.7	AER	[C-I-C] [redacted]									
CP.01429	South West Queensland Augmentation	Oct-12	94.4	67.7	$229.2m ($2008/09)										
CP.02030	Columboola to Wandoan Area Network Augmentation	Mar-13	1.3	45.8	$82.6m ($2009/10) $92.5m (escal)										
CP.00880	Tully - Cardwell 132kV Line Replacement	Oct-12	2.4	41.1	$57.3m (escal)										
CP.01780	Calliope River Substation Establishment	Jun-13	47.6	40.5	$149.1m (escal)										
CP.01705	Calvale - Stanwell 275kV DCST Transmission Line	Oct-13	4.1	34.4	$104.6m ($2009/10) $116.8m (escal)										
CP.01163	Swanbank B 275kV Substation Rebuild	Mar-13	5.6	27.1	$52.6m (escal)										
CPxxxxx	Kogan Creek Asset Transfer	Jun-12	-	25.4	AER										
CP.01875	Halys-Blackwall 500kV	Oct-14	8.5	19.5	$387.3m ($2008/09)										
CP.00881	Ingham/Yabulu Sth 275/132kV Line Replacement	Oct-11	81.7	17.7	$97.3m (escal)										
CP.01658	Richlands Primary & Secondary Plant Replacement	Apr-13	0.7	12.8	$30.0 m (escal)										
CP.01019	Moranbah Secondary Systems Replacement	Oct-12	2.4	12.3	$17.4m (escal)										
CP.01420	Woree - Kamerunga 132kV Line Life Extension	Oct-12	0.2	11.4											
CP.01091	Garbutt - Alan Sherriff T/L Replacement	Oct-12	0.0	10.9											
CP.02039	Collinsville 132kV Substation Replacement	Oct-13	-	10.5											
	Sub Total		**248.8**	**451.7**											
CP.01563	Bouldercombe Secondary Systems Replacement	Nov-13	3.5	9.8	$18.7m (escal)										
CP.01620	Bouldercombe 275/132kV Transformer Reinf	Oct-12	1.4	9.7	$13.9m ($2009/10)										
CP.01177	Belmont 110kV Substation Replacement	Nov-11	42.5	9.3	$42.3m (escal)										
CP.02098	MPLS Wide Area Network Deployment	Oct-13	0.0	8.6											
CP.01493	Bulli Creek iPass Secondary System Replacement	Oct-13	0.0	8.3	$17.1m (escal)										
CP.01245	Mackay-Pioneer Val Transm Line Life Extension	Dec-11	1.1	7.8	$5.3m (escal)										
CP.01732	Runcorn 110kv Substation Replacement	Apr-13	0.4	7.2	$15.4m (escal)										
CP.01566	Chalumbin Secondary Systems Replacement	Dec-13	0.5	6.8	$12.5m (escal)										
CP.00882	Cardwell - Ingham South 132kV Line Replacement	Dec-13	1.6	6.6	$60.3m (escal)										
CP.02067	Substation Security Upgrade - Stage 1	Jun-12	1.7	6.5	$8.3m (escal)										
CP.01127	Loganlea 110kV Secondary Systems Replacement	Jun-14	0.4	6.3	$11.8m (escal)										
CP.01397	Nebo 275/132kV No. 1 Transformer Replacement	Jul-13	-	6.0											
CP.01292	Broadsound Secondary Systems Replacement	Nov-12	5.8	5.4	$13.1m (escal)										

Table 21 *: Assessment of projects in current RCP – forecast vs. actual spend*

Current RCP Major Projects (>$25m) - Forecast vs Actual Spend* Real $ 2011/12										
* Actual refers to Powerlink's forecast capex in the current RCP as presented in its Revenue Submission										
Projects with 100% Probability										
Project ID	**Scenarios**	**Probability**	**Project Description**	**Commission Date**	**Total**	**Project ID**	**Project Description**	**Commission Date**	**Total**	**Delta**
[C-I-C]										
				Sub-total	**1,022**				**933**	**-89**
Projects >70% (<100%) Probability										
[C-I-C]										
Sub-total					**267**				**95**	**-172**
Total					**1,288**				**1,027**	**-261**
High probability less than <$25m spend				**Spend > 25% above Revenue Proposal**			**Spend < 25% below Revenue Proposal**			

Projects >$25m Not Forecast or Forecast at <$25m				
Project ID	**Project Description**	**Commission Date**	**Forecast**	**Actual**
	Projects >$25m Not Forecast			
[C-I-C]				
			124.6	**647.0**

Annex 2: Evaluation framework (for sample projects)

Project review guideline

Project reference number:	
Project description:	
Project cost:	
Project timing:	

Rating: 3 = Fully covered, 2 = Partly covered, 1 = Not covered

Component	Check	Reviewer comments	Rating
Needs assessment	Is there a need for the project?		
Options analysis	Has a reasonable range of alternatives been investigates by Powerlink including non-network options?		
Scope assessment	Is the project scope reasonable?		
Cost estimation	Are the proposed costs reasonable?		
Timing	Is the proposed project timing reasonable?		
CGF alignment	Does the project align with Powerlink's Capital Governance structures including strategic plans? Assess against Powerlink's Investment Decision Making Process and the Capital Approval Procedure documents		
Accuracy	Is the information provided by Powerlink accurate?		
Project classification	Has the project been correctly classified as a prescribed service?		
	Should this project have been classified as a contingent project?		

	Clause 6A.8: Summary: Project must be greater than $48m AND • Probable (within the RCP); AND • EITHER not sufficiently certain to be required within the RCP, as to warrant inclusion in the Forecast Capex under 6A.6.7; OR • Costs are not sufficiently certain; AND • the uncertainty (re need or cost) must be able to be resolved by a specific, objective, single (i.e. non-conditional) trigger event that affects a "specific location" not "network as a whole"		
Trigger event	IF project should have been classified as "contingent", what should be the "trigger event"?		
Forecast value and timing	Is the value and timing at which the project has been included in the forecast appropriate?		

Annex 3: Selection of sample projects for review

Selection of detailed projects for review

480. This annex describes our proposed approach to sample project selection. The approach and sample project list was submitted to the AER for approval prior to its use.

Sample selection process

481. In order to reduce the number of projects to a manageable size for evaluation we produced an initial sample of 36 projects out of the total population of 454 provided by Powerlink. To ensure that the sample was representative of the range of projects it was stratified across three dimensions: total project cost, date of commission and project category.

482. The project's total cost was calculated as a simple sum of the costs in each year and the total costs were separated into strata $50 million wide, beginning at $25 million. For example, every project costing a total of $0-25 million was grouped into the first stratum, while every project costing $25-75 million was grouped in to the second stratum. The reason for the inconsistent first stratum is that 96% of projects have a total cost of under $50 million so we wanted to provide slightly more detail below that level. The date of commission was separated into two strata, pre-2014 and 2014 or later. Finally, the project categories were left in their raw state, as provided by Powerlink. These three dimensions are assumed to interact so, for example, an augmentation project costing $2 million in 2013 is assumed to be different from the same project commissioned in 2015. The stratification across these three dimensions produced 25 strata in total.

483. Once the population had been stratified a random sample was drawn without replacement from each stratum. The number of projects sampled from each stratum was the greater of 1 or 4% of the total number of projects in that stratum (rounding up to the nearest integer value). That condition biases the sample in favour of including outlier values, while still ensuring that a good number of common projects are included. It means that at least one project is sampled from every stratum but, because of the small sample size relative to the number of strata, leaves common categories of project slightly under-represented in the sample. For example, for each stratum containing only one project we sample 100% of that stratum but, for the stratum with 116 projects, we sample only five of them. However, that bias is preferable to the alternative, which is to neglect to evaluate outliers.

484. The sample was then adjusted to remove sample projects in asset categories that were considered to be of minor relevance (e.g. commercial buildings and moveable plant). An adjustment to the sample numbers was also made to avoid the review being focused on low cost projects. To do this sample numbers were increased in the high cost strata and reduced in the low cost strata.

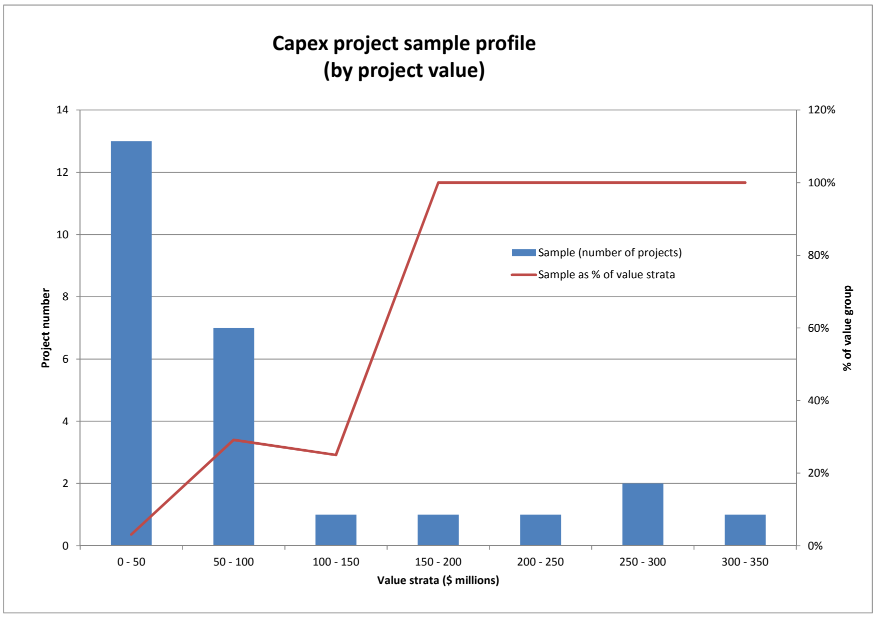
485. An additional adjustment was made to ensure that the review focused on the asset categories that contributed most to the total capex forecast. This was undertaken by increasing the sample numbers in categories that made the highest contribution (augmentation and replacement) and slightly reduced numbers in categories that contributed least.

486. The above adjustments produced and overall sample of 25 projects covering a majority of the highest value projects and with the largest samples drawn from the categories

that contributed most to the capex forecast. The total value of the 25 projects selected account for 53% of the forecast capex and 42% of the total value of the project list.

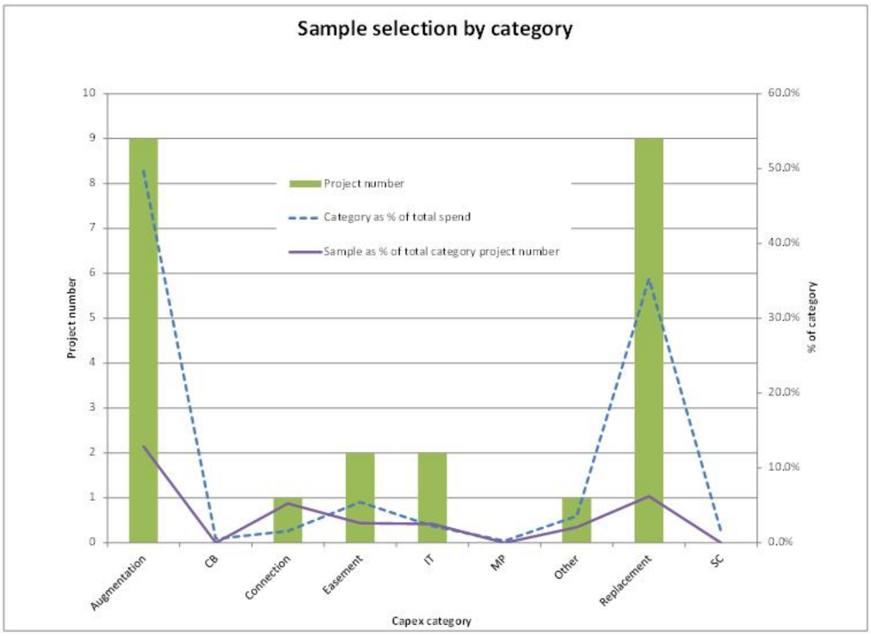
487. The following charts provide a view of the representation of the selected sample.

Figure 15 : *Capex sample projects profile*



Source: EMCa/Strata

Figure 16 : *Sample projects selected – by category*



Source: EMCa/Strata

Table 22: *Sample projects selected – by category*

Project numbers by category	Augmentation	CB	Connection	Easement	IT	MP	Other	Replacement	SC
Category as % of total spend	49.6%	0.5%	1.6%	5.4%	2.2%	0.3%	3.6%	35.3%	1.5%
Original sample	9	1	2	5	5	2	3	7	2
Revised sample	9	0	1	2	2	0	1	11	0
Original sample	13%	100%	11%	7%	6%	100%	6%	5%	14%
Revised sample	13%	0%	5%	3%	3%	0%	2%	8%	0%

Source: EMCa/Strata

Table 23: *Project sample for review*

Project ID	Description	Commencement Date	Category	Scenerio status	Total expenditure in RCP	Reason for expenditure	BusCas
CP.01546	Callide A Switchyard Replacement	Oct-15	Replacement	scenario	34.4	Age / Condition / Obsolescence	None
CP.01477.2	Western Downs to Halys 1st 500kV DCST Operating at 275kV	Oct-15	Augmentation	scenario	317.4	Reliability	None
CP.01470	Halys to Greenbank 500kV DCST Operating at 275kV	Oct-18	Augmentation	scenario	193.9	Reliability	None
CP.01423.2	Western Downs to Halys 500kV Easement Compensation	Oct-16	Easement	scenario	36.1	Reliability	None
CP.02039	Collinsville 132kV Substation Replacement	Oct-13	Replacement	non scenario	22.5	Age / Condition / Obsolescence	None
	Columboola to Wandoan South Network Augmentation						
CP.02030 and CP.02031	Columboola to Wandoan South and Western Downs Network Augmentation	Mar-14	Augmentation	non scenario	132.3	Reliability	Reg Test
CP.01875	Halys-Blackwall 500kV	Oct-14	Augmentation	non scenario	357.8	Reliability	Reg Test
CP.01710	Gin Gin Substation Replacement	Oct-16	Replacement	non scenario	46.6	Age / Condition / Obsolescence	None
CP.01957	Calvale to Larcom Creek 275kV DCST	Oct-16	Augmentation	scenario	116.0	Reliability	None
CP.01781	Northern Bowen Basin Augmentation	Oct-14	Augmentation	scenario	87.6	Reliability	None
CP.01748	Ashgrove West 2 x 100MVA 110/33kV Transformers	Oct-13	Connection	scenario	7.6	Reliability	None
CP.02583	OHEW Fault Rating Upgrade Stage 1	Jun-15	Replacement	non scenario	28.3	Age / Condition / Obsolescence	None
CP.02534	West Darra to Upper Kedron 110kV T/L Life Extension	Mar-14	Replacement	non scenario	9.5	Age / Condition / Obsolescence	None
CP.02507	Collinsville to Proserpine T/L Life Extension	Jun-15	Replacement	non scenario	35.9	Age / Condition / Obsolescence	None
CP.01762	Calvale 2nd 275/132kV Transformer	Oct-15	Augmentation	scenario	12.9	Reliability	None
CP.02599	Calvale to Wandoan South Easement Acquisition	Nov-18	Easement	non scenario	3.5	Reliability	None
CP.02585	Belmont Substation Transformer Upgrade Options	Oct-15	Replacement	non scenario	19.1	Age / Condition / Obsolescence	None
CP.02520	Tarong PS 66kV Cable Replacement	Oct-16	Replacement	non scenario	5.0	Age / Condition / Obsolescence	None
CP.01924	System Spare 330/275kV Transformer	Jun-12	Other	non scenario	0.0	Reliability	Bus Case
CP.96958	Extended Web Based Integration of Power Systems Information	Jun-17	Information Technology		1.0	Operational	None
CP.96945	Improved Access to Operational and Event	Jun-15	Information Technology		1.6	Operational	None
CP.01156.2	Stanwell to Broadsound Stringing 2nd 275kV Circuit	Oct-13	Augmentation	scenario	35.9	Reliability	None
CP.02363	Dynamic Line Ratings	Jun-17	Other	non scenario	6.6	Reliability	None
CP.00882	Cardwell - Ingham South 132kV Line Replacement	Dec-13	Replacement	non scenario	50.4	Age / Condition / Obsolescence	Bus Case

Source: EMCa Strata

Annex 4: Description of Powerlink's capital governance framework

488. Our understanding of Powerlink's capital governance framework has been gained by reviewing its structure, components and how it is implemented in practice. Powerlink have provided information and documentation on the various components that make up their capital governance framework and discussed how it is applied in practice as a coordinated end to end framework.

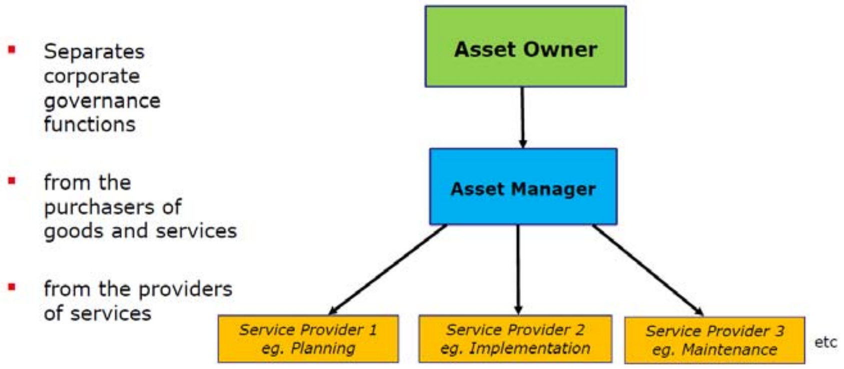
489. We expected that Powerlink would have provided a description and diagram (preferably a flow chart) setting out the end to end capital governance framework structure and its components. However, as this documentation could not be provided, the following description is based on the understanding we have gained from the suite of related documents provided and our on-site discussions with Powerlink.

490. Initially, we discuss the structure of the framework followed by a description of its key components.

Structure

491. Powerlink has adopted an organisational structure that separates the asset ownership from management. Powerlink considers that the asset Ownership/Asset Management/Service Provision business model (AO/AM/SP) it has implemented provides: an integrated and responsive management structure that is capable of reconciling complex issues through areas of expert knowledge coupled with collaboration to ensure all relevant information is available.

Figure 17*: Powerlink's Asset Ownership structure*



Source: Powerlink

492. Powerlink has described that, at the governance level, the Powerlink Board operates in a strategic role and delegates the management and operation of the assets to management. Key performance indicators are used to inform the Board of the organisation's performance against targets set by the Board.

493. The Board have set a single KPI for expenditure to date against the annual capex budget. There are asset performance KPI's which provide the Board with a view of the level of service that the assets are currently delivering. As with capex these KPIs are actual year to date performance against annual targets. In addition, the Board are

provided with reports on capital projects that have a total approved expenditure of $10m and above.

494. The Board have delegated the management and operation of the assets to the Chief Executive and management team. Through this delegation, management develop the structure and implement the various components of the capital governance framework.

495. The role of the Asset Management function is to develop and implement strategies that support the full life cycle asset management objectives. Key responsibilities of the Asset Management function are:

- planning;
- asset investment;
- operation and maintenance; and
- asset replacement and disposal.

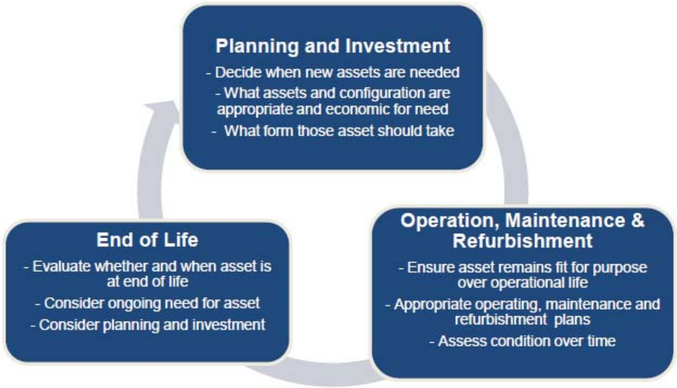
496. The Asset Management function has a team based structure responsible for the initiation, approval and sponsorship of all capital investment, maintenance and refurbishment work.

497. The structure of the capital governance framework, through which capital projects and expenditure decisions are made, is based on Asset Management and Asset Life Cycles. Through the use of the Asset Management Cycle Powerlink aligns the management of its assets with its obligations and stakeholder expectations. The Asset Life Cycle structure enables planning and investment to be undertaken from an informed and intelligence based assessment of the asset condition and expected life.

Figure 18 : *Powerlink's Asset Management Cycle*

Source: Powerlink

Figure 19 : *Powerlink's Asset Life Cycle*



Source: Powerlink Asset Management Strategy (2011)

498. Asset Management and Asset Life Cycles are given prominence in Powerlink's asset management documentation.

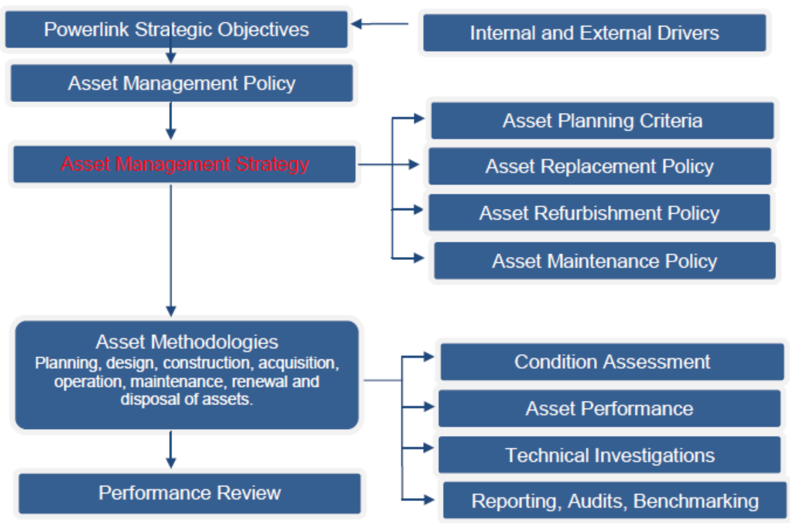
499. An important component of good practice asset management structures is virtual cycle of improvement. Powerlink's Asset Management Cycle includes continuous review where, through performance monitoring, improvements can be identified and adopted.

500. In summary, the structure of capital governance framework adopted by Powerlink is, in our opinion, consistent with good industry practice standards and models and is supported by an appropriate organisational structure.

Components

501. Powerlink describe the components of its capital governance framework in its Asset Management Strategy. The following diagram sets out Powerlink's Asset Management System and its components at a high level.

Figure 20 : *Components of capital governance framework*



Source: Powerlink Asset Management Strategy (2011)

502. Powerlink has documented its asset management policy and strategies. However, there is some variation in the quality of the documentation. For example, the Asset Management Policy has very limited information and is unlikely to be used as a working guide and reference within the organisation. However, the Asset Management Policy does provide a list of, generally measurable, policy objectives relevant to the management of assets. There objectives are reproduced below:

- complying with applicable legislation, regulatory and statutory requirements;
- providing a safe and reliable electricity supply which is consistent with network and asset capability;
- developing its grid in a timely manner to meet emerging needs;
- adopting a proactive approach to the management of its assets that optimises whole of life-cycle costs, benefits and risks;
- making asset management decisions based on a balanced evaluation of all relevant factors and alternatives over a reasonable duration;
- promoting the awareness of asset management practices to our people to guide day to day decision making;
- proactively communicating and consulting with our customers, our people and other relevant stakeholders regarding asset management practices and outcomes;
- developing the skills and knowledge of our people to sustain and reinforce asset management capability; and
- monitoring and reviewing performance against asset management outcomes and seeking continual improvement

503. The above policy objectives provide the foundation for the development of the asset management strategy and the procedures and methodologies that flow from these.

504. The Asset Management Strategy translates the Asset Management Policy objectives into the following Asset Management Strategy objectives:

- *“Develop the Networks We Own and Manage*
    - o *Develop the Queensland transmission grid to cost effectively meet customer needs including regulated, negotiated and non-regulated investments.*
- *Achieve Operational Excellence*
    - o *Safety - provide a safe environment for employees and the public.*
    - o *Environment - demonstrate regard for the environment by complying with all relevant legislation.*
    - o *Cost-efficiency - be the most cost effective transmission business in the NEM, and achieve improved results across the whole business each year.*
    - o *Network performance - exceed the service standards.*
- *Grow non-regulated profits*
    - o *Selectively grow non-regulated business by leveraging core competencies where Powerlink has a sustainable competitive advantage.”*

505. It can be seen that the corporate strategies selected by Powerlink for directing the Asset Management Strategy contain environmental, technical and economic objectives. We note that cost effectiveness and cost efficiency are very clear strategic objectives that

have been set at the corporate level. Accordingly, it would be expected that these objectives are prominent in most stages of the capital governance and investment decision making process and that the performance monitoring and reporting systems record progress made towards achieving them.

506. The Asset Management Strategy provides linkages between strategic drivers and asset management practices. Specific asset policies are developed from the strategic direction and guidance provided by the Asset Management Strategy.

507. Specific capital governance framework policies reviewed include:

- Capital project approval procedure
- The Asset Planning Criteria
- The Asset Replacement Functional Policy
- The Asset Maintenance Functional Policy
- The Asset Refurbishment Functional Policy
- Powerlink Risk Management Charter
- Capital Investment Decision making Process

508. Specific asset strategies and methodologies reviewed include:

- Investment Decision making Process
- Joint Planning Process
- The transmission line asset methodology
- The substation asset methodology
- The underground cable asset methodology

509. The Investment Decision Making process is a key component of the capital governance framework that influences both forecast and actual capex. Powerlink describe the Investment Decision Making Process [22] as being a “well established process for network investment decision making”. The objectives set for the process are:

- To ensure that there is a clearly identifiable need for the proposed capital investment;
- That the proposed investment is the best option based on economic and regulatory compliance criteria; and
- The investment is implemented in a cost efficient manner.

510. The Investment Decision Making Process is not a documented and approved process but rather an implied process derived from the application of Asset Management Strategy, Joint Planning Process, Capital Project Approval Procedure and Project

[22] Powerlink Asset Management Strategy

Implementation Process. The following diagram produced by Powerlink provides an overview of the Investment Decision Making Process.

Figure 21 *: Powerlink's investment decision process*

[C-I-C]

[redacted]

511. An important procedure of the Investment Decision making process is the Capital Project Approval Procedure as this provides direction and guidance on how capital project proposals are to be developed and assessed. The procedure can be considered to consist of the procedure document and the templates that have been developed to ensure consistent and compliant application of the procedure in practice. The templates include the suite of documentation such and concept, business case, project scope, RIT documentation, project approval and other project related documentation.

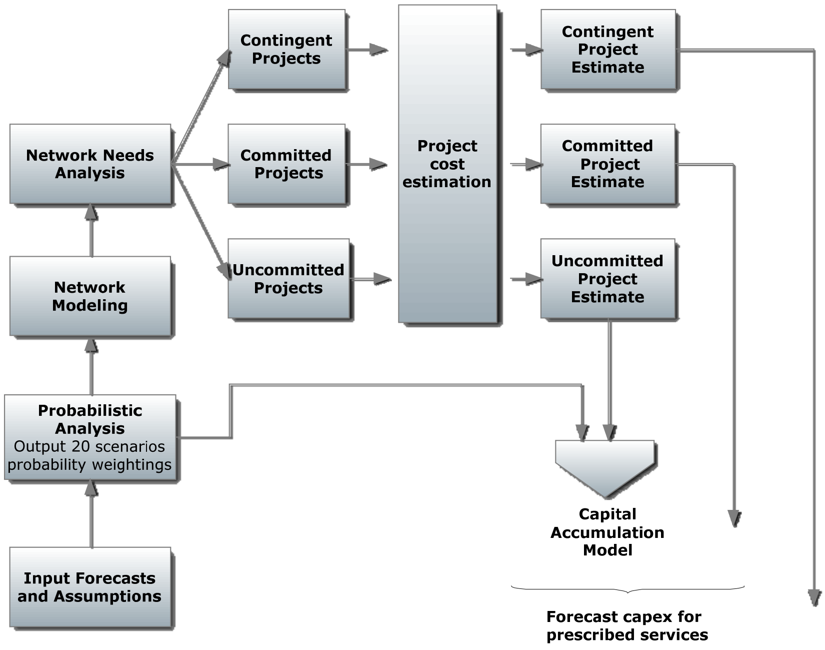
[23] Provided in Response to EMCa request

Annex 5: Key components of the capital cost estimation and capex forecasting processes

Load driven projects

512. The following diagram sets out our understanding of the main components of the Load driven capex forecasting process and its flow from input assumptions to the CAM.

Figure 22 :*Powerlink's load driven capex forecasting process*



Source: EMCa Strata (from Powerlink description)

513. The capex forecasting process commences with input forecasts for expected demand, for generation and for inter-state energy transfers. Uncertainty across a range of possible forecast outcomes has led Powerlink to adopt a scenario approach to forecasting demand and generation.

514. The probabilistic approach is discussed in section 4.6 of this report. The methodology used for demand forecasting is described in the Demand Forecasting consultants' report to the AER[24].

515. For the 2012/17 Proposal Powerlink have used 20 market development scenarios that are each subjected to network needs analysis to determine the required capital

[24] *Powerlink Revenue Determination; Demand Forecast Review;. Report to AER.* (EMCa in association with NZIER, September 2011)

investment projects that would be needed to ensure Powerlink continues to comply with its Planning Criteria should the particular scenario eventuate.

516. The capital investment projects that result from the probabilistic analysis are considered to be load driven projects

517. Committed and uncommitted projects are identified through standard network modelling practice to determine a list of load driven capital projects for all 20 market driven scenarios. Contingent projects are not included in the forecast capex for prescribed revenue determination purposes, and the capex estimation processes for these projects are described in section 6.2.

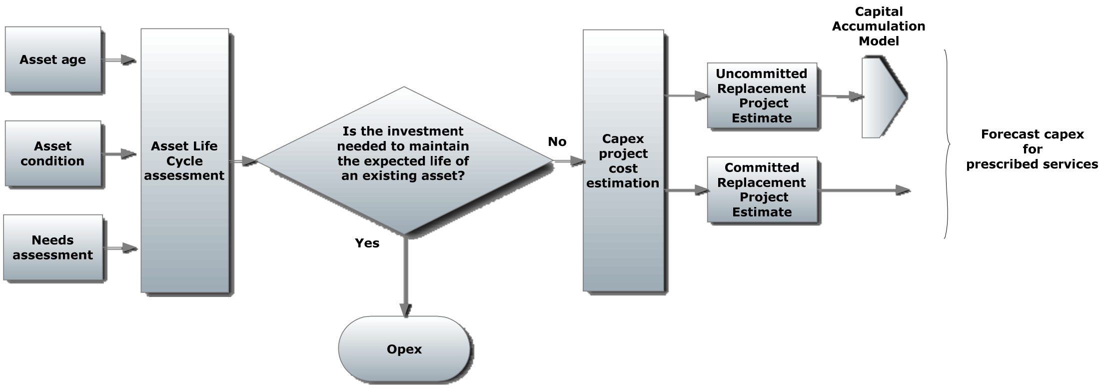
518. All projects are subjected to cost estimation using Powerlink's cost estimation process..

519. Project estimates are inputs to Powerlink's CAM. In the CAM uncommitted projects are weighted according to the probability of their related scenario.

Non load driven projects

520. The following diagram sets out our understanding of the main components of the non-load driven capex forecasting process and its flow from input assumptions to the CAM.

Figure 23 *: Powerlink's non load driven capex forecasting*



Source: EMCa Strata (from Powerlink description)

521. Powerlink's Asset Life Cycle assessment identifies the need for a timing of the replacement of an asset. Powerlink evaluates assets in the end of life phase against a set of parameters that may lead to asset replacement, life extension or disposal. The on-going need to extend the life of, or replace assets is collectively referred to as asset replacement[25].

522. If an Uncommitted project is required to extend the life of an asset, a project cost estimate is developed and the project is input into the CAM.

[25] Revenue Proposal Page 62 8.6.5

Key CAM inputs

523. Key inputs for the 2013/17 RCP include:

a. a set of 20 capex spend scenarios, each of which is comprised of projects determined on the basis of a range of generation and load growth assumptions driven (among other things) by expert views regarding: LNG industry expansion, mining industry requirements and the carbon price trajectory;

b. forecast project costs;

c. forecast project completion dates for each project in each scenario;

d. cost escalators to reflect the anticipated movement of key components of the cost structure over the term of the RCP;

e. S-curves for each of 10 asset categories, which are used to distribute project costs over time;

f. a Cost Risk Estimation Factor ("CERF") of 3%, which is added to all projects processed in the CAM.

Steps in CAM Process

524. The process commences with generation of the inputs to the CAM through to producing a capex forecast as per the following:

a. Powerlink prepares **demand forecasts;**

b. **Scenario development** – in respect of the next RCP ROAM has advised Powerlink regarding 20 different generation scenarios (with associated probabilities) based on a combination of different assumptions relating to factors such:

   i. low, medium, high demand growth;

   ii. -5%, -10/15%, -25% downwards Carbon Reduction Trajectory;

   iii. Moderate and aggressive LNG industry expansion;

c. **Identification of load-driven projects -** the nature, extent and likely timing of power system constraints and issues are identified by Powerlink based on powerflow analysis using Powerlink's demand forecasts and a range of generation scenarios produced by ROAM;

d. **Identification of non load-driven projects** – Powerlink identifies non load-driven projects, which are primarily replacement projects, identified through condition assessment processes;

e. **Selection of optimal solution -** Powerlink identifies a range of options to deal with each issue. Based on a high level analysis Powerlink identifies the optimal solution and creates a concept level project;

f. **Cost estimation using BPO's -** Powerlink calculates a cost estimate for each concept level project using its Base Planning Objects ("BPO"). The Powerlink Estimating Manual contains these BPO's which model the costs associated with a unit of plant or equipment such as a kilometre of transmission line or a substation bay;

g. **Project selection** – Powerlink determines which suite of projects is appropriate for each of the 20 different scenarios. The expected project completion dates for projects in each scenario are also determined. Note the same project will not necessarily have the same completion date under different scenarios;

h. **S-curves are determined** – based on actual historical capex data at the project-level S-curves are developed for key asset categories to reflect the distribution of capex costs over time for that type of asset. These curves are applied in the CAM;

i. **Setting escalators -** the escalators and other variables applied to scenario based project data input to the CAM are determined on the basis of advice from external experts commissioned by Powerlink;

j. **Running the CAM** – the CAM is run to apply the escalators and other variables to the base project data on project cost and completion date. This produces a probability weighted forecast for Uncommitted capex for each year of the RCP.

Assessment of the Cost Accumulation Model (CAM) for forecasting uncommitted project capex

525. Our approach to the assessment of the outputs from the CAM has been to:

a. review the base project data inputs to the CAM;

b. review project documentation for a sample of Committed projects;

c. review the escalators and other variables used to manipulate the base project data;

d. review the linkages and calculations in the model;

e. run sensitivity analyses to gauge the impacts of each set of variables;

f. stress test the validity of the model through the input of a range of different data, questioning Powerlink where results have not been as expected;

g. review CAM output data;

h. hold discussions with Powerlink staff regarding CAM inputs and functionality.

526. The following has been assumed in conducting our analysis:

a. an audit of the model is not within the scope of this review;

b. replication of the load-flow analysis, on which the selection and timing of load-driven projects within each scenario is largely based, is not within the scope of this review;

c. verification of the methodology used and the accuracy of the calculation of escalators by independent consultants for use in the CAM is not within the scope of this review.

Committed Projects

527. Our approach to the review of Committed projects has been to:

- review and analyse the data provided by Powerlink;
- review project documentation for a sample of Committed projects;
- hold discussions with Powerlink regarding the processes applied to capex cost estimation for Committed projects.

Non-network Projects

528. Our approach to the review of Non-Network projects has been to:

- review and analyse the data provided by Powerlink
- review of project documentation for a sample of Non-network projects.

Annex 6: Refurbishment/replacement capex

Financial Classifications for opex and capex refurbishment/replacement

529. Powerlink's Financial Management Practices Manual (FMPM) defines the financial classification for capex and opex. Powerlink have confirmed that all assignments of capex or opex are made in accordance with the FMPM.

530. Powerlink has provided the following explanation on expenditure categorisation:

Opex	Expenditure that is undertaken to ensure an asset meets its original intended useful life; this is classified by Powerlink as opex. For example, this would include early life tower painting to ensure the towers reach their expected useful life. All refurbishment works are categorised as opex as a result. In addition, the renewal or replacement of part/components of a unit of plant which merely contributes to restoring the unit to its condition when first acquired or which reduces future deterioration of the unit and does not significantly extend the life of the unit, is also considered opex. Transmission line insulator replacements are an example of component replacements and are considered and accounted for as opex refurbishment.
Capex	Where expenditure is undertaken which extends the asset beyond its useful life, this is classified as capex. For example, the replacement of multiple components to a standard where the equivalent age of the asset is returned to near new condition.

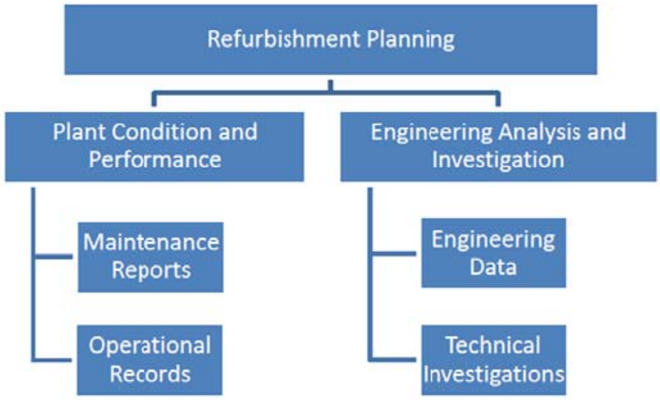
531. In the Revenue Proposal, Powerlink classify asset refurbishment and asset replacement as 'replacement capex'.

532. Triggers for network asset replacement planning are defined as:

- Age;
- Capacity;
- Capability; and
- Compliance.

533. Powerlink have Asset Refurbishment and Asset Replacement Policies that are generally well structured, have the appropriate contents and are likely to be used as a reference within the organisation. The process used to determine the need for a refurbishment project is set out in the following diagram.

Figure 24*: Powerlink's Asset Refurbishment process*



Source: Powerlink Asset Refurbishment Policy

534. Powerlink develops refurbishment plans using base data derived from plant condition assessments, maintenance service provider feedback and root cause analysis of plant and equipment failures. In the review it was found that Powerlink's systems and processes for the acquisition management and analysis of asset data were sound.

535. Replacement capex projects are considered to be non-load driven in the sense that they are required to maintain the existing network capacity. Figure 24 sets out our understanding of the main components of the non-load driven capex forecasting process and its flow from input assumptions to the Capital Accumulation Model used to set the prescribed transmission services capex forecast.

536. Powerlink's Asset Life Cycle assessment identifies the need for a timing of the replacement of an asset. Powerlink evaluates assets in the end of life phase against a set of parameters that may lead to asset replacement, life extension or disposal. The on-going need to extend the life of, or replace assets is collectively referred to as asset replacement[26].

537. If an Uncommitted project is required to extend the life of an asset, capital project cost estimation is undertaken and the project is transferred to the CAM.

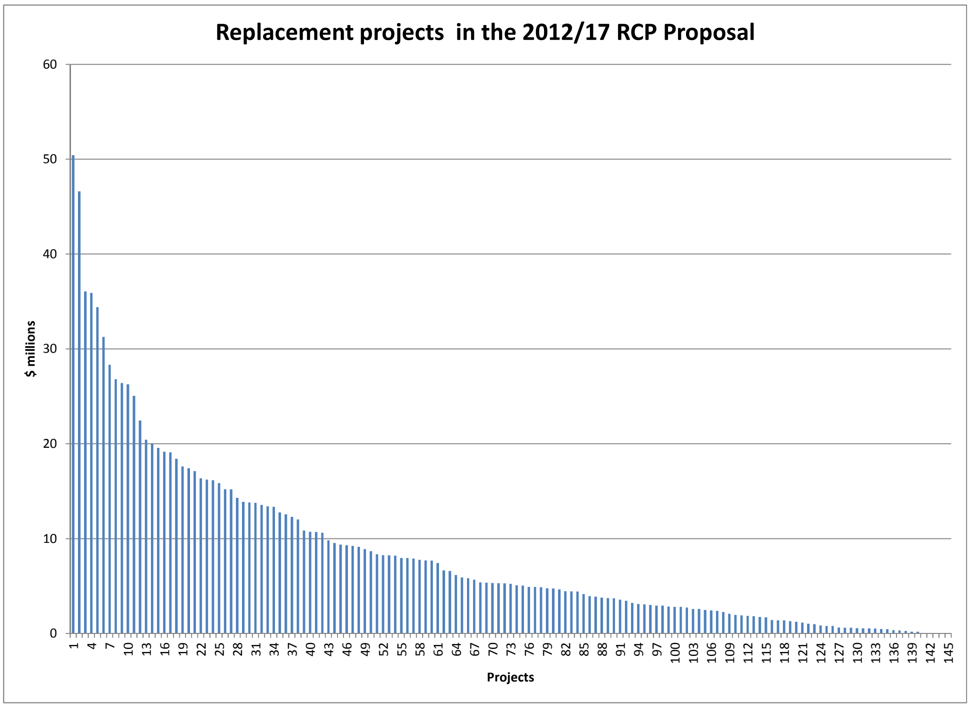
[26] Revenue Proposal Page 62

Annex 7: Replacement capex projects

538. For the 2012/17 RCP Powerlink has identified and included in its forecast for prescribed transmission service expenditure 145 replacement capex projects totalling $1.23 billion expenditure within the RCP.

539. The chart below shows expenditure profile for replacement capex projects.

Figure 25: *Replacement projects in the 2012/17 RCP Proposal*



Source: EMCa Strata (from Powerlink data)

540. We have reviewed nine replacement capex projects in detail. These projects are:

CP.01546	Callide A Switchyard Replacement
CP.02039	Collinsville 132kV Substation Replacement
CP.01710	Gin Gin Substation Replacement
CP.02583	OHEW Fault Rating Upgrade Stage 1
CP.02534	West Darra to Upper Kedron 110kV T/L Life Extension
CP.02507	Collinsville to Proserpine T/L Life Extension
CP.02585	Belmont Substation Transformer Upgrade Options
CP.02520	Tarong PS 66kV Cable Replacement
CP.00882	Cardwell - Ingham South 132kV Line Replacement

541. The total estimated expenditure on these projects in the 2012/17 RCP is $252 million which represents just over 20% of the total forecast replacement capex.

Issues identified in the reviews

542. For all the projects reviewed it was found that there was a good level of alignment and compliance with Powerlink's investment decision making framework commensurate with the commitment status of the project.

543. An issue, regarding the optimisation of the whole capex program was identified in the review. There appears to be opportunities to smooth the expenditure over the RCP and, through this, obtain a more efficient use of resources e.g. contractor utilisation. Managing the timing of replacement capex may be a method to achieve this efficiency gain.

544. A further issue highlighted in our review of replacement capex projects was the implications that arise from the classification of life extending refurbishment projects as capex. This is a key feature to take into account when considering the capex/opex trade-off (see Annex 8).

Annex 8: Capex/opex trade-off

545. The Asset Management Cycle and Asset Life Cycle approaches adopted by Powerlink, if implemented appropriately and consistently in practice, are likely to result in the optimisation of opex and capex.

546. Implicit in asset life cycle management is the achievement of whole of asset life least cost outcomes. This will take into consideration and determine the right time to maintain, refurbish assets and replace assets. Such an approach should include appropriate economic analysis.

547. Powerlink consider that their approach to asset management to resolves how best to address identified needs or triggers over the life cycle of the asset, from planning and investment, operation, maintenance and refurbishment to end of life. In addition, Powerlink considers its broader business environment and overarching business requirements, such as safety and the environment.

548. When considering the results of ITOMS benchmarking the capex/opex trade off methods of transmission companies is relevant and should be taken into account. For example, a transmission service provided could, for a period, be seen in more favourable light if it had deferred opex to the point where life extension refurbishment was required.

549. Our view is that, in the absence of a capex benchmarking scheme and /or adjustments to reflect opex/capex categorisation differences, caution should be used when drawing overall expenditure performance conclusions from ITOMS alone.

550. Otherwise, our review of Powerlink's capital governance framework and in particular the Asset Management and Asset Life Cycles, found that they should deliver optimum opex/capex trade-offs. We also found that Powerlink's systems to capture and manage asset data were sound and likely to compare well with good industry practice.

Annex 9: Description of the probabilistic capital expenditure forecasting approach (load driven network projects)

551. The following provides a detailed description of the overall probabilistic capital expenditure forecasting approach applied by Powerlink for load driven network projects.

552. Included in this description is an overview of the ROAM methodology to a detail that allows understanding of the methodology applied by Powerlink in their probabilistic planning approach. However, we do not provide a detailed description of the ROAM Consulting methodology for developing Generation Scenarios used within the overall probabilistic planning approach applied by Powerlink. For such a description we refer the reader to Appendix E of Powerlink's submission (ROAM Consulting, Generation Scenarios for 2012 Revenue Reset Application).

553. The full probabilistic planning approach has currently been applied by Powerlink at 5 yearly intervals, as part of their capex forecast methodology in preparation of their Revenue Proposals. The results from probabilistic planning are also used, during the RCPs, as part of Powerlink's on-going network planning processes (as described and commented on in Section 4.6).

554. The probabilistic methodology has remained fundamentally the same since it was first adopted in 2001. The most significant change, since its introduction, has been the reduction of demand forecasts supplied by Powerlink to ROAM. This, in turn, has led to a significant reduction in the generation scenarios provided by ROAM for study in the overall probabilistic planning methodology. In addition, ROAM have introduced some refinements to their methodology for developing the generation scenarios, based upon their experience with Powerlink but also other transmission network operators in Australia.

555. The overall objective of probabilistic planning, is to develop a probability weighted average expenditure profile for the load driven capex that can be used as an input to the development of a forecast of total capex to be included in a Revenue Proposal.

556. The starting point of the probabilistic process is the determination (by Powerlink) of the load forecasts that ROAM will use as the basis for developing Generation Scenarios. The methodology for developing the load forecasts is covered in the EMCa/NZIER Demand Forecast Consultant report.

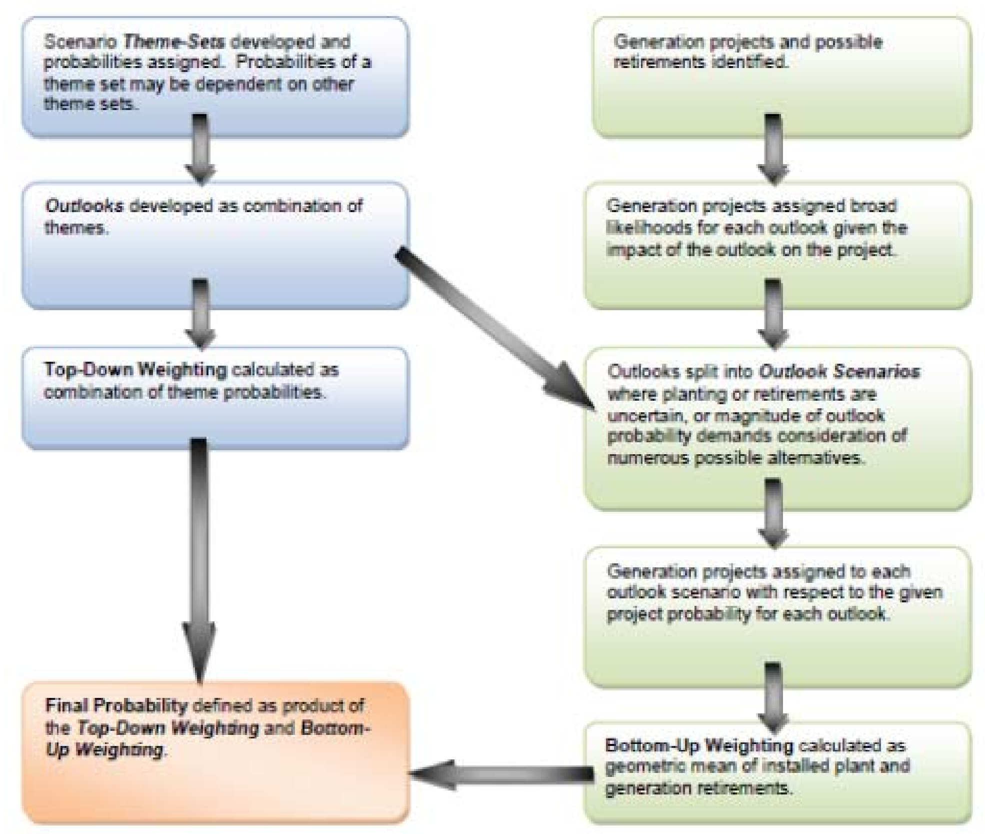
557. On the basis of the load forecast scenarios ROAM develop a number of plausible generation scenarios, which are in turn utilised by Powerlink within their network modelling. Through the modelling Powerlink determine potential transmission network limitations, and, consequently, identify the need for load driven augmentations, and works to reinforce connections to the DSNPs under each scenario.

558. The ROAM methodology provides a probabilistic assessment of generation and load development options over a ten year period, comprising the five year revenue reset period and a number of years post-revenue reset for which to assess any end-effects. Although identified as generation scenarios, the scenarios developed by ROAM can be considered to be market scenarios as they also include LNG expansion possibilities,

which have significant impact on load within the ten transmission zones studied by Powerlink.

559. Powerlink summarise the top down - bottom up approach in the following diagram:

Figure 26*: Overview of the probabilistic top down – bottom up planning approach*



Source: Powerlink

560. The following descriptions may assist in understanding the actions undertaken in each part of the approach:

Summary of Powerlink's probabilistic planning approach	
Part A	A set of themes are developed around each of the load forecasts by firstly ascribing probabilities to each load forecast and then taking into account such factors as : • Carbon price trajectory scenarios • LNG industry development scenarios • Announced large plant retirements • Possible impacts not already factored into the load forecasts • These are then developed into a set of outlooks with calculated probabilities and initial planting schedule requirements from a top down

	perspective.
Part B	Planting schedules for each outlook in Part A are developed from a bottom approach utilising: • Existing and committed plant • Possible retirements • Market knowledge and understood behaviour of participants • The result is one or more planting schedules developed for each outlook with initial ascribed probabilities.
Part C	Part C is the final stage in which in which the top down planting probabilities in Part A are combined with the bottom up planting probabilities of Part B to generate a final likelihood for each scenario. • This final stage the results in a number of scenarios each described by a thematic influenced outlook attached to one or more of the planting schedules. • The number of scenarios is limited to those with a probability weighting that make them a plausible possibility of occurrence. • The final probability for each proposed generator (and retirement) is calculated as the sum of the scenario probabilities in which the generator is installed. A generator which is installed in many scenarios is likely to have a higher overall probability, depending upon the probability of the scenarios it is planted within. Similarly, a generator which is installed in only a few scenarios is likely to have a lower overall probability, depending upon the probability of the scenarios it is planted within.

561. The final output from the ROAM studies is a number of plausible time based market development scenarios with various associated load growth assumptions, levels and locations of generation development. Each scenario having a probability assigned to it relative to the probability of all the other scenarios.

562. As identified earlier these scenarios are then input to Powerlink's network modelling to determine future transmission network limitations, and, consequently, identify the need for load driven augmentations, and works to reinforce connections to the DSNPs. This represents the first stage of developing a probabilistic capital expenditure forecast for load driven network projects within the total capital expenditure forecasting methodology. The description and analysis of the total capital expenditure forecasting methodology is covered in Annex 5 of this report.

563. For each network limitation a number of network options for augmentation to overcome these limitations are developed and considered as well as the potential for non-network solutions. Options considered include technically and economically feasible network projects. Powerlink then performs an economic comparison of the options using techniques consistent with the assessment of options for the Regulatory Test to

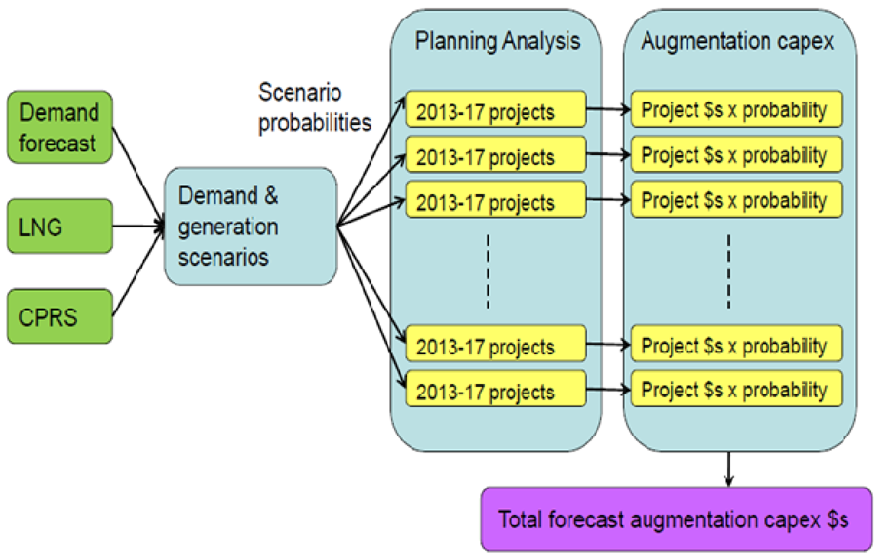
determine the preferred option. Where applicable, net market benefits are also considered in the economic analysis.

564. The result for each of the scenarios examined, is a sequential series of works consisting of preferred network augmentation options associated with time based 'triggers' leading to the network limitation within the applicable scenario.

565. Powerlink undertake a filtering process to identify series of works that are linked to unique investment drivers such as a major point load. Also identified are projects that, due to their indicative cost exceeding the threshold cost, can be classified as Contingent Projects. The Contingent Projects are removed from each scenario before developing a probabilistic capital expenditure forecast for load driven network projects.

566. At the final stage a probabilistic capital expenditure forecast for load driven network projects is derived. This is developed by taking the estimated cost for each project within individual scenarios and multiplying the forecast cost by the probability of occurrence. In order to develop the total a probabilistic capital expenditure forecast for load driven network projects, the sum of the probability weighted expenditure for each project within each scenario is calculated. The diagram below provides a pictorial representation of this stage within the methodology.

Figure 27: *Powerlink's probabilistic process for developing load driven forecast capex*



Source: Powerlink

567. A view can be gained on how the probabilistic approach fits within the total capital forecasting methodology by referring to the diagram provided in Figure 27 .

Annex 10: Expanding non-network solution opportunities

Uses of non-network solutions

568. Non network solutions can be used for

- management of short term network and system constraints;
- optimisation of long term capital investments.

569. Non-network solutions used for the management of short term system constraints include demand response and peaking generation plant. These resources can be brought on line at relatively short notice to assist in the management of events such as maintenance outages and peak demand control.

570. Transmission network service providers in many jurisdictions[27] are developing and implementing network support arrangements through which suppliers of non-network resource providers are paid for their availability and use. In response to these opportunities new 'demand-side aggregator" companies are becoming established[28].

571. It is important to note that a key to the success of network support arrangements is the offering of payment for availability and use.

572. Non-network solutions can also be used to optimise capital investments in transmission networks. These are often called 'transmission alternatives'. However, the non-network solution must be considered to be capable of providing an equivalent service to the network solution. Applicable non-network solutions for use in the deferment of network capital investments include:

a. Generation plant located close to the point of demand. Note that the generation plant would need to be considered to be as reliable as a transmission circuit and therefore multiple units may be required to achieve this;

b. Co-generation at industrial sites;

c. Loads switching to alternative fuels. Note that this may be either permanently or at peak demand times;

d. Demand-side response capable of being used for long periods. Note this may involve a portfolio of dispatchable loads with the ability to cycle.

[27] Western Australia (Western Power) and New Zealand (Transpower) are jurisdictions network support arrangements are being implemented.

[28] EnerNOC (www.enernoc.com) is an example of an international aggregated demand-side service provider that operates in several countries including the USA, New Zealand and Australia.

573. A range of features are used in electricity markets to provide incentives for transmission alternatives to emerge these include; nodal pricing[29] and Capacity markets[30]. A key feature for the emergence of non-network transmission alternatives is that the proponent experiences an incentive to provide the service.

Transmission alternatives in Queensland

574. In many regions, significant planned capital investment in Powerlink's network is being driven by coal mining, coal seam gas development and the compression of LNG. It is reasonable to assume that, for much of this load, transmission alternatives would be available for consideration. Yet these alternatives appear not to be being proactively identified and considered.

575. The availability of gas in areas such as the Surat and Bowen Basins indicates that gas, as an alternative fuel, is available to meeting at least a significant proportion of the regions increasing demand. For example:

Use of gas for LNG compression	Significant loads are being added to the electricity networks due to the conversion of gas to electricity for compression of LNG. We have been informed by Powerlink that this is mainly due to gas compression being unable to meet the environmental noise conditions. We understand that the problem is due to 'background noise' being used as a reference and that in these remote locations background noise is so low any increase breaches allowable levels. It is possible that visibility of the economic cost to the State due to the need for electricity network investment to supply LNG compression would lead to a reconsideration of the noise limitations in remote areas. Note that in the absence of an economic cost to supply signal such decisions are unlikely to emerge.
Co-generation	Co-generation situated at a gas field can be used to supply both demand of the gas production and other local loads. As the availability of the co-generation is linked to gas production it can provide (as a physical hedge) an appropriate alternative to transmission. Revenue arising from the net benefits of transmission investment deferral may be required to assist Co-generation projects to become viable.

[29] New Zealand, PJM, New England

[30] Western Australia

Local generation	A proportion of the local fuel resources could be used for the generation of electricity in local power stations. This could be enhanced with additional innovative solutions such as using waste heat for water heating or through absorption chiillers for district cooling schemes. Renewable electricity schemes such as solar and wind could be developed to complement local fossil fuel resources. As with co-generation, revenue arising from the net benefits of transmission investment deferral may enable projects to become viable.
Piped gas	Gas transmission investment is an alternative to electricity transmission. The piping of gas from the production fields to areas where electricity loads are growing will enable generation to be established closer to loads. This reduces electricity transmission system losses and defers the capital investment in electricity transmission. The cost of electricity transmission augmentation would need to become visible to those that make alternative investment decisions. The revenue available from the net benefits arising from the alternative should be available to fund the alternative if necessary.

Why alternatives are not emerging

576. Currently, when Powerlink produces a business case for a major capital project a Request for Information (RFI) is released. In all the projects that we have reviewed all RFI's have failed to identify any non-network alternatives that may be available.

577. Two key features that are required for non-network transmission alternatives to emerge are the visibility of the cost of capital investment programmes and access to revenues for alternatives. Importantly, the RFI can be considered to be a passive approach to identification of alternatives because it is structured to only 'pull' information form potential providers.

578. Additionally, if the costs of capital investments in electricity transmission are recovered across all electricity consumers, market incentives to identify transmission alternatives do not exist. Under these circumstances, very significant economic costs may be being incurred by consumers.

579. Current regulation places no stranding risk on Powerlink if its assets are bypassed at a point in the future. This means that little financial incentive exists for Powerlink to be proactive in flushing out all transmission alternatives prior to making a significant capital investment.

How alternatives can be encouraged

580. An alternative proactive approach would be for Powerlink to be required identify to potential transmission alternative providers:

   a. what the alternative costs of the transmission augmentation will be;

b. any revenues that could be available to providers of transmission alternatives; and

c. the types of transmission alternatives that would be considered.

581. In addition, a structured arrangement for contracting and rewarding transmission alternative providers is likely to be beneficial.

582. Introduction of a mechanism that exposed Powerlink to some of the stranding risk of its investment decisions could also be considered.

Annex 11: Grandfathered prescribed connection services

583. Powerlink has provided the following reasons for its interpretation of the Grandfathered Prescribed Connection Services.

584. The quoted AER interpretation of clause 11.6.11 of the Rules is identical in form to that set out in the AEMC's Rule Determination on the Economic Regulation of Transmission Services. In that Rule Determination the Commission stated:

> *The Commission's approach has been to define connection services as negotiable, recognising that these services are generally between two commercial enterprises such that a negotiable outcome is preferable to regulation for the achievement of the NEM objective. In this regard, it would be appropriate that any replacement or reconfiguration of a connection asset, grandfathered as providing prescribed services in accordance with clause 11.6.11 of the Revenue Rule, should be treated as a negotiated service asset.*[31]

585. However, this view was subsequently amended in the AEMC's Rule Determination on Cost Allocation Arrangements for Transmission Services. In that later Rule Determination the Commission stated:

> *The Commission has concluded that the approach to grandfathering assets adopted in clause 11.6.11 does not work in the intended manner. As a result, the Commission considered that other approaches to grandfathering should be explored with a view to adopting a workable and practical approach that would meet the regulatory objectives set out in the Revenue Determination.*

586. Clause 11.6.11 (b)3, provides that

> *(b) References to prescribed transmission services in new Chapter 6A include prescribed connection services and, where a service is a prescribed transmission service by virtue of the operation of this clause 11.6.11, that service is taken not to be a negotiated transmission service.*

587. The definitions of existing asset, replacement asset and eligible asset in clause 11.6.11 provide a framework whereby an existing connection service that would otherwise be treated as a negotiated transmission service under Chapter 6A of the Rules, is grandfathered as providing a prescribed connection service. The framework also provides, in specified circumstances, for the grandfathering to continue following asset replacement.

588. In summary, where an existing connection asset, grandfathered as providing a prescribed transmission service, is replaced without the Transmission Network User requesting any amendment to the services provided, and the services are being provided under a pre-existing Connection Agreement, then the resultant replacement assets will be treated as continuing to provide prescribed transmission services.

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[31] AEMC 2006, Draft National Electricity Amendment (Economic Regulation of Transmission Services) Rule 2006, Rule Determination, 16 November 2006, p74.

Annex 12: Continuous improvement

589. Throughout the review we have sought to establish the process through which Powerlink identifies areas for improvements that will, when implemented, reduce expenditure requirements. Powerlink informed us that they do not have a formal continuous improvement process but rely on individual managers identifying and implementing improvements. Whilst we found that several improvements had been identified and implemented, we observed that Powerlink found it difficult to immediately identify and quantify them.

590. We concluded that, whilst improvements were taking place, an executive led improvement and cost reduction program that gave visibility and priority to improvement initiatives, would be likely to realise material gains above those that Powerlink's current approach produced.

591. In this annex we set out the improvements identified in the desk top and on site reviews and discuss areas where we consider further improvements may be seen through the introduction of more formal continuous improvement management.

592. Powerlink identified the following improvements that have been made during the current RCP:

Portfolio Management	The establishment of the Projects and Portfolio Management team within the Network Strategy and Performance Business Unit. The effect of this restructure is to combine the teams responsible for project sponsorship and forecasting of capital works with the team tasked with operation and maintenance works, sponsorship and forecasting. Powerlink anticipates that the merger will provide greater alignment, coordination and optimisation of capex and opex through Powerlink's maintenance delivery strategies, delivery processes, financial reporting and network performance analysis and reporting.
Program Management	Enhanced program management practices to further improve capital works delivery capability. This has included the establishment of internal structures to better align the linkages and interdependencies between projects. One of the benefits of this approach is to achieve synergies in contractor establishment and management for projects undertaken within the same area.
Project Monitoring	Powerlink has taken steps to further improve its ability to monitor, understand and respond to factors that impact upon the implementation of its projects.

Information Management	The introduction and progressive roll-out of information technology tools. These tools have facilitated greater visibility, integration and coordination of project scheduling and reporting information across the business.
Regulatory Management	The review and amendment to systems and documentation to reflect the requirements associated with the introduction of various new or amended regulatory instruments.

593. Powerlink noted that:

> *"some of the initiatives identified above were either implemented recently or will occur in stages throughout the current regulatory period. For example, in relation to program management. Therefore, Powerlink considers that while some of the benefits associated with their introduction have or will be achieved in the current regulatory period, further benefits are expected to be realised well into the 2013-17 regulatory period"*

594. Powerlink identified the following improvements that are expected to be made during the next RCP:

Management of easement approvals.	One key area in which Powerlink proposes to adapt its governance approach is in relation to the management of easement approvals. Specifically, Powerlink intends to give further consideration into the adoption of a two phase approval process for easement projects, similar to that which currently applies to IT projects. The expected benefits of this change include: • improved accuracy of estimates which form the basis of full project approval; and • a more formal basis for preliminary funding to conduct necessary investigation works prior to full approval.

Management of Land Assets	In the future regulatory control period, Powerlink will continue to develop the land management strategy to enhance interaction with maintenance service providers to include: 1. Introducing a performance system for Land maintenance works; 2. Introduction of routine maintenance plans for land assets, such as for chemical treatment; 3. Develop and enhance land management standards across the business and between maintenance service providers. It is anticipated that there will be additional costs, and some savings, when optimising the land maintenance procedures and they will partially offset each other.
IEC61850	Powerlink is looking to establish an IEC68150 station bus solution in the next regulatory control period and further investigate the rollout of the second stage "process bus". There is limited opportunity for cost savings in the rollout of the first stage of the station bus solution. The potential for savings is related to the second stage with the implementation of process bus which should reduce the amount of field wiring. The timing for the second stage is dependent on the development of mature process bus products by the equipment manufacturers, but will be after the next regulatory period.

595. Powerlink noted that:

> *"In preparing its 2013-17 Revenue Proposal, Powerlink has incorporated the expected delivery outcomes of these initiatives in terms of cost, into the project cost estimates for both the remainder of this regulatory period and 2013-17 regulatory period. These arrangements are also implicit in asset management philosophy and strategies which underpin Powerlink's Revenue Proposal."*

596. In addition to the improvements identified by Powerlink we consider that the following should be highlighted:

Cost estimation improvement	Powerlink has initiated a number of cost estimate improvement initiatives, Improvements to the content of the project scope report (PSR) by: • Introduction of Concept Estimate Reports and Project Proposal • More rigorous sign off process for the Concept Estimate and Project Proposals • Network Operations group views included in estimate requests

	Improvements to easement project scope report.
Development of Network Support Platform	Powerlink has initiated Network Support Arrangements for non-network solutions. We understand that these arrangements can be used to manage outage planning and for temporary relief of network constraints. The further development of these agreements is likely to provide low cost options for managing short term network issues.
Network Investment Steering Committee	The NISC has been established by Powerlink to: • Actively oversee the process associated with investment decision making • Consider investment options and obtaining buy-in of stakeholder managers • Provide oversight of capital projects • Consider special governance requirements We consider that the cross divisional constitution of the NISC together with its terms of reference is likely to have and continue to have a material impact on improving projects management and reducing costs.
Life cycle asset management	The level and quality of condition monitors appears to have seen significant improvement. Evidence of this can be seen through the development, analysis and implementation of the 132kV refurbishment/replacement programme in North Queensland. Powerlink has found, through condition monitoring, that the assets are deteriorating and, to maintain reliable electricity supplies in North Queensland must be improved. The fact that the condition of the assets was not previously known suggests that an improvement in condition monitoring has been implemented. The improvements in condition monitoring and asset life cycle management are likely to reduce the overall life cycle costs of assets.

597. Whilst it is Powerlink that is best able to identify areas where efficiency gains can be made, the review team considered the following areas may be worthy of consideration.

598. Smoothing of capex is likely to achieve a reduction in actual costs per project which would flow through to a reduced total capex. Our experience is that a component of capex can be smoothed without detriment to the business, over periods of a few years. Smoothing will lead to a more efficient and effective use of resources and, through this, is likely to reduce costs. We consider that smoothing replacement capex is likely to release benefits through improved internal and external resource utilisation.

599. Members of the review team have knowledge and experience in the management of contractor resources and consider that providing flatter work profiles can realise material gains through cost reductions.

600. In Annex 10 we have discussed our views on how Powerlink could be more proactive in exploiting transmission alternatives to defer or replace transmission capex. We consider that this area has the potential to produce significant economic gains. Our review team has experience in transmission alternatives and how they can be incentivised. The team considers that, given the availability of primary energy resources in the State and the opportunities for locating generation adjacent to load (e.g. cogeneration), a proactive approach to transmission alternatives is likely to produce valuable opportunities for efficiency gains.

601. An efficiency and cost reduction program may focus on ways to drive the network harder such a focus would consider smart grid technology, flexible ac transmission systems (FACTS), new transmission technologies and non-network solutions. The program would give these visibility and strategic prominence within the organisation. These technologies have been used in transmission networks to reduce the requirement for capital expenditure.

602. Capex benchmarking is not undertaken currently by Powerlink. Benchmarking capex has the potential to identify areas for efficiency and cost reduction. A 2010 study undertaken for the Netherlands transmission operator TenneT[32] concluded that:

> *The TenneT Capex that was declared efficient in 2000 in fact contained at least 21.8% of Capex inefficiency compared to a conservative set of average European continental operators. Further, we note that a "continental best-practice" capex ratio would lower the TenneT score to 49%.*

603. While a similarly-detailed study would be required to determine the full extent of efficiency gains applicable to Powerlink, and where they could be realised, we nevertheless regard this study as evidence that a transmission utility presenting itself as efficient may nevertheless have considerable opportunity for further improvement. In our view, efficiency gains in excess of 5% are likely to be feasible targets for such programs, even in otherwise well-managed utilities, and we consider our recommended efficiency improvements of 1% to 2% to be a conservative initial track towards such goals.

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[32] PROJECT STENA Benchmarking TenneT EHV/HV final report by the authors, professors Per AGRELL and Peter BOGETOFT for SUMICSID AB, analyses EHV and HV operations by TenneT Transmission System Operator as part of a mission, Special TENnet Assessment (STENA), commissioned by the Office of Energy Regulation (Energiekamer, EK), Den Haag.

http://www.nma.nl/images/Report_stena_open_final22-157222.pdf

B. Glossary

AARR	Aggregate Annual Revenue Requirement
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
APR	Annual Planning Review
BPO	Base Planning Object
CAM	Cost Accumulation Model
CERF	Cost Estimation Risk Factor
EMCa	Energy Market Consulting associates
EMS	Energy Management System
FACTS	Flexible AC Transmission Systems
FMPM	Financial Management Practices Manual
LOS	Loss of Supply
NER	National Electricity Rules
NERC	North American Electric Reliability Corporation
NISC	Network Investment Steering Committee
NZIER	NZIER Consulting
PSR	Project scope report
RAB	Regulatory Asset Base

RCP	Regulatory Control Period
RFI	Request for Information
ROAM	ROAM Consulting
STPIS	Service Target Performance Incentive Scheme
Strata	Strata Energy Consulting
TNSP	Transmission network service providers
TOR	Terms of Reference
NEM	National Electricity Market