MEMO

To Ralph Matthes

From Mike Hensen

Date 18 January 2021

Subject Cross-submission TPM Development Options Parts B and C

Purpose

This note is the suggested background for a MEUG cross-submission on the stakeholder submissions on:

- TPM Development TPM Options PART B: Benefit-based charge (Part B)
- TPM Development TPM Options PART C: Adjustments to charges (Part C)

Transpower's Part B and Part C reports describe its proposals for a transmission pricing methodology (TPM) that implements the 'Transmission pricing methodology, 2020 Guidelines, 10 June 2020' (the guidelines) set by the Electricity Authority (EA).

The report includes comment on aspects of the submissions and extension of the comments made in my initial report.

Key points

Our initial comment that Transpower has not provided sufficient quantitative data to compare the options has also been made by many other submitters. The absence of projections of future benefit-based charges (BBC) and the likely drivers of those charges from Part B and Part C have:

- Skewed the submissions toward qualitative discussion of the relative complexity of the options for the standard method when the simple method will be the allocator of increases in BBC. (The exception to this comment is the submission by John Culy on the benefit modelling of the Clutha Upper Waitaki Lines Project (CUWLP).)
- Hindered a quantitative assessment of the materiality of the differences in BBC allocations under the proposed methods given the underlying track of the switch from residual to benefit based recovery of transmission charges.
- Missed an opportunity to address the uncertainty many submitters expressed over the future level of BBC and their exposure to volatility in the BBC from re-allocation or adjustment.

Estimated BBC by component

To encourage discussion of the relative significance of the options for allocation methods, our cross-submission includes a more detailed estimate of the outlook for BBC and the source of the BBC over the next 15 years than the summary comments included in our submission. These estimates are prepared from a mixture of sources which may not be fully consistent and are intended as an indicator of the order of magnitude of the BBC rather than forecast. The initial allocation of BBC is also modified by the transition cap proposed

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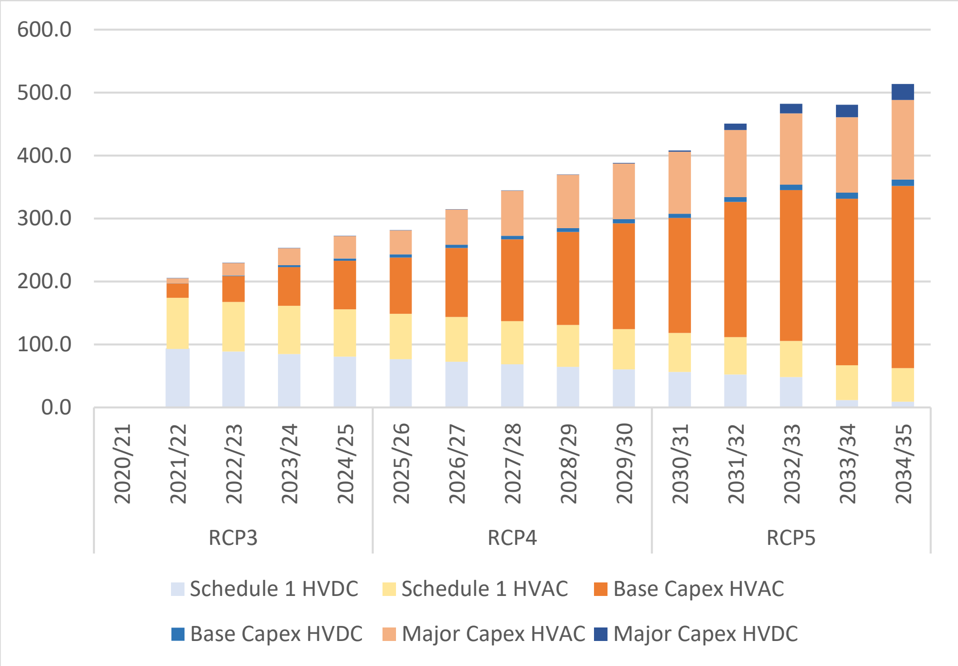
by the EA in the TPM. However, this effect is modest for most stakeholders and is not mentioned in either Part B or Part C. A more granular analysis of the components of the BBC and a detailed description of the approach is included in Appendix A.

The change in estimated BBC components for Schedule 1 assets and 'major' and 'base' capital expenditure by HVAC and HVDC components is shown in Figure 1 below.

Figure 1 Estimated BBC ($million)



Source: NZIER

The main observations from the figure that are relevant to the Part B and the submissions are:

- Most of the initial BBC are attributable to Schedule 1 HVDC assets (45 percent) followed by Schedule 1 HVAC assets (39 percent) but this declines rapidly due to the high depreciation on HVDC assets. After 5 years (2027) Schedule 1 assets account for only $144 million or 46 percent of estimated BBC (split evenly between HVDC and HVAC assets). As generators are allocated a higher share of Schedule 1 HVDC BBC (50 percent) than Schedule 1 HVAC BBC (26 percent), their share of Schedule 1 BBC declines relative to load customers. (This trend could be partially offset by allocation of BBC from the Clutha - Upper Waitaki lines project.)
- Major capital expenditure is not the main driver of growth in BBC over the forecast period reaching $56 million (18 percent of BBC) by 2027 and $151million (29 percent of BBC) by 2035. Accordingly, the 'standard method' for BBC allocation is unlikely to be the main method of allocation for the BBC. Most (80 percent) of Transpower's major

capital expenditure projects[1] $2,051 million over 2021 to 2025 generate benefits for load rather than generators[2].

- BBC to recover base capital expenditure (almost entirely for HVAC assets) is estimated to be the main driver of BBC allocation reaching $115 million (37 percent of BBC) by 2027 and $300 million (58 percent of BBC) by 2035. The description of base capital expenditure projects does not give a clear indication of the extent to which the expenditure would be to address 'Peak demand driven investments' as opposed to 'Non-peak demand driven investments'[3].

Part B – comment on submissions

The estimates of the BBC components suggest the following observations about the materiality and time sensitivity of the options Transpower has suggested for the BBC allocation methods for capital expenditure after 2020.

Standard method

Many of the submitters did not comment in detail on the Transpower's proposal to use stochastic dynamic dual programming (SDDP). Expert advisers engaged by Trustpower made detailed comments on the Transpower proposal:

- Creative Economic Consulting (CEC) argued that:
  - modelling methods such as SDDP could not be the basis for a durable allocation of BBC because they could not deliver credible long- term forecasts of electricity prices let alone network asset benefits
  - suggested an alternative paradigm 'the coalition of the willing' which relied on informed negotiations between customers based on a simple heuristic model of benefits
- John Culy analysed the application of benefit modelling to the Clutha Upper Waitaki Lines Project and:
  - identified several modelling questions about the estimation of generator producer surplus, spill reduction benefits, water values, demand side elasticity and investment plans
  - suggested Transpower could provide a strawman benefit analysis CUWLP on a without of prejudice as Transpower has already completed SDDP modelling of the benefits.

I think the CEC and John Culy submissions provide useful starting points for discussion of the BBC modelling that would help to build a common understanding of how benefits can be estimated:

- CEC. The major capital expenditure planned by Transpower includes three large projects: HVDC capacity upgrade - $357 million, Waikato and Upper North Island

1 See: Integrated Transmission Plan 2020, Schedules, 5. Major capital expenditure—outputs, page 7

2 The major projects 'HVDC capacity upgrade - $273 million', 'Wairakei Ring transmission constraint – phase 2 - $53 million and some of 'Enabling new connections - $151 million)

3 See Part B page 36 to 38. Paragraphs 134 to 137 on page 36 express Transpower's view that a physical allocator can be used to allocate benefits to customers within a regional load or generation group because they are identified as 'benefiting similarly from the investment'. Paragraph 143 on page 137 refers to 'peak' and 'non-peak' driven investment and proposes the allocator method could be fixed for the simple method. Page 38 includes a table of the suggested allocators and asks submitters for their views at Question 2.14

voltage management - $273 million and Central North Island transmission capacity - $244 million. (The next two largest projects are: Enabling new connections - $150 million and Brunswick - Stratford B reconductoring - $100 million.) I suggest that in its response to the CEC submission Transpower focus on how the ideas suggested by CEC could be applied to these large projects to test the feasibility of developing simpler models of the benefits and how the transparency and durability of the CEC approach would compare to the transparency and durability of an allocation based on SDDP modelling. While the concept of a coalition of the willing is appealing, the experience of the TPM development suggests such coalitions are hard to build.

- John Culy: I support John Culy's suggestion that Transpower provide a strawman benefit analysis of the CUWLP both to answer the specific modelling questions asked by John in his submission and to illustrate how the SDDP allocation of benefits would work. More importantly a strawman would also test the propositions in the CEC paper that a coalition of the willing can be developed for major capital expenditure projects, that a simple heuristic model can be developed for benefit allocation and that this type of approach is more transparent and durable for the beneficiaries of the project than an imposed SDDP type approach.

Simple method

Most submissions that commented on an allocator:

- supported the use of either an energy use (MWh) or contribution to peak demand allocator (MW) as opposed to a capacity-based allocator.
- did not suggest how the decision to use an energy or peak demand share allocator should be made let alone quantify what proportion of BBC for capital expenditure they expected would be allocated using energy based as opposed to peak demand allocators.

As discussed above, I estimate that the simple method will be the dominant allocator for BBC. The Electricity Authority modelling of the benefits of its new TPM relied heavily on the differences in consumer surplus at what it defined as peak and shoulder periods from the replacement of RCPD based charges with a tax-like residual charge and BBC. The analysis in Part B does not provide an explanation of either how:

- the proposed peak based demand allocator would differ from the RCPD charge
- an allocator based on total energy usage would deliver the same changes in behaviour as the peak and shoulder pricing signals which were the core of the EA modelling.

Part C -comment on submissions

Expert advisors CEC (for Trustpower) and Axiom (for Northpower and Vector) commented on the re-openers and re-allocation mechanisms proposed by Transpower in Part C.

CEC commented about the selective variability created by allowing re-openers in limited circumstances and cliff-edges created by the different reallocation thresholds. I agree in principle with these comments. However, they are function of the design of the TPM rather than Transpower's proposed methodology.

Axiom commented on the possibility that BBC could exceed the value of benefits from an asset under the Transpower proposal, Axiom also noted that the example of benefit re-allocation used by Transpower for a new entrant had BBC that exceeded the benefits and questioned why the project would have been built. I share Axiom's puzzlement as to why Transpower chose to illustrate its approach to benefit re-allocation with this example. Aside from BBC exceeding benefits the example also:

- uses a very short asset life compared to the life of the asset life described In Transpower's annual report
- does not reflect the fact that the BBC (as opposed to the value of the benefit) for a given asset is likely to decline in nominal terms[4] over the life of the asset
- does not explain how either the present value of benefits or BBC are included in the calculation.

4 I understand the value of a benefit-based investment (BBI) is set at historical cost and depreciated on a straight-line basis -a fixed nominal amount per year. This lowers the RAB value of the BBI which in turn lowers the return on capital component of the BBC associated with the BBI

Appendix A

Estimating future BBC

The key elements needed in estimating the total future BBC are the planned capital expenditure, capital charge and the expected deprecation rate for the capital expenditure and the allocation method that is likely to be applied. The estimates in this note are based on the following information sources:

- Starting regulated asset base (RAB) values for Schedule 1 HVDC assets were taken from the Transpower Information Disclosures for 2020[5] and starting values for Schedule 1 BBC were taken from the EA TPM decision paper[6].
- Planned capital (major, listed and base) expenditure from Transpower's Integrated Transmission Plan[7] are the additions to the RAB
- Depreciation for Schedule 1 elements was estimated as follows:
  - HVDC; average of depreciation expenditure over the period 2016 to 2020 obtained from Transpower Information Disclosures[8]
  - HVAC; estimated average deprecation rates for HVAC assets over the period 2016 to 2020. (This was converted to an annual straight-line depreciation per $100 million of RAB).
- Straight-line depreciation amounts for 'Base' and Major' capital expenditure for 'HVAC Substations', 'HVAC Lines and Transmission cables', 'HVDC Substations and Submarine cables' and 'HVDC Lines' were calculated using depreciation rates based on the asset lives reported in Transpower's annual report for 2020[9]
- Schedule 1 RAB for year 'y' is calculated for RAB for year y-1 less depreciation. RAB for post 2021 assets is calculated RAB for year y-1 plus capital expenditure in year y less straight-line depreciation on new capital expenditure for the years y-1 to 2022
- WACC (67th percentile vanilla WACC) of 4.57 percent from the Transpower price quality path[10] (which is also used to estimate the value of Transpower's regulated asset base at $4,858 million in 2021 by dividing the capital charge on this page by the WACC)
- Non-network expenditure for RCP3, RCP4 and RCP5 from Transpower's Integrated Transmission Plan[11] which is allocated to Schedule 1 and post-2021 RAB in proportion to their share of estimated Transpower RAB

5 I was not able to find an estimate of the RAB for the Schedule 1 HVAC assets. I estimate the starting RAB by calculating what the BBC would be for $100 million of HVAC asset and divide the Schedule 1 HVAC BBC for 2022. I multiply this scale factor by $100 million to estimate the staring RAB for Schedule 1 HVAC RAB

6 Transmission pricing methodology, 2020 Guidelines, and process for development of a proposed TPM, Decision, 10 June 2020 p125, Table 7 Estimates of year 1 benefit-based charges have reduced over time

7 See: Integrated Transmission Plan 2020, Schedules, 2. Base capital expenditure and 4. Major capital expenditure—approved projects and 3. Operating expenditure, pages 4 and 6

8 See SCHEDULE F1: VALUE OF THE REGULATORY ASSET BASE (RAB ROLL FORWARD) - Information Disclosure version, F1(iii): Disclosure by Asset Category

9 See: 'Transpower, Annual Report 2019/20, Keeping the energy flowing', page 48. The values used are: HVAC substations 43 years – 2.33 percent, HVAC transmission lines 58 years – 1.72 percent, HVDC substations (incl submarine cables) 28 years – 3.57 percent and HVDC transmission lines 55 years – 1.82 percent.

10 Transpower Individual Price-Quality Path from 1 April 2020, Companion paper to final RCP3 IPP determination and information gathering notices, Date of publication: 14 November 2019, p83, Table B2: Forecast MAR building block values

11 See: Integrated Transmission Plan 2020, Schedules, 3. Operating expenditure, page 5

Table 1 BBC estimates

$ million

Allocation method	Schedule 1		Base Capex		Major Capex		Total
Year	HVDC	HVAC	HVAC	HVDC	HVAC	HVDC	
2021/22	93.0	81.0	23.1	0.1	7.9	0.1	**205.1**
2022/23	88.9	78.6	41.2	0.8	20.0	0.2	**229.8**
2023/24	84.9	76.8	61.3	2.9	27.3	0.1	**253.2**
2024/25	80.8	75.0	77.4	3.7	35.5	0.1	**272.5**
2025/26	76.8	72.3	89.4	4.8	38.2	0.2	**281.6**
2026/27	72.7	70.9	109.6	5.4	55.6	0.2	**314.4**
2027/28	68.7	68.3	130.2	5.7	71.4	0.2	**344.4**
2028/29	64.6	66.3	148.1	6.1	84.6	0.4	**370.1**
2029/30	60.6	63.9	168.0	6.7	88.4	1.0	**388.4**
2030/31	56.5	61.7	182.7	6.8	98.5	2.2	**408.3**
2031/32	52.5	59.5	214.4	7.8	106.7	9.8	**450.6**
2032/33	48.4	57.3	239.6	8.7	113.3	14.9	**482.1**
2033/34	11.9	55.1	264.6	9.5	119.8	19.9	**480.8**
2034/35	9.6	53.0	289.4	10.3	126.3	24.9	**513.5**

Source: NZIER

Table 2 BBC estimates by capital expenditure and asset type

$ million

	Schedule 1		Base Capex				Major Capex				Total
Year	HVDC	HVAC	HVAC Substations	HVAC Lines	HVAC Substations	HVDC Lines	HVAC Substations	HVAC Lines	HVAC Substations	HVDC Lines	
2021/22	93.0	81.0	13.7	9.4	0.0	0.1	3.3	4.5	0.1	0.0	**205.1**
2022/23	88.9	78.6	23.3	18.0	0.0	0.8	10.7	9.3	0.2	0.0	**229.8**
2023/24	84.9	76.8	32.3	28.9	0.0	2.9	14.7	12.5	0.1	0.0	**253.2**
2024/25	80.8	75.0	40.1	37.3	0.0	3.7	17.8	17.7	0.1	0.0	**272.5**
2025/26	76.8	72.3	46.6	42.8	0.0	4.8	17.5	20.7	0.2	0.0	**281.6**
2026/27	72.7	70.9	51.8	57.9	0.0	5.4	19.8	35.8	0.2	0.0	**314.4**
2027/28	68.7	68.3	57.3	72.9	0.0	5.7	23.8	47.6	0.2	0.0	**344.4**
2028/29	64.6	66.3	61.8	86.3	0.0	6.1	25.3	59.3	0.4	0.0	**370.1**
2029/30	60.6	63.9	68.2	99.8	0.0	6.7	25.6	62.7	1.0	0.0	**388.4**
2030/31	56.5	61.7	71.4	111.2	0.0	6.8	29.4	69.0	2.2	0.0	**408.3**
2031/32	52.5	59.5	81.2	133.2	0.0	7.8	30.4	76.3	9.8	0.0	**450.6**
2032/33	48.4	57.3	88.5	151.0	0.0	8.7	31.1	82.2	14.9	0.0	**482.1**
2033/34	11.9	55.1	95.8	168.7	0.0	9.5	31.8	88.0	19.9	0.0	**480.8**
2034/35	9.6	53.0	103.1	186.3	0.0	10.3	32.5	93.8	24.9	0.0	**513.5**

Source: NZIER