From: Jo Mackay
Sent: Saturday, 11 May 2019 2:55 PM
To: Tim Sparks; Jean-Pierre de Raad
Subject: FW: TPM progress

FYI

From: Brian Bull [mailto:bbull1@hotmail.com]
Sent: Friday, May 10, 2019 11:44 PM
To: Jo Mackay
Subject: Re: TPM progress

That's great that they are doing such a thorough check.

> I have raised with JP my concerns about valuing the reduction in water heating caused by RCPD as if it had value to consumers. Ripple control works because the timing of this consumption does not matter to consumers. If this consumption is shifted to peak periods and this is the source of the benefits then I think there is a logical problem with what has been done which amounts to valuing what is not valuable.

This is related to my 'methodological query #9'. Both Doug and I are expressing a view that the cost of the current response to RCPD is overstated (and hence the allocative efficiency benefit of the proposal is overstated). Tim has recently been working on this issue with John and I understand some improvements are coming.

> Can you please write me a commentary on your checking process in a similar format to that below, so that I can circulate that to our steering group?

Try the below. I wasn't sure whether you wanted a commentary on my checks of the Python code, or all checking activities - so have done the latter - but feel free to prune stuff out if you wanted the former.

cheers BB

TPM CBA - checking activities to date - Brian Bull

Checking the model specification

I was assigned to carry out Task 2 of the MP team's checklist, that being to "Check empirical models (as set out in the 'Electricity demand models' doc and in Appendix A) are consistent with theoretical models". I compared:

- section 3.3 of "1137287_1_TPM Project Step 2 Working Paper v1.0.DOCX" with bullet points A.11 - A.58 of "2019 TPM CBA report v0.2.docx"
- section 3.4 of "1137287_1_TPM Project Step 2 Working Paper v1.0.DOCX" with bullet points A.59 - A.140 of "2019 TPM CBA report v0.2.docx"
- section 3.5 of "1137287_1_TPM Project Step 2 Working Paper v1.0.DOCX" with bullet points A.141 - A.167 of "2019 TPM CBA report v0.2.docx".

I found no major problems, but had some queries and lodged them with John.

I did not check "Electricity demand models v0.1.docx", suggesting the MP team would be better placed to do it.

Checking the preparation of input data

I checked the preparation of input data in the following spreadsheets.

- Battery assumptions.xlsx
- Generation data.xlsx
- Model_data_generation.xlsx
- Model_data_load.xlsx
- Shares of historic assets.xlsx
- Transmission_revenue.xlsx

The check covered the transcription of the source data from its ultimate source (where this was possible - and noting that I have not checked the accuracy of the ultimate source itself), and the manipulation of that data within the spreadsheet. Any calculations that did not impact the data products actually used in Python were not necessarily checked.

I also checked the transcription of the input data from the above spreadsheets to the data files for loading into Python.

I also checked the hard-coded parameters in the Python code.

I raised various issues with John as I went along. These are listed in the checking spreadsheet tabs 'BB data - Externally sourced', 'BB data - Calculations', 'BB data-Cols of Model_data_load', 'BB data-Cols of Model_data_gen', 'BB data - Transcription to CSV', 'BB - Hard coded parameters', 'BB data - Final comments'. Possibly the most significant related to the treatment of batteries, which he has now revamped.

I am still to check the input data that was used to estimate the parameters of the demand model - this is pending the arrival of relevant files from John.

Checking the Python code

I reran one set of Python scripts to make sure I reproduced John's outputs.

I carried out detailed checking of:

- the main Python code file for the base case scenario
- the two auxiliary Python code files for the base case scenario

This check did not include a full line-by-line audit, but did include:

- scrutinising each function
- line-by-line checks of some parts of the code
- rerunning some small segments of code to see how they operate
- comparing what the code appears to do, with my understanding of what it was intended to do.

I checked the Python code files for nine other scenarios by diff'ing them against the base case and scrutinising the diffs.

I recorded my workings in tabs 'BB - Python code - Base case' and 'BB- Python code - 9 other cases', and passed comments to John.

I have not yet checked the Python code for various sensitivity scenarios that vary key parameters.

Checking the transcription of outputs

I have not yet checked the transcription of results from the Python output to the CBA document, or the presentation of those results in the CBA document.

I have also not checked the description of the model in the CBA document (except as noted above).

Methodological queries

As I went along, I raised some conceptual issues with John. These are listed in the checking spreadsheet (tabs 'BB - Methodological queries' and 'BB - Modelling of AoB').

Until recently, my top five issues were that:

- the results in the CBA document were dominated by wealth transfers, as opposed to net economic benefits
- the modelling greatly overestimated the magnitude and cost of the response to the status quo RCPD charge
- the allocation of the AoB charge (post 2022) was poorly modelled
- the CBA did not consider the benefit of the proposal in terms of making transmission investment more efficient by giving beneficiaries an incentive to enter into the transmission investment decision making process more constructively
- the CBA did not consider the benefits of the proposal in terms of co-optimisation of generation and transmission.

However I understand steps are now being taken to address all these issues (to varying extents).

From: Jo Mackay <Jo.Mackay@ea.govt.nz>
Sent: Thursday, May 9, 2019 10:43 PM
To: Brian Bull
Subject: FW: TPM progress

Hi Brian

Doug has put his team onto looking at the python code – he's just supplied an explanation, below, of what they are doing. Your approach to checking the same code seems to be a lot quicker so I assume you've adopted different methods.

Can you please write me a commentary on your checking process in a similar format to that below, so that I can circulate that to our steering group? We've having a bit of an overview across the checking process next week and this kind of an explanation of approach would be helpful to go alongside the checking sheets.

Thank you

Jo

From: Doug Watt
Sent: Friday, May 10, 2019 12:35 PM
To: Jo Mackay
Cc: Rory Blundell; Jean-Pierre de Raad
Subject: TPM progress

- We got the material we needed to start the code check on 12 April. Most of us were away from that point on leave.

- Once we came back to work on the 29th we started reading the material.
- We started checking the code itself later that week.
- The code broken up into 33 lots. Each lot is a scenario more or less.
-
- We have started with one central scenario. This is AoB_All_Major_Capex. So we are working on 1/33 of what we need to check.

- We are taking a two pronged approach. Three of us are reviewing the functions. There are 17 functions. These are all interactive, so one function can use output from another function as an input.

- The longest function is over 300 lines of code.

- One of us is re-writing the code to be more amenable to checking, and more compact.

- The functions read in and process data. We are not checking the efficacy of the input data. It is sometimes very processed in spreadsheets. So all our checking is conditional on the input data being correct.

- To check a function we cut out a line at a time and run it to understand what it does. At times we have to feed the functions data from the output files because they are written to work in a loop where prior steps have created the input data for later steps.

- Once we have checked the functions in the central scenario we need to go though and understand the flow of how the model iterates forward through time. And all the other code that is used. We have not started either of these two tasks.

- Once we have done that and we have an understanding of the entire process we need to check with John that each of the calculations that is done is what is intended. At the moment we are assuming that the calculations are the right ones to do.

- Once we have done that we can start on the other scenarios.

- My best guess is that we will use all the time we have to the end of June—the date that JP and I have spoken about.

- At any point prior to that the best we can say is that we haven't found anything to date.

- I have raised with JP my concerns about valuing the reduction in water heating caused by RCPD as if it had value to consumers. Ripple control works because the timing of this consumption does not matter to consumers. If this consumption is shifted to peak periods and this is the source of the benefits then I think there is a logical problem with what has been done which amounts to valuing what is not valuable.

- My other concern is that the Code is extensive and difficult to assess. The documentation we have got so far is not adequate for anyone to check the Code. What is needed is something that links the material in appendix A to the code. This is something that I have been asking for for a couple of months now. Even with this, consideration should be given to re-writing the code to make it easier for stakeholders to scrutinise.

Doug

☐ **Doug Watt**
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