

26 August 2019

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Dear Phil

## **Opinion with respect to audit of the vectorised Scheduling, Pricing and Dispatch (vSPD) software**

### **Introduction**

Robinson Bowmaker Paul Limited (RBP) conducted an audit of the Electricity Authority's (the Authority) "*vectorised Scheduling Pricing and Dispatch*" (vSPD) software regarding its Scheduling Pricing and Dispatch (SPD) and Financial Transmission Right (FTR) rental functionality.

The purpose of the testing was to ensure that the results produced by vSPD are compliant with the relevant software specifications:

- For the SPD functionality, Scheduling, Pricing and Dispatch Software: Formulation Version 11.2 (referred to as the SPD Formulation)
- For the FTR Rentals functionality, Schedule 14.3 of the Electricity Industry Participation Code as at 30th January 2019 (the Code)

### **Approach to testing**

We have assessed vSPD's compliance with the software specifications above by verifying that vSPD produces results which are equivalent to the results produced by the SPD

(version 39.3.9) and i-HEDGE (version 3.1.2) software used by Transpower and Energy Market Services respectively<sup>1</sup>.

Our approach to testing involved:

- Providing the Authority with input and output test files for all in-scope SPD and iHedge audit test cases.
- The Authority converted the above test cases into a format usable by vSPD, ran the tests and provided us with the outputs.
- We reviewed the Authority's testing process to verify that the Authority was running the correct set of tests and providing us with the appropriate outputs.
- We reviewed the outputs to verify that vSPD's results were equivalent to SPD and iHedge.
  - A number of SPD test cases produced degenerate solutions. In these cases, we examined the inputs and outputs to verify that the vSPD solution is an equivalent alternative optima of the SPD solution.

## Out of Scope

The following functionality is out of scope of this audit:

- SPD:
  - Dead and disconnected node logic (Section 2.1 of the SPD formulation).
  - e-node/p-node mapping logic (Section 2.1 of the SPD formulation).
  - Post-processing logic to remove bad bus prices (Section 6.1 of the SPD formulation).
  - Intermittent generation offer arrangements introduced in SPD version 39.5.0 (corresponding to Scheduling, Pricing and Dispatch Software: Formulation Version 11.3).
- FTR Rentals (iHedge):
  - Determination of FTR Injection Patterns (Clause 5, Schedule 14.3 of the Code).

## Testing results

All tests passed for both the SPD and FTR functionality.

Further details of the testing are provided in the document "*Audit of SPD and FTR rentals functionality of vSPD*" dated 30 August 2019.

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<sup>1</sup> Both SPD and iHedge have been audited for compliance against their respective software specifications pursuant to clause 3.17(1) of the Code.

## Opinion

The following, therefore, is our opinion as to the extent to which SPD complies with its software specification:

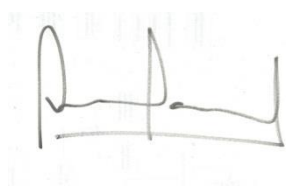
*Subject to the scope limitations outlined above, we certify the following with respect to vSPD version 3.0.4:*

- *vSPD's Scheduling, Pricing and Dispatch (SPD) functionality complies with Scheduling, Pricing and Dispatch Software: Formulation Version 11.2 in all material respects.*
- *vSPD's FTR Rentals functionality complies with Schedule 14.3 of the Code in all material respects.*

## Limitation of Liability

This opinion has been prepared by Robinson Bowmaker Paul Limited for the Electricity Authority based on information supplied by Transpower, Energy Market Services, and the Electricity Authority. To the maximum extent permitted in law, Robinson Bowmaker Paul excludes all liability to any other persons for any loss or damage, whether direct or indirect and however caused (including through negligence) that may be suffered as a result of reliance on this opinion by that third party.

Yours sincerely



Sue Paul

Principal