



Government
Actuary's
Department

Quality Assurance of Ofgem RIIO-2 Financial Models

Project Update – Final Determination

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At GAD, we seek to achieve a high standard in all our work. We are accredited under the Institute and Faculty of Actuaries' Quality Assurance Scheme. Our website describes **the standards** we apply.

1 Introduction

Background

The Government Actuary's Department (GAD) has been commissioned by the office of Gas and Electricity Markets (Ofgem) to perform a quality assurance, using the Ofgem Model Quality Assurance Checklist, for the draft Licence Model (LiMo) and Price Control Framework Model (PCFM) for RIIO-2 (GD, T and ESO), for the four sector models (GD, ET, GT and ESO), at three different stages, as follows:

1. Publication of RIIO-2 LiMo as part of draft determinations (DD) – July 2020;
2. Publication of RIIO-2 LiMo as part of final determinations (FD) – December 2020; and
3. Publication of the final RIIO-2 PCFM as part of the statutory licence modification – February 2021.

This report has been prepared by GAD to provide an update on the quality assurance at the final determination stage.

Scope

The full scope of this stage of the review is described in the checklist provided by Ofgem (Appendix B). The prime focus of the complete review (up to stage 3 above) is on the accuracy of the calculations, the integrity of the model and compliance with best practice in modelling.

To facilitate this review Ofgem provided GAD with a copy of each of the models and limited draft documentation. This documentation does not cover the full model at present but does provide some useful guidance concerning some sections of the calculations.

This review is on-going, with changes expected to be made to the models between final determination and the publication of the final RIIO-2 PCFM. At final determination stage our review is limited to those aspects of the models and calculations that are used as part of the final determinations, other functionality of the models that is not used for final determination will be reviewed as part of the on-going project.

The review is based on the calculation formula included within the published models; however, it is possible that change to the numerical inputs used could be made after our final review.

Models

The models are Microsoft Excel based financial models.

The models reviewed at final determination stage are:

- I. GD Licence Model
- II. ET Licence Model
- III. GT Licence Model
- IV. ESO Licence Model

GAD approach

We have performed a desk top review of the model to look at the formula and calculations on a line by line basis. We have also used software to assist with checking the integrity of models.

A more detailed description of the GAD approach to model quality assurance is provided in Appendix A of this report.

At each stage of the review we have shared the issues logs with Ofgem and after they have considered the findings, they have advised their proposed actions. We have also asked specific questions in relation to the operation of the model and calculations in order to help verify that the approach taken is as intended.

2 Final determination update

Overview

We have provided Ofgem with detailed issues logs and each issue has been classified into one of the following headings:

- I. Calculation & Data Integrity
- II. Documentation
- III. User Interface
- IV. Model Standards

This project is an on-going model QA and it is our understanding that Ofgem will be seeking to address many of the issues we raised and incorporate many of the recommendations made into the subsequent versions of the models that will be prepared between final determination and the publication of the final RIIO-2 PCFM. It is not expected that all our recommendations (other than those in respect of calculation accuracy) will have been implemented at final determination.

Calculations for final determination

At final determination stage we have not identified any issues in respect of the accuracy of calculations that have not either been resolved, or a satisfactory explanation provided as to why this issue would not affect the final determination process.

This assurance on the accuracy of the calculations is subject to the limitations below. We would expect these limitations to have reduced before the final PCFM model is published.

- I. At final determination stage we have restricted our observations to the items covered in the scope checklist provided by Ofgem. We are working with Ofgem on a more detailed checklist covering full best practice modelling for the publication of the final PCFM.
- II. Our assessment is based on the model being used by members of the relevant Ofgem team, who have detailed knowledge of the operations of the model. At this stage, given the absence of final user documentation and some issues raised over user interface, there are risks the model could be mis-used if the user does not have detailed knowledge of the model.
- III. We have been provided with some draft documentation of the model and licence; however, this does not cover all aspects of the calculations in the model. In this respect we verified that the calculations follow a logical approach and relied on assurances from Ofgem that the calculation approach is as intended. However, until the model and documentation is finalised, there remains risks of inappropriate use / audit trail.
- IV. As specified in the overview, there are issues that we have identified and will be addressed as part of the on-going work, but which do not impact the accuracy of the calculations. In particular we note that some calculations will need to change between final determination

and the production of the PCFM, as they relate to functionalities only applicable to the final determination model.

3 Next Steps

Following final determination Ofgem will be updating the models for the publication of the final RIIO-2 PCFM. We understand that, where appropriate, the items raised in the issues log will be incorporated into these future versions of the models.

We will continue to provide a model QA for the future versions of the model and will provide a final report using the full Ofgem Model QA checklist once the PCFM models are complete.

4 Limitations

GAD does not have expertise in Gas and Electricity Markets and the advice does not cover any of the model's capabilities in this area.

In preparing this report, GAD has relied on data and other information supplied by Ofgem as described in the report. Any checks that GAD has made on this information are limited to those described in the report, including any checks on the overall reasonableness and consistency of the data. These checks do not represent a full independent audit of the data supplied. In particular, GAD has relied on the general completeness and accuracy of the information supplied without independent verification.

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02 December 2020

Appendix A: Quality Assurance Process

Our model QA process splits our findings across five areas: Calculation & Data Integrity, User Interface, Documentation and Model Standards, which are described further below.

Calculation & Data Integrity

This encompasses the following areas:

- Reasonable protection of the user against erroneous input (e.g. cell validation, cell checks)
- Input locking with audit trail for confidence in pre-completed inputs
- Direction of data flow in model
- Appropriate level of accuracy for outputs
- Sensitivity of outputs to inputs

Documentation

Documentation is part of the model standards, however as it is an important area we have separated it out for the purpose of this QA.

GAD's scope in reviewing the documentation was limited specifically to the wording and use of the model itself, and the model's compliance with calculations as set out by the Licence and model handbook. We didn't assess if all good practice documentation was in place and review any other documentation (e.g. model change control logs).

User Interface

This encompasses the following areas:

- Layout of the model and data
- Colour coding of cells and worksheets
- Model functionality
- Clarity of outputs
- General usability

Model Standards

We have included checks against GAD modelling standards and spreadsheet best practice in this section as this largely overlaps with the model standards.

Essential

- Model summary containing: Model name, Model purpose, Scope and specification, Creation date, File location, Owner/Contact, Version number, Link to QA log, and Link to assumptions log
- Model map
- Sheet descriptions

Recommended

- Structure diagram showing the links between specific inputs, calculations, and outputs
- Formatting and colour coding to illustrate cell/worksheet function
- Glossary of acronyms/abbreviations and technical terms

Consider Using

- Tables and named ranges (for robust referencing)

Spreadsheet Best Practice

- Plan a model structure before starting to build
- Aim to move data from left to right and top to bottom through the workbook
- Try to keep formulae consistent across columns or rows
- Avoid complex nested formulae (break them down across columns)
- Use meaningful headings
- Keep inputs, calculations, and outputs on separate worksheets (it can be appropriate to have outputs on inputs pages for real time testing)
- Avoid external links; include source data in its raw form in the workbook
- Avoid circularity (worksheet A refers to worksheet B so worksheet B should not refer back to worksheet A)
- It's intuitive to scroll vertically so aim to use more rows than columns
- Aim for consistency between worksheets (heading text, column and row positioning)
- Avoid duplication
- Keep it as simple as possible to do the job

Appendix B : Ofgem Model Quality Assurance Checklist

QA activities to be performed	Completed (Yes, No, NA)	Comment (must be provided if answer in column 2 is other than "Yes")
Structure and clarity		
Model structure		
Model logic map or flowchart	No	There is no model map or flowchart other than for the ESO model.
Are calculation flows within worksheet logical and easy to understand?	Yes	In general calculation flows are understandable but there are several occasions where the model does not use a one way flow with results referenced from latter worksheets or from further down the same sheet. Ideally a left to right and top down approach should be used. The model would also benefit from more documentation within the model or in a separate handbook to explain the flow.
Do similar worksheets have similar structures?	Yes	All tables related to PCFM work have the same structures whilst the finance sheets tend to be bespoke.
Are similar tables laid out in similar way?	Yes	
Is the model free from anomalous calculation/label/text cells?	Yes	
Titles and labels are present, logical and accurate	Yes	
Units are indicated	Yes	
Rounding is performed in a clear and correct way	Yes	
Formula clarity & robustness		

QA activities to be performed	Completed (Yes, No, NA)	Comment (must be provided if answer in column 2 is other than "Yes")
All unique formulae have been checked for correctness	Yes	We have confirmed that calculations are sensible and consistent with provided formula to the extent possible. Since the model itself is seen as part of the licence, and hence specifies the correct calculations, we rely on Ofgem to confirm the approach is as intended but are satisfied that the calculations appear sensible.
Hardcoded values within formulae are used only when absolutely necessary	Yes	There are a few remaining cases of hardcoding within formula, but most instances have been removed.
Are formulae easily understood?	Yes	Individual formula are straightforward to understand.
Are merged cells avoided for inputs, calculations and outputs?	Yes	
Named ranges management		
Named ranges follow agreed naming convention	Yes	Named ranges are used and have clear distinct names. We are unaware of any convention.
Named ranges naming convention is meaningful and easy to understand	NA	We are unaware of any convention.
There are no corrupted names	Yes	
Verification		
Formula correctness		
None of the following errors exist in cell outputs: #NULL!, #DIV/0!, #VALUE!, #REF!, #NAME?, #NUM!, #N/A!	Yes	There are some error messages on the RatingSimulator sheets but these relate to unused

QA activities to be performed	Completed (Yes, No, NA)	Comment (must be provided if answer in column 2 is other than "Yes")
		scenarios so do not impact the results.
Do all formulae refer to the correct cell?	Yes	
Have formulae been copied down and across as far as they should be?	Yes	
Are all formulae which refer to named ranges calling the correct range?	Yes	
Is the data being pulled into the calculation modules correctly?	Yes	Data calls from inputs appear sensible but we rely on Ofgem for assurance that these are all as intended since the licence says that the calculations are as per the model.
Do numbers apply to the correct time period (e.g. the middle of the month/year versus the beginning/end)?	Yes	
Are financial year and calendar year data managed correctly?	Yes	
Code correctness (if applicable)		
Does the code function as intended without error, and produce the intended results?	Yes	The results appear sensible.
Are hard-coded references to cells used only when absolutely necessary?	Yes	
If they are used, are they referring to the correct values?	Yes	
External links		
Are links to external documents used only when absolutely necessary?	Yes	Links to external documents have been removed for the final versions of the models.
Are they properly documented?	NA	No external links are used
If external links are used, do they pull in the correct, up to date data?	NA	No external links are used

QA activities to be performed	Completed (Yes, No, NA)	Comment (must be provided if answer in column 2 is other than “Yes”)
Can the external data be 'refreshed'?	NA	No external links are used
Open the file on a different machine to original to ensure no undocumented error messages occur	Yes	We have opened the model on GAD machines
Check the external links to ensure the most up to date data is used. This may involve requesting access to source files and engaging with owners of the data.	NA	No external links are used