



Government
Actuary's
Department

Quality Assurance of Ofgem RIIO-2 Financial Models

Project Update – Draft 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) / 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. Informal consultation with licensees of draft RIIO-2 PCFM – September 2020; and
3. Publication of draft RIIO-2 PCFM as part of RIIO-2 final determinations (FD) and statutory licence consultation.

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

Scope

The full scope of the review is described in the checklist provided by Ofgem at the start of the review (Appendix B). The prime focus of the review 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 significant changes expected to be made to the models between draft determination and final determination. At draft determination stage our review is limited to those aspects of the models and calculations that are used as part of the draft determinations, other functionality of the models that is not used for draft determination will be reviewed as part of the on-going project.

Models

The models are Microsoft Excel based financial models.

The models reviewed at draft 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. All models have had at least 2 people review the calculations relating to the draft determination revenue values.

A more detailed description of the GAD approach to model quality assurance is provided in Appendix A: Quality Assurance Process 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 Draft 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 draft and final determination. It is not expected that all our recommendations (other than those in respect of calculation accuracy) will have been implemented at draft determination.

Calculations for draft determination

At draft 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 draft determination process.

This assurance on the accuracy of the calculations is subject to the limitations below. We would expect these limitations to have been considerably reduced before final determination.

- I. At draft determination stage we have restricted our review to those areas of the model and the functionality of the model which are used for draft determination. Our review specifically excludes the following parts of the model:
 - TaxTrigger worksheets in all models
 - MOD worksheets in all models
 - Annual iteration calculations used to derive MOD adjustments
- 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 address as part of the on-going work, but which do not impact the accuracy of the calculations.

3 Next Steps

Following draft determination Ofgem will be updating the models for the informal consultation and final determination stages. 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 Ofgem Model QA checklist once final determination stage is reached.

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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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		
Are calculation flows within worksheet logical and easy to understand?		
Do similar worksheets have similar structures?		
Are similar tables laid out in similar way?		
Is the model free from anomalous calculation/label/text cells?		
Assumptions, calculations and outputs should be on separate sheets		
Titles and labels are present, logical and accurate		
Units are indicated		
Rounding is performed in a clear and correct way		
Formatting clearly distinguishes inputs, outputs and calculations and aid understanding		
Workbook Comments		
Is there a cover sheet that provides a brief description of all worksheets?		
Cover sheet includes model version number		
Is model sufficiently annotated with up to date comments?		

QA activities to be performed	Completed (Yes, No, NA)	Comment (must be provided if answer in column 2 is other than "Yes")
Are all data sources cited in the model?		
Are complex formulae sufficiently explained?		
If formulae change midway through an array, row or column are there comments to state this has happened and why?		
Code Comments (if applicable)		
Is there a description of what each macro/code does?		
Is the code sufficiently and appropriately commented to allow someone with VBA/coding language knowledge to follow the code?		
Is the code implementing the policy in the correct way?		
Formula clarity & robustness		
All unique formulae have been checked for correctness		
Hardcoded values within formulae are used only when absolutely necessary		
Are formulae easily understood?		
Are merged cells avoided for inputs, calculations and outputs?		
Named ranges management		
Named ranges follow agreed naming convention		
Named ranges naming convention is meaningful and easy to understand		
There are no corrupted names		

QA activities to be performed	Completed (Yes, No, NA)	Comment (must be provided if answer in column 2 is other than "Yes")
Verification		
Formula correctness		
None of the following errors exist in cell outputs: #NULL!, #DIV/0!, #VALUE!, #REF!, #NAME?, #NUM!, #N/A!.		
Do all formulae refer to the correct cell?		
Have formulae been copied down and across as far as they should be?		
Are all formulae which refer to named ranges calling the correct range?		
Is the data being pulled into the calculation modules correctly?		
Do numbers apply to the correct time period (e.g. the middle of the month/year versus the beginning/end)?		
Are financial year and calendar year data managed correctly?		
Usability Testing		
Can a new user easily operate the model and view outputs?		
Do hyperlinks, macros and buttons work?		
Is routine operation of the model smooth and free of bugs?		
Does the model open in an acceptable amount of time?		
Is the run-time of the model appropriate for the demand placed on the model and the complexity of what is being modelled?		
Can all user options be selected without generating errors or unexpected results?		

QA activities to be performed	Completed (Yes, No, NA)	Comment (must be provided if answer in column 2 is other than "Yes")
Do routines work without runtime errors?		
Are there buttons with dead links?		
Code correctness (if applicable)		
Does the code function as intended without error, and produce the intended results?		
Are hard-coded references to cells used only when absolutely necessary?		
If they are used, are they referring to the correct values?		
External links		
Are links to external documents used only when absolutely necessary?		
Are they properly documented?		
If external links are used, do they pull in the correct, up to date data?		
Can the external data be 'refreshed'?		
Open the file on a different machine to original to ensure no undocumented error messages occur		
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.		
Auto-checks & Error trapping		
Are auto-checks used to highlight correct functionality (e.g. a cell within Excel to highlight when all data is filled in)		

QA activities to be performed	Completed (Yes, No, NA)	Comment (must be provided if answer in column 2 is other than "Yes")
Are they implemented correctly?		
Are error-trapping auto-checks used in the model (e.g. conditional formatting for negative values, overall data sums when data is disaggregated in different ways)		
Are they implemented correctly?		
Check that auto-checks / error trapping produce expected results.		
Validation		
Methodology correctness		
Is the methodology used sensible and fit for purpose?		
Was the model methodology reviewed and agreed with relevant stakeholders?		
Does the model produce "logical" outputs?		
Are they in the range of what would be expected?		
Do the values change in expected direction, at an expected magnitude when inputs are changed?		
Have model outputs been sense / reality checked and agreed with relevant stakeholders?		
Sensitivity of Outputs		
Comparison with historical data / backcasting		
Sensitivity and scenario testing		
Extreme values testing / model breaking		
Regression Testing		