

Cap and Floor Financial Model 1 Handbook (CFFM1H)

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The purpose of the CFFM1H is to provide an overview of the aim, structure and functioning of the Cap and Floor Financial Model 1 (CFFM1), the underlying building blocks approach, and the content of each worksheet within the model (in terms of its inputs, calculations and outputs).

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1. CFFM1 Version Control Log

Handbook Version	Model Version	Prepared by	Reviewed By
20190320	2.1	Martin Namor, Senior Manager, Regulatory Finance	Svitlana Voronkova, Senior Analyst, ORE; Rahmatullah Kawsary, Analyst, ORE
20190902	2.2	Martin Namor, Senior Manager, Regulatory Finance	Svitlana Voronkova, Senior Analyst, ORE
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2. Purpose of the CFFM1H

The purpose of the CFFM1H is to provide an overview of the aim, structure and functioning of the CFFM1, the underlying building-blocks approach, and the content of each worksheet within the model (in terms of its inputs, calculations and outputs).

Section 3, "Introduction to the CFFM1", provides a high level overview of the purpose of the CFFM1; it sets out at what stages in the lifetime of a cap and floor project the CFFM1 is used, and at what stage its outputs are finalised and exported into the Cap and Floor Financial Model2 (CFFM2).

Section 4, "Building blocks of the CFFM1", explains what the building blocks used in the CFFM1 are and how they interact with each other to determine revenue cap and floor levels; this is also illustrated through the flowchart in Figure 1.

Section 5, "Relevant documents and inputs data to the CFFM1", provides a brief overview of the policy documents that are relevant to the CFFM1 and of the type and source of input data that are used in the model.

Section 6, "High-level overview of the CFFM1 worksheets", provides a brief overview of the content of each worksheet within the CFFM1:

- Cover;
- Version Control;
- Inputs;
- Data Sources;
- Pre Op RAV;
- Finance;
- Op RAV;
- Allowances Cap;
- Allowances Floor;
- Tax Deductions;
- Tax Cap;
- Tax Floor; and
- Cap Floor Levels.

Appendix 1 provides a detailed overview of the purpose and structure of each worksheet within the CFFM1; of the inputs and calculations used within each worksheet; of the outputs produced by each worksheet; and of the interlinkages between different worksheets.

Appendix 2 is a technical appendix that provides a detailed explanation of the formula used to calculate the interest during construction (IDC) allowance that is capitalised into the Regulatory Asset Value (RAV) on which the developer is allowed to earn a return during the operational period.

Appendix 3 provides a detailed overview of the data sources and calculations used to determine the value of each individual input used in the CFFM1 for the purpose of setting NSL's preliminary cap and floor levels at Post Construction Review (PCR) stage.

3. Introduction to the CFFM1

The CFFM1 is a Microsoft Excel based financial model that is used to determine, for any electricity interconnector granted the cap and floor regime:

1. The preliminary notional cap and floor levels at the Final Project Assessment (FPA) stage; and
2. The final notional cap and floor levels¹, and resulting Post Construction Adjustment (PCA)² to the preliminary cap and floor levels, at the Post Construction Review (PCR) stage.

These notional cap and floor levels are determined as real-term annuities aimed to limit the upward and downward exposure to merchant risk of the revenue earned by the interconnector developer during the 25-year operational period.

The cap level represents the maximum amount of annual revenue that the developer is allowed to retain; any revenue above this level has to be transferred to consumers.

The floor level represents the minimum amount of annual revenue that the developer is guaranteed to earn (provided it meets a minimum availability threshold³); revenue below this level has to be topped up by consumers.

During operations, the cap and floor levels are subject to inflation indexation, incentives, and potential adjustments to reflect changes to operating and decommissioning cost baselines; these are all outside the scope of the CFFM1, which is only used to set preliminary cap and floor levels at the FPA stage and final cap and floor levels at the PCR stage.

The final cap and floor levels set at the PCR stage are the final output of the CFFM1 and an input into the CFFM2, which is used during operations to apply inflation indexation, incentives and adjustments; and to determine the amount of any payments due from the developer to consumers or from consumers to the developer by comparing the revenue earned by the developer to the relevant cap and floor levels.

¹ Any reference to cap and floor levels within this handbook should be considered a reference to the notional cap and floor levels that are set using the CFFM1.

² Any reference to the Post Construction Adjustment (PCA) to the cap and floor levels within this handbook should be considered a reference to the PCA to notional cap and floor levels that are set using the CFFM1.

³ The minimum availability threshold is set through a separate Interconnector Availability Calculator.

Key points:

- The CFFM1 covers only the period up to the start date of the cap and floor regime (i.e. the pre-operational period); the period of 25 years from the start date of the regime onwards (i.e. the operational period) is covered in the CFFM2.

The CFFM1 is run twice: first at the FPA stage to set preliminary cap and floor levels based mostly on construction cost estimates and initial economic and financial assumptions; then at the PCR stage to set final cap and floor levels based mostly on actual construction costs and revised economic and financial assumptions.⁴

⁴ As explained in Appendix 1, the 'Cap Floor Levels' sheet within the CFFM1 has a section where the preliminary cap and floor levels calculated through the model need to be hardcoded at the end of the FPA stage, so that once the inputs to the model are updated at the PCR stage, the model determines the required Post Construction Adjustment (PCA) to the preliminary cap and floor levels as the difference between the final cap and floor levels calculated at PCR and the preliminary cap and floor levels previously calculated and hardcoded at FPA.

4. Building Blocks of the CFFM1

As explained in section 2, the CFFM1 is used to determine preliminary cap and floor levels at the FPA stage and final cap and floor levels at the PCR stage. These levels are calculated using a building-blocks approach.

There are 4 revenue building blocks to the overall cap and floor levels:

1. Operating expenditure (Opex) and Decommissioning costs (Decom);
2. Depreciation of the Regulatory Asset Value (RAV);
3. Return on the RAV; and
4. Tax.

The first two building blocks (Opex/Decom and depreciation) are common to the cap and the floor, while the other two (return and tax) have different values at the cap and the floor. Opex is an estimate of the annual operating expenditure that will be incurred during the 25-year operational period; Decom an estimate of the costs that will need to be incurred to decommission the assets at the end of the operational period.

Depreciation is the annual run-off of the RAV built up during the pre-operational period as the sum of development expenditure (Devex), capital expenditure (Capex), cost of spares, capitalised interest during construction (IDC) and capitalised transaction costs; and during the operational period through the addition of replacement expenditure (Repex).

The return earned on the RAV depends on the rate of return applied:

- The allowed return at the cap is calculated by applying to the RAV a rate of return set to reflect the cost of equity; and
- The allowed return at the floor is calculated by applying to the RAV a rate of return set to reflect the cost of debt.

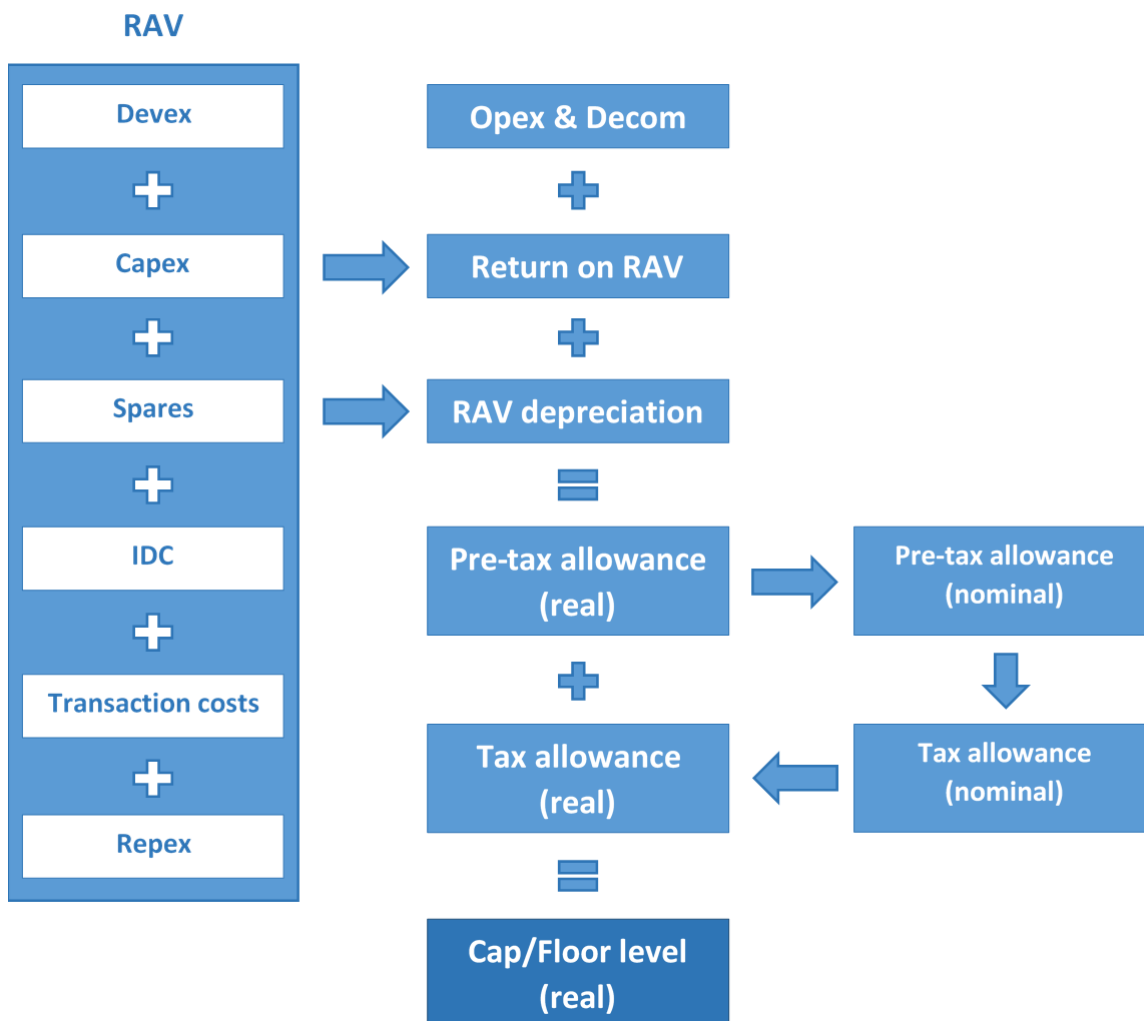
Once the first three building blocks have been calculated, they are aggregated to determine pre-tax cap and floor allowances. These are set in real terms and are then inflated to allow for tax calculations, which require nominal inputs.

Cap and floor tax allowances are then calculated in nominal terms relative to pre-tax cap and floor allowances respectively, and subsequently deflated back to real terms so that they can

be added to the other three building blocks previously determined in real terms (Opex/Decom, RAV depreciation and RAV return).

The overall cap and floor levels are therefore determined as the sum of pre-tax cap and floor allowances and tax cap and floor allowances (all expressed in real terms). The flow chart in the next page illustrates this building blocks approach and the key calculations underpinning the cap and floor levels.

Figure 1: Building blocks of the CFFM1



5. Relevant Documents and data inputs to the CFFM1

The CFFM1 is structured to comply with the licence conditions to which the developer granted the cap and floor regime is subject. Similarly, this handbook (CFFM1H) is written to comply with the relevant licence conditions and, where stated, integrate these conditions where the licence does not prescribe a specific approach or calculation.

In addition to the project's licence, the CFFM1 and its handbook aim to reflect any relevant policy decision taken during the pre-operational phase of the project, at the:

- Initial Project Assessment (IPA) stage;
- Final Project Assessment (FPA) stage, and
- Post Construction Review (PCR) stage.

Licence conditions, decision documents and other relevant documents (e.g. technical availability models) concur to determine the structure and functioning of the CFFM1, the content of this handbook and the value of some of the data inputs used within the model.

Overall, the CFFM1 uses inputs from a variety of sources, including submissions from the developer and Ofgem's subsequent assessment of these submissions (e.g. in relation to capital and operating costs); determinations made by Ofgem in relation to the appropriate value of certain parameters (e.g. cost of capital); and a number of independent external data sources (e.g. inflation and exchange rate).

The inputs used throughout the model are populated in the 'Inputs' sheet; the sources of these inputs are listed in the 'Data Sources' sheet.

6. High-Level overview of the CFFM1 worksheets

This section provides a brief overview of the content of each worksheet within the CFFM1; for a detailed overview of the purpose and functioning of each sheet, please refer to Appendix 1.

The CFFM1 comprises 13 sheets:

Cover

The 'Cover' sheet includes a key to interpret the formatting used throughout the model, a brief description of the content of each sheet in the model and a summary of the checks performed throughout the model.

Version Control

The 'Version Control' sheet contains a log tracking all relevant versions of the CFFM1 and detailing the changes introduced within each version relative to the previous version.

Inputs

The 'Inputs' sheet contains all the inputs used throughout the model to calculate preliminary (at FPA) and final (at PCR) cap and floor levels.

All values exported from this sheet to the rest of the model are either inserted manually into the sheet or calculated in the sheet using manually inserted inputs.

Data Sources

The 'Data Sources' sheet details the sources of all the inputs in the 'Inputs' sheet and provides links to these sources.

Pre Op RAV

The 'Pre Op RAV' sheet contains the calculations used to build up the Regulatory Asset Value (RAV) during the pre-operational period and determine the final RAV amount at the end of this period, which is then used as a starting point to calculate two of the building blocks of the revenue allowed during operations: RAV depreciation and return on RAV.

Finance

The 'Finance' sheet contains the calculations used to determine the amount of IDC and transaction costs (including IDC capitalised on transaction costs) that are capitalised into the RAV before the start of the operational period.

Op RAV

The 'Op RAV' sheet contains the calculations used to carry forward the RAV throughout the operational period and to calculate two of the building blocks of the revenue allowed during operations: RAV depreciation and return on RAV.

Allowances Cap

The 'Allowances Cap' sheet contains the calculations used to determine the annual revenue cap allowances (excluding tax) through a building blocks approach, and then convert these annual revenue cap allowances into an annuity.

Allowances Floor

The 'Allowances Floor' sheet contains the calculations used to determine the annual revenue floor allowances (excluding tax) through a building blocks approach, and then convert these annual revenue floor allowances into an annuity.

Tax Deductions

The 'Tax Deductions' sheet contains the calculations used to determine the annual amount of tax deductions during the 25-year operational period. Tax deductions are calculated as the sum of revenue pool additions, capital allowances, interest payable, and debt transaction costs.

Tax Cap

The 'Tax Cap' sheet contains the calculations used to determine the annual tax allowances at the cap to be added to the revenue cap allowances (excluding tax), and then convert these annual tax allowances into an annuity.

Tax Floor

The 'Tax Floor' sheet contains the calculations used to determine the annual tax allowances at the floor to be added to the revenue floor allowances (excluding tax), and then convert these annual tax allowances into an annuity.

Cap Floor Levels

The annual cap and floor allowances (excluding tax) and the annual tax allowances at the cap and floor calculated, respectively, in the 'Allowances Cap/Floor' and 'Tax Cap/Floor' sheets are imported into the 'Cap Floor Levels' sheet and aggregated to determine the overall cap and floor levels (including tax).

Appendices

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Appendix 1- Detailed overview of the CFFM1 worksheets

The purpose of Appendix 1 is to provide a detailed overview of the purpose and structure of each worksheet within the CFFM1; of the inputs and calculations used within each worksheet; of the outputs produced by each worksheet; and of the interlinkages between different worksheets.

The CFFM1 comprises 13 sheets:

- a. Cover;
- b. Version Control;
- c. Inputs;
- d. Data Sources;
- e. Pre Op RAV;
- f. Finance;
- g. Op RAV;
- h. Allowances Cap;
- i. Allowances Floor;
- j. Tax Deductions;
- k. Tax Cap;
- l. Tax Floor; and
- m. Cap Floor Levels.

a. Cover

The 'Cover' sheet contains three sections:

- **Model key:** a key to interpret the font and fill colours used throughout the model;
- **Contents:** a brief description of the content of each sheet in the model (with hyperlink to the sheets to aid navigation), with colour coding used to group the sheets depending on whether they contain inputs (yellow sheets), calculations (purple sheets) or final outputs of the model (green sheet); and
- **Checks:** a summary of the checks performed throughout the model.

b. Version Control

The 'Version Control' sheet contains a log listing, for each relevant version of the CFFM1:

- Version number, with any major changes to the model being identified through an increase in integer (e.g. from 1.0 to 2.0) and minor change through an increase in decimal (e.g. from 1.0 to 1.1);

- File pathname;
- Previous version of the model on which the relevant version is based;
- Name of the model author or editor responsible for implementing the changes in the relevant version;
- Date on which the relevant version is finalised;
- High-level description of the changes implemented;
- Rationale for implementing the changes;
- Location of the changes within the model;
- Impact of the changes on the outputs of the model (if any);
- Indication of whether quality assurance (QA) was performed and by whom; and
- Any relevant comments relating to QA.

c. Inputs

The 'Inputs' sheet contains all the inputs used throughout the model to calculate preliminary (at FPA stage) and final (at PCR stage) Cap and Floor levels.

All values exported from this sheet to the rest of the model are either inserted manually in the sheet or calculated in the sheet using manually inserted inputs.

Section **Indexation, currency and base year price return** requires three values to be input:

- GB indexed portion of the interconnector (cell I6): this is generally equal to 100% if UK currency and inflation are applied to the entire project (e.g. for NSL), or 50% if UK currency and inflation are applied to half of the project, with foreign currency and inflation applied to the other half (e.g. for Nemo Link: half UK and half Belgium); the cell below, 'Non-GB indexed portion of the interconnector' (cell I7), is populated automatically through a formula based on the input in cell I6;
- Currency of cost inputs (cell I9): this requires a selection between GBP (£) and EUR (€), depending on whether the cost inputs in the section below are submitted in Pound Sterling (e.g. for NSL) or Euro (e.g. for Nemo Link); and
- Base year price term (cell I11): this indicates the base year in which the cap and floor values are expressed and therefore the base year to which the cost inputs need to be converted before being exported into the calculation sheets, as the model sets Cap

and Floor levels in real terms and in a predetermined base year (e.g. £m 13/14 prices for Nemo Link).

Section **Variables set after financial close**⁵ contains two sub-sections: 'Actual values' and 'Ex-ante allowances for the operational period'.

In sub-section **Actual values**, costs during construction (Development costs, Capex and Spares) are input in rows 20-22 for each relevant financial year in nominal terms and in the currency indicated in cell I9.

Row 24 and 28 are populated, respectively, with the relevant UK inflation index in the base year (in column I, 'Constant') and the average value of the same index in each financial year covered by the model, from row K onwards.

Rows 25 and 29 are populated in a similar way with values relating to the relevant foreign inflation index (only if the project is not fully GB-indexed; otherwise, the rows are to be left empty). These rows should not be deleted even if left empty, since they are used in the formulas below.

Rows 26 and 30 are populated in a similar way with values relating to the relevant exchange rate (only if the project is not fully GB-indexed; otherwise, the rows are to be left empty). These rows should not be deleted even if left empty, since they are used in the formulas below.

In row 32, an indexation factor is calculated in compliance with the licence (formula referred to as PPPIt in projects with a dual nature such as Nemo Link, or CRPIt in fully GB-indexed projects such as NSL) for each financial year covered by the model. The formula contains an IF statement that applies different calculations depending on whether the project has a dual nature or not.

In rows 34-36, the nominal costs input in rows 20-22 are converted from nominal to real terms, and from one currency to another, also reflecting the purchasing power parity principle (if the project has a dual nature).

In sub-section **Ex-ante allowances for the operational period**, costs during operations (Replacement Capex, Decommissioning baseline, Controllable Opex and Non-controllable Opex baseline) are input in real terms (with reference to a base year which is generally different from the base year required to set Cap and Floor levels as indicated in row 11) in

⁵ Financial close is also referred to as Final Investment Decision (FID)

rows 42-45 for the 25 operational years (please note these are referred to generically as year 1 to year 25, as the exact date on which operations will start might be unknown or subject to change at the time when the CFFM1 is used).

Rows 47-49 equal rows 24-26 previously described.

Rows 51-53 are populated in a similar way but with reference to the base year in which costs during operations are input, rather than the base year required to set cap and floor levels.

Rows 52-53 should not be deleted even if left empty, since they are used in the formulas below.

Row 55 is populated with the relevant exchange rate⁶ (only if the project is not fully GB-indexed; otherwise, the rows are to be left empty). Row 55 should not be deleted even if left empty, since they are used in the formulas below.

In row 57, an indexation factor is calculated to convert real terms costs during construction from one base year to another. The formula contains an IF statement that applies different calculations depending on whether the project has a dual nature or not.

In rows 59-62, the real terms costs input in rows 42-45 are converted from one base year to another, and possibly from one currency to another, also reflecting the purchasing power parity principle (if the project has a dual nature).

Section **Variables set at financial close**⁷ contains five sub-sections: 'Finance', 'Model operation', 'Tax – Financial years', 'Tax – Operational years', and 'Tax – Annuity'.

In sub-section **Finance**, the allowed cap return rate, floor return rate and interest during construction (IDC) rate are input into cells I68-70. The cost of debt for tax purposes in cell I71 equals the floor return rate in cell I69.

Pre-operational and operational notional gearing are input in cells I73-74.

⁶ Appendix 2 – Technical Appendix details the approach adopted to estimate the average value of the exchange rate (row 55) for those years for which actual data are not yet available to calculate the historical average. The same approach will be applied to any future cap and floor project (the only difference being that, for single currency projects, foreign inflation index and exchange rate estimates will not be required).

⁷ Financial close is also referred to as Final Investment Decision (FID); for those projects for which FPA is published before FID, these variables are set at FPA using a recent ad-hoc reference date that precedes FID.

Equity and debt transaction cost allowances are input in cells I76-77 as percentages to be applied to the Regulatory Asset Value (RAV) transferred from the pre-operational phase into the operational phase.

In sub-section **Model operation**, a number of key dates are input in cells I84-87 and calculated in cell I88.

The number of operational years is input in cell I89.

In row 91, the number of days in each financial year is calculated.

Rows 92-96 contain a number of key flags, determined through formulas applied to the dates in the sheet and used throughout the model.

In sub-section **Tax – Financial years**, annual inflation uplifts are calculated relative to the base year in row 107 to allow for tax calculations to be undertaken in nominal terms in the 'Deductions' sheet.

These uplifts are calculated by dividing the annual relevant inflation index in row 106 (populated with actuals up to the point these are available, followed by calculations where the long-term expected inflation rate in cell I103 is applied to the index in the previous year) by the inflation index in the base year (cell I104). Appendix 3 "*Variables set at financial close – Finance*" provides detail on how the rate in cell I103 is calculated.

In sub-section **Tax – Operational years**, annual corporation tax rates and capital allowance rates (to be applied using a declining balance approach) are input in rows 113-114.

In addition, an inflation uplift between the base year and the start date of the regime is calculated in cell I119 using start and end dates of the base year cells I117-118) and long-term expected inflation rate (cell I116).

Both the uplift and long-term expected inflation rate are fed through to the 'Deductions' sheet to allow for tax calculations to be undertaken in nominal terms.

In sub-section **Tax – Annuity**, cell I123 contains a switch to select whether the tax elements of the cap and floor levels were calculated and fixed at a previous stage (FPA) and are not to be updated at the relevant subsequent stage (PCR) at which the model is being re-run (e.g. for Nemo Link, these elements were calculated and fixed at FPA stage and not to be updated at PCR stage), or whether they are to be updated when the model is being re-run at PCR. In the first instance, "Yes" should be selected; in the second, "No" should be selected.

d. Data Sources

The 'Data Sources' sheet details the sources to all the inputs in the 'Inputs' sheet (yellow cells) and, where relevant, provides hyperlinks to these sources.

The structure of the sheet is the same as the structure of the 'Inputs' sheet, with the same sections and sub-sections, but a reduced number of rows, as only the rows of the 'Inputs' sheet in which values are input directly (rather than being calculated or imported from other rows) are covered in the 'Data Sources' sheet.

For each parameter in the 'Data Sources' sheet, column I shows the relevant row in which the parameter is input in the 'Inputs' sheet; column K is to be populated with a text string describing the source of the data; and column L with a hyperlink to the source of the data (if the data was sourced from an online source).

e. Pre Op Rav

The 'Pre Op RAV' sheet contains the calculations used to build up the Regulatory Asset Value (RAV) during the construction period and determine the final amount which is then used as a starting point to calculate two of the building blocks of the revenue allowed during operations: RAV depreciation and return on RAV.

Section **Flags** contains four flags imported from the 'Inputs' sheet:

- The 'IDC flag' in row 8 equals 1 when IDC is earned in the entire year (construction year); is between 0 and 1 when IDC is earned for part of the year (i.e. because operations start during that year); and equals 0 when no IDC is earned (in years after the year in which operations start).
- The 'Post-IDC and pre-operations flag' in row 9 identifies whether there is a gap between the time when the project stops earning IDC and the time when operations start.
- The 'Operations flag' in row 10 equals 0 during construction years; is between 0 and 1 in the year during which operations start; and equals 1 during full operational years.
- The 'Transfer construction to operations flag' in row 11 identifies the year in which the final value of the RAV built up during construction is transferred into the operational RAV to determine the depreciation allowance and return allowance that are included in the revenue cap and floor during operations.

Section **RAV**, sub-section **Pre-operational**, contains the calculation used to build up the RAV during construction.

Row 17 contains the opening pre-operational RAV (before transfers) for the year, which is equal to zero in the first year and then equals the closing pre-operational RAV (after IDC and adjusted for RAV transfers) in the previous year.

In rows 18-20, costs during construction (Development costs, Capex and Spares) are imported from rows 34-36 of the 'Inputs' sheet.

In row 21, the capitalised interest during construction is imported from sheet 'Finance'.

In row 22, the closing pre-operational RAV (after IDC but before any transfers) is calculated as the sum of the values in rows 17-21.

Row 23 determines when a RAV transfer occurs between pre-operational and operational RAV, by multiplying the closing pre-operational RAV in row 22 by the 'Transfer construction to operations flag' in row 11.

In row 24, the closing pre-operational RAV (after IDC and transfers) is calculated by deducting the RAV in row 22 from the transfers in row 23.

f. Finance

Section **Flags** contains five flags imported from the 'Inputs' sheet:

- The 'IDC flag', the 'Post-IDC and pre-operations flag', the 'Operations flag', and the 'Transfer construction to operations flag' are the same as those in the 'Pre Op RAV' sheet.
- The 'Initial transaction costs flag' in row 12 identifies the year in which transaction costs are calculated and start being rolled over, earning interest during construction (this is the year immediately before the year in which Capex starts to be incurred).

Section **Pre-operational interest during construction** contains the calculations used to determine the amount of interest during construction (IDC) that is capitalised into the preoperational RAV in the 'Pre Op RAV' sheet.

In cell I18, the interest during construction rate is imported from the 'Inputs' sheet. In row 20, the opening pre-operational RAV (before transfers) is imported from row 17 of the 'Pre Op RAV' sheet.

In rows 21-23, costs during construction (Development costs, Capex and Spares) are imported from rows 34-36 of the 'Inputs' sheet.

Rows 24 calculates the interest during construction that is capitalised into the pre-operational RAV in the 'Pre Op RAV' sheet, based on the following formula:

$$IDC = ((1 + IDC\ rate)^{IDC\ flag} - 1) * (Opn\ PreOp\ RAV + \frac{Devex + Capex + Spares}{2 + IDC\ rate})$$

Where:

- IDC rate is from cell I18;
- IDC flag is from row 8;
- Opn PreOp RAV is the opening pre-operational RAV (before transfers) from row 20;
and
- Devex, Capex and Spares are the costs from rows 21-23.

The formula calculates IDC by applying the IDC rate to the NPV at the start of the year of the average RAV during the year, which in turn is calculated by adding to the opening RAV half of the costs incurred during the year, discounted from halfway through the year to the start of the year.

The flag is used to ensure that no IDC is earned after the IDC end date.

Section **Transaction costs** contains two sub-sections: 'Parameters' and 'Allowance'.

Sub-section **Parameters** contains the relevant transaction costs parameters.

Pre-operational and operational notional gearing in cells I30-31 are imported from the 'Inputs' sheet.

Debt and equity transaction costs rates in cells I33-34 are also imported from the 'Inputs' sheet.

Sub-section **Allowance** contains the calculations used to determine the value of transaction costs (including capitalised IDC on transaction costs) that is added to the RAV at the start of operations.

The opening balance of transaction costs in row 38 equals the closing balance in the previous year (from row 46).

Initial debt transaction costs in row 39 are calculated by multiplying pre-operational RAV transfers to the operational RAV (from sheet 'Op RAV') by the pre-operational notional gearing in cell I30, by the debt transaction costs rate in cell I33, and by the 'initial transaction costs flag' in row 12.

Initial equity transaction costs in row 40 are calculated by multiplying pre-operational RAV transfers to the operational RAV (from sheet 'Op RAV') by one minus the pre-operational notional gearing in cell I30, by the equity transaction costs rate in cell I34, and by the 'initial transaction costs flag' in row 12.

Final debt transaction costs in row 41 are calculated by multiplying the final pre-operational RAV transfers to the operational RAV (from sheet 'Op RAV') by the difference between operational notional gearing in cell I31 and pre-operational notional gearing in cell I30, by the debt transaction costs rate in cell I33, and by the 'transfer construction to operations flag' in row 11.

Final equity transaction costs in cell I42 are calculated by multiplying the final pre-operational RAV transfers to the operational RAV (from sheet 'Op RAV') by the difference between preoperational notional gearing in cell I30 and operational notional gearing in cell I31, by the equity transaction costs rate in cell I34, and by the 'transfer construction to operations flag' in row 11.⁸

Transaction costs annual movements in row 43 are calculated as the sum of rows 39-42. Capitalised IDC on transaction costs in row 44 is calculated using the same approach and formula as the IDC on construction costs calculated in row 24, but with initial/final debt/equity transaction costs as additions to the opening balance (instead of construction costs).

⁸ Initial debt and equity transaction costs at the start of the construction period are calculated based on the initial notional gearing level – debt transaction costs based on gearing and equity transaction costs based on (one minus gearing). At the end of construction/start of the operational period, the notional gearing level increases, which means that more debt is issued while some of the equity is retired, so the formulas in cells E45-46 calculate the required adjustment to transaction costs to reflect the issue of additional debt and the repurchase of some of the equity.

$$IDC = ((1 + IDC\ rate)^{IDC\ flag} - 1) * (Opening\ balance + \frac{Transaction\ costs}{2 + IDC\ rate})$$

Transaction costs transfers to the operational RAV in row 45 are calculated as the sum of opening transaction costs balance from row 38, movement in transaction costs from row 43, and capitalised IDC on transaction costs from row 44, multiplied by the 'transfer construction to operations flag' in row 11.

The closing balance of transaction costs in row 46 is calculated as the sum of opening balance (row 38), annual movements (row 43), capitalised IDC (row 44) and transfers to operational RAV (row 45).

g. Op Rav

The 'Op RAV' sheet contains the calculations used to update the RAV during the operational period and to calculate two of the building blocks of the revenue allowed during operations: RAV depreciation and return on RAV.

Section **RAV**, sub-section **Operational**, contains the calculations used to update the RAV during operations.

The opening operational RAV (before transfers) in row 9 is equal to the closing operational RAV in the previous year (row 15).

The transfers of transaction costs and pre-operational RAV in rows 10-11 are imported from sheets 'Finance' and 'Pre Op RAV' respectively.

Opening operational RAV (after transfers) in row 12 is the sum of rows 9-11.

Replacement Capex in row 13 is imported from the 'Inputs' sheet.

Depreciation in row 14 is the negative of row 25 'RAV depreciation' from sub-section 'Operational RAV depreciation'.

Closing operational RAV in row 15 is the sum of rows 12-14.

Average operational RAV in row 17 is the average of opening operational RAV (after transfers) from row 12 and closing operational RAV from row 15.

Section **Operational RAV depreciation** is used to calculate the annual depreciation which is deducted from the opening balance of the operational RAV in section 'RAV', and which is one of the building blocks of the operational revenue cap and floor.

The number of operation years in cell I21 is imported from the 'Inputs' sheet.

In row 22, a countdown to the end of operations is calculated by setting year 1 equal to the value in cell I21, and then deducting one in each subsequent year.

The flag in row 23 checks that the number of remaining years in row 22 is greater than zero and returns 'TRUE' where this is the case.

In row 25, an IF statement calculates annual depreciation where the flag is TRUE and return zero where it is FALSE. Annual depreciation is calculated according to a second IF statement: if the countdown in row 22 is equal to 1 (i.e. the last year of operations), then depreciation equals the full residual balance (calculated as opening balance plus replacement Capex in the year); in any other year, depreciation is calculated by dividing the sum of opening operational RAV (after transfers) in row 12 and replacement Capex in row 13 by the number of remaining year in the operational period from row 22.

The test in cell I27 checks that total depreciation over the operational period in row 25 equals the sum of total construction costs and capitalised IDC on these costs from rows 18-21 in the 'Pre Op RAV' sheet, total transaction costs and capitalised IDC on these costs from rows 44-47 and 49 in the 'Finance' sheet and total replacement Capex from row 13 in the 'Op RAV' sheet.⁹

Section **Operational RAV return** is used to calculate another one of the building blocks of the operational revenue cap and floor: the return on RAV.

Cap and floor return rates in cells I31-32 are imported from the 'Inputs' sheet. Opening operational RAV (after transfers) and closing operation RAV in rows 34-35 are imported from the 'RAV – Operational' section of the sheet.

The NPV-neutral return base for the cap and floor in rows 37-38 is calculated by averaging the opening RAV from row 34 and the closing RAV from row 35, with the latest discounted using the discount rate in cells I31-32 (i.e. cap return rate for the cap return base and floor return rate for the floor return base).

⁹ The formula in cell I27 applies this test by checking that the absolute value of the difference is less than £0.01, rather than by testing for absolute equality, as this might return a 'FALSE' output due to Microsoft Excel applying rounding to numbers with repeating decimals, and the fact that some of the 12-month averages of inflation indices and exchange rate used to convert base year and currency of cost figures that are then added to the RAV might have repeating decimals.

In rows 40-41, allowed return at cap and floor are calculated by multiplying, respectively, the cap return rate in cell I31 by the NPV-neutral cap return base in row 37, and the floor return rate in cell I32 by the NPV-neutral floor return base in row 38.

h. Allowances Cap

The 'Allowances Cap' sheet contains the calculations used to determine the annual revenue allowances (excluding tax) at the cap through a building blocks approach, and then convert these revenue allowances into an annuity.

Section **Unprofiled allowances except tax (cap)** imports all relevant building blocks into rows 8-12 and then aggregates the values from these rows to determine the un-profiled (i.e. prior to annuitisation smoothing) cap allowances (except tax) in row 13; the relevant building blocks included in the cap allowances are:

- Controllable Opex in row 8, imported from the 'Inputs' sheet;
- Non-controllable Opex baseline in row 9, from the 'Inputs' sheet;
- Decommissioning baseline in row 10, from the 'Inputs' sheet;
- RAV depreciation in row 11, from the 'Op RAV' sheet; and
- RAV return at the cap in row 12, from the 'Op RAV' sheet.

Section **Profiled allowances except tax (cap)** contains to sub sections: 'Annuity parameters' and 'Allowances except tax'.

In sub-section **Annuity parameters**, the cap return rate and number of operational years are imported into cells I19-20 from the 'Inputs' sheet, and used to calculate the annuity factor for the cap in cell I21 through the following formula:

$$Annuity\ factor = \frac{CapRate}{1 - (1 + CapRate)^{-(no.\ of\ op\ years)}}$$

The flag in row 23 checks that the progressive year reference in row 4 is within the operational period (i.e. larger than zero and equal to or smaller than 25).

Row 24 calculates a discount factor to the start of operations, to be used in the following subsection to discount the un-profiled revenue allowances at the cap; this discount factor is calculated according to the following formula:

$$Discount\ factor = (1 + CapRate)^{-year}$$

In sub-section **Allowances except tax**, the un-profiled revenue allowances calculated in section 'Unprofiled revenue allowances except tax (cap)' are discounted, aggregated and reprofiled in the form of an annuity.

In row 28, discounted un-profiled allowances are calculated by multiplying the un-profiled allowances in row 13 by the discount factor in row 24.

The net present value (NPV) of the un-profiled allowances is calculated in cell I29 as the sum of all discounted un-profiled allowances in row 28.

This NPV is then multiplied by the annuity factor in cell I31 (imported from cell I21) to determine the annual revenue cap allowance in the form of an annuity in cell I33.

In row 34, the annual revenue allowance (except tax) at the cap is set equal to the annuity calculated in cell I33.

i. Allowances Floor

The 'Allowances Floor' sheet contains the calculations used to determine the annual revenue allowances (excluding tax) at the floor through a building blocks approach, and then convert these revenue allowances into an annuity.

Section **Unprofiled allowances except tax (floor)** imports all relevant building blocks into rows 8-12 and then aggregates the values from these rows to determine the un-profiled (i.e. prior to annuitisation smoothing) floor allowances (except tax) in row 13; the relevant building blocks included in the floor allowances are:

- Controllable Opex in row 8, imported from the 'Inputs' sheet;
- Non-controllable Opex baseline in row 9, from the 'Inputs' sheet;
- Decommissioning baseline in row 10, from the 'Inputs' sheet;
- RAV depreciation in row 11, from the 'Op RAV' sheet; and
- RAV return at the floor in row 12, from the 'Op RAV' sheet.

Section **Profiled allowances except tax (floor)** contains to sub sections: 'Annuity parameters' and 'Allowances except tax'.

In sub-section **Annuity parameters**, the floor return rate and number of operational years are imported into cells I19-20 from the 'Inputs' sheet, and used to calculate the annuity factor for the floor in cell I21 through the following formula:

$$\text{Annuity factor} = \frac{\text{FloorRate}}{1 - (1 + \text{FloorRate})^{-(\text{no. of op years})}}$$

The flag in row 23 checks that the progressive year reference in row 4 is within the operational period (i.e. larger than zero and equal to or smaller than 25).

Row 24 calculates a discount factor to the start of operations, to be used in the following subsection to discount the un-profiled revenue allowances at the floor; this discount factor is calculated according to the following formula:

$$\text{Discount factor} = (1 + \text{FloorRate})^{-\text{year}}$$

In sub-section **Allowances except tax**, the un-profiled revenue allowances calculated in section 'Unprofiled revenue allowances except tax (floor)' are discounted, aggregated and reprofiled in the form of an annuity.

In row 28, discounted un-profiled allowances are calculated by multiplying the un-profiled allowances in row 13 by the discount factor in row 24.

The net present value (NPV) of the un-profiled allowances is calculated in cell I29 as the sum of all discounted un-profiled allowances in row 28.

This NPV is then multiplied by the annuity factor in cell I31 (imported from cell I21) to determine the annual revenue floor allowance in the form of an annuity in cell I33.

In row 34, the annual revenue allowance (except tax) at the floor is set equal to the annuity calculated in cell I33.

j. Tax deductions

Section **Tax deductions** contains two sub-sections: 'Inflation' and 'Total tax deductions'.

In sub-section **Inflation**, an RPI uplift scalar (from the base year to the start of the regime) and a long-term expected RPI inflation rate are imported into cells I9-10 from the 'Inputs' sheet.¹⁰

In row 11, projected future values of the RPI inflation index are calculated by applying the long-term expected RPI inflation rate in cell I10 to the RPI uplift scalar (in year 1 of operations) and then to the value in the cell immediately to the left (from year 2 of operations onwards).¹¹

Inflation forecasts are required because tax calculations must be performed in nominal terms, while the core of the CFFM operates in real terms.

In sub-section **Total tax deductions**, the total annual amount of tax deductions during the 25 years of operations are calculated as the sum of the following four components:

1. Revenue pool additions, from row 27 (section 'Tax pools', sub-section 'Revenue pool');
2. Capital allowances, from row 42 (section 'Tax pools', sub-section 'Capital allowance pool');
3. Interest payable, from row 58 (section 'Interest', sub-section 'Net debt'); and
4. Debt transaction costs from row 18, imported in real terms from the 'Finance' sheet and inflated using an inflation uplift from the 'Inputs' sheet.

Section **Tax pools** contains two sub-sections: 'Revenue pool' and 'Capital allowance pool'.

¹⁰ In the 'Tax Deductions' sheet two inflation uplifts are used: one from line 11 and one from the 'Inputs' sheet, line 109. The two inflation uplift profiles can be different because the one in row 109 of the Inputs sheet refers to the relevant calendar or financial years while the one in row 11 of the Tax Deductions sheet refers to operational years. Since the base year for the uplift is the same for both, the uplifts in the second profile can be higher (lower), because they cover periods that start after (before) the periods covered by the uplifts in the first profile. The first profile is applied to Capex and transactions costs (because the relevant years for the construction period are calendar or financial years), while the second is applied to Opex and Repex (because the relevant years for the operational period are the operational years).

¹¹ The formula is cell K11 of the Tax Deductions sheet has a power of 0.5 because it calculates an uplift for the first operational year based on a previous uplift (cell I9) from base year to the start of that same operational year; the formula uplifts the inflation uplift in cell I9 further, taking it from the start of the year to the mid-point of the year (as row K is meant to capture the average inflation index during the year, which is assumed to be equivalent to the inflation index halfway through the year). In all subsequent cells in row K (K12 onwards), the power of 0.5 is dropped because these uplifts are calculated from average of one year to average of next year (or mid-point of one year to mid-point of next year) and therefore based on an implicit power of 1.

In sub-section **Revenue pool**, the revenue pool additions are calculated as the sum of controllable Opex and non-controllable Opex baseline, which are imported in real terms from the 'Inputs' sheet and inflated using the forecast inflation uplift in row 11.

In sub-section **Capital allowance pool**, the annual capital allowance rates in row 31 and the number of operational years in cell I25 are imported from the 'Inputs' sheet.

In row 34, the opening asset balance brought forward is set equal to the closing balance in the previous year, in row 40.

Capex in cell K35 is imported in real terms from the 'Pre Op RAV' sheet and inflated using an inflation uplift from the 'Inputs' sheet.

Replacement Capex in row 36 is imported in real terms from the 'Op RAV' sheet and inflated using the forecast inflation uplift in row 11.

The tax book value pre-depreciation in row 37 is the sum of rows 34-36.

The capital allowances in row 38 are calculated by multiplying the tax book value predepreciation in row 37 by the capital allowance rate in row 31, based on a 'declining balance' approach.

The write-back allowance in cell AI39 (year 25 of operations) is calculated as the negative of the residual asset balance after capital allowances in the year, so that the resulting closing balance in year 25 is equal to zero.

In row 40, the closing balance carried forward is the sum of rows 37-39.

Capital allowances in row 42, which are exported to section 'Tax deductions', sub-section 'Total tax deductions', are calculated as the negative of the sum of capital allowances and write-back allowance in rows 38-39 (as these two lines are populated with negative values, while the figures need to be exported as positive values).

Section **Interest** contains two sub-sections: 'Cost of debt' and 'Net debt'.

In sub-section **Cost of debt**, real terms cost of debt and expected RPI inflation rate are imported into cells I48-49 from the 'Inputs' sheet, and used to calculate nominal cost of debt in cell I50 through the Fisher formula:

$$NominalRate = (1 + RealRate) * (1 + InflationRate) - 1$$

In sub-section **Net debt**, the number of operational years and the operational notional gearing are imported into cells I54-55 from the 'Inputs' sheet.

The principal repayment in row 57 is calculated by subtracting the net interest paid in row 58 from the total debt payment in row 59.

The net interest paid in row 58, which is then exported into section 'Tax deductions', subsection 'Total tax deductions', is calculated by multiplying the opening net debt balance in row 61 by the nominal cost of debt rate in cell I50.

The total annual debt payment in row 59 is calculate as a fixed annuity according to the following formula:

$$DebtPayment = OpeningDebtYear1 * \frac{CostOfDebt}{1 - (1 + CostOfDebt)^{-no.of\ op\ years}}$$

The opening net debt balance in row 61 is calculated, in Year 1, by multiplying the opening preoperational RAV (in real terms) imported from sheet 'Op RAV' by the notional gearing in cell I55 and inflation uplift in cell I9; in all subsequent years, it is set equal to the closing net debt balance from the previous year (row 63).

The principal repayment in row 62 is set equal to the negative of principal repayment in row 57 in years 1-24, and equal to the negative of the opening net debt balance in row 61 in year 25 (using an IF statement).

The closing net debt balance in row 63 is the sum of rows 61-62.

Debt payment calculations are set up in the way described above to avoid circularities.

k. Tax Cap

The 'Tax Cap' sheet contains the calculations used to determine the annual tax allowances at the cap to be added to the revenue cap allowances (excluding tax), and then convert these annual tax allowances into an annuity.

Section **Unprofiled tax allowance (cap)** has three sub-sections: 'Profits attributable to corporation tax', 'Tax losses', and 'Tax allowance'.

In sub-section **Profits attributable to corporation tax**, annual tax deductions (row 10) are imported from the 'Tax Deductions' sheet and deducted from the revenue allowances at the cap (row 9), which are imported from the 'Allowances Cap' sheet and inflated using the

inflation uplift in row 11 of the 'Tax Deductions' sheet, to determine the annual level of profit attributable to corporation tax (row 11).

Sub-section **Tax losses** is used to calculate the balance of losses that are carried forward into subsequent years and netted off the profits attributable to corporation tax.

In row 15, the opening balance of taxable losses brought forward is set equal to the closing balance of taxable losses in the previous year (row 18).

In row 16, in-year taxable losses are set equal to profits attributable to corporation tax in row 11 if these are negative, or equal to zero if these are positive (using a MIN function).

In row 17, profits used to offset losses are set equal to zero if profits attributable to corporation tax (row 11) are negative or, if these are positive, equal to the smaller of profits attributable to corporation tax and the negative of the opening balance of taxable losses brought forward in row 15 (using an IF statement and a MIN function).

In row 18, taxable losses carried forward into the next year are calculated as the sum of rows 15-17.

Sub-section **Tax allowance** is used to calculate the un-profiled tax allowances at the cap (row 28).

In row 22, profits attributable to corporation tax (after taxable losses) are set equal to the difference between profits attributable to corporation tax in row 11 and profits used to offset tax losses in row 17 if this difference is positive, or equal to zero if this difference is negative (using a MAX function).

In row 23, the corporation tax rate is imported from the 'Inputs' sheet.

In row 24, corporation tax charges after losses are calculated by multiplying profits after losses from row 22 by the corporation tax rate in row 23.

The tax grossing-up factor in row 26 is calculated using the corporation tax rate in row 23 and the following formula:

$$\text{Grossing-up factor} = \frac{1}{1 - \text{Corporation tax rate}}$$

In section **Profiled tax allowance (cap)**, the annual un-profiled tax allowances calculated in section 'Unprofiled tax allowances (cap)' are deflated, discounted, aggregated and re-profiled in the form of an annuity.

In row 32, nominal tax allowances are deflated to real term equivalents using the inflation uplift in row 11 of the 'Tax Deductions' sheet.

In row 35, discounted un-profiled allowances are calculated by multiplying the deflated unprofiled allowances from row 32 by the discount factor in row 33, which is imported from the 'Allowances Cap' sheet.

The net present value (NPV) of the un-profiled allowances is calculated in cell I36 as the sum of all discounted un-profiled allowances in row 35.

This NPV is then multiplied by the annuity factor in cell I38 (imported from the 'Allowances Cap' sheet) to determine the annual tax allowance at the cap in the form of an annuity in cell I40.

I. Tax Floor

The 'Tax Floor' sheet contains the calculations used to determine the annual tax allowances at the floor to be added to the revenue floor allowances (excluding tax), and then convert these annual tax allowances into an annuity.

Section **Unprofiled tax allowance (floor)** has three sub-sections: 'Profits attributable to corporation tax', 'Tax losses', and 'Tax allowance'.

In sub-section **Profits attributable to corporation tax**, annual tax deductions (row 10) are imported from the 'Tax Deductions' sheet and deducted from the revenue allowances at the floor (row 9), which are imported from the 'Allowances Floor' sheet and inflated using the inflation uplift in row 11 of the 'Tax Deductions' sheet, to determine the annual level of profit attributable to corporation tax (row 11).

Sub-section **Tax losses** is used to calculate the balance of losses that are carried forward into subsequent years and netted off the profits attributable to corporation tax.

In row 15, the opening balance of taxable losses brought forward is set equal to the closing balance of taxable losses in the previous year (row 18).

In row 16, in-year taxable losses are set equal to profits attributable to corporation tax in row 11 if these are negative, or equal to zero if these are positive (using a MIN function).

In row 17, profits used to offset losses are set equal to zero if profits attributable to corporation tax (row 11) are negative or, if these are positive, equal to the smaller of profits

attributable to corporation tax and the negative of the opening balance of taxable losses brought forward in row 15 (using an IF statement and a MIN function).

In row 18, taxable losses carried forward into the next year are calculated as the sum of rows 15-17.

Sub-section **Tax allowance** is used to calculate the un-profiled tax allowances at the floor (row 28).

In row 22, profits attributable to corporation tax (after taxable losses) are set equal to the difference between profits attributable to corporation tax in row 11 and profits used to offset tax losses in row 17 if this difference is positive, or equal to zero if this difference is negative (using a MAX function).

In row 23, the corporation tax rate is imported from the 'Inputs' sheet.

In row 24, corporation tax charges after losses are calculated by multiplying profits after losses from row 22 by the corporation tax rate in row 23.

The tax grossing-up factor in row 26 is calculated using the corporation tax rate in row 23 and the following formula:

$$\text{Grossing-up factor} = \frac{1}{1 - \text{Corporation tax rate}}$$

In section **Profiled tax allowance (floor)**, the annual un-profiled tax allowances calculated in section 'Unprofiled tax allowances (floor)' are deflated, discounted, aggregated and reprofiled in the form of an annuity.

In row 32, nominal tax allowances are deflated to real term equivalents using the inflation uplift in row 11 of the 'Tax Deductions' sheet.

In row 35, discounted un-profiled allowances are calculated by multiplying the deflated unprofiled allowances from row 32 by the discount factor in row 33, which is imported from the 'Allowances Floor' sheet.

The net present value (NPV) of the un-profiled allowances is calculated in cell I36 as the sum of all discounted un-profiled allowances in row 35.

This NPV is then multiplied by the annuity factor in cell I38 (imported from the 'Allowances Floor' sheet) to determine the annual tax allowance at the floor in the form of an annuity in cell I40.

m. Cap Floor Levels

The annual cap and floor allowances (excluding tax) and the annual tax allowances at the cap and the floor calculated throughout the model are imported into the 'Cap Floor Level' sheet and aggregated to determine the overall cap and floor levels (including tax).

At Post Construction Review (PCR) stage, these allowances are finalised and compared against preliminary allowances set at the Final Project Assessment (FPA) stage to determine the required Post Construction Adjustment (PCA) to the preliminary cap and floor levels.

Cells I8 and I9 display, respectively, the annual cap and floor allowances (excluding tax) calculated through the model and imported from the 'Allowances Cap' and 'Allowances Floor' sheets.

Cells I11 and I12 display the annual tax allowances at the cap and the floor calculated through the model and imported from the 'Tax Cap' and 'Tax Floor' sheets.

At the PCR stage, cap and floor allowances (excluding tax) are updated for all projects; however, tax allowances might be fixed at FPA stage and not updated at PCR stage. When this is the case, when the model is run at PCR stage, the fixed tax allowances previously set at FPA stage need to be input in cells I14 and I15.

Cells I17 displays the total annual cap allowance including tax, which is calculated as the sum of I8 and I11 at FPA stage, and at PCR stage when the tax allowance was not fixed at FPA stage; or as the sum of I8 and I14 at PCR stage when the tax allowance was fixed at FPA stage (using an IF statement based on whether cell I125 in the 'Inputs' sheet – 'Tax element of Cap and Floor annuity previously calculated and fixed' – is populated as, respectively, No or Yes).

Cells I18 displays the total annual floor allowance including tax, which is calculated as the sum of I9 and I12 at FPA stage, and at PCR stage when the tax allowance was not fixed at FPA stage; or as the sum of I9 and I15 at PCR stage when the tax allowance was fixed at FPA stage (using an IF statement based on whether cell I125 in the 'Inputs' sheet – 'Tax element of Cap and Floor annuity previously calculated and fixed' – is populated as, respectively, No or Yes).

When the model is run at PCR stage, total annual cap and floor allowances including tax previously set at FPA stage need to be input in rows 20 and 21.

At PCR stage, rows I23 and I24 display the required post construction adjustments (PCA) to the cap and the floor, which are calculated, respectively, as the difference between cells I17 and I20 (cap) and between I18 and I21 (floor).

Appendix 2 – Technical appendix

Capitalised IDC

This appendix provides a detailed breakdown and explanation of the formula that is used to calculate the interest during construction (IDC) that is capitalised into the regulatory asset value (RAV), building on the explanation already provided in Appendix 1, section 'f. Finance'.

$$IDC = ((1 + IDC\ rate)^{IDC\ flag} - 1) * (Opn\ PreOp\ RAV + \frac{Devex + Capex + Spares}{2 + IDC\ rate})$$

Where:

- IDC rate is from cell I18;
- IDC flag is from row 8;
- Opn PreOp RAV is the opening pre-operational RAV (before transfers) from row 20; and
- Devex, Capex and Spares are the costs from rows 21-23.¹²

The IDC formula used in the CFFM1 assumes that capital additions (Devex, Capex and cost of spares) are incurred (and added to the RAV) uniformly throughout the year and, therefore, half of the annual additions are added by the mid-point of the year (e.g. in this case, by the end of June). The intent is for the IDC formula to approximate the timing of when Devex, Capex and cost of spares are actually incurred.

To determine the IDC value to be capitalised into the RAV in each year, the IDC rate is applied to the estimated value at the start of the year of the RAV half-way through the year. This value is calculated by adding to the opening RAV at the start of the year half of the capital additions added throughout the year (based on the assumption that these are added uniformly and, therefore, halfway through the year half of the annual additions have been added, as explained above). These additions are discounted to bring their value back to the start of the year. Since only half of the annual additions are added to the opening RAV, these are discounted back from halfway through the year to the start of the year using half the IDC rate as the discount rate. So, ultimately, the IDC formula applies the IDC rate to the sum of

¹² All the cell and row references in these bullet points refer to the 'Finance' sheet.

opening RAV at the start of the year and half additions discounted from the mid-point to the start of the year.

Ignoring the relevant flags for the purpose of this explanation, and labelling the sum of Devex, Capex and Spares as “Additions”, the formula above can be simplified as follows:

$$IDC = IDCrate * (Opening\ RAV + \frac{\frac{Additions}{2}}{1 + \frac{IDCrate}{2}})$$

Which can in turn be simplified as follows:

$$IDC = IDCrate * (Opening\ RAV + \frac{Additions}{2 * (1 + \frac{IDCrate}{2})})$$

And finally as follows:

$$IDC = IDCrate * (Opening\ RAV + \frac{Additions}{2 + IDCrate})$$

This formula is equivalent to the formula used in the model (other than for the flags, which can be ignored for the purpose of this explanation):

$$IDC = ((1 + IDC\ rate)^{IDC\ flag} - 1) * (Opn\ PreOp\ RAV + \frac{Devex + Capex + Spares}{2 + IDC\ rate})$$

Appendix 3 – Project specific inputs for NSL

This appendix provides a detailed overview of how each input in the 'Inputs' sheet of the NSLCFFM1 financial model used for NSL's Post Construction Review (PCR) was sourced or calculated.

Indexation, currency and base year price term

GB indexed portion of interconnector: 100%

Currency of cost inputs: £

Base year price term: 2015-16

The first input indicates that GB indexation is used for the entirety of the costs input into the CFFM1. This is due to the fact that the CFFM1 is used to set cap and floor levels only for the British half of the project; therefore, only half of the total project's costs are input into the CFFM1, and GB indexation is applied to 100% of these input costs.

The second and third inputs indicate, respectively, that cost figures input into the CFFM1 are expressed in Pound Sterling (GBP, £) and that cap and floor levels, which are set in real terms, are expressed in 2015-16 prices.

Variables set after financial close – Actual values

FY	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-22	22-23
Devex	0.332	0.510	6.463	1.397	3.863	-1.578	-	-	-	-	-	-	-
Capex	-	-	-	-	-	20.166	42.074	42.074	103.510	157.463	107.629	32.813	-0.215
Spares	-	-	-	-	-	0.098	0.277	0.177	0.691	2.574	0.722	0.620	-

These are the cost inputs provided (in £m, nominal terms) by the developer, and subsequently revised by Ofgem as part of the cost assessment process, in relation to the estimated development expenditure (Devex), capital expenditure (Capex) and cost of spares to be incurred by the developer.

Base year UK RPI inflation index value (CHAW): 259.43

12 month average UK RPI inflation index value (CHAW):

RPI	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-22	22-23
Actual	226.47 5	237.34 2	244.67 5	251.73 3	256.66 7	259.43 3	264.99 2	274.90 8	283.30 8	290.64 2	294.16 7	311.15 8	-
Forecast	-	-	-	-	-	-	-	-	-	-	-	-	319.59 1

Actual Retail Price Index (RPI) values for financial years up to 2021-22 were sourced from the ONS¹³

Long-term forecast values for financial years from 2022-23 onwards were calculated assuming long-term annual RPI inflation of 2.72%; this figure was determined as explained in section 'Variables set at financial close – Finance' of this Annex. However, since no construction costs were input into the CFFM1 after 2022-23, the long-term forecast inflation values in this section of the CFFM1 have no impact on cap and floor levels, as there are no costs to be converted from 2022-23 onwards.

Variables set after financial close – Ex-ante allowances for the operational period

Operational Years	Years 1	Year 2	Year 3	Year 4	Year 5	Year 10	Year 15	Year 20	Year 25
Repex	-	0.921	-	-	0.830	0.657	-	0.265	0.376
Decomm	-	-	-	-	-	-	-	-	24.215
C.Opex	18.565	22.827	25.232	25.991	22.979	22.939	23.481	24.022	24.776
NC.Opex	1.151	1.142	1.134	1.125	1.117	1.075	1.035	0.996	0.959

These are the cost inputs provided (in £m, real terms, 2015/16 prices) by the developer, and subsequently revised by Ofgem as part of the cost assessment process, in relation to the estimated replacement expenditure (Repex), decommissioning costs (Decomm), controllable operating expenditure (C.Opex), and non-controllable operating expenditure (NC.Opex).

Variables set at financial close – Finance

The cap return rate used to determine allowed returns at the cap represents the allowed cost of equity (CoE) during operations; it was estimated using the Capital Asset Pricing Model (CAPM) with the following input values and calculations:

Parameter	Value	Explanation
Risk-free rate (RfR)	1.60%	Fixed for Window 1 projects

¹³ <https://www.ons.gov.uk/economy/inflationandpriceindices/timeseries/chaw/mm23>

Total market return (TMR)	7.10%	Arithmetic mean of real UK equity returns since 1900 (DMS 2018)
RPI 'formula effect' adjustment (RPI adj)	0.40%	Fixed for Window 1 projects
Market risk premium (MRP)	5.10%	= TMR – RfR – RPI adj
Asset beta (β_a)	0.625	Fixed for Window 1 projects
Notional operational gearing (g)	50%	Fixed for Window 1 projects
Equity beta (β_e)	1.04	= $\beta_a / (1-g)$
Cap return	7.98%	= RfR + ($\beta_e \times$ MRP)

The floor return rate used to determine allowed returns at the floor represent the allowed cost of debt (CoD) during operations; it was estimated using the Final Investment Decision (FID) date (25th March 2015) as the reference date for the input values in the table below, where:

- The two benchmark indices used to estimate the cost of debt (in nominal terms) are the UK iBoxx non-financials 10+ A-rated and BBB-rated indices; and
- The inflation rate used to deflate the cost of debt from nominal to real is the breakeven inflation rate underpinning the difference between the yields on nominal and real 10-year UK Gilts (Inflation Zero Coupon, IUDMIZC).

Date	Index 1	Index 2	Average	Inflation	Real Average Rate
20 days to FID	A	BBB	Avg = (A+BBB) / 2	IUDMIZC	= (1+Avg) / (1+IUDMIZC) - 1
26/02/2015	3.51%	3.72%	3.62%	2.73%	0.87%
27/02/2015	3.57%	3.77%	3.64%	2.78%	0.84%
02/03/2015	3.55%	3.70%	3.63%	2.77%	0.84%
03/03/2015	3.62%	3.77%	3.70%	2.78%	0.90%
04/03/2015	3.66%	3.81%	3.74%	2.74%	0.97%
05/03/2015	3.65%	3.79%	3.72%	2.72%	0.97%
06/03/2015	3.72%	3.86%	3.79%	2.78%	0.98%
09/03/2015	3.72%	3.86%	3.79%	2.76%	1.00%
10/03/2015	3.63%	3.76%	3.80%	2.72%	1.05%
11/03/2015	3.63%	3.76%	3.80%	2.71%	1.06%
12/03/2015	3.57%	3.71%	3.64%	2.68%	0.93%
13/03/2015	3.56%	3.69%	3.63%	2.63%	0.97%
16/03/2015	3.53%	3.66%	3.60%	2.61%	0.96%

17/03/2015	3.53%	3.66%	3.60%	2.62%	0.95%
18/03/2015	3.48%	3.61%	3.55%	2.66%	0.87%
19/03/2015	3.40%	3.51%	3.46%	2.69%	0.75%
20/03/2015	3.39%	3.52%	3.46%	2.74%	0.70%
23/03/2015	3.39%	3.52%	3.46%	2.71%	0.73%
24/03/2015	3.39%	3.52%	3.46%	2.70%	0.74%
25/03/2015	3.37%	3.50%	3.44%	2.80%	0.62%
20-day average to FID (unrounded)				2.7165%	0.88%
20-day average to FID (rounded)				2.72%	0.88%

The average IUDMIZC inflation rate over the 20 days to FID (2.7165% rounded to 2.72%) is used as a long-term inflation forecast, as explained under sections 'Variables set after financial close – Actual values' and 'Variable set at financial close – Tax – Operational years' of this appendix.

The interest during construction (IDC) rate used to determine allowed returns during construction, which are capitalised on pre-operational RAV and transaction costs, represents the allowed weighted average cost of capital (WACC); it was estimated using the Capital Asset Pricing Model (CAPM) for the CoE (but with different cost of debt and risk-free rate from those used to estimate the cap return rate¹⁴) and the floor return rate as the CoD; the input values and calculations used to estimate the IDC rate are as follows:

Parameter	Value	Explanation
Cost of debt (CoD)	0.88%	= Floor return rate (see above)
Risk-free rate (RfR)	0.60%	10-year average of monthly yields on real 10-year UK Gilts (IUMAMRZC) to the month of FID
Total market return (TMR)	7.10%	Arithmetic mean of real UK equity returns since 1900 (DMS 2018)
RPI 'formula effect' adjustment (RPI adj)	0.40%	Fixed for Window 1 projects
Market risk premium (MRP)	5.10%	= TMR – RfR – RPI adj
Equity beta (β_e)	1.04	Market-cap-weighted average raw equity beta of four comparators (CNA, EON, RWE, SSE)

¹⁴ This is to reflect the fact that the IDC rate applies to the construction period, which is significantly shorter and closer in time to the financial close date than the operational period, to which the cap return rate applies. For this reason, more emphasis is placed on recent prevailing market rates that are project-specific for the IDC rate, and on historical long-term averages that are fixed for all Window 1 projects for the cap return rate.

Cost of equity (CoE)	6.94%	= $RfR + (\beta_e \times MRP)$
Pre-operational gearing (g)	33.41%	Market-cap-weighted average gearing of four comparators (CNA, EON, RWE, SSE)
Vanilla WACC	4.92%	= $CoD \times g + CoE \times (1-g)$
Development risk premium (DRP)	0.54%	Fixed for Window 1 projects
Construction risk premium (CRP)	0.91%	Fixed for Window 1 projects
IDC (unrounded)	6.3265%	= Vanilla WACC + DRP + CRP
IDC (rounded)	6.37%	Percentage rounded to 2 decimal places

Pre-operational notional gearing: 33.41%

Operational notional gearing: 50.00%

Equity transaction costs: 5.00%

Debt transaction costs: 2.50%

Pre-operational and operational notional gearing levels were determined as explained above in the tables explaining the calculations underpinning the cap return rate and the IDC rate.

Equity and debt transaction costs are fixed values for Window 1 projects.

Variables set at financial close – Model operation

Model start date: 01/04/2009

Regime start date: 01/01/2021

End date for IDC: 30/09/2021

Start of operations: 01/10/2022

Number of operational years: 25

The choice of model start date is to ensure that the first time period covered by the model (FY 2009-10) precedes the first time period in which costs were incurred by the developer (FY 2010-11).

The regime start date (1st January 2021) is set in NSL's licence and is the latest possible regime start date for Windows 1 projects for which no delays are granted to account for Force Majeure (FM) events.

The operations start date was set based on information provided by the developer and is the date that the NSL entered commercial operations.

The number of operational years (25) is the default length of the cap and floor regime, as set in NSL's licence.

Variables set at financial close – Tax – Financial years

Long-term expected UK RPI inflation: 2.72%

This value was estimated as explained in section 'Variables set at financial close – Finance' of this appendix.

Values for 12-month average UK RPI inflation index (CHAW) were determined as explained in section 'Variables set after financial close – Actual values' of this appendix.

In the case of NSL, the two inflation profiles (the one used for cost indexation and the one used for tax calculations) are the same because the relevant reference years for both construction costs and tax calculations are UK financial years, i.e. 1st April to 31st March. For other projects, these two profiles might differ.

Variables set at financial close – Tax – Operational years

Corporate tax rate: 20.00%

Capital allowance rate: 8.00%

Corporation Tax Rate and Capital Allowance Rate are set in line with the values confirmed at FPA. The values at FPA are set to match the values set by the UK Government in the year licensee took FID or in this case any public statements announced about future movements at time of FID.

Variables set at financial close – Tax – Annuity

Tax element of Cap and Floor annuity previously calculated and fixed: No

This input only applies at the Post Construction Review (PCR) stage and reflects the choice of whether the tax allowances at the cap and the floor, first calculated at Final Project Assessment (FPA) stage, are to be updated at PCR.

At FPA, there is no tax element previously calculated and fixed, so the selection for the input is 'No'.