Innovation Fund (InnovFund)

Call for proposals

Annex B: Methodology for Relevant Costs calculation

Innovation Fund Large-scale Projects
InnovFund-LSC-2020-two-stage

Version 3.1
23 April 2021

HISTORY OF CHANGES		
Version	Publication date	Change
1.0	03.07.2020	Initial version.
2.0	15.09.2020	Revision 1 – change Table 3.1 and Figure 4.1.
3.0	24.03.2021	Revision 2 - amendment to Decision tree (Figure 3.1) to replace 'reference unit cost/product' with 'Reference price'; change in column title in Table 3.1 to say 'No Reference Plant' instead on 'Reference Scenario Ignored'; relocation of section 4.1.2.11 to section 3.3.3 as it applies to all methodologies; textual adjustments for greater clarity on Revenues and Operational Benefits across Section 4; revised 2 year average carbon price for 2019/20 in section 4.1.2.6.; updated Harmonised Indices of Consumer Prices for 2020 (Table 4.2) in section 4.1.2.8; new section introduced (4.1.3.), entitled 'Costs which must be excluded from relevant costs calculations'; Figure 4.2 sourced from Version 6.0 of Lazard's Levelised Cost of Storage Analysis (2020), replacing that taken from Version 5.0; new Glossary of key terms added as Appendix 1; and, industrial sectors that are not relevant for the Innovation Fund have been removed from the reference market betas table in Appendix 2.
3.1	23.04.2021	Adjustments in text in sections 4.2.2.2 and 4.2.2.4. to provide greater clarify on how to determine reference price under the LCOS methodology

Annex B: Methodology for Relevant Costs calculation

Contents

1. Introduction

The Innovation Fund supports the additional costs that are borne by the applicant as a result of the application of the innovative technology related to GHG emission avoidance. According to Article 5(1) of the Innovation Fund Regulation:

> *"The relevant costs shall be the additional costs that are borne by the project applicant as a result of the application of the innovative technology related to the reduction or avoidance of the greenhouse gas emissions.*
>
> *The relevant costs shall be calculated as the difference between the best estimate of the total capital expenditure, the net present value of operating costs and benefits arising during 10 years after the entry into operation of the project compared to the result of the same calculation for a conventional production with the same capacity in terms of effective production of the respective final product."*
>
> *Where conventional production … does not exist, the relevant costs shall be the best estimate of the total capital expenditure and the net present value of operating costs and benefits arising during 10 years after the entry into operation of the project."*

The relevant cost is not to be confused with the maximum grant award that is equivalent to 60% of the relevant costs.

Since the Innovation Fund is a competitive scheme, and cost-efficiency is one of the five award criteria, once relevant costs have been determined, applicants are free to request less than 60% of the relevant costs – due to a higher contribution from private resources or through public support – to improve their scoring under the award criterion related to cost-efficiency.

2. Calculation of relevant costs compared to reference scenario

The calculations of GHG emission avoidance as well as of relevant costs rely on a comparison with reference scenarios that should reflect the current state-of-the-art in the different sectors:

Table 2.1 Reference Scenarios

Sector	Reference scenarios for GHG emission avoidance
Energy-intensive industries (EIIs)	EU ETS benchmark(s)
Carbon Capture and Storage (CCS)	CO_2 releases that would occur in the absence of the project
Renewable electricity	Expected 2030 electricity mix
Renewable heat	Natural gas (NG) boiler
Energy storage	Single-cycle NG turbine (peaking power)

To be consistent with the calculations of GHG emission avoidance (see Annex C for the full methodology, including a complete list of sectors covered under EIIs), the calculation of the relevant costs should build on the same reference scenarios and their respective costs.

However, applicants should be aware that in some cases the reference product or process (and therefore methodology) used for relevant costs calculations may differ from the methodology used for the reference GHG emissions avoidance calculations. For example, for manufacturing of components, such as a manufacturing plant for innovative solar PVs, the reference for relevant costs for such a manufacturing plant should be based on the market price for standard solar PV (or the costs for such a manufacturing plant), while the reference for GHG avoidance is determined by emissions that will be displaced from the grid by the innovative PV panels, when implemented.

Consequently, the project applicant needs to work with the relevant costs methodology that is best suited to a specific innovative project.

3. Choice of the cost methodology

3.1. Decision tree

The Decision tree presented in Figure 3.1 below directs applicants to the most appropriate reference scenario for the calculation of their relevant costs. The Decision tree follows the requirements of the Innovation Fund Delegated Regulation and is based on the key characteristics of the project. By working down the left side of the diagram, and based on the characteristics of their projects, applicants will arrive at with the appropriate relevant cost methodology.

The default methodology is Option 1, based on a Levelised Cost methodology that should be suitable for a wide variety of projects covering:

- Option 1a – Energy/electricity generation;
- Option 1b – Product manufacture from energy-intensive industries (as well as the manufacture of innovative renewable or storage technology components from a new production facility[1]);
- Option 1c –Electricity storage.

The current market prices of products ("Reference price") reflect the cost of the conventional technologies (including financing cost), as used in a given Reference scenario, and are therefore used in the calculation steps below as the Reference price (see the detailed approach to calculate the levelised cost in section 4.1.2).

In some, limited, situations, where a Reference price is not available, applicants will find that the Decision tree takes them to the reference plant methodology (Option 2). The project costs are then compared to the best estimate of the CAPEX and OPEX of a plant with conventional technology (e.g. ETS benchmark installation in the case of industrial products).

Finally, Option 3 is the "last-resort" methodology for cases where neither Option 1 nor Option 2 are applicable and relies on a methodology without a Reference scenario.

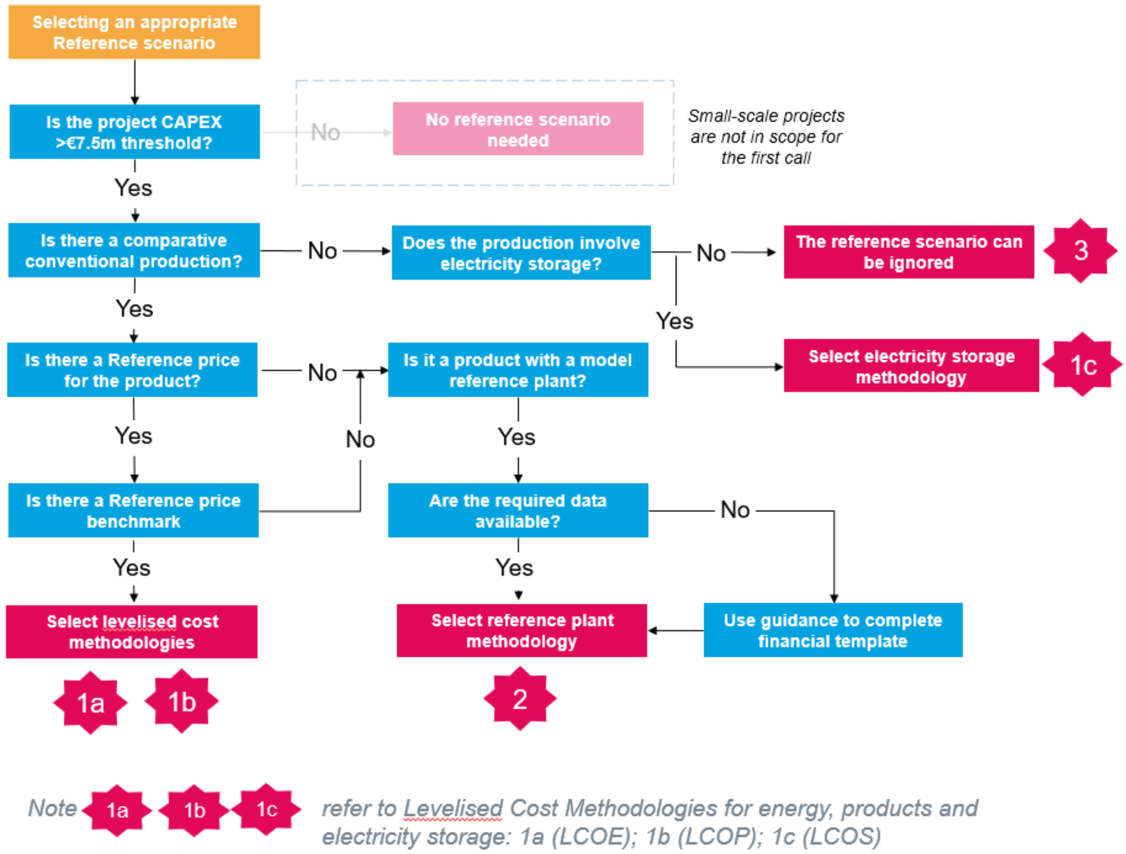
Applicants will need to decide whether or not to deviate from the default methodology in Option 1. Applicants will however have to justify their choice based on the principles outlined below and ensure the traceability and transparency of the calculations.

For the purposes of ensuring a fair and transparent evaluation process, any applicant deviating from the methodology on specific parameters will have to justify this, based on considerations such as accuracy and availability of data, and comparability of the

[1] Applicants with projects falling under this category should already have demonstrated through the GHG emission avoidance methodology the existence of a buyer of the components (i.e. a company that will run the innovative technology to generate renewable electrical or thermal energy) to ensure that the intended GHG avoidance will be delivered. Therefore, it is assumed in the first instance that the product replaces an existing product in the market where there is a comparable product price.

final product, or process. The evaluators should be able to understand the quantitative impact from any deviation from specific or default parameters.

Figure 3.1 The Decision tree to help applicants select the correct calculation methodology



3.2. Introduction to the cost methodologies

3.2.1. Option 1 – The levelised cost methodology

This methodology calculates the relevant costs based on the difference between the levelised cost of producing an output unit computed over the full project lifetime using the project's innovative technology, and the Reference price expected to be received in the market for the quantity to be produced (be it electricity or an industrial product for example).

The levelised cost can be computed using the following models:

- **Energy model (Levelised Cost of Energy - LCOE):** This model can be used for power or heat generation and equates to the well-known LCOE calculation which is a standard when comparing technologies' cost of producing a MWh or equivalent of energy;

  Average wholesale electricity prices of the past two years should be used as the default value for the Reference price.

- **Industrial Product model (Levelised Cost of Product - LCOP):** This model computes a levelised cost of production per unit for the new technology and compares this cost to the market price of the industrial product.

The default values for the expected Reference price (for the final product as well as the EU ETS allowances) will have to be at least as high as the average of the last two years.

- **Electricity Storage model (Levelised Cost of Storage - LCOS):** This model computes a blended cost per discharge for several and specific use cases of a storage technology in a particular country, focusing only on those services offered and remunerated in that country. It then compares that blended cost to the income that would be received by those services at the levels of remuneration unique to that setting. This second calculation is the assumed market price for that use case. As per the other Levelised Cost methodologies, the difference in these two calculations per unit provides the basis for the calculation of relevant costs.

3.2.2. Option 2 – The reference plant methodology

This methodology uses the project's capital expenditure (CAPEX) and the Net Present Value (NPV)[2] of the Revenues, Operational Benefits and Operational Costs (OPEX) and compares them to those of a Reference Plant with conventional technology but of the same size and output, over the first ten years of operation. This is the "fall-back" methodology to be used when a product Reference price is not available.

The Reference Plant should be based on a plant that achieves the EU ETS benchmarks for industrial products[3].

3.2.3. Option 3 – The 'no reference scenario' methodology

This methodology derives the relevant costs based on the best estimate of the total CAPEX and the NPV of the Revenues, Operational Benefits, and OPEX arising over the first ten years of operation. This is the "last-resort" methodology that can only be applied in case no reference product or conventional technology is available as reference.

3.3. Key parameters and data inputs

3.3.1. Key parameters that will impact the selection of the cost methodology

Applicants need to consider various parameters to determine whether deviating from the default cost methodology under option 1 is justified:

[2] Net Present Value (NPV) is the difference between the present value of cash inflows and the present value of cash outflows. In contrast, Present Value (PV) is the present value of future cash inflows given a specific rate of return.

[3] A product benchmark is based on the average GHG emissions of the best performing 10% of the installations producing that product in the EU and EEA-EFTA states. Revised ETS benchmarks have now been published, so applicants should refer to: Commission Implementing Regulation (EU) 2021/447 of 12 March 2021 determining revised benchmark values for free allocation of emission allowances for the period from 2021 to 2025 pursuant to Article 10a(2) of Directive 2003/87/EC of the European Parliament and of the Council. Available at: https://eur-lex.europa.eu/eli/reg_impl/2021/447.

Option 1 – The levelised-cost methodology

- **Existence of a product Reference price** - In the vast majority of cases there will be some form of reference product[4] and therefore a Reference price. For substitute products, the same approach will be used.
- **Project boundaries -** A general principle is to establish an identifiable final product in most cases. When a project is only focused on part of an installation, then the contribution of this partial process to the overall cost of the full process must be assessed. Where a project combines industrial production with electricity storage, and if the storage is integrated into an industrial process then only the LCOP model is used, with the benefit (i.e. electricity cost saving) taken into account. The LCOS model is only for electricity storage as a standalone service.

If a project :

- is focused only on producing an intermediate product (e.g. liquid steel) or
- concerns a well-defined innovation in a certain process step,

and there exists no reliable market price or substitute product, or this product is traded below its face value or with an uncertain price, and internal cost data is more reliable for the calculation of the costs in the reference scenario, then option 2 based on a Reference Plant scenario should be followed.

Option 2 – The reference plant methodology

- **Existence of a Reference Plant** - which should be a conventional plant (e.g. EU ETS benchmark installation for industrial products or a fossil fuel-equivalent for renewable electricity or heat).
- **Reliable Reference Plant cost data** – required to ensure that the relevant costs calculation can be robustly calculated.

In some cases, neither a substitute product nor a conventional technology will exist (e.g. when a new and additional production step is added to the process or a new service is offered – such as standalone CO_2 storage and transport project). Only in these cases and if the costs related to and necessary for the innovation itself have been well documented, can option 3 be chosen.

Option 3 – No reference plant methodology

- **No comparable conventional production plant exists** – either in the EU (i.e. an EU ETS benchmark installation for industrial products or a fossil fuel-equivalent for renewable electricity or heat) or globally.
- **No reference product exists –** this is the case where relevant costs are derived from cost data, Revenues and any Operational Benefits from the planned project.

3.3.2. Key data inputs across the methodologies

The key data inputs are based on standard financial indicators that would typically form the basis of a project financing model. These include:

- Capacity of the project
- Project lifetime
- CAPEX
- Variable annual OPEX

[4] Note, this does not refer to ETS product benchmarks which are sometimes wrongly termed 'Reference products' (see https://ec.europa.eu/clima/policies/ets/allowances/industrial_en for more details)

- Fixed annual OPEX
- Non-annual periodic costs (for example maintenance costs)
- Decommissioning costs
- Timing inputs (for example, construction start/end date, commercial operational date, financial close)
- Expected Annual production (tpa, MWh/annum, tCO_2 stored/annum, etc.)
- Operational Benefits

Table 3.1 sets out these and other input parameters across the different models and reference scenarios. Applicants will need to ensure they have the complete set of data in order to derive an accurate relevant costs calculation.

Table 3.1 Input parameters across different relevant costs methodologies

Parameter	Option 1a	Option 1b	Option 1c	Option 2	Option 3
	Energy Model	Industrial Product Model	Electricity Storage Model	Reference Plant Model	No Reference Plant
Capacity	Y	Y	Y		
Capacity Factor	Y				
Degradation	Y		Y		
Total Annual Electricity Discharged			Y		
Financial Close Date	Y	Y	Y	Y	Y
Construction Cost	Y	Y	Y	Y	Y
Construction Duration	Y	Y	Y	Y	Y
Project Lifetime	Y	Y	Y	Y	Y
Production Ramp-Up for First 3 years	Y	Y	Y		
Indexation Rate	Y	Y	Y		
Public support related to the price or quantity sold	Y	Y	Y	Y	Y
Public support related to support capital or operating expenditure					
Carbon Allowances Sold		Y		Y	Y
Annual Income Streams			Y	Y	Y
Associated O&M Costs			Y	Y	Y
Variable Operating Costs	Y	Y	Y	Y	Y
Fixed Operating Costs	Y	Y	Y	Y	Y
Lifecycle Costs	Y	Y	Y		
Lifecycle Cost Frequency	Y	Y	Y		
Decommissioning Costs	Y	Y	Y		
Reference Levelised Cost	Y				
Reference Product Price		Y			
Premium/(Reduction) to Reference	Y	Y			
Reference Plant Construction Cost				Y	
Reference Plant Construction Duration				Y	
Reference Plant Annual Revenues				Y	
Reference Plant Annual Costs				Y	
Cost of Equity	Y	Y	Y	Y	Y
Cost of Debt	Y	Y	Y	Y	Y
Equity %	Y	Y	Y	Y	Y
Debt %	Y	Y	Y	Y	Y
Corporation Tax Rate	Y	Y	Y	Y	Y
Proportion of Relevant Costs Applied For	Y	Y	Y	Y	Y

3.3.3. How to account for possible differences in regulatory regimes and public support which affect relevant costs across all methodologies

There could be differences in electricity prices, indirect cost compensation or other Operational Costs (OPEX) and Operational Benefits (i.e. income from electricity tariffs) due to differences in regulatory regimes. If applicants are aware of particular regulatory features in their Member State in which their project is situated that could have a positive or negative impact on their relevant costs calculation, they should explain carefully how these will be taken into account in the proposal.

For example, when calculating OPEX in the Levelised Cost methodology and the Operational benefits in the reference plant model, it is important to include public support related to the price or quantity sold of the final product, such as a feed-in tariff or feed-in premium.

As a guiding principle, applicants must include any such public support to which a project has a right and that is equally applicable and accessible to all market participants on a common basis (market wide). It must be included either as a reduction of OPEX in the Levelised Cost methodology or as an Operational Benefit in the reference plant model.

On the contrary, any public support that is project-specific must be excluded from the calculation of the relevant costs. Instead, it must be counted as a contribution by the project applicant in the cost efficiency criterion. For example, if a project benefits from other public support specific to the capital or operating costs of the project itself, this should not reduce the relevant costs. Such public support then needs to be counted as "other contributions" as defined by Article 11(1)(e) of the Innovation Fund Delegated Regulation for the purposes of the calculation of the cost efficiency criterion.

4. Methodologies for calculating relevant costs

4.1. Levelised Cost methodology

4.1.1. Principles

In many industries there are accepted methodologies for the calculation of levelised unit costs. The levelised unit cost is the cost of one unit of production, including the financing costs (i.e. the return expected from debt and equity investors), over the lifetime of a project. This is akin to an estimated fair price of the unit produced based on the costs of production and the costs of finance.

Levelised Cost of Energy (LCOE) formula

LCOE means the present value of the costs divided by the discounted sum of energy units produced (MWh) over the project lifetime:

$$LCOE\left[\frac{€}{MWh}\right] = \frac{CAPEX + \sum_n^N \frac{O\&M cost}{(1+r)^n} + \sum_n^N \frac{Fuel\ cost}{(1+r)^n}}{\sum_n^N \frac{Elec_{Produced}}{(1+r)^n}}$$

Where:

- CAPEX = capital expenditure
- O&M = Operations & Maintenance (net of Operational Benefits)
- r = discount rate (WACC)
- n = the year
- N = project lifetime
- Fuel Cost = feedstock cost (for example Biomass or Waste streams)
- MWh = Megawatt Hour

Note that there is no fuel cost in most renewables projects.

Levelised Cost of Product (LCOP) formula

The product price methodology uses the same approach as LCOE to calculate the fixed nominal unit price (over the project lifetime) that would need to be paid for the innovative product in order to justify the investment to build the project (Levelised Cost of Product, or LCOP) including its cost of funding:

$$LCOP\left[\frac{€}{Product}\right] = \frac{CAPEX + \sum_n^N \frac{O\&M cost}{(1+r)^n} + \sum_n^N \frac{Fuel\ cost, Materials\ cost\ etc.}{(1+r)^n}}{\sum_n^N \frac{Units_{Produced}}{(1+r)^n}}$$

Where:

- CAPEX = capital expenditure
- O&M = Operations & Maintenance (net of Operational Benefits)
- r = discount rate (WACC)
- n = the year
- N = project lifetime

The discount rate used for the NPV calculations is the Weighted Average Cost of Capital (WACC) of the project. This is the blended cost of capital depending on the ratio of equity and debt in the project and is calculated using the formula below:

*WACC = E/V * Re + D/V*Rd * (1-Td)*[5]

- Re = total cost of equity
- Rd = total cost of debt
- E/V = equity portion of total financing (Equity over total Value), as expected at financial close[6]
- D/V = debt portion of total financing (Debt over total Value), as expected at financial close
- Td = Tax rate[7]

Note that the CAPEX (even if disbursed over a period longer than one year), are committed at financial close and are not discounted.

The resulting LCOE or LCOP for the innovative product will be compared to the reference price. The LCOE or LCOP is the price at which the product would have to be sold on average to reach a market-related return for investors (i.e. the theoretical product market price using the new process). Except for the OPEX costs occurring after ten years, this difference per unit would be the basis of the estimated relevant costs in the Innovation Fund Delegated Regulation. Adjustment is therefore made to exclude the post 10-year OPEX in the final calculation of relevant costs using this methodology (see below).

The potential value of the support is calculated by building financial projections for the innovative project and using the reference product (benchmark) price as the unit sales price assumption.

A key component of the relevant cost calculation is the calculation of the NPV of the Operational Costs (OPEX) of the project with an appropriate discount rate over the lifetime of the project.

The NPV (using the WACC as the discount rate, and the nominal market unit price) of the free cashflows from the innovative project (including all CAPEX and OPEX) will be negative and this amount is defined as the relevant costs.

The calculation of relevant cost for each innovative project should ideally be based on a relevant cost excel file template(mandatory) available to download from the Tenders and Funding Portal[8]. In parallel, applicants are required to fill a Financial Model Summary Sheet (mandatory) with the output of their own financial model including a summary overview of the cash flow projections from revenues and costs, down to free cash flows, as well as key elements of the P&L and balance sheet. The projections should be consistent with those used in the calculation of relevant costs. For guidance on modelling practice, applicants can download from the Portal a fully developed financial model example (optional, for information only).

[5] This is a nominal discount rate calculation (the debt and equity funding cost already take into account inflation).

[6] Applicants need to present the projected capital structure at financial close (i.e. as agreed by the project funders) and which should be in line with the financial information provided in the Financial Model Summary Sheet.

[7] Note that the inherent tax shield reduces the debt cost.

[8] https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/home

4.1.2. Detailed approach

4.1.2.1. Summary of the steps for calculating the relevant costs using the Levelised cost methodology

Step 1: Establish the CAPEX and OPEX
Upfront costs of construction and ongoing Operational Costs (OPEX) for the full project lifetime must be established.

Step 2: Reduce the OPEX by any Operational Benefits (such as EU ETS Allowance sales or preferential electricity tariffs)
See section 4.1.2.6 below on Carbon price assumptions.

Step 3: Determine the number of units forecast to be produced by the project over the full lifetime of the project

Step 4: Discount the OPEX and units forecast to be produced over the full project lifetime using the WACC as discount factor
See section 4.1.2.3 below on Determining the WACC.

Step 5: Divide CAPEX plus NPV of the OPEX (the "total discounted costs") by the total discounted units produced over the full project lifetime (the "Levelised cost")

Step 6: Establish the difference between the Levelised Cost and the Reference price
See section 4.1.2.5 below on Determining a comparable Reference price.

Step 7: Multiply this difference by the total discounted units produced over the full project lifetime

Step 8: Calculate the percentage of Discounted Costs that the discounted OPEX after 10 years of operation represents
This will be the total OPEX after 10 years until the end of the project's operational lifetime. See section 4.1.2.10 below on OPEX adjustment.

Step 9: Subtract this percentage from 100% and multiply this difference by the total in Step 7
This will be the relevant cost.

4.1.2.2. Rules regarding input parameters

In the two models (Option 1a and 1b) under this relevant costs methodology (and other methodologies to varying degrees – see Table 3.1), applicants need to make assumptions in order to enable a robust calculation of relevant costs across the following areas:

- WACC (discount rate);
- tax rate;
- determining a comparable Reference product price (reference scenario);[9]
- carbon price and carbon allowances;
- project lifetime;
- indexation/inflation;
- decommissioning; and,
- OPEX adjustments.

[9] Product price will be assumed to include Carbon Costs

Each of these aspects is briefly described in the following sections, along with exclusion rules which applicants must follow relating to (i) terminal value and (ii) the write down of existing (old) technologies (see section 4.1.3.).

4.1.2.3. Determining the WACC (discount rate) across different project types

The WACC is applied to discount future income and cost streams over the project lifetime to make them comparable.

Many applicants will be experienced and familiar with the cost of equity and debt - and therefore the WACCs used - in their company and sector. For some applicants, however, this could pose a challenge. This section helps applicants to understand what the appropriate WACC should be for a particular project.

Applicants should use the indicated default values for the WACC, including cost of equity and cost of debt. The applicants should justify any higher value due to increased risks and quantify its impact on the relevant costs.

i) Establishing the WACC for a renewable energy project

As a default, the applicant shall use the company discount rate (WACC) or follow the methodology provided in this section.

Cost of equity

If for a project, the equity return of a comparable technology project is known, applicants should use that equity return. If it is not available, applicants can add a premium to another benchmark that is available across the market for equity. For example, if looking at the equity return for an offshore wind investment, applicants can make realistic assumptions regarding the premium to a known reference in the sector. The all-in equity return expectations would typically be in the range of 8% to 16% based on observed transactions, but these might be different in exceptional circumstances. Table 4.1 below provides an indicative cost of equity for five different groups of European countries, although applicants should note that in some markets the speed of development may mean rates could fall quickly in a short period (for example, with offshore wind).

Table 4.1 Indicative cost of equity for WACC calculation for RES projects

	Group 1	Group 2	Group 3	Group 4	Group 5
Offshore Wind	8.50%	9.50%	11.00%	13.00%	16.00%
Offshore Floating Wind	10.50%	11.50%	13.00%	15.00%	18.00%
Floating Solar PV	8.00%	9.00%	10.50%	12.50%	15.50%
Biomass (Advanced Technologies)	10.00%	11.00%	12.50%	14.50%	17.50%
Geothermal	10.00%	11.00%	12.50%	14.50%	17.50%
Tidal	12.00%	13.00%	14.50%	16.50%	19.50%
Wave	12.00%	13.00%	14.50%	16.50%	19.50%

Source: ICF

Country Grouping	*Relates to where project is located
Austria	1
Belgium	2
Bulgaria	3
Croatia	4
Republic of Cyprus	4
Czech Republic	3
Denmark	2
Estonia	5
Finland	3
France	3
Germany	1
Greece	4
Hungary	5
Iceland	4
Ireland	3
Italy	3
Latvia	5
Lithuania	5
Luxembourg	1
Malta	5
Netherlands	3
Norway	2
Poland	5
Portugal	2
Romania	5
Slovakia	3
Slovenia	3
Spain	3
Sweden	3

Source: ICF

Cost of debt

Applicants can assume a margin for risk above the base bank lending rate[10] as they would be quoted for project finance by a commercial lender. If a reference is not available for the particular technology a premium over an established technology debt margin can be used.

Unlike the cost of equity, it is not possible to provide applicants with market assumptions about the cost of debt, since this requires knowledge of the base rate in each country (and currency) and then the margin for debt in each country and for each technology. It will also have a different base rate depending on the tenor of the debt for each specific project. However, applicants should consider a default range of 150 to 650 basis points[11] over the base rate, or alternatively use the credit spread of BBB- to C[12]. Applicants should provide appropriate documentation for their chosen cost of debt.

Applicants should use the debt-to-equity ratio they contemplate and expect to be achievable for the project. In some cases, this might be 100% equity.

ii) Establishing the WACC for an energy-intensive industrial project or for an innovative manufacturing facility

As default, the applicant shall use the company discount rate (WACC) or follow the methodology provided in this section. For innovative manufacturing facilities (for example, of renewables components), the new products will inevitably fall into a specific market sector. In this case applicants should use the WACC calculations for industry, not a renewables project.

The final product price should be determined in the financial model based on calculations assuming a specific WACC, whether calculated or provided by the company's internal treasury.

If the applicant is an SME or a Special Purpose Vehicle (SPV), then the general WACC for the sector covering the project should be applied. This is also the approach taken when assessing state aid to companies. To achieve this, applicants would need to justify their WACC calculation using appropriate reference sources (for example, as noted in a published annual report).

WACC rates for energy-intensive industrial projects should be calculated according to the country in which the projects will be executed as well as the sector. Reference market betas for industrial projects, as well as the equity risk premium by country, are provided to applicants in order to perform this calculation and are included in Appendix 1 at the end of this document.

The calculation will follow the following steps for a notional project, as shown in Figure 4.1:

[10] Even if government yields are negative, banks will not lend money at negative rates

[11] One basis point is one hundredth of one percentage point

[12] As per S&P's credit rating score. Anything above this is considered not risky enough and anything below this is considered too risky

Figure 4.1 Calculation of the Cost of Equity for a notional innovative project in the Chemicals sector

		Reference
Risk Free Rate (a)	0.65%	Eoipa Figures
Market Risk Premium (b)	5.20%	Domadoran ***b = c-a***
Equity Return (Market) (c)	5.85%	
Chemical Sector Unlevered Beta (d)	1.79	Domadoran (we assume a sector standard leverage at project and company level)
Equity Return (e)	9.96%	***e = a+b*d***

Applicants may add a further premium in case the high degree of innovation leads to risks that go beyond the sector or company WACC. However, such an "innovation premium" must be related to the determined degree of innovation and take into account how many process steps or products are being changed. To the extent possible, the applicant should quantify the perceived risks. Furthermore, the applicant should calculate and transparently show the impact of the "innovation premium" on the relevant costs. The upper bound on such an "innovation premium" is 4%.[13]

If there is no comparable reference market beta for an industry (e.g. for renewable hydrogen production), a cost of equity and debt must be justified by reference to similar technologies' WACC in Appendix 1. For this particular example, depending on the predominant capital expenditure, this might be either the chemical sector beta plus an "innovation premium" or based on a higher risk renewable technology.

4.1.2.4. Tax rate assumptions

As shown above (section 4.1.1), an important aspect of the WACC formula is the determination of the prevailing tax rate which prevails in the country of project demonstration.

4.1.2.5. Determining a comparable reference price

i) Assumptions about the price of the product from the project and implications for the Reference price

Achieving some comparability between product prices in relevant costs calculations is important, both for ensuring fairness and for determining the project's revenue line.

As the levelised cost of the innovative product includes a cost of capital, it should be compared to a market price, or production cost plus an appropriate profit margin in the reference scenario.

ii) General rules for establishing Reference prices

Unless specified otherwise, applicants need to provide Reference price data. The default choice should be a two-year historic average price, but applicants may, in specific cases, propose another methodology if there are specific reasons why historic average pricing would not provide a good basis for forecasting future prices.

[13] This percentage has been calculated as a blended market observed equity risk premium based on research from Ibbotson Associates, Duff and Phelps and KPMG (see Appendix for further details on premia by company size)

For energy (power/heat) projects using the LCOE approach:
The project LCOE should be compared against the long-term market price for either power or heat.[14]

For industrial projects using the LCOP approach:
The market price of the innovative product should be compared with the market price of its reference product. Where the project involves the manufacture of innovative renewable or storage technology components from a new production facility, the same procedure will apply.

iii) Consideration of EU ETS costs in Reference prices

For the LCOP and LCOE methodologies, the market price (i.e. the comparable reference) should already include the EU ETS costs (of the marginal installation) that are passed on to consumers.

If unit costs (that do not include EU ETS costs of the marginal installation) are used, the EU ETS costs of the marginal installation need to be added to the unit cost as per the product emissions calculation, if that particular unit cost benchmark does not include Carbon costs. This might vary from cost benchmark to cost benchmark and will have to be verified by the applicants.

iv) Obtaining Reference price data

It is assumed that applicants considering introducing an innovative product to an existing market will know what the reference price is for the product they are seeking to compete with or displace. Indeed, in many cases, applicants will be seeking to enhance their own existing production facilities and will therefore already be well versed in reference costs and prices.

Reference price data is available for most sectors. For products that have a clear reference price that applies across Member States (for instance, London Metal Exchange prices for certain metals), applicants may choose to specify a fixed source for the reference price. The price of most products will vary by country and therefore applicants will need to propose the most appropriate reference in each case.

In general, historic information is often available, as well as limited spot and futures traded prices[15]. Prices are however volatile and widely different results are typical, depending on the timeframe you calculate any average for.

Pricing for specialty chemicals is more opaque, but it is likely that most applicants will already have activities in the relevant sector and will therefore be able to provide EU evaluators with pricing information and supporting evidence.

v) Determining an appropriate Reference price for new or multiple products

Whilst, in many cases, perfect substitute products will be generated by an innovative project, and hence the price should be the same irrespective of the production technology, there are likely to be exceptions.

For example:

- If a product can be obtained by several processes (i.e. hydrogen from steam reforming or hydrolysis), the process with the largest current market share should be used.

[14] The reference price will be the wholesale market price with an appropriate discount applied for the achievable PPA (i.e. the long-term project contract with PPA off-takers and do not receive 100% of the market price of wholesale electricity). An appropriate discount would normally be in the region of 90-95% of the wholesale market price.

[15] For example, a futures or spot market price could be used to justify a situation where a reference price falls below the average wholesale price of the last 2 years.

- For CCU projects, the reference should be guided by what it will replace (the reference is a proxy for the price that the innovative product will sell for).
- Projects in some sectors might not have comparable prices that are easy to establish and therefore a comparable product is required. For example, alternative fuels / oil-based products are two such identified sectors, where mineral oil could be a comparable product.
- If a project is focused only on producing an intermediate product (e.g. liquid steel) or on well-defined innovation in a certain process step, with no reliable market price or substitute product, and internal cost data more reliable for the calculation of the costs in the reference scenario, then option 2 based on a Reference plant model should be followed.

vi) Approach to follow where the innovative product is different in quality to its reference

Where a product will substitute another one of different composition (for example, ethanol to substitute gasoline in transport, rather than ethanol as a fine chemical), the relevant EU ETS sector of the substituted product may be chosen (the refinery sector in this case).

A new product that is not identical to the reference product may attract different prices in the market. Applicants applying into the IF will most likely have already demonstrated the production process at small scale. Sample production from a pilot plant is then used to obtain a purchase (off-take) contract for the proposed larger plant (often required before the plant can be financed). It should therefore be clear in most cases whether there will be a product price difference.

The achievable market sale price for the new product produced by the applicant is the reference price.

If the price of the new product and reference is expected to be different, either due to a premium for 'being Green' or a better product, adjustments need to be made. In the LCOP methodology, if a qualitatively different product is sold with a price premium, the cost line should be reduced by this premium when computing the unit cost before comparing it to the reference price.

A new superior product may not initially be able to secure a price premium until the market has fully understood the proven benefits. Therefore, it might be reasonable to assume that a new product starts at the same price as the reference, but is able to obtain a premium in the market after a period of time. For reasons of simplicity, the model does not allow for this level of detail.

There may also be situations where the new product will be sold into more than one market (i.e. supply of hydrogen for transport and heating), with different prices achievable in each market. In these situations, the weighted average reference price should be used.

4.1.2.6. Carbon price and carbon allowance assumptions

The expected revenues from the sale of the free allocation of EU ETS allowances during operation will need to be taken into account in the relevant costs calculation. Furthermore, if the reference price does not include the carbon costs, the applicant needs to include them in the calculation of the revenues in the Reference scenario.

To be conservative in view of the volatility of the carbon price, applicants are advised to use at least a carbon price estimate based on an averaged EU ETS price over the last two years before application (the average price through 2019/20 was 24.81 EUR/t). However, applicants are free to use higher carbon prices if they consider this appropriate, explaining why they have chosen to follow this approach in the application form.

Projects that reduce the GHG emissions compared to the reference scenario will benefit from the revenues from the sale of the free allocation of EU ETS allowances that they have received and do not need to surrender because of the reduced process emissions below the applicable benchmark(s). These additional revenues from the sale of the excess allowances need to be included in the calculating the Operational Benefits. While installations could theoretically hold onto the excess allowances for sale later, for the purposes of calculation, the excess allowances are assumed to be sold in the year received.

4.1.2.7. Project lifetime assumptions

For the purposes of the calculation of the relevant costs using the Levelised Cost methodology, the full project lifetime should be taken into account. Applicants will be required to use a market standard asset lifetime with no terminal value (as stated in section 4.1.3.1 below). This will normally be the same for all the projects in a sector (generally associated with the depreciation period of the assets financed or asset lifetime which is typically 20 – 25 years for renewables but in some cases may extend to 25 or 30 years or longer). For some industrial projects the asset lifetimes might be shorter.

The 10-year horizon forms the basis of the relevant costs calculations, as set out in Article 5 of the Innovation Fund Delegated Regulation, since this covers the *"additional operating costs and benefits arising during 10 years after the entry into operation of the project compared to the result of the same calculation for a conventional production with the same capacity in terms of effective production of the respective final product".*

This period then links to the amount of the Innovation Fund support which can be disbursed (in accordance with paragraph 5 of Article 6) after the financial close, which *"shall be dependent on the avoidance of greenhouse gas emissions verified on the basis of annual reports submitted by the applicant for a period between 3 to 10 years following the entry into operation."*

This means that once the Levelised Cost per unit has been established, the difference between this figure and reference price is calculated and subsequently multiplied by the discounted number of units produced over the project lifetime. This is then adjusted for the contribution of that percentage of OPEX which occurs after 10 years of operations, to the Levelised Cost, in order to make it consistent with the Innovation Fund Delegated Regulation.

4.1.2.8. Indexation/inflation assumptions

Indexation refers to the adjustment of OPEX by inflation over the period of the action. Applicants are allowed to provide their own inflation rate linked to the Member State where the project is planned to operate. Table 4.2 below provides Harmonised Indices of Consumer Prices (HICP) which are designed for international comparisons of consumer price inflation. Due to the variation evident between years, applicants are advised to use an inflation rate averaged over the last two years (i.e. 2019/20).

Table 4.2 Harmonised Indices of Consumer Prices (HICP), Inflation rate - Annual average rate of change for EU27 (%)

	2015	2016	2017	2018	2019	2020
EU (27 countries - from 2020)	0.1	0.2	1.6	1.8	1.4	0.7
Euro area - 19 countries (from 2015)	0.2	0.2	1.5	1.8	1.2	0.3
Belgium	0.6	1.8	2.2	2.3	1.2	0.4
Bulgaria	-1.1	-1.3	1.2	2.6	2.5	1.2
Czechia	0.3	0.6	2.4	2.0	2.6	3.3
Denmark	0.2	0.0	1.1	0.7	0.7	0.3
Germany	0.7	0.4	1.7	1.9	1.4	0.4
Estonia	0.1	0.8	3.7	3.4	2.3	-0.6
Ireland	0.0	-0.2	0.3	0.7	0.9	-0.5
Greece	-1.1	0.0	1.1	0.8	0.5	-1.3
Spain	-0.6	-0.3	2.0	1.7	0.8	-0.3
France	0.1	0.3	1.2	2.1	1.3	0.5
Croatia	-0.3	-0.6	1.3	1.6	0.8	0.0
Italy	0.1	-0.1	1.3	1.2	0.6	-0.1
Cyprus	-1.5	-1.2	0.7	0.8	0.5	-1.1
Latvia	0.2	0.1	2.9	2.6	2.7	0.1
Lithuania	-0.7	0.7	3.7	2.5	2.2	1.1
Luxembourg	0.1	0.0	2.1	2.0	1.6	0.0
Hungary	0.1	0.4	2.4	2.9	3.4	3.4
Malta	1.2	0.9	1.3	1.7	1.5	0.8
Netherlands	0.2	0.1	1.3	1.6	2.7	1.1
Austria	0.8	1.0	2.2	2.1	1.5	1.4
Poland	-0.7	-0.2	1.6	1.2	2.1	3.7
Portugal	0.5	0.6	1.6	1.2	0.3	-0.1
Romania	-0.4	-1.1	1.1	4.1	3.9	2.3
Slovenia	-0.8	-0.2	1.6	1.9	1.7	-0.3
Slovakia	-0.3	-0.5	1.4	2.5	2.8	2.0
Finland	-0.2	0.4	0.8	1.2	1.1	0.4
Sweden	0.7	1.1	1.9	2.0	1.7	0.7

Source: Eurostat[16]

4.1.2.9. Decommissioning assumptions

Where decommissioning costs arise during the first 10-year period, they may be taken into account as part of the relevant costs calculation. Cost estimates will vary by project and therefore need to be accurately accounted for in the calculation.

4.1.2.10. OPEX adjustment

The default adjustment assumes that the relative share of OPEX in total costs is the same in the project and conventional technologies. While this will be a good approximation, the relative share of OPEX may in some cases significantly differ between the project and conventional technologies and introduce an inconsistency in the calculation. In such cases, the applicant should verify the effect of the Present Value of the difference between the total OPEX of the project and the pre-dominant

[16] https://ec.europa.eu/eurostat/databrowser/bookmark/f4a84965-5cdb-4242-9b29-ee2599c57995?lang=en

conventional technology for the remaining lifetime after 10 years of operation. In case of a significant impact on the relevant costs, given a reliable estimate of the OPEX for the pre-dominant conventional technology, a more detailed calculation should be applied for the OPEX adjustment.[17]

4.1.3. Costs which must be excluded from relevant costs calculations

4.1.3.1. Terminal value assumptions

Applicants are advised that terminal value beyond the asset lifetime is not to be taken into account in the relevant costs calculations. The exclusion of terminal value is consistent with project finance practice for calculation of IRR (which is usually done on the useful life of the assets).

4.1.3.2. Write down of existing (old) technologies

It is recognised that some large company applicants may have to replace old technology that is not fully depreciated. The costs associated with any stranded assets that might arise as a result of a project being supported are not allowable under the relevant costs calculations. Therefore, for the purposes of calculating the relevant costs for any calculation methodology, costs associated with the replacement of existing technologies should be excluded.

This approach is necessary not only because it is difficult to incorporate this aspect into the relevant costs methodology, but because it ensures a level playing field with new market players. These would be disadvantaged by not having made previous investments in technology and not being able to claim such a benefit.

4.2. Electricity storage methodology

4.2.1. Principles

Electricity storage technologies can be used in numerous applications or 'use cases' offering different services to different components of the electricity system. Different regulatory treatments, the availability of commercial service requests and technical requirements across Member States determine the applicability of use cases. For example:

- Pumped hydro and underground compressed air energy storage are characterised by relatively slow response times (>10 seconds) and large minimum system sizes (>5 MW). Therefore, they are ill suited to fast-response applications such as primary response and power quality and small-scale consumption applications.
- Flywheels and supercapacitors are characterised by short discharge durations (<1 hour) and are not suitable for applications requiring longer-term power provision.
- Seasonal storage requires power provision for months. This can only be met by technologies where energy storage capacity can be designed to be fully independent of power capacity.

[17] This effect will be amplified where the project has a very different cash flow profile to that of the comparable technology (i.e. a very high CAPEX, low OPEX compared to Very low CAPEX and High OPEX and the reverse), and the project carries a far higher WACC than the conventional technology would bear.

An electricity storage project proposed for support under the IF will envisage a specific 'use case'[18] within the country in which it is implemented. This will in turn determine the nature of the services to be provided and the extent to which these services can be rewarded in that market; it will also affect the reference price of the 'use case'. Therefore, comparison of LCOS with the Reference price will be based on each specific application (use case).

Lazard publishes a LCOS survey each year which examines the different use cases for each type of existing storage application and offers a number of examples for markets around the world[19]. The universe of use cases proposed by Lazard is presented in Figure 4.2:[20]

Figure 4.2 Summary of Energy Storage Use Cases

			Use Cases					
		Description	Wholesale	Transmission & Distribution	Wholesale (PV + S)	Commercial (Standalone)	Commercial (PV + S)	Residential (PV + S)
Wholesale	Demand Response—Wholesale	• Manages high wholesale price or emergency conditions on the grid by calling on users to reduce or shift electricity demand				✓	✓	✓
Wholesale	Energy Arbitrage	• Storage of inexpensive electricity to sell later at higher prices (only evaluated in the context of a wholesale market)	✓	✓	✓			
Wholesale	Frequency Regulation	• Provides immediate (four-second) power to maintain generation-load balance and prevent frequency fluctuations	✓	✓	✓	✓	✓	
Wholesale	Resource Adequacy	• Provides capacity to meet generation requirements at peak loading	✓	✓	✓	✓	✓	
Wholesale	Spinning/ Non-Spinning Reserves	• Maintains electricity output during unexpected contingency events (e.g., outages) immediately (spinning reserve) or within a short period of time (non-spinning reserve)	✓	✓	✓	✓	✓	
Utility	Distribution Deferral	• Provides extra capacity to meet projected load growth for the purpose of delaying, reducing or avoiding distribution system investment		✓				
Utility	Transmission Deferral	• Provides extra capacity to meet projected load growth for the purpose of delaying, reducing or avoiding transmission system investment		✓				
Utility	Demand Response—Utility	• Manages high wholesale price or emergency conditions on the grid by calling on users to reduce or shift electricity demand				✓	✓	✓
Customer	Bill Management	• Allows reduction of demand charge using battery discharge and the daily storage of electricity for use when time of use rates are highest				✓	✓	✓
Customer	Backup Power	• Provides backup power for use by Residential and Commercial customers during grid outages				✓	✓	✓

Source: *Lazard (2020)*

The LCOS electricity storage methodology has been specifically developed for standalone storage facilities providing specialist services of storage only. It can take account of the different types of business cases for electricity storage: multiple services can be entered, based on revenue 'stackability', thereby avoiding any limitations in the relevant costs calculations and creating a more realistic assessment.

If an energy-intensive industry project incorporates storage technology which provides, for example, some heat and electricity to the project, it will represent an increased CAPEX but will reduce the OPEX (energy costs) of that project calculation. Consequently, applicants for such a project should use the LCOP approach and should deduct from OPEX any savings in Operational Costs caused by the storage device. If

[18] A use case refers to the group of services that the particular energy storage installation in a particular country sets out to fund in their IF application.

[19] Most recently, Lazard's Levelised Cost of Storage Analysis – Version 6.0 (2020). Available at: https://www.lazard.com/media/451566/lazards-levelized-cost-of-storage-version-60-vf2.pdf [Accessed 18 March 2021]

[20] Note that these use cases are specific to the Lazard LCOS analysis. The use case of the applicant will be specific to its installation.

the project is designed to also operate electricity services then it should be regarded as a discrete project and will follow the LCOS methodology.

4.2.2. Detailed approach

4.2.2.1. LCOS Methodology

The LCOS methodology is unique to electricity storage and follows a similar methodology to that applied in the product based LCOE/LCOP approaches. However, because electricity storage technologies can be used in numerous applications covering the entire electricity supply chain, it is applied differently and therefore forms a unique relevant costs approach in its own right.

Revenue streams from different technologies and applications vary enormously according to the following factors:

1. Time to dispatch (which will determine the service it can provide);
2. Where the storage is located (i.e. front-of-meter (FTM) or behind-the-meter (BTM)[21];
3. Whether (in the case of FTM) it is serving the wholesale market, it is embedded in the transmission operations addressing local network constraints or a combination of the two which may allow revenue stacking; and,
4. The extent to which the jurisdiction in which it is implemented rewards (or has a market to reward) the specific service that it provides.

The LCOS methodology computes the discounted cost per unit of discharged electricity for a specific storage technology application over the lifetime of the project. It includes all capital and ongoing costs affecting the lifetime cost of discharging stored electricity in order to derive the LCOS of the project.

For calculation purposes, the LCOS can be described as the total discounted lifetime cost of the investment net of potential Operational Benefits in an electricity storage technology divided by its discounted cumulative delivered electricity, including financing costs (as per the LCOE/LCOP approach). Note that since terminal costs are not covered by the IF, the end-of-life cost has been excluded (Figure 4.3).

Figure 4.3 IF Relevant Cost LCOS equation

$$LCOS\left[\frac{€}{MWh}\right]=\frac{CAPEX+\sum_{n}^{N}\frac{O\&Mcost}{(1+r)^{n}}+\sum_{n}^{N}\frac{Chargingcost}{(1+r)^{n}}}{\sum_{n}^{N}\frac{Elec_{Discharged}}{(1+r)^{n}}}$$

Where:

- CAPEX = capital expenditure
- O&M = Operations & Maintenance (net of Operational Benefits)

[21] BTM storage installation typically refers to storage connected behind the meter of commercial, industrial or residential consumers, whereas FTM storage is connected to the distribution or transmission network or in conjunction with generation. For the avoidance of doubt, FTM are also metered for utilisation and settlement purposes. However, there are some network specific services (not provided by storage) that are truly not metered (for example, tap stagger).

- r = discount rate (WACC)
- n = the year
- N = project lifetime

It is important for applicants to note that the calculation is different both for each use case and for each market.[22] The revenues for each use case differ from country to country, as do the O&M costs for each use case. In calculating their relevant costs, applicants should reflect these differences for their specific installation in their specific regulatory environment.

4.2.2.2. Determining the Reference price

Applicants should also be aware that unlike, for example, the LCOE model for renewable power, the reference price in this electricity storage model is **not** a single external market price. The 'market price' is derived by using the prices for each service achievable in the particular market to determine a price for the unique set of services offered, and calculating a per discharged MWh reference price This includes both utilization and availability income. This derived referenceprice is compared to the LCOS of the innovative technology. The actual or expected market price for specific services related to storage is used (either as published by the Regulator or as realised auction prices).

4.2.2.3. Determination of the WACC

As for LCOE, the determination of WACC is an important component of calculation when determining the LCOS. The WACC for the reference price and for the LCOS should be the same. The leverage should be the actual expected or target leverage of the project. The same leverage should be used for the LCOS and reference price calculation.

A standard debt margin for a project such as this should be employed. The default for all electricity storage applications to use is a debt margin of swap rate plus a margin of 450 bps (which is approximately the margin associated with higher risk, but proven technologies in the renewables market). Applicants are free to deviate from this suggested debt margin if well justified.

Equity cost of capital will vary from technology to technology, country to country, by currency and must be justified by the applicant based on a relevant reference, publicly-available date or recent funding round. It is expected that equity cost of capital for electricity storage projects will be in the range of 8-15%, although it could fall out of this range in unique circumstances and Member States. Applicants have to justify any deviation from the default values and to calculate the impact on the relevant costs.

The tax rate will be the tax rate of the country in question (required for the calculation of the cost of debt in the WACC calculation for the Levelised Cost and Reference Price calculation).

4.2.2.4. Calculating the relevant costs

Step 1: Definition of use case

The use case should be justified based on the best estimated revenue streams for the project, i.e. should be based on their best forecast of achievable revenues for each service (based on bid pricing, observed pricing, or regulatory pricing and for both utilization and availability revenue streams). Where a specific use case is envisaged,

[22] Use case refers to the combination of services that a single installation might use in a particular market. For example, a 'wholesale' use case might include frequency response, capacity, and demand response.

but the associated revenue stream is uncertain and there is no market data whatsoever, this service may be excluded from the inputs.

Step 2: Calculate LCOS for that specific use case
As per the LCOE calculation, and following the formula shown in Figure 4.3 above, the LCOS calculation will include:

- CAPEX (the same rules in options 1a and 1b apply);
- OPEX net of Operational Benefits (the same rules in options 1a and 1b apply with O&M costs and fixed charging costs as main parameters);
- the LCOS calculation would also contain certain storage specific elements in the calculations:
  - discharges per annum
  - depth of discharge
  - storage efficiency
  - project lifetime

Step 3: Determine reference price based on best estimate of projected market revenues
The reference price will only assume revenue derived from the use cases (revenue streams / sales per service or 'product' in the revenue stack). . This reference price is calculated by dividing the current annual aggregate sales (e.g. for services such as flexibility, voltage optimization, arbitrage etc.) by the energy discharged in one year to get current per MWH discharged price.

Step 4: Calculate the difference between the LCOS and reference price
This will be the difference between the LCOS and the reference price based on the services provided by this specific installation in its specific market (applicants should refer to the worked example in the Guidance for further information).

Step 5: Multiply this by the discounted MWh discharged over the project lifetime

Step 6: Calculate the percentage of the Discounted Costs that the discounted OPEX after 10 years of operation represents

Step 7: Subtract this percentage from 100% and multiply with the total in Step 5
This will be the Relevant Cost.

4.3. Reference plant methodology

4.3.1. Principles

The reference plant methodology – designed to be used only when a reference unit cost or product price is not available – will not apply in many cases. It therefore represents a fall-back option when the Levelised cost methodology (Option 1) does not work.

Examples of situations where the reference plant methodology may be preferable to a product-based approach include processes that either generate intermediate or multiple products, whose market prices cannot be easily established, or are limited to trade/are traded below their face value, or prices are uncertain, or where neither market prices nor substitute products exist and internal cost data deliver more reliable results.

The Reference Plant model assumes an installation that emits the emissions at exactly the level of the applicable benchmark value (the 'benchmark setter'). This installation will therefore have zero costs under the EU ETS, because the emissions for which it has to surrender the corresponding allowances are equal to the amount of free allowances it receives under the EU ETS.

Further rules that applicants should adhere to in their choice of Reference plant are shown in the box below.

Applicants should follow the following rules when considering Reference Plants:
1/ Establish the type of Reference Plant to be used for industrial products
The Reference Plant should be defined by the product produced, not the sector.
2/ Choose the type and location of the Reference Plant
The Reference Plant should be the most widely deployed process in the EU or, if required, globally for producing a given product, i.e. that is the best in class for each sector and sets the standard. In the first instance it shall always be the benchmark plant under the EU ETS if such a plant exists. This means that applicants should choose their Reference Plant in the first instance from the Member State where the project is to be located, or else a European installation or, if that does not exist, then internationally. A strong justification will be required for the use of a different plant.

The methodology is based on a formula that examines the difference in CAPEX and the difference in the Net Present Value (NPV) of the Operational Costs (OPEX) net of Revenues and Operational Benefits over a 10-year period for both the project and the Reference Plant:

$$Relevant costs = (IF\ project\ CAPEX - Reference\ Plant\ \ CAPEX) \\ + (NPV\ of\ IF\ project\ OPEX - NPV\ of\ Reference\ Plant\ OPEX) \\ -(NPV\ of\ IF\ project\ Operational\ Benefits - NPV\ of\ Reference\ Plant\ Operational\ Benefits)$$

See Glossary in Appendix 1 for a definition of Operational Benefits and Revenues.

In the calculation of the NPV, the level of the applied WACC will be different for the project and for the Reference Plant (see section 4.3.2.1 below for more details).[23]

4.3.2. Detailed approach

In the reference plant model, applicants need to be fully aware of the following key assumptions both for the project and the Reference Plant in order to enable a robust calculation of relevant costs for their project:

- WACC (discount rate);
- tax rate;
- Revenues[24];
- Operational Costs (OPEX);
- Operational Benefits (such as carbon price and carbon allowances); and,
- Indexation/inflation.

[23] Subject to the maximum differences between project and reference scenario, as explained further below.

[24] Product price will be assumed to include Carbon Costs

4.3.2.1. Calculating the WACC

The discount rate to be used for the calculation of the NPV will follow the WACC approach, as set out more fully in Option 1 (see section 4.1.2.3). However, there are key differences in the WACC for the Reference Plant and the project plant.

i) Cost of equity for project plant

The WACC calculation for the project plant shall follow the guidelines set out in section 4.1.2.3.

ii) Cost of equity for Reference Plant

The Reference Plant WACC will follow the guidelines set out in in section 4.1.2.3 with the following differences:

- For renewables projects, the cost of equity shall follow the methodology set out in section 4.1.2.3, but the cost of equity shall be assumed to be (for the purposes of calculation) 2% lower than that for offshore wind[25] (which is used as a baseline cost of equity comparator in Table 4.1, presented previously).
- For energy-intensive industrial projects, the cost of equity shall be limited to the level assumed for company WACC or the sector average.

iii) Cost of debt

- For the project plant: applicants can assume a margin for risk above the base rate[26] as they would be quoted for project finance by a commercial lender (project finance bank). If a reference is not available for the particular technology, a premium over an established technology debt margin can be used.
- For the Reference Plant: applicants should make a uniform assumption of 2% above the base rate.

iv) Leverage

- For the project plant: applicants must use whatever achievable debt equity ratio they expect for their plant. In certain cases, for example for higher risk propositions, the new plant might only be able to secure 100% equity.
- For the Reference Plant: applicants must assume a uniform debt-to-equity ratio of 70:30.

4.3.2.2. Tax rate

As shown in section 4.1.1, an important aspect of the WACC formula is the determination of the tax rate prevailing in the country of project demonstration.

4.3.2.3. Revenues

This covers all sources of revenue into the project plant and Reference Plant.

Applicants should also review the rules on how to account for public support – see section 3.3.3.

[25] In the Cost of Equity tables presented under Option 1, Offshore Wind is used as a benchmark cost of equity for the calculations. It is assumed that mature technologies will have a cost of equity which is 2% lower than for offshore wind. This is an assumption for calculation purposes, but is deemed robust based on observations of transactions in the period 2015-2020.

[26] Base rate will be the risk-free rate: from the ten-year government bond yield of the country of the project

4.3.2.4. Operational Costs (OPEX)

This covers all Operational Costs (both fixed and variable) over the first ten years of the project and the Reference Plant.

4.3.2.5. Operational Benefits

Sales of excess EU ETS allowances are to be considered as an Operational Benefit, leading to a reduction in relevant costs. The treatment of the EU ETS allowances income calculation will be the same as for the LCOP methodology, and applicants should refer to section 4.1.2.6 above for the correct approach.

4.3.2.6. Indexation/inflation

Applicants should follow section 4.1.2.8.

4.4. Calculations in the absence of a reference product or conventional technology

4.4.1. Principles

As noted in Section 1, the Innovation Fund Delegated Regulation creates an exception to the use of a reference scenario where conventional production does not exist. This "last-resort" option will apply to very few projects because in most cases it will be possible to identify a reference product or plant based on a conventional technology. In such circumstances, Article 5(1) states that:

> *"the relevant costs shall be the best estimate of the total capital expenditure and the net present value of operating costs and benefits arising during 10 years after the entry into operation of the project."*

Such projects can therefore use a much simpler relevant cost calculation methodology:

Relevant cost = CAPEX + NPV of OPEX – NPV of Operational Benefits

The applicant must justify in detail why it was not possible to apply another methodology.

4.4.2. Detailed approach

This methodology derives the relevant costs based on the best estimate of the total capital expenditure and the NPV of Revenues, Operational Costs (OPEX) and Operational Benefits arising over the first ten years of operation.

It mimics the reference plant model approach (Option 2), however applicants do not include the Reference plant data.

Under this methodology, the following rules need to be adhered to:

1. Any applicant choosing this methodology cannot use the other methodologies.

2. The discount rate to be used for the calculation of the NPV will follow the WACC approach, set out more fully in Option 1 (see section 4.1.2.3).

3. The approach taken for CAPEX is that it is committed (price wise) in its entirety on day one and therefore does not need to be discounted.

4. Any CAPEX and OPEX must be strictly related to and necessary for the innovative aspects as identified in the award criterion on degree of innovation. CAPEX and OPEX should not be included if they were related to other activities based on conventional technology and unnecessary for carrying out the identified innovative aspects. CAPEX and OPEX related to replacement investments and deployment of conventional technologies are not to be included in the calculation.

5. Any additional revenues due to the project, are to be included in the calculation. Any applicant needs to justify in detail the scope of the included revenues and costs.

6. As with other methodologies, close attention is required for the treatment of carbon costs and benefits. These must be included as per the rules referred to earlier in this document (see section 4.1.2.6). Specifically, any revenues from the sale of excess allowances must be included in the calculation.

7. Finally, regarding the write down of existing (old) technologies, as with other methodologies, the costs associated with any stranded assets that might arise as a result of a project being supported are not allowable under the relevant costs calculations.

Appendix 1– Glossary

Terms specific to Annex B are included in the present Glossary.

Term	Meaning
Capital Expenditure (CAPEX)	The following costs incurred or to be incurred in connection with the development and construction of the project (without double counting): (a) Construction costs (b) Site infrastructure costs (c) Development costs (d) Intangible assets *(For each area of capital expenditure, please see individual term definitions for their full meanings)*
Construction costs	All costs and expenses incurred in connection with design, engineering, procurement, construction, commissioning and testing of the project: (i) costs of employee benefits arising directly from the construction or the acquisition of the item of property, plant and equipment; (ii) costs of site preparation; (iii) initial delivery and handling costs; (iv) installation and assembly costs; (v) costs of testing whether the asset is functioning properly, after deducting the net proceeds from selling any items produced while bringing the asset to that location and condition; (vi) professional fees and fees for environmental permits; (vii) certifications expenses for necessary repairs during the construction phase; (viii) expenses for removing hurdles on the site (e.g. demolition of old building).
Development costs	All costs and expenditures incurred that are specifically required for the development activities of the project: (i) permitting and environmental assessment; (ii) planning, design, engineering, start-up and testing; (iii) legal, insurance and other advisors; (iv) personnel costs. However, applicants should exclude any costs or expenses incurred including personnel costs which do not demonstrate a direct link with the project's development, training expenses, VAT, advertising and marketing expenses (e.g. for introduction of new product or service), insurance premiums and costs linked to any corporate reorganization including establishment of new entities.
Discounted Costs	The sum of CAPEX (undiscounted) and the Net Present Value ("NPV") of the future stream of OPEX (net of any

	Operational Benefits) discounted over full the project lifetime using the WACC as discount factor.
Financial Close	The moment in the project development cycle where all the project and financing agreements have been signed and all the required conditions contained in them have been met.
Financial Model Summary Sheet	As part of Application Form B, applicants must complete a standardized financial information sheet, available to download from the Funding and Tenders Portal[27], with the output of their own financial model including a summary overview of the cash flow projections from revenues and costs, down to free cash flows, as well as key elements of the P&L and balance sheet. The projections should be consistent with ones those used in the calculation of relevant costs. For guidance on modelling practice, applicants can download from the Portal a fully developed financial model example (optional, for information only).
Intangible assets	These include licensing of patents and intellectual property (IP) from a third party by the project developer in order to introduce innovation into Member State for demonstration. The acquisition of IP for the purposes of use can be capitalized and is allowable under the following conditions: (i) the transaction must be justified (it must be necessary to purchase it outright and licensing must not be an option). The price of acquisition must be justified given the level of development of the IP and both the reason for acquisition and the price should be verified by an independent expert. (ii) under no conditions can a sale of IP be executed to a project entity supported by IF in order for one of the project sponsors to make a profit.
Levelised Costs	The project's Discounted Costs divided by the total discounted units produced over the full project lifetime using the WACC as discount factor.
Operational Benefits	Any revenue received by the project from the sale of EU ETS allowances for reductions in CO_2 emissions, preferential tariffs or feed-in premia, or other regulatory support programmes.
Operational Costs (OPEX)	Should include all Operations and Maintenance (O&M), and include any feedstock costs such as fuel usage, where applicable. Replacement costs are also considered in the relevant costs methodologies and are

[27] https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/home

	eligible O&M costs. O&M costs are the best estimate of operational costs arising due to the application of the project during the first ten years of operation. Decommissioning costs for demonstration projects, including electricity storage, will be acceptable if they occur in the first ten years.
Revenues	All sources of revenues generated by the project, excluding operational benefits and external benefits outside the project boundary.
Reference Plant	An installation which reflects the current state-of-the-art in the sector of the project and for industrial products the plant which achieves the EU ETS benchmarks.
Reference scenario	One of the scenarios referred to in the Decision tree in Figure 1.3.
Site infrastructure costs	The following can be included: (i) the purchase of land; and (ii) expenses incurred to maintain authorisation (e.g. licence, filing, notarisation or registration). However, land lease costs should be excluded.

Appendix 2 – Support with WACC calculations

1. Reference market betas for industrial project cost of equity calculation

European Market Sector Betas		
Industry Name	**Number of firms**	**Beta**
Beverage (Alcoholic)	51	0,60
Beverage (Soft)	16	0,61
Building Materials	86	1,01
Chemical (Basic)	53	0,92
Chemical (Diversified)	7	1,79
Chemical (Specialty)	95	1,22
Coal & Related Energy	16	1,10
Construction Supplies	111	1,20
Diversified	65	1,28
Drugs (Biotechnology)	202	1,46
Drugs (Pharmaceutical)	116	1,15
Electrical Equipment	131	1,34
Electronics (Consumer & Office)	17	1,36
Electronics (General)	160	1,29
Engineering/Construction	139	1,13
Environmental & Waste Services	49	0,97
Food Processing	144	0,71
Green & Renewable Energy	48	0,92
Healthcare Products	183	1,23
Household Products	72	0,86
Machinery	214	1,31
Metals & Mining	101	1,28
Oil/Gas (Integrated)	14	1,27
Oil/Gas (Production and Exploration)	110	1,55
Oil/Gas Distribution	27	1,28
Packaging & Container	51	1,11
Paper/Forest Products	36	1,07
Power	71	0,86
Precious Metals	59	1,13

Publishing & Newspapers	89	0,81
Rubber & Tyres	8	1,26
Semiconductor	34	1,87
Semiconductor Equipment	19	2,08
Shoe	8	2,01
Steel	55	1,39
Utility (General)	21	0,68
Utility (Water)	10	0,49

Source: Damadoran Columbia University 2020

2. Equity risk premium by country

Equity Risk premium by country	
Country	**Total Equity Risk Premium**
Croatia	8,16%
Czech Republic	5,80%
Estonia	5,89%
Hungary	7,37%
Latvia	6,38%
Lithuania	6,38%
Poland	6,04%
Romania	7,37%
Serbia	8,75%
Slovakia	6,04%
Slovenia	6,77%
Austria	5,59%
Belgium	5,80%
Cyprus	8,16%
Denmark	5,20%
Finland	5,59%
France	5,69%
Germany	5,20%
Greece	9,64%
Iceland	6,04%
Ireland	6,04%

Italy	7,37%
Luxembourg	5,20%
Malta	6,04%
Netherlands	5,20%
Norway	5,20%
Portugal	7,37%
Spain	6,77%
Sweden	5,20%
Switzerland	5,20%

Source: Damadoran 2020

3. Innovation premium benchmarks for cost of equity calculations

The Innovation premium is based on observed Small Cap equity risk premia observed in three studies:

1. Small Cap Equity premia across three studies

Company size	Premium
Large companies USD 3,322m <	0.00%
Mid-cap companies USD 774m-USD 3,321m	+1.04%
Low-cap companies USD 202m-USD 773m	+1.75%
Micro-cap USD 201m <	+3.47%

Source: Ibbotson Associates 2015

Company size	Premium
Market cap USD 1,400m <	0.00%
Market cap USD 845m-USD 1,400m	+1.6%
Market cap USD 449m-USD 844m	+2.0%
Market cap USD 210m-USD 448m	+2.5%
Market cap USD 109m-USD 209m	+4.0%

Source: Duff & Phelps 2016 Valuation Handbook

Company size	Premium
Market cap USD 1,001m <	0.0%
Market cap USD 501m-USD 1,000m	0.0%
Market cap USD 251m-USD 500m	0.9%

Company size	Premium
Market cap USD 101m-USD 250m	+1.4%
Market cap USD 51m-USD 100m	+3%
Market cap USD 50m <	+5%

Source: KPMG (Australia) study 2017 on Small Cap premia