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Methodology for Calculation of relevant costs

First Call for proposals under the Innovation Fund

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TURQUOISE Finance | Energy, Environment, Efficiency

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Agenda

Main principles | Basis of methodologies and cross-cutting assumptions	14:20h – 14:30h
Relevant costs methodologies | Second stage calculations including how stakeholder feedback used	14:30h – 14:50h

Organisation of the methodology

- Low-carbon projects in energy-intensive industries, including biorefineries, substitute products and carbon capture and utilisation (CCU);
- Carbon capture and geological storage (CCS);
- Renewable energy (RES) projects, including production facilities
- Energy storage projects, including production facilities

- Application and scope
- Choice of relevant cost methodology using the decision tree
- Principles and methodologies
- Worked examples

Application of the methodology

Scope of relevant costs

- The **additional costs borne by applicants as a result of the application of the innovative technology related to GHG emission avoidance**
- Covers difference in total CAPEX and OPEX difference for 10 years
- Compared to reference products and their current prices in the market or, more rarely, to a reference production plant
- In exceptional circumstances there will be no reference scenario to compare with

Use of relevant costs

- To **support applicant to quantify the maximum allowable grant award from the IF over the first 10 years of operation**
  - Maximum grant is equivalent to 60% of total relevant costs
- To **form basis of scoring for the "Cost efficiency criterion"**
  - Applicants that choose not to apply for the maximum grant will be more competitive in their sector when ranked against other applicants in 'cost per unit performance' metric

Principles covering methodology choice

Levelised Cost methodology (Option 1)

- **The default for applicants** - based on a reference unit costs / product methodology
- **Suitable for a wide variety of most projects using different variants**
  - Energy/electricity generation (Option 1a)
  - Product manufacture from energy intensive industries (Option 1b)
  - Manufacture of innovative renewable or storage technology components from a new production facility (Option 1b)
  - Electricity storage (Option 1c)

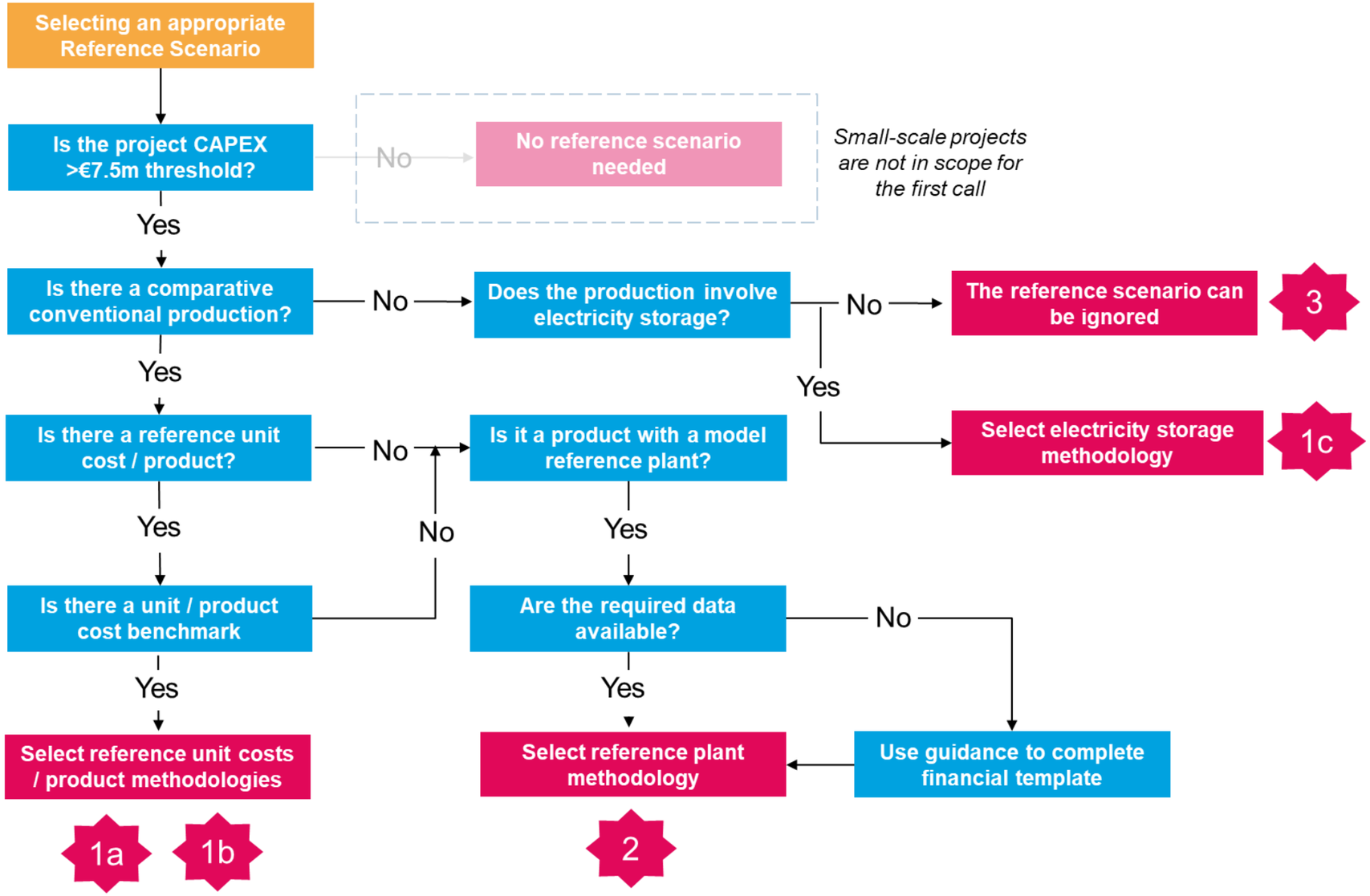
Reference plant methodology (Option 2)

- **To be used in limited situations only**, i.e. when a reference unit price is not available
- Project costs are 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)

“Last resort” methodology (Option 3)

- Where a reference product or conventional production technology is absent
- Relies on a methodology where the reference scenario can be ignored

Decision tree helps applicants to select the right calculation methodology



Only one relevant cost methodology may be used by applicants

1a 1b 1c

Refer to Levelised Cost Models:

- ❑ *Energy - 1a (LCOE)*
- ❑ *Products - 1b (LCOP)*
- ❑ *Electricity storage - 1c (LCOS)*

Main principles across all methodologies (1)

Reference scenarios

Calculations of relevant costs (like GHG emission avoidance) rely on a comparison to reference scenarios which **should reflect current state-of-the-art in the different sectors**:

	Reference scenarios for GHG emissions
Energy intensive industry, incl. CCU; CCS	EU ETS benchmark(s)
Renewable electricity	Expected 2030 electricity mix
Renewable heat	Natural gas (NG) boiler
Energy storage	Single-cycle NG turbine (peaking power)

To be consistent with GHG emission avoidance calculations, **calculation of relevant costs should build on the same reference scenarios and their respective costs**.

Main principles across all methodologies (2)

EU ETS allowances

1. Expected revenues from sale of free allocation of EU ETS allowances during operation (brought about by process reductions) **need to be taken into account in the calculation of relevant costs**.

2. If the product price or unit cost does not yet include carbon costs, the applicant needs to **include the carbon costs in the calculation** (by reducing the OPEX in the LCO model).

3. Carbon prices will have to be **at least as high as the average of the last two years**.

The overall **impact of failing to make this adjustment will inflate relevant costs**.

Main principles across all methodologies (3)

Public support

Does figure in the relevant cost calculation

- Public support **related to the price or quantity sold of the final product** (e.g. a feed-in tariff for renewable generation offered by a Member State) and **equally applicable and accessible to all market participants and is known to be certain** (i.e. not conditional on any outstanding application or competition) at the time of application
- Where support is certain then applicant should either:
  - Reduce OPEX in the Levelised Cost methodology; or,
  - Define this as an Operational benefit in the Reference plant model.

Doesn't figure in the relevant cost calculation

- Public support **related to support capital or OPEX of the project itself** (i.e. that which is conditional or uncertain and not known at time of application and is unique to the project).
- However, such public support needs to be counted as "other contributions" in the meaning of Article 11(1)(e) of the IF Regulation when calculating the cost efficiency criterion.

Focus on each relevant cost methodology

Levelised Cost methodologies

Key principles

- Levelised unit cost is the cost of producing a unit of production, including financing costs, over the lifetime of a project → akin to a fair price of innovative unit produced
- Existence of a reference product with reliable product price is fundamental
- Substitute products will apply the same approach

Sectoral application

- Energy/electricity generation (Option 1a)
- Product manufacture from energy intensive industries (Option 1b)
- Manufacture of innovative components from a new production facility (Option 1b)
- Electricity storage (Option 1c)

Levelised Cost methodology – LCOE (Option 1a)

Key principles

- Applies Levelised Cost of Energy (LCOE) approach in reverse
- Generates per unit production cost compared to reference product costs → relevant costs
- Mimics long-term forward pricing forecasts used for project funding

Reference

- Reference price is the long-term market price for either power or heat

Approach

- LCOE = [present value of the costs over the lifetime]/discounted number energy units produced (MWh) over the lifetime

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

Where:

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

NB: no fuel cost in most renewables projects

Levelised Cost methodology – LCOP (Option 1b)

Key principles

- Use a similar approach to the LCOE approach
- Calculates fixed nominal unit price (over 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) including its cost of funding.

Reference

- Reliant on standardised market price benchmarks for reference products

Approach

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

Where:
r = discount rate (WACC)
n = the year
N = lifetime

Correction for 10-years OPEX to be applied in separate step

Weighted Average Cost of Capital (WACC)

Key principles

- WACC is applied to discount future income and cost streams over the project lifetime to make them comparable
- Applicants should use default values for WACC, including costs of equity and debt.
- Applicants will have to:
  - justify higher values in relation to increased risks
  - quantify the impact of these values on relevant costs

Approach

$$WACC = E/V * Re + D/V*Rd * (1-Td)$$

Re = total cost of equity
Rd = total cost of debt
E/V = equity portion of total financing (Equity over total Value)
D/V = debt portion of total financing (Debt over total Value)
Td = Tax rate

WACC continued….

RES project

- **Cost of equity:** equity return expectations typically in **8-16% range**
- **Cost of debt:** default range of **150 to 650 basis points over base rate**, or else use the credit spread of BBB- to C

Industry project

- **Default WACC** for most projects:
  - **Company discount rate (WACC)** to be used, tailored to sector and country of project
  - Applicants should use Reference Market Betas and Equity Risk premia by country
- **Sector WACC** used for SME, SPV or Innovative manufacturing facilities

OPEX adjustment to the Levelised Costs

Rationale

- Levelised cost calculation assumes the relative share of OPEX and CAPEX in total levelized cost is equal between the project and conventional technology.
- However, sometimes this share may significantly differ, introducing an inconsistency in the calculation.

Approach

- In such cases, the applicant should verify the effect of the NPV of the difference between the OPEX of the project and of the pre-dominant 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.

LCOP – Hypothetical project example

Industrial facility producing a substitute ceramic product with lower emission process

Objective: Calculate discounted cost per unit of production using Levelised Cost of Product

- **Step 1:** Establish the Capex an the OPEX of the project
- Key inputs which applicants need to consider include:
  - Upfront costs of construction (CAPEX);
  - Fixed OPEX & Variable OPEX for the full project lifetime
  - Production (number of units produced by project)
  - Indexation
  - Carbon allowances sold (based on 25% emissions reduction, with revenues reducing OPEX. Overall impact is to reduce relevant cost by 4%)
  - Public support (not applicable in this example)
- **Step 2:** Reduce the OPEX by any additional operational benefits (such as EU ETS Allowance sales or preferential electricity tariffs)

LCOP hypothetical project - Key inputs (1)

Key inputs			
	Capacity	100,000	**tpa**
	Reference product price	100.0	**EUR/ton**
	Premium/(reduction) to reference	0.0	**EUR/ton**
	Date of financial close	31-Dec-20	
	Construction cost	25,000	**EURk**
	Construction duration	1	**years**
	Project lifetime	20	**years**
		Construction	**Year 1**
	Production ramp up	0.00%	100.00%
	Indexation	2.00%	

LCOP hypothetical project - Key inputs (2)

Key inputs

Benefits		
other state aid received towards construction costs	0	EURk
state aid subsidies received annually	0.00	EUR/ton
carbon allowances sold	2,660	Tons/year
carbon price	25	EUR/ton
Operating costs - variable		
O&M and other variable costs	10	EUR/ton
feedstock	50	EUR/ton
total	60	EUR/ton
Operating costs - fixed		
fixed opex	1,500	EURk/year
Operating costs - total	7,500	EURk/year
Lifecycle		
occasional lifecycle costs	0	EUR/ton
lifecycle cost frequency - once every…	10	years

LCOP hypothetical project – use of WACC

- **Step 3:** Determine the number of units forecast to be produced by the project
- **Step 4:** Discount the OPEX and units produced over the project lifetime using the WACC (see table)
- **Step 5:** Divide the CAPEX plus NPV of the OPEX by the discounted Units produced over the project lifetime

WACC calculation	
Cost of equity	14.0%
Cost of debt	4.0%
Equity percentage	40.0%
Debt percentage	60.0%
Corporation tax rate	28.0%
WACC	**7.33%**

**Done in order to reflect a flat nominal price of production for the term of the plant operation as per Levelised Cost calculation norms*

LCOP hypothetical project – cost difference

- **Step 6:** Establish the difference between the:

  a) Reference product price (100 EUR/ton); and

  b) Levelised cost calculated for new product (115.88 EUR/ton)

  = **15.88 EUR/ton**

Discount rate	7.33%	
Discounted costs	111,527	
Production discounted	962,398	
Discounted cost per ton	115.88	EUR/ton
Comparable unit cost	100	EUR/ton
Difference	15.88	EUR

LCOP hypothetical project – relevant cost

- **Step 7:** Calculate percentage representing the contribution of the new plant OPEX beyond 10 years to the LCOP
- **Step 8:** Multiply difference by 1-OPEX % past 10 years
- **Step 9:** Multiply the above by the discounted number of units produced over lifetime to derive **relevant cost = EUR 10.8m**
- **Step 10:** Apply IF's 60% maximum intervention rate to relevant cost to derive project's **maximum grant award level = EUR 6.5m**

Subtract OPEX percentage after 10 years		
End date	31 Dec 31	
Opex beyond 10 years NPV	32,510	EURk
Percentage of discounted costs	29.15%	
Cost gap	11.25	EUR/ton
Lifetime discounted production	962,398	tons
Relevant Cost	**10,831**	EURk
Maximum IF grant	**6,499**	EURk

Levelised Cost methodology – LCOS (Option 1c)

Key principles

- Follows similar methodology to that applied in the product-based LCOE/LCOP approaches
- Quantifies the discounted cost per unit of discharged electricity for a specific storage technology and application over the first 10 years of the project.
- Accounts for all capital and ongoing costs affecting the lifetime cost of discharging stored electricity in order to derive the relevant costs of the project

Reference

- ‘Market price’ derived by using current market prices and achievable volume for each service in the particular Member State market

Approach

$$LCOS\left[\frac{€}{MWh}\right] = \frac{Investment\ cost + \sum_n^N \frac{O\&M\ cost}{(1+r)^n} + \sum_n^N \frac{Charging\ cost}{(1+r)^n}}{\sum_n^N \frac{Elec_{Discharged}}{(1+r)^n}}$$

Where:

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

Correction for 10-years OPEX to be applied in separate step

LCOS – Hypothetical project example

- **Step 1:** **Definition of use case:** use case should be justified based on best estimated revenue streams for the project. It contains certain storage specific elements in the calculations: Depth of discharge, Storage efficiency, O&M, Discharges per annum, Project lifetime.

- **Each service under the use case will have a different line of both Revenue and OPEX**

	Revenue (EURk/yr)	O&M (EURk/yr)
➢ 1 (Availability)	1000	100
➢ 2 (Frequency response)	2000	700
➢ 3 (Arbitrage)	450	100
➢ 4 (Voltage Control)	500	100

- **Step 2:** Calculate LCOS for that specific technology with a specific use case using CAPEX (here EUR 50m) and OPEX, and discount this with the WACC (EUR 2.61 p/kWh discharged)

LCOS – Hypothetical project example (2)

- **Step 3:** Determine the use case reference price of discharge (LCOS) based on best estimate market revenue: **1.20 EUR per kWh discharged**
- **Step 4:** Calculate difference between the two LCOS figures: **1.41 EUR per kWh discharged**
- **Step 5:** Multiple by electricity units discharged over the project lifetime: **EUR 39.64m**
- **Step 6:** Adjust by the OPEX after 10 years % of Levelised Cost i.e. 8*(1-12%)
- **Step 7:** Subtract this percentage from the total in Step 5 to derive **relevant cost = EUR 34.75m**
- **Step 8:** Apply IF's 60% maximum intervention rate to derive **maximum grant = EUR 20.85m**

Reference plant methodology

Key principles

- **Designed for rare situations where reference unit cost or product price not available**
- Examines the difference in CAPEX and the difference in the Net Present Value (NPV) of the operational costs (OPEX) and operational benefits over a 10-year period for both the project and the reference plant.

Approach

$$
\begin{aligned}
&Relevant\ costs \\
&= (IF\ project\ investment\ cost - Reference\ Plant\ investment\ cost) \\
&+ (NPV\ of\ IF\ project\ operational\ costs - NPV\ of\ Reference\ Plant\ operational\ costs) \\
&- (NPV\ of\ IF\ project\ operational\ benefits - NVP\ of\ Reference\ Plant\ operational\ benefits
\end{aligned}
$$

NB: level of applied WACC will differ for project and reference plant and follows LCO methodology protocols

Reference plant methodology (2)

Reference

- Reference plant scenario assumes an installation that exactly emits the emissions at 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 corresponding allowances are equal to the amount of free allowances it receives under the EU ETS.

Sectoral application

- Processes that either generate intermediate or multiple products, which do not have easily establishable market prices, or are illiquidly traded, or are uncertain, or where neither market prices nor substitute products exist whatsoever.

No reference scenario methodology

Key principles

- Article 5(1) of Innovation Fund Regulation creates an exception to the use of a reference scenario 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."

- **Any CAPEX and OPEX must strictly be related to and necessary for the innovative aspects** as identified in the award criterion on degree of innovation.

Approach

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

Sectoral application

- 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.
- Applicant to justify in detail why it was not possible to apply another methodology.

Thank you

Stakeholder feedback - methodologies

Category	Comment	Handled through…
Electricity storage	Concerns about how to accurately determine relevant costs for such projects	LCOS methodology was introduced and validated for electricity storage projects
Multiple Products	How do product methodologies account for multiple products	Methodologies have been revised to enable applicants to define multiple products.
Public subsidies	Questions about whether/how to account for subsidies in relevant costs	Greater clarity of what is meant by subsidies and when these should be taken into account
Coherence between relevant costs and GHG methodologies	Can the reference scenarios be the same for the evaluation of costs and GHG emissions and the same system boundaries apply?	Methodologies consistent with EU ETS benchmarks on system boundaries for EIIs/CCU & CCS. However, references will differ since the LCOE/LCOP methodologies derived from comparison with product prices. LCOS methodology applies a ‘use case’ specific with pricing forecasts

Stakeholder feedback - methodologies

Category	Comment	Handled through
Reference prices	Greater guidance required	Clear protocols are to be followed on carbon, product and electricity/heat prices
WACC	Provide guidance on Weighted Average Cost of Capital (WACC)	Methodologies have been more defined to enable applicants to fully understand the approach and how they should calculate the WACC including use of default values for equity and debt
Equity / debt references	Need to provide references for particular equity and debt ratios	Insights have been given on what protocols to follow
Ramp up in production	This should be taken into account to reflect project realities	Methodologies account for ramp-up in production

Stakeholder feedback – reference plants

Category	Comment	Handled through
Reference scenario	Conventional fossil-based reference plant should be used	This is now a rule within the reference plant methodology
Relevance of reference plant	Reference should be most widely deployed process globally for producing a given product	This is indeed the case, but an important caveat is that the reference plant should be chosen within Europe (re. EU ETS)
Reference plant examples	Refinements required to the examples originally circulated in IFEG papers	Examples have been modified and will be used to inform evaluators about projects