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Technical Workshop on Draft Methodologies for Calculation of Relevant Costs

First Call for proposals under the Innovation Fund

Presented by Jonathan Lonsdale, Jerome Kisielewicz and Gregor Paterson-Jones (ICF S.A.); Francis Wright and Luke Taylor (Turquoise International)

Fraunhofer ISI

milieu Law & Policy Consulting

TURQUOISE Finance | Energy, Environment, Efficiency

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Workshop objectives

- **Elicit comprehensive feedback and recommendations on how to refine these emerging methodologies and associated calculation tools.**

- **It is also to seek expert judgements on how to limit the choice of parameters for project proponents in order to ensure:**
  - (a) ease and simplicity of application;
  - (b) fair comparability across applications; and,
  - (c) robustness and simplicity of evaluations which will be required by a number of independent evaluators

- **Inform the drafting of the guidance documents that will support the first call for proposal under the IF**

Key questions to consider in the workshop

1. Can the outlined methodologies be applied across multiple project types and industries and generate comparable results while not prejudicing one against the other?

2. Are the calculations generating a realistic estimate of the additional investment and ten-year operational costs and revenues associated with the application of innovative low carbon technologies?

3. Are the methodologies relatively easy to use by project proponents while being difficult to ‘game’?

4. Can the methodologies be simplified in any way and what are the critical parameters where a choice can be left to project proponents?

Relevant Costs: “extra costs” of a project compared to reference production

- **Relevant costs are defined as:**

“the additional costs that are borne by the project proponent as a result of the application of the innovative technology related to the reduction or avoidance of the greenhouse gas emissions.” (Art. 5, Innovation Fund Delegated Regulation)

- **Used to estimate what grant support a proponent could receive** – this is set at a maximum of 60% of the total relevant costs for the Innovation Fund.

Relevant cost methodologies seek to simplify calculations as much as possible

- Calculation is typically based on analysis of **Capital Costs, Operational Costs and Operational Benefits** (including subsidies) during the **first 10 years of project's life** (i.e. including construction, commissioning & operation).

- However, **actual calculations will depend on several factors:**
  - Project type
  - What will be produced (i.e. power, heat, biofuel, commodity products)
  - Project's fit with a 'reference scenario'.

- **Various parameters have a bearing on the reference scenario**, such as project size and, crucially, whether there is some form of reference product or project with which to compare your innovative project.

Detailed presentation of the decision tree

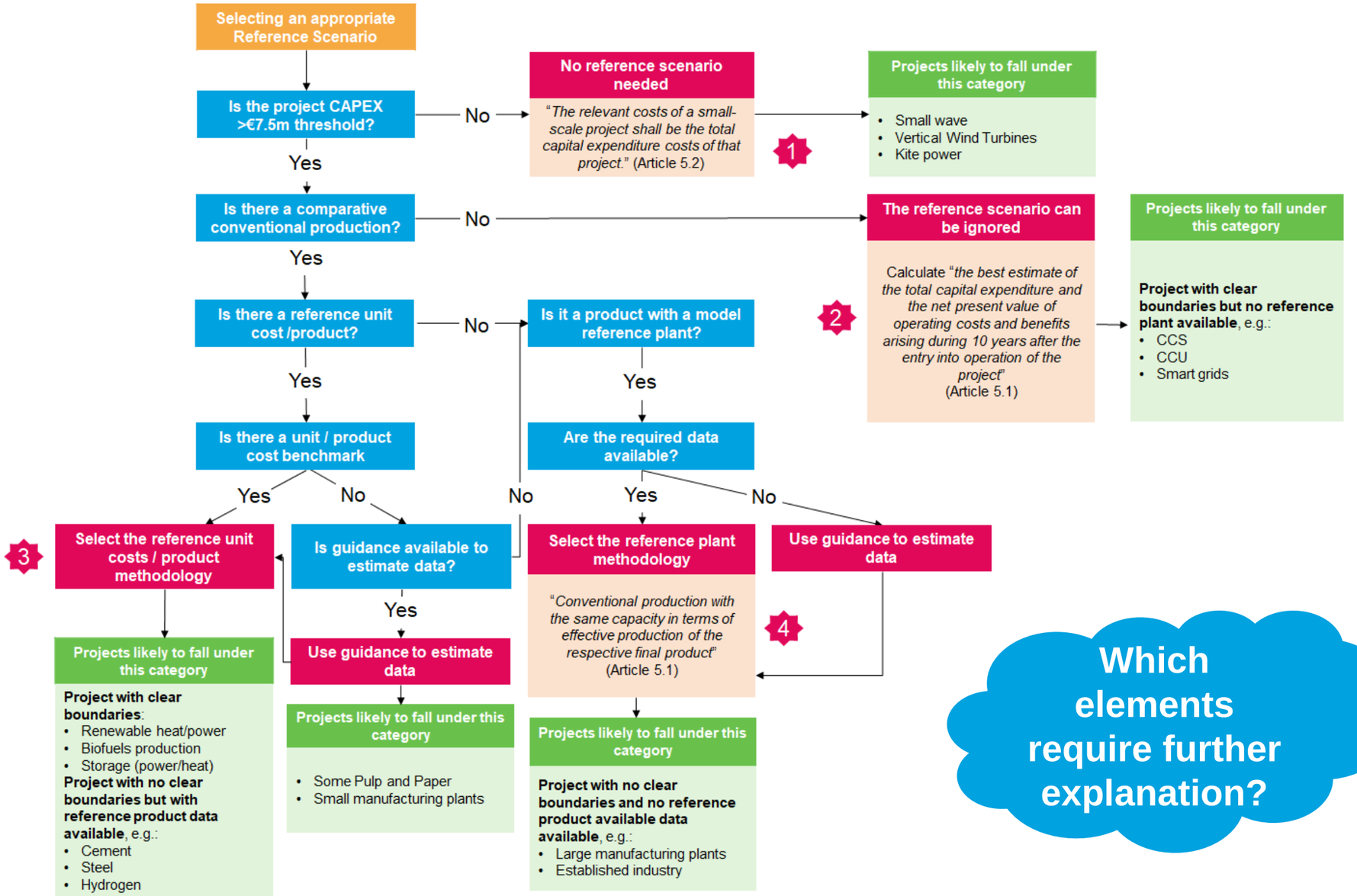
Jonathan Lonsdale, ICF

Parameters identified as impacting the selection of the appropriate reference scenarios

- **Size** of project – to understand whether the project fits into the small-scale project category of less than EUR 7.5 million;
- Existence of **reference product** – vast majority of cases will have one;
- Availability of **reliable reference product price information and reference product and/or plant cost data** to inform the Relevant Costs calculation;
- Existence of **reference plant** (which may or may not be available); and,
- Discreet **ring-fenced** project (e.g. greenfield renewables project) or an **embedded** process (e.g. retrofit to an existing plant) ➔ impacts on both product pricing (e.g. for an intermediate product) and/or financing.

4 relevant cost scenarios

Decision tree guides proponents to an appropriate relevant cost methodology



Is the sequencing logical?

Which elements require further explanation?

Key conclusions from reviewing over 20 example projects

- **Product-based comparison methodology is preferable scenario for most**
- **Choice of reference plants often challenging to define for proponents**
- **Final decision tree developed after this workshop**

➔**Specific project types that fit example boxes welcomed!**

Product based relevant cost methodology

Gregor Paterson-Jones, ICF

Product-based Relevant Cost approach: leaves additional 'innovative' costs of the project in scope of IF award

Model 1:

- 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
- Appropriate for power & heat projects

Model 2:

- Use a similar approach to Model 1
- Uses cost of production of innovative product, compared with production cost of reference product ➔ relevant costs
- Reliant on standardised or market benchmarks for costs
- Appropriate for industrial projects and biorefineries/biofuels production

Applicability

- Vast majority of projects (with capital costs >€7.5m) should end up being able to follow this methodology.

Key principles and assumptions that will form the basis of both models

1. **Comparable product costs** – proponents to state costs (NB as assessed on cost efficiency this should not be open to exploitation). Guidance to evaluators on how they should check this.
2. **Product and cost benchmarks** – need to source good reference data for the guidance.
3. **WACC assumptions** – allow proponents to supply their WACC (e.g. based on published annual report). Provide guidance on exceptions, e.g. for SMEs (an approach used currently in assessing state aid).
4. **Indexation** – proponents provide their rate, but guidance to refer to country-specific inflation rate.
5. **Project lifetime** – proponent to set out their full project lifetime in order to calculate the unit cost of the product. Should be similar in a sector and appropriate lifetimes would be set in the guidance. The relevant cost will then be calculated based on production in the first 10 years.

Key principles and assumptions cont…

6. **Carbon price** - value of income stream or cost saving will need to be taken into account if a key operational benefit of the project. Suggestion to take average over past two years. NB: for CCU, where CO_2 is transferred outside an ETS installation, this cost saving is applicable only for the production of precipitation of calcium carbonate.

7. **Terminal value** – terminal value beyond asset lifetime is not taken into account in model.

8. **Decommissioning** – cost estimates vary by project. Need including as OPEX in models if occurs in the first 10 years of project lifetime (i.e. short project life).

9. **Regulatory regimes & public support** – Could be differences in electricity prices, indirect cost compensation or other operating costs/benefits. Key points will need to be given by proponents to enable evaluators to understand some of the underlying factors.

10. **Income tax** – Member State rate to be used.

Further discussion on parameter rules, potential simplification and product price benchmarks in breakout sessions

Calculation of the WACC is a key part of the model and driven by proponent choice

❑ Weighted Average Cost of Capital (WACC)

- Calculation of a project of company average costs of capital by determining a blended return expectation based on the financial structure (ratio of debt & equity funding and respective rates of return expected from those two sources of capital pro rata).

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

- Can be applied to determine either the correct LCOE or unit cost price, by discounting future income and cost streams to make them comparable.

❑ Calculating a ring-fenced project WACC

- Determine the cost of debt by assuming a margin for risk above the base rate.
- Determine cost of equity either by using a comparable technology project construction equity return (IRR) or a premium to another market benchmark for the technology.

❑ Calculating an embedded / industrial project WACC

- Use the company assumed discount rate (WACC) for new projects.

Worked example Model 1: Wave Power

- **Project** – grid-connected wave energy converter array demonstrator
- **Key inputs** – project proponent provided key project inputs which we have used as indicative financial indicators to test the calculation of Relevant Costs
- These inputs include (but are not limited to):
  - Capacity of the project
  - Project life
  - Capex cost
  - Variable annual opex
  - Fixed annual opex
  - Non-annual periodic costs
  - Decommissioning costs
  - Timing inputs

Key Project Inputs		
Date of financial close	31-Dec-20	
Construction		
capacity	1,500	kW
construction cost	8,000	EUR/kW
construction duration	8	quarters
Production and revenues		
project life	10	years
capacity factor	30.0%	
market price	50.0	EUR/MWh
percentage of PPA price realised	100%	
Indexation	2.00%	%
Operating costs - variable		
O&M	800	EUR/kW/year
feedstock	-	EUR/kW/year
total	800	EUR/kW/year
Operating costs - fixed		
fixed opex	600	EURk/year

Worked example Model 1: Wave Power

- **Calculations** – with key inputs provided, the model calculates simple project cashflows over the defined operational timeframe.

These are used to calculate the relevant cost for the project by using the following steps:

1. Calculate relevant **WACC**

Weighted average cost of capital	
Cost of equity	11.00%
Cost of debt	3.60%
Equity percentage	65.00%
Debt percentage	35.00%
Income tax	28.00%
WACC	8.06%

Worked example Model 1: Wave Power

2. **Discount OPEX** using the WACC
3. **Discount the actual energy produced using the same WACC or discount rate**
4. Use these totals to **calculate the LCOE**
5. **Calculate NPV of average realised tariff** as evidenced from Power Purchase Agreement
6. Use this to **calculate the LCOE to Realised Tariff Difference'** (i.e. based on difference between the all in cost (including funding cost) of a technology, and what it can earn by selling that output, expressed as a tariff difference (per unit)
7. Multiply the above by energy produced in first 10 years to calculate **Relevant Cost = € 38.9m**
8. Apply IF's 60% maximum intervention rate to Relevant Cost to derive **project's maximum grant award level = € 23.4m**

Relevant Cost Calculation							
LCOE			31 Dec 20	31 Dec 21	31 Dec 22	31 Dec 23	31 Dec 24
NPV of costs			n/a	(6,000)	(6,000)	(1,948)	(1,987)
Discount rate	8.06%	*per year*					
Discount factor		1	1.000	0.925	0.856	0.793	0.733
Discounted costs	23,451		-	(5,553)	(5,139)	(1,544)	(1,458)
Energy produced discounted	22,595		-	-	-	3,124	2,891
LCOE	1.04	EUR/kWh					
NPV of realised tariff	1,130		-	-	-	156	145
Benefit	0.05	EUR/kWh					
Tariff gap	0.99	EUR/kWh					
first 10 years of production	31 Dec 32		-	-	-	3,942	3,942
total energy produced		MWh	39,420				
Relevant Cost		EUR	38,941,475				
Maximum Innovation Fund Grant Award		EUR	23,364,885				

Worked example Model 2: Industry – product substitution

- **Project** – industrial facility producing a substitute product from carbon capture in order to replace an alternative in the market.
- **Key inputs** – same process as for renewable energy projects, proponents provide the key inputs.
- However, for ETS facilities, ETS allowance revenues from avoided emissions have to be added as part of Operational Benefits, under product cash flows.

Key Project Inputs		
Date of financial close	31-Dec-20	
Construction		
capacity	100,000	tpa
construction cost - 2019 prices	350	EUR/ton
construction duration	4	quarters
indexation rate	2.00%	%
Production and revenues		
project life	20	years
Operating costs - general		
O&M - percentage of capex	3.00%	%
operating costs indexation rate	2.00%	%
Operating costs - variable		
total	3	EUR/ton/year
Operating costs - fixed		
labour	500	EURk/year
electricity & heat	1,500	EURk/year
admin/other fixed costs	50	EURk/year
total	2,050	EURk/year

Worked example Model 2: Industry

- **Calculations – again a similar process is used to calculate the Relevant Cost, with the following differences to renewable energy projects:**

1. Instead of calculating an LCOE, it calculates a **discounted cost per unit of production**
2. Proponents also provide the **cost per unit of production for a comparable product**
3. Calculate the **difference between the reference product cost of production (€35/ton) and the cost calculated by the model** (€77.87/ton) = €43/ton
4. Multiply the above by the number of units produced in the first 10 years to calculate **Relevant Cost = € 42.87m**
5. Apply IF's 60% maximum intervention rate to Relevant Cost to derive **project's maximum grant award level = € 25.72m**

Relevant Cost Calculation							
				30 Sep 20	31 Dec 20	31 Mar 21	30 Jun 21
Total costs				n/a	n/a	(9,104)	(9,104)
Discount rate	7.73%	*per year*	1.88%	*per period*			
Discount factor			1	1.000	1.000	0.982	0.963
Discounted costs		74,465		-	-	(8,936)	(8,771)
Production discounted		956,332		-	-	-	-
Discounted cost per unit		77.87	EUR/ton				
Comparable unit cost		35	EUR/ton				
Additional costs		43	EUR/ton				
First 10 years of production	10	31 Dec 31		-	-	-	-
Total product produced			tons	1,000,000			
Relevant Cost			EURk	42,866			
Maximum grant	60.0%		EURk	25,719			

Our engagement with proponents shows the product-based RC approach works well

- **Challenge of obtaining financials** from TRL 7-8 projects 'ready to go'
- However, **8 models developed and tested** in the following sectors: floating wind, wave, tidal, geothermal, hydrogen, ceramics, CCU, bioenergy
- **Important feedback on WACC and other aspects**
- **Positive feedback from project proponents on our sample models:**

- *"The concept is fine for our technology. We changed some of the figures in the model to match more or less our business case" (Ceramics)*
- *"It's a simple but strong model" (CCU)*
- *"The overall model makes sense and catches the project characteristics well….We were positively surprised to see that the calculation model for relevant cost is based on the LCOE of the project minus the reference LCOE, then multiplied by the power delivered. This means that the OPEX cost of emerging technologies like ocean energy is also included in the relevant cost calculations. This we find essential and will be very helpful to achieve financial close on the project." (Ocean)*

Reference plant relevant cost methodology

Jonathan Lonsdale, ICF

Reference Plant Relevant Cost approach

- **Key principles underpinning the approach**
  - Based on the presence of a counterfactual (Reference Plant)
  - Funding costs are reduced by the costs of the counterfactual
  - Leaves additional 'innovative' costs of the project in scope of the Innovation Fund award.
  - Based on a formula that examines the difference in CAPEX, OPEX and Operational Benefits over the 10 year period that is allowable under the Innovation Fund, i.e.:

$$Difference\ in\ CAPEX\ (between\ the\ demonstration\ plant\ and\ reference\ plant) + Difference\ in\ NPV\ of\ OPEX - Difference\ in\ NPV\ of\ Operational\ Benefits$$

- **Previous usage of Reference plants?**
  - Under the NER 300 Programme, a typical Reference Plant used for renewable energy projects was a Combined Cycle Gas Turbine (CCGT).

Reference Plant Relevant Cost approach

- **Worked example**

	CAPEX (€ m)		OPEX (€ m, NPV)		Benefits (€ m, NPV)		
Demonstration Plant	240		35		40		
Reference Plant	180		20		32		
Difference	*60*		*15*		*8*		
Relevant Costs	**60**	**+**	**15**	**-**	**8**	**=**	**67**

- Relevant Costs → **€ 67m**
- Maximum Innovation Fund grant support = is 60% of Relevant Costs → **€ 40.2m**

Key questions on the reference plant methodology

- **Application**
  - **Inherent challenges in applying a reference plant approach. When to apply?**
  - **Examples provided by proponents pose various questions needing clarification**
    - **Definitions:** What exactly is meant by "conventional" production" (as quoted in the IF Delegated Regulation)? Is it always considered to be fossil-fuel-based or can it be low-carbon-based?
    - **Application:** How many years of operation before a new process can be accepted as a reference technology? Can former large-scale, commercial-scale demonstration plants be allowed as a reference if they have operated for some time successfully? Will they show the costs of an efficient working plant?
    - **Geographic variation:** Do we need a different reference plant for different locations?

Further discussion on Reference plants in the breakout session

Break-out group discussions

Break-out sessions

Main questions

Simplified product based approach

1. Which areas in the methodology could be simplified?
2. What are the critical parameters where a choice can be left to project proponents?
3. Which areas need to be researched further?
4. What are the benchmark WACCs used in your sector which could be used to guide proponents without a defined WACC?

Product bench-marks

1. What benchmark product cost/price data can be provided for different sectors?
2. Which sectors might product costs be difficult to obtain? For these, what alternative benchmarks could be used? (E.g. if using price, what could be used: an average, a forward curve, today's price etc.).
3. What factors do we need to consider in setting guidance on this issue?
4. What rules are required to deal with situations where the product differs (i.e. quality / composition / price / emissions profile / regulation) between the new product and the reference one (e.g. biofuel, hydrogen)?

Reference plant examples & rules

1. Sectors where reference plants appear to be the preferable option?
2. Can a single reference plant be defined per sector?
3. Rules to be used to identify an appropriate reference plant where required?
4. Do we need a different reference plant for different locations?

Product-based Relevant Cost approach

- **Key principles underpinning the approach**
  - The end-product can be used as a reference for a comparative cost calculation:
    - In many industries accepted **long-term forward pricing forecasts** are used for project funding (for example, the Levelised Cost of Energy (LCOE) in electricity production) OR
    - There are **standardised per product cost benchmarks** (e.g. blast furnace steel).

- **Key parameters are used to calculate relevant costs:** includes Weighted Average Cost of Capital (WACC), which is a blended return expectation based on the financial structure of the project (i.e. the ratio of debt & equity funding and respective rates of return expected from those two sources of capital pro rata). The WACC is applied to determine either the correct LCOE or unit cost price, by discounting future income and cost streams to make them comparable.

- **Positive feedback:** proponents from across different sectors have told us that our initial relevant cost product models capture their project finances well and produce robust results

Reference Plant Relevant Cost approach

- **Key principles underpinning the approach**
  - A formula is used to show the difference in CAPEX, OPEX and Operational Benefits over a 10 year period with the presence of a counterfactual, i.e. the reference plant.

$$Difference\ in\ CAPEX\ (between\ the\ demonstration\ plant\ and\ reference\ plant) + Difference\ in\ NPV\ of\ OPEX - Difference\ in\ NPV\ of\ Operational\ Benefits$$

- **Worked example for hypothetical demonstration project**

Relevant costs → € 67m

Maximum IF grant support = 60% of Relevant Costs → € 40.2m

	CAPEX (€ m)		OPEX (€ m, NPV)		Benefits (€ m, NPV)		
Demonstration Plant	240		35		40		
Reference Plant	180		20		32		
Difference	*60*		*15*		*8*		
Relevant Costs	**60**	**+**	**15**	**-**	**8**	**=**	**67**

- **Application:** limited projects/sectors where the reference plant methodology will be preferable to others

Simplified product-based RC methodology

Summary feedback from break out sessions

Areas where approach could be simplified

1. Weighted Average Cost of Capital (WACC) guidance
2. Provide example references for particular technology costs of equity and debt
3. Be clear that the project WACC is not corporate WACC or reference plant WACC

Areas requiring further research

1. On-going feedback being sought on how to establish relevant costs for projects with multiple revenue streams: weighted average preferable route
2. Energy storage – reason that the revenue streams differ significantly between technologies and subject to different regulatory regimes across and sometimes with a Member State

Product cost benchmarks

Summary feedback from break out sessions

Product cost data sources	1. Some believe global commodity price data should be stipulated for products where this is available 2. However, for many niche products, this would not apply as large variations are evident 3. Proponent would need to specify their choice of the most appropriate benchmark, providing evidence in support
Sectors where cost data hard to obtain	1. Speciality chemicals 2. Energy storage – particularly given the different market applications of storage
Rules for where product differs	1. Need to take account of product price differences in the relevant cost calculations because in some cases the new product might be more or less expensive than the benchmark product (e.g. a product that is less pure than the market benchmark or vice versa)

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Reference plants and development of rules

Summary feedback from break out sessions

Sectors where ref plants preferable

1. Reference plants are most likely for specific product types, not necessarily a sector per se.
2. Examples cited: A process that generates multiple products may lend itself to a reference plant
3. Processes that are generating intermediate products.

Rules for Reference plants

1. The reference plant should be principally defined by the product, not the sector.
2. The reference should be most widely deployed process globally for producing a given product.
3. Geographical variation should be allowed (up to global level) if applicable.
4. A conventional fossil-based reference plant should be used – low carbon alternatives might be suitable if they have achieved sufficient proven performance (or that which has been verified).
5. Third party verification might be required for a reference plant with limited track record.

Thank you