



*Support to the realisation of the ocean energy implementation plan of the SET-Plan*

## Webinar

An update on the ocean energy sector based on the 1<sup>st</sup> OceanSET annual report

7 May 2020



THE UNIVERSITY of EDINBURGH



OceanSET has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°840651



- 1 | OceanSET project and its surveying activity**  
France Energies Marines
  
- 2 | Annual assessment of the EU ocean energy sector**  
Sustainable Energy Authority Of Ireland
  
- 3 | Pre-commercial procurement programme for wave energy**  
Wave Energy Scotland
  
- 4 | Q/A session**





# 1 | OceanSET project and its surveying activity

France Energies Marines

Brussels, 15.9.2015  
C(2015) 6317 final

COMMUNICATION FROM THE COMMISSION  
Towards an Integrated Strategic Energy Technology (SET) Plan: Accelerating the European Energy System Transformation

**Strategic Energy Technology (SET) Plan**  
*EU Number 1 in renewable energy*

1. Sustain technological leadership by developing highly performant renewable technologies and their integration in the EU's energy system.
2. Reduce the cost of key technologies.

EUROPEAN COMMISSION  
RTD - Energy  
ENER - Renewables, R&I, Energy Efficiency  
JRC - Energy, Transport and Climate  
SET Plan Secretariat

SET Plan – Declaration of Intent on Strategic Targets in the context of an Initiative for Global Leadership in Ocean Energy

**Declaration of Intent for Ocean Energy**  
Levelized cost of energy targets.

	Tidal Stream	Wave
2025	≤15 c€/kWh	≤20 c€/kWh
2030	≤10 c€/kWh	≤15 c€/kWh
2035		≤10 c€/kWh

SET-Plan Ocean Energy - Implementation Plan

**Final**  
21 March 2018  
adopted by SET-plan steering committee

**SET Plan Ocean Energy Implementation Plan**  
11 technology development actions creating “a structured approach ... [for] a development path ... [to] a commercially viable wave and tidal industry”.

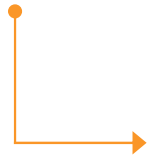


# From the SET Plan to OceanSET

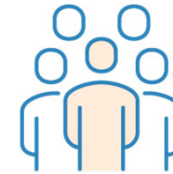
## How it works



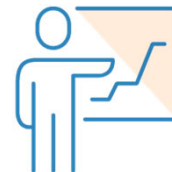
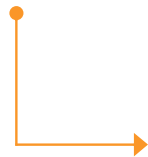
The **SET Plan** is the technology pillar of the EU's energy and climate policy



An **Implementation Plan** was developed for ocean energy actions in the SET Plan



The **Implementation Working Group** will deliver actions



OceanSET



## Overview of OceanSET

OceanSET aims to obtain a solid understanding of **evolution in the European ocean energy sector** in order to **optimally tailor future funding** for member states, regions and the European Commission.



## An annual process comprising 4 key stages:



- To **gather information** on the ocean energy sector across Europe
- To **compile and analyse** the data collected from stakeholders and to conduct a gap analysis
- To **assess the progress** of the ocean energy sector by tracking key metrics and to consider other factors (identification of best practices, state-of-the-art...)
- To **provide recommendations** on the next steps required to progress the implementation of the SET Plan and suggest approaches to stimulate industry and research progress in key priority areas

## 4 types of information aligned with the requirements of the Implementation Plan



### General

Policy  
Revenue support



### Technical

Technology deployment  
Supply chain  
LCOE analysis



### Financial

Pre-commercial  
procurement

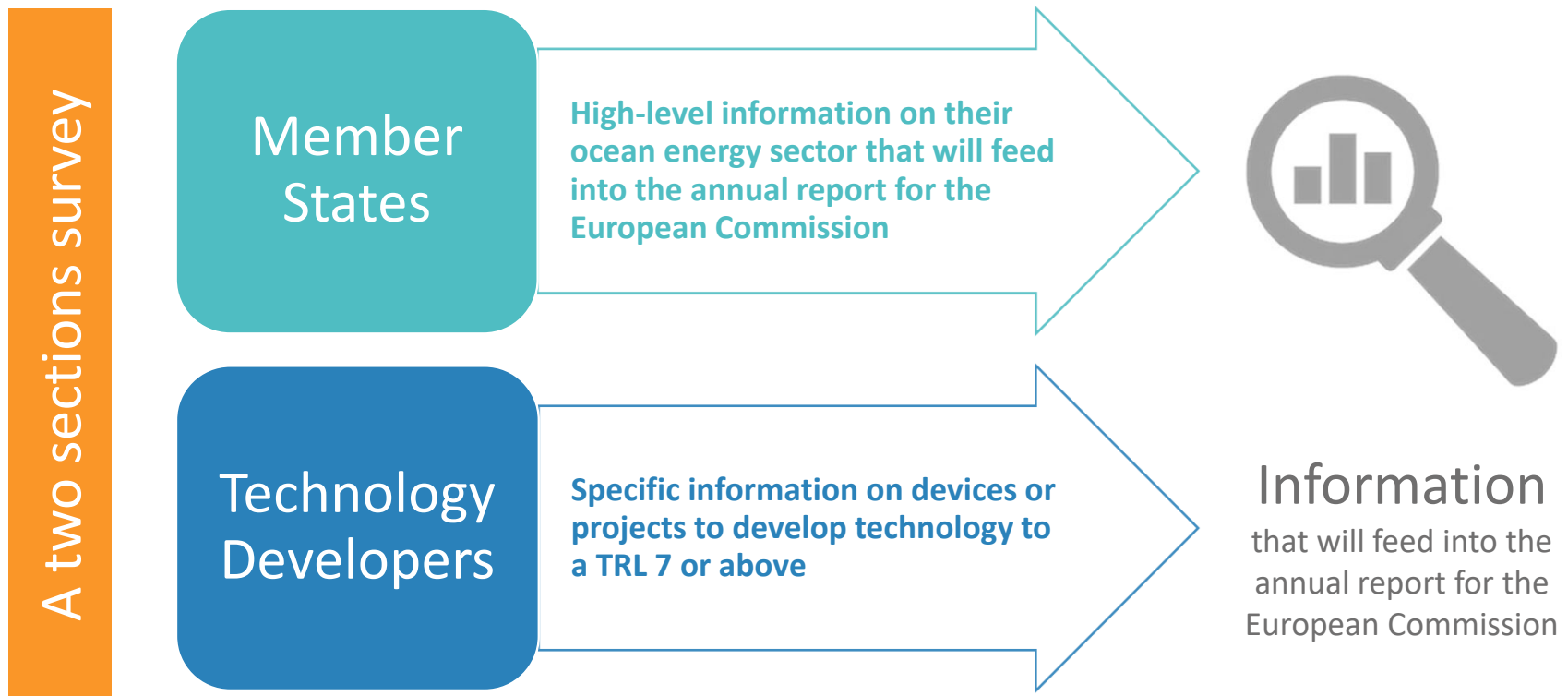


### Environmental

Measures for  
consenting



# What targets for such a survey?



# Definition of appropriate metrics for 2018

## Policy and funding



- **Amount spent on OE:** total, percentage of budgeted amount spent
- **Funding** by Government, EC, private sector, grants, debt
- **OE policy,** revenue support, licensing/consenting

## Supply chain, capacity, jobs



- **Supply chain** development level
- **Installed capacity :** newly installed
- **Jobs** created

## Concepts and technologies



- **TRL 1-6 projects:** number of projects financed in each MS (wave, tidal, other)
- **TRL 7-9 projects :** number of projects financed in each MS, technology, installation, capacity factor, availability, CAPEX, OPEX, lifetime, LCOE



2 | Annual assessment of the EU ocean energy sector  
Sustainable Energy Authority Of Ireland

# OceanSET



- The OceanSET project has the overall goal to support the realisation of the ocean energy SET-Plan IP
- OceanSET will focus on assessing the **progress of the Ocean Energy sector** and will monitor National and European Union (EU) funded projects in delivering successful supports.
- Relevant data will be collected annually and will be used to inform MS and the EC on the progress of the sector.
- **3 annual reports** will be published

Work Package	Code	Leader
Ethics requirements	WP1	SEAI
Mapping & Analysis	WP2	SEAI
Finance	WP3	WES
Pre-Commercial Procurement Programme Development	WP4	WES
Monitoring & Review	WP5	DGEG
Communication & Dissemination	WP6	FEM
Management	WP7	SEAI



## An annual process comprising 4 key stages:



- To **gather information** on the ocean energy sector across Europe
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# Mapping and Analysis (WP2)

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## The survey was laid out in two sections:

- **Section 1** captured high-level information from Member States on their OE sector
- **Section 2** gathered detailed information on developers who have devices with a TRL 7

## Survey responses:

### **Section 1 – for Member States**

- 11 out of 14 MS responded
- A total of 90 Ocean Energy projects are reported as being supported in 2018:
  - 57 wave projects, 22 tidal projects, and 11 projects categorised as “other”.
- 7 MS said they funded Ocean Energy projects of TRL 7+ in 2018 (20 in total)

### **Section 2 – for Ocean Energy developers**

- These 20 ocean energy developers were sent survey section 2.
- 15 out of the 20 responded. An additional 10 responses were received (25 total)
- Only 12 projects were eligible for use in the mapping and analysis

# Policy & Budget support

## Policy:

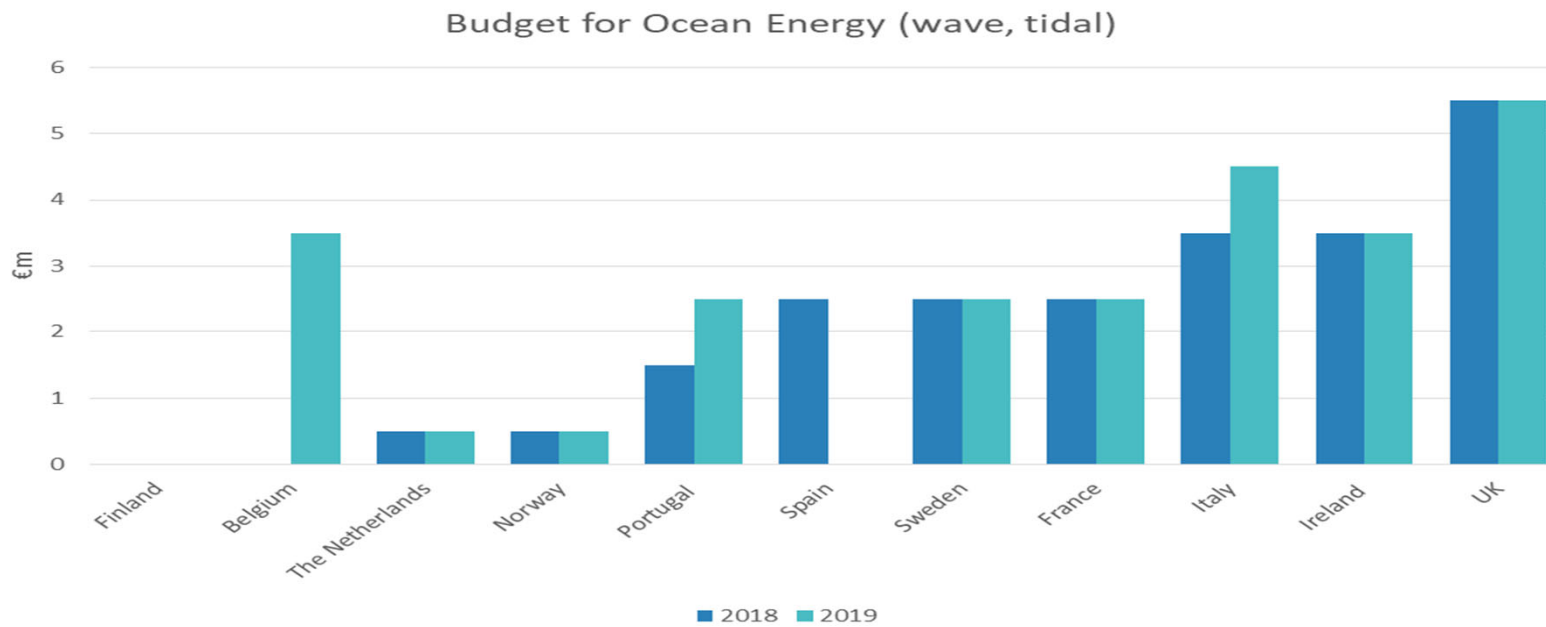
The mapping exercise shows that 6 out of 11 MS have an Ocean Energy Policy

## Budget:

Finland	Belgium
France	Ireland
Norway	Italy
Sweden	Portugal
The Netherlands	Spain
	United Kingdom

No (5)

Yes (6)



## Annual pipeline of wave and tidal projects in each MS

The table shows the annual pipeline of wave and tidal stream projects.

Country	How many projects funded in 2018?	Projects you supported in 'wave'	projects you supported in 'tidal stream'	projects you supported in 'other'	Budget
Italy	5	4	1	-	€3m - 4m
Spain	3	2	1	-	€2m - €3m
Ireland	10	3	3	4	€3m - 4m
Sweden	30	21	6	3	€2m - €3m
Portugal	10	5	1	4	€1m - €2m
France	9	4	5	-	€2m - €3m
UK	<b>23</b>	18	5	0	more than €5m



# Commercial status of WEC and TEC technologies

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In total 12 projects were eligible to be considered TRL 7 or above. WEC's accounted for the majority for projects at TRL 7 or above that occurred during 2018

## Tidal energy system demonstration in operational environment (TRL 7-9)

- 5 tidal project were at TRL 7+
- Developers identify “Increasing device reliability and survivability” as there development area.
- Horizontal axis turbine is most predominant in tidal technology systems that have reached TRL 7 or above
- As for installation types, it was split. Three are using fixed gravity-based installations and two are using floating Semi-taut mooring.

## Wave energy system demonstration and deployment TRL 7-9

- 7 wave projects were at TRL 7+
- Developers identified “Increasing device reliability and survivability” as the development area
- Unlike tidal stream, wave technology types that have reached TRL 7 or above does not show a clear front runner. The technology types are mixed between point absorbers, Oscillating water column, and others.
- This has resulted in a high mix of installation types: 2 fixed gravity based, 3 floating Slack moored, 1 floating Semi-taut moored, 1 'other' - Pre-tension with technical anchors



# Test Facilities and Supply Chain

**Test Facilities:** Nearly all Member States (10 of 11) had test site facilities in their country.

**Supply Chain:** 50% chose *Part of the supply chain well complemented by suppliers from other sectors* to best describe the supply chain in their country. Only the UK classified their supply chain as Dedicated/self-sufficient.

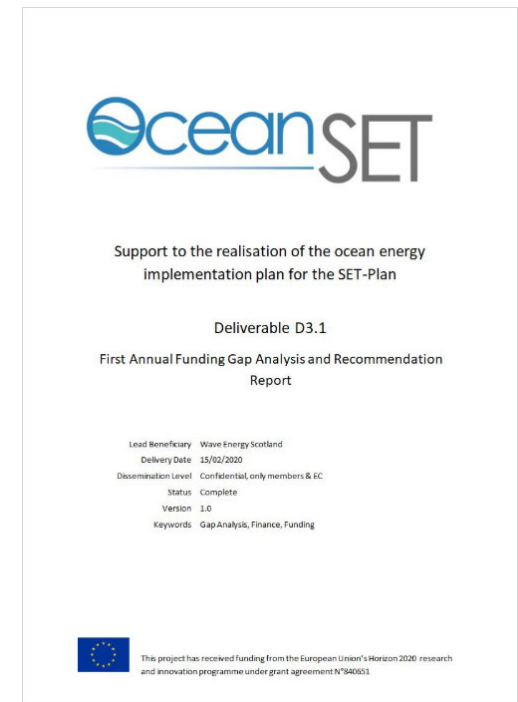
How would you classify OE?	Country
Dedicated/self-sufficient	UK
Part of the chain well complemented by suppliers from other sectors	Finland, Italy, Spain, France, Belgium (Ghent), Portugal
Part of the chain hardly complemented by suppliers from other sectors	The Netherlands and Ireland
Partial lack of supply	Sweden and Norway

It is recommended that more detail is sought during the next survey to get a better understanding of the gaps in the supply chain across Member States.



# Gap Analysis (WP3)

- Overall funding of technology development was well supported in 2018
- Overall public funding from MSs and Regions of around €26.3M. Aligns well with the estimated requirements of the Ocean Energy IP of €21.25M
- There is difficulty in accessing accurate funding information and performance of technology
- Industry partners are reluctant to provide accurate information



- In tidal a significant number of concepts are being developed and 5 at or above TRL7. First array scale demo is underway and progressing ahead of the expectations of the IP
- Wave also showed a significant number of sub-TRL7 technologies in development. Demonstration of full-scale wave energy technology was progressing broadly in line with the expectations of the IP
- Actions to support standards through the development of agreed metrics for wave and tidal energy were on track to meet the targets of the IP



- The main objective of the first monitoring and review report was to provide a baseline against which future data can be tracked
- Quantitative metrics were set to track the level of development towards these objectives, known as the **key metrics**
- Data collected in the mapping exercise was analysed where possible to track the evolution of the sector
- Lesson learned were also captured

- Overall the responses received from MS were of good quality and allowed us to map, analysis and create a monitoring baseline for the OE sector.
- In the budget question several respondents answered that their MS have not a defined support for OE.
- Budget and average licensing and consenting times were questioned in terms of ranges to simplify the effort required from MS representatives.
- Questions about TRL 1-6 projects in survey Section 1 were simplified, in order to encourage consistent responses. Some clarification required in Year 2
- Need to include more detailed Qs on supply chain and standards



- Overall, respondents were happy to give high level information and these questions were answered by nearly all the respondents.
- Commercially sensitive information and questions on cost and funding were not as readily answered. The metrics set out in Q13 requested about technical characteristics of TRL 7+ devices including:
  - Electrical energy production
  - Capacity factor
  - Availability (h/year)
  - CAPEX
  - OPEX (€/W/year)
  - LCOE (€/MWh) etc.
- Of the 12 respondents, 2 developers skipped these questions entirely and a further 2 only provided information on the number of jobs or technical lifetime and several respondents provided values which did not align with unit of measurement provided.

- Need to understand why questions aren't being answered and to build trust on why data being collected and how confidentiality is being handled
- Other areas should be included in the 2nd survey to widen the understanding on the development of the ocean sector as a whole, including:
  - Infrastructure development and capacity of the supply chain
  - Development of environmental standards, safety standards and best practice

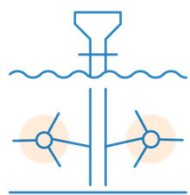




# Summary of findings

## Annual report key findings – 2018

Results from responses of 11 member states. Ref year 2018.



A total of  
**90**  
ocean energy  
projects supported



**€26.3**  
million in public funding from  
member states and regions

**10** member  
states have an  
ocean energy  
budget



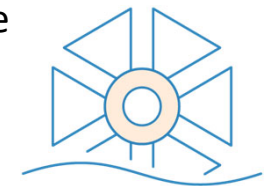
**10** member states  
had test site facilities

**6**

member states  
have an ocean  
energy policy



**7** member states were  
funding ocean energy  
projects and all 7 were  
were funding TRL 7+



## Ocean energy projects survey

Overview of data from 12 projects over TRL 7 active in 2018.



### 5 tidal projects

- > 4 were horizontal axis turbines
- > 96' #average annual availability for tidal prototypes
- > 7.9 €/W average capital expenditure
- > 0.1 €/W/year average operational expenditure

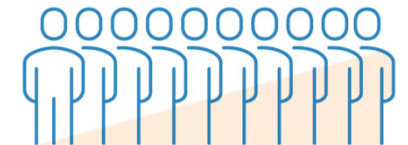


### 7 wave projects

- > No technology front runner. Technologies included point absorbers and oscillating water columns
- > ::' #average annual availability for wave prototypes
- > 12.7 €/W average capital expenditure
- > 0.7 €/W/year average operational expenditure

# 200

jobs created by the 12 projects



# OceanSET Progress



SET Plan IP 11 Technology Development Actions are outlined below by using a traffic light system to identify the progress OceanSET has made during the first year of the discovery phase. This is a review of the progress OceanSET have made in mapping the Ocean Energy sector against these 11 actions, not of the fulfilment of these actions.

- Green: on track
- Orange: behind progress
- Red: no activity or progress

Technical Actions	Progress
1.1 Tidal Energy technology device development and knowledge building up to TRL 6	Green
1.2 Tidal energy system demonstration in operational environment (TRL 7-9)	Green
1.3 Wave energy technology development and demonstration up to TRL 6	Green
1.4 Wave energy system demonstration and deployment TRL 7-9	Green
1.5 Installation, logistics and testing infrastructure [and] supply chain development.	Orange
1.6 Co-ordinate the development of standards and guidelines for technology evaluation and LCOE analysis.	Green
Finance Actions	
2.1 Creation of an investment fund for Ocean Energy farms	Red
2.2 Creation of an EU insurance and guarantee fund to underwrite project risks.	Red
2.3 Pre-Commercial Procurement (PCP) action for development of wave energy technology.	Green
Environmental Actions	
3.1 Development of certification and standards to support the offshore renewable technology sector	Red
3.2 De-risking environmental consenting through an integrated programme of measures	Orange





3 | Pre-commercial procurement programme for wave energy

Wave Energy Scotland

## Action 2.3: Pre-Commercial Procurement action for development of wave energy technology

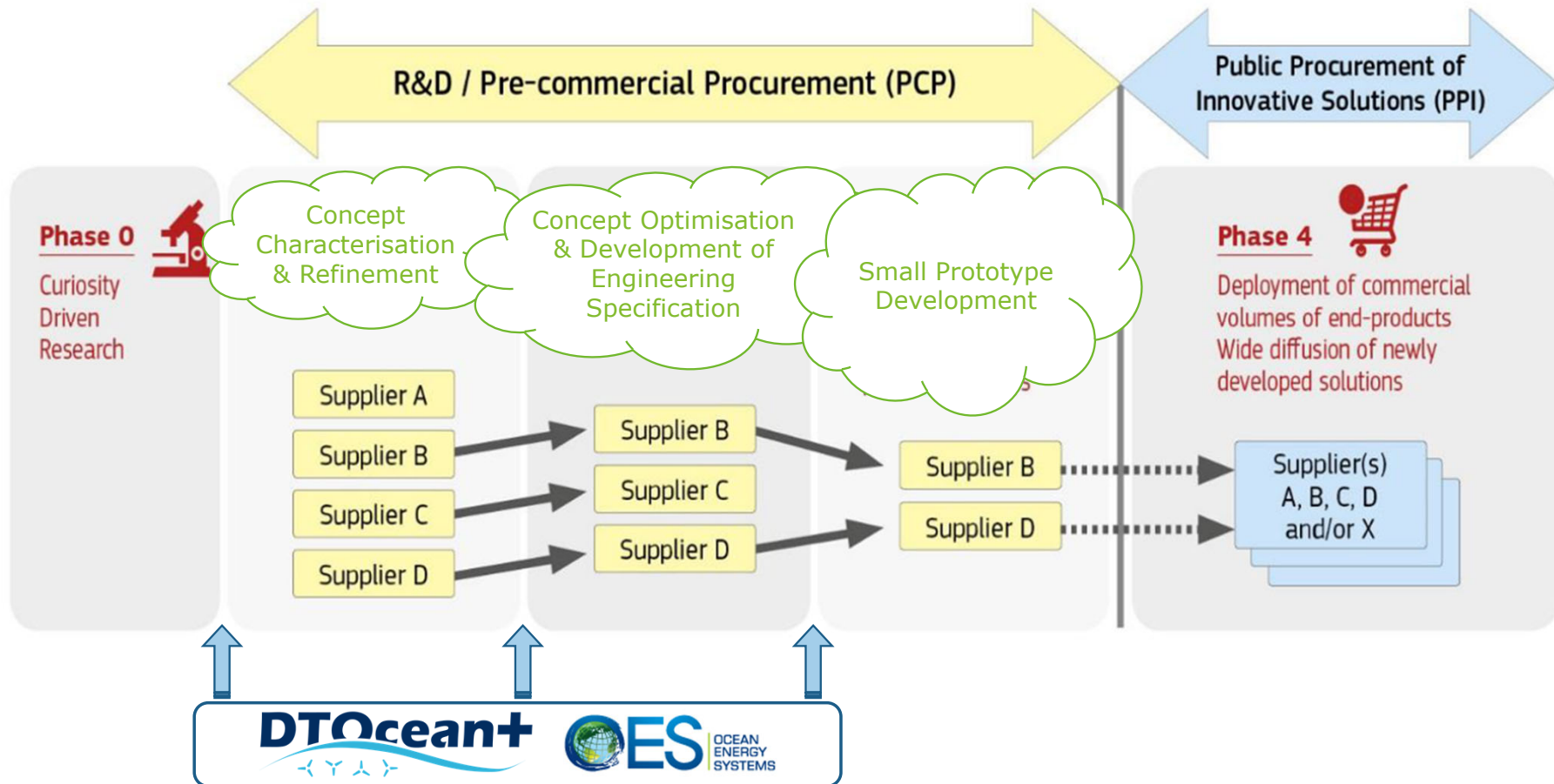
Implementation of an EU-wide innovation programme to develop innovative solutions to the technical challenges in key sub-systems, systems and devices in the wave energy sector.

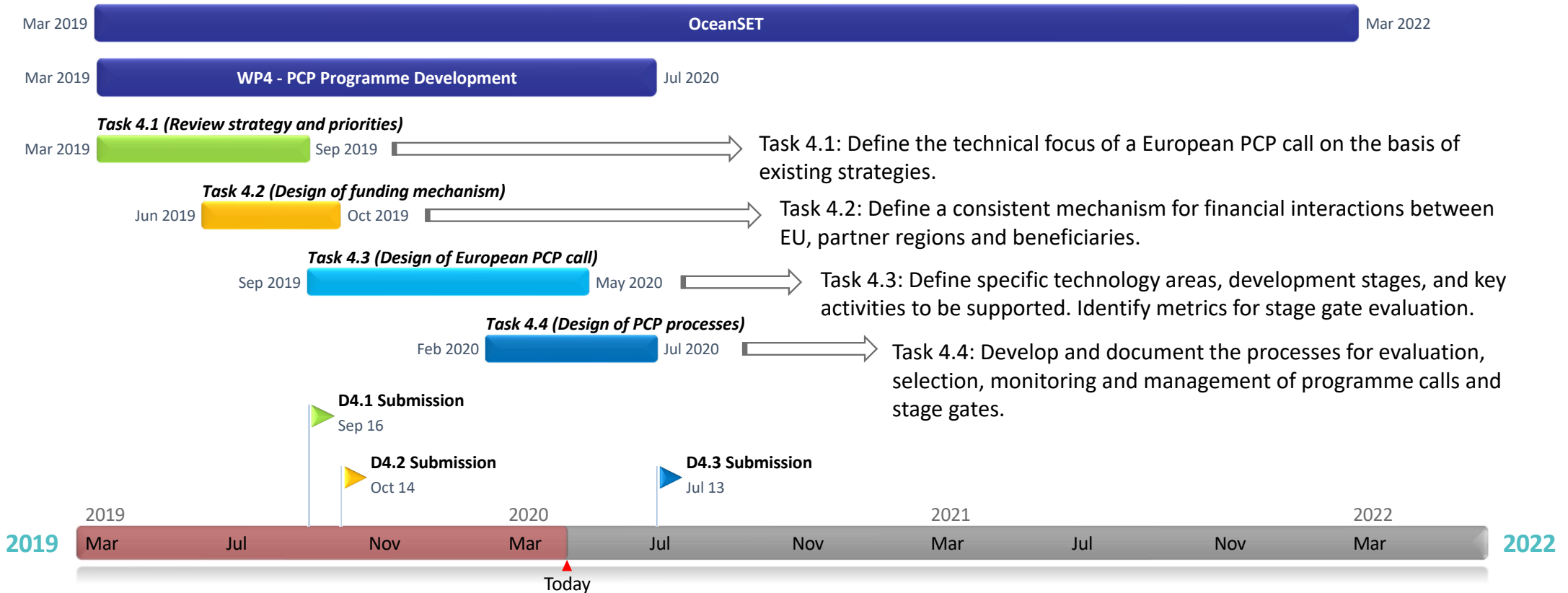
The innovation programme based on the EU's pre-commercial procurement (PCP) of research services model.

Action 2.3 Wave Energy Europe Pre Commercial Procurement (PCP) action for development of wave energy technology.			
Description of each R&I Activity (repeat as many times as the number of R&I Activities)			
<b>Title:</b> Wave Energy Europe Pre Commercial Procurement (PCP) action for development of wave energy technology.			
<b>Targets:</b> <i>Reduction of LCOE for wave energy to 15 cEUR/kWh by 2030</i>		<b>Monitoring mechanism:</b> <i>Annual progress reports</i>	
<b>Scope:</b> Driving the development and the convergence of emerging wave energy technology to full device stage through the adoption of an EU-wide innovation programme.			
<b>Description:</b> Wave Energy Europe (WEE) will drive the search for innovative solutions to the technical challenges facing the wave energy sector up to TRL8. Through a competitive procurement programme key sub-systems, systems and devices, as identified requiring support in Actions 1.3, will be selected and given up to 100% funding support to progress. Development is carefully managed and controlled using the stage gate metrics system (Action 1.7). The ultimate aim is to produce reliable technology which will result in cost effective wave energy generation.			
The WEE programme approach requires a dedicated, informed and capable organisation and team to operate the programme. Sufficient technical expertise to be able to specify what is required, assess applications against key metrics, select best projects, manage project delivery and integrate solutions is a vital.			
WEE will build on the model and experience within the Wave Energy Scotland programme (WES), which uses European Pre-Commercial Procurement (PCP), provides a clear demonstration of a potential delivery model. WES has demonstrated that it can stimulate significant innovation activity and attract interest from out with the marine energy sector leading to good examples of technology transfer from more mature sectors. In addition such a concentrated and focussed programme has led to high levels of collaboration and partnership between organisations across Europe and has led to greater levels of innovation and progress. Specific technology specialists have the opportunity to focus on what they are good at and others specialists can provide other solutions leading a stronger overall WEC solution.			
<b>TRL:</b> Advanced research /Industrial research & demonstration -> TRL 1-8			
<b>Total budget required:</b> 24M EUR (including programme management costs, R&D budget covered in action 1.3)			
Expected deliverables		Timeline	
Portfolio of stage 1, 2, 3 projects awarded, and progressed to stage 4 in participating MS		01/2018 – 12/2019 01/2019 to 12/2024	
Party / Parties		Implementation instruments	Indicative financing contribution
EU, IE, UK ← countries already involved		National funding programmes (incl. public & private contributions) combined in bi- or multilateral projects.	Included in national programs. 18M EUR from MS 6M EUR EC Contribution
EU, MS			
<b>Fiche Curator (initials):</b>	<b>Date:</b>	<b>Revised by (chair initials)</b>	<b>Date of revision:</b>
TWG	23/02/2018	DM	23/02/2018



# Pre-Commercial Procurement (PCP)





# Task 4.1 - Review Strategies and Priorities

## Member State & Regional priorities

- Spain / Basque Region / Canary Islands
- UK / Scotland / Wales
- Ireland
- Portugal

## Technology roadmaps

- Ireland
- UK
- France
- Denmark

## ETIP Ocean – Strategic research priorities


- Strategic Research Agenda (2016)
- Strategic Research & Innovation Agenda (2020)



# Member State & Regional Priorities

Ambition best summarised by aspiration to become  
*“a research, development and innovation hub for  
the deployment of marine renewable energy technologies and services ...  
[to facilitate] ... the creation of an early stage industry and research cluster”*

Actions generally consistent:

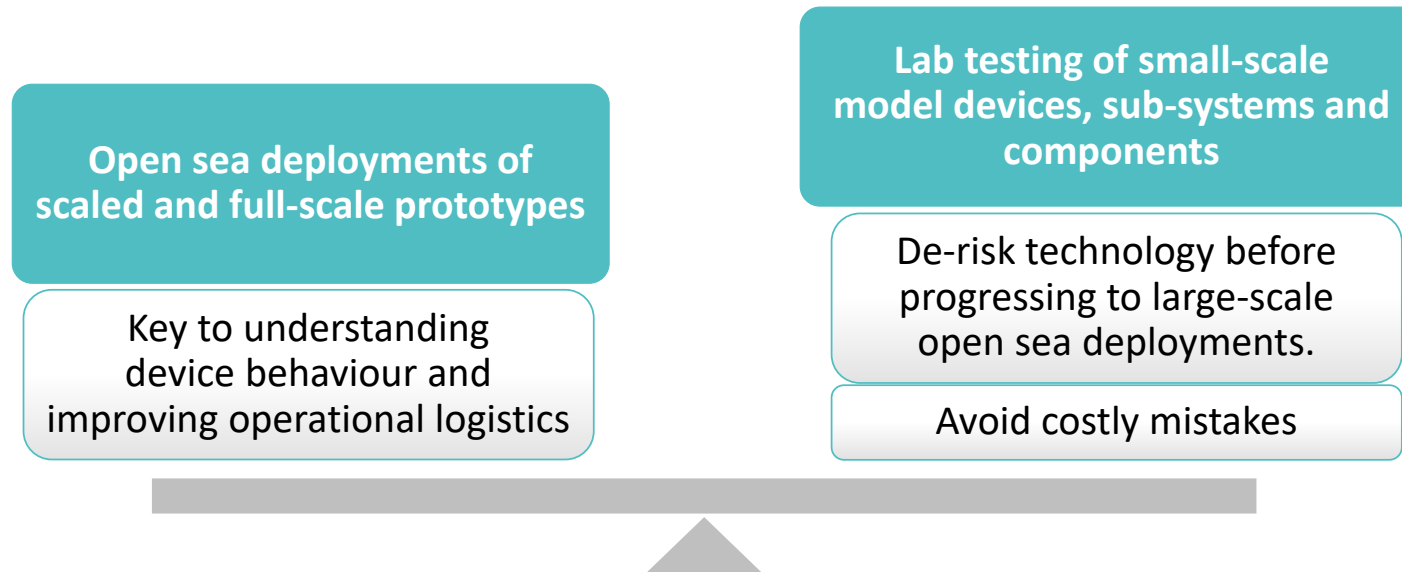
-  Support research and development in universities
-  Support technology innovation through appropriate national funding vehicles
-  Establish and operate national test facilities for prototype testing
-  Develop local expertise in manufacturing, operation and maintenance, and specialist support services
-  Develop industry supportive policies for pre-commercial array demonstration



# Technology Roadmaps & Research Agendas

Technology Roadmaps perhaps best summarised as  
*“learning by doing at a meaningful scale”*

*“Improve reliability and survivability, reduce technology risks and then bring down costs ... in that order!”*  
Strategic Research Agenda 2016



# Proposed Technology Priority Areas

## Scaled prototype testing

Progression to open water testing of utility-scale generation technology at an appreciable scale with functional subsystems, demonstrating performance in representative and then operational wave climates, i.e. between TRL 5 and 7.

## Technology for off-grid applications

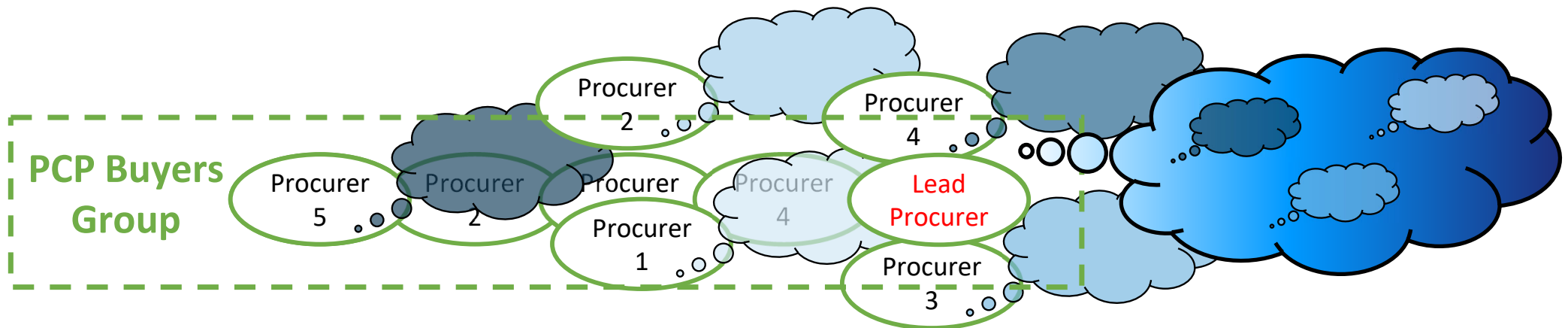
Product development for the blue economy sectors – Lower power requirements (a few hundred watts to a few hundred kilowatts) allow for smaller designs and faster design cycle iteration.

## Mooring and anchoring systems

Improved mooring and anchoring concepts to provide a cost effective sub-system in a wide range of seabed conditions and permit rapid installation and removal operations through improvements in connection and disconnection techniques.

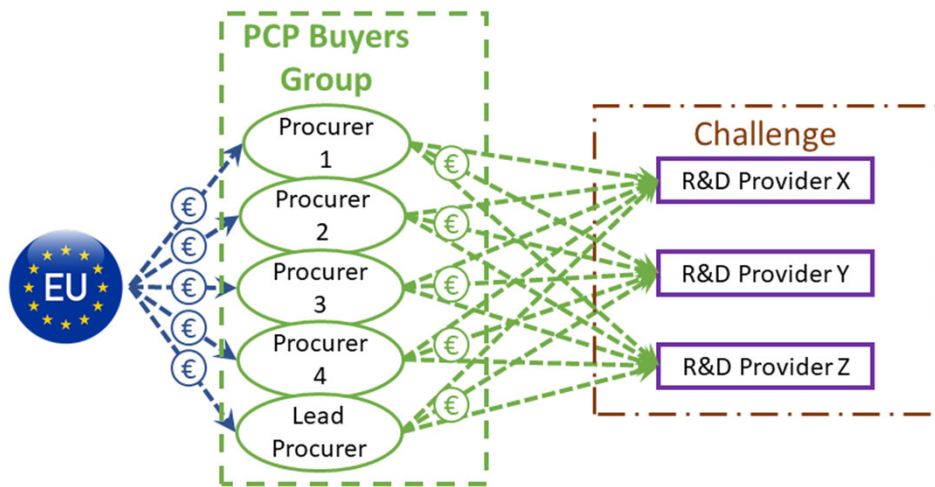
## Task 4.2 - Design of funding mechanism

Develop an approach for cross-border multi-partner PCP programme for wave energy technology compliant with EU PCP model.

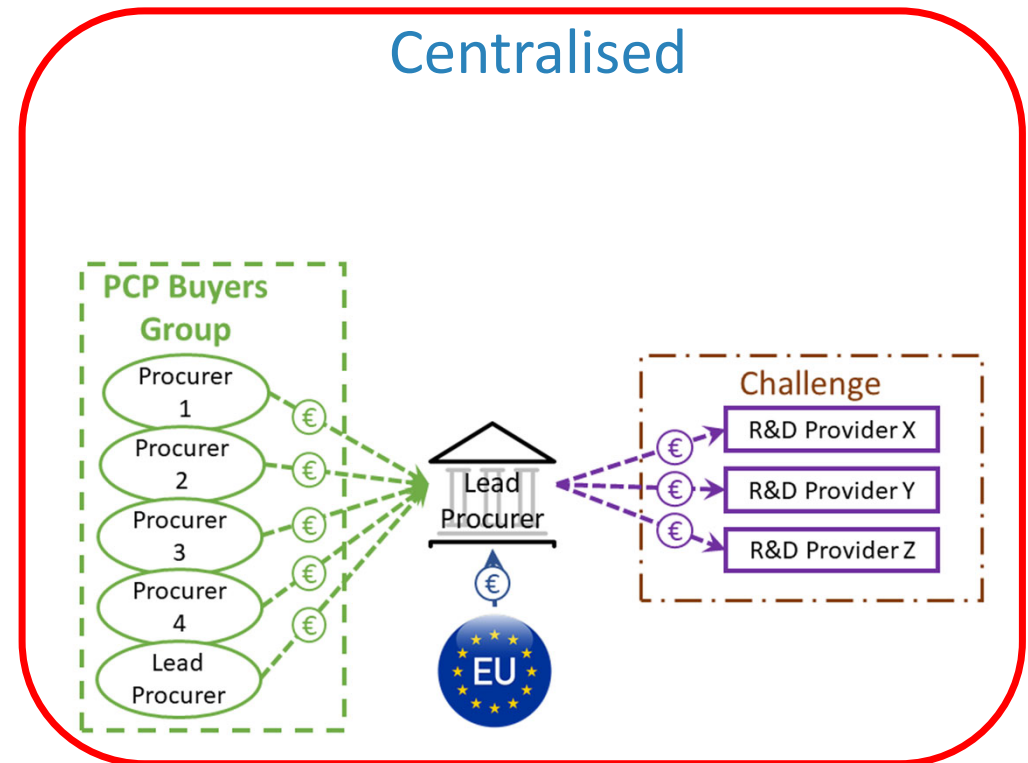


# Approaches to Payments

## Decentralised

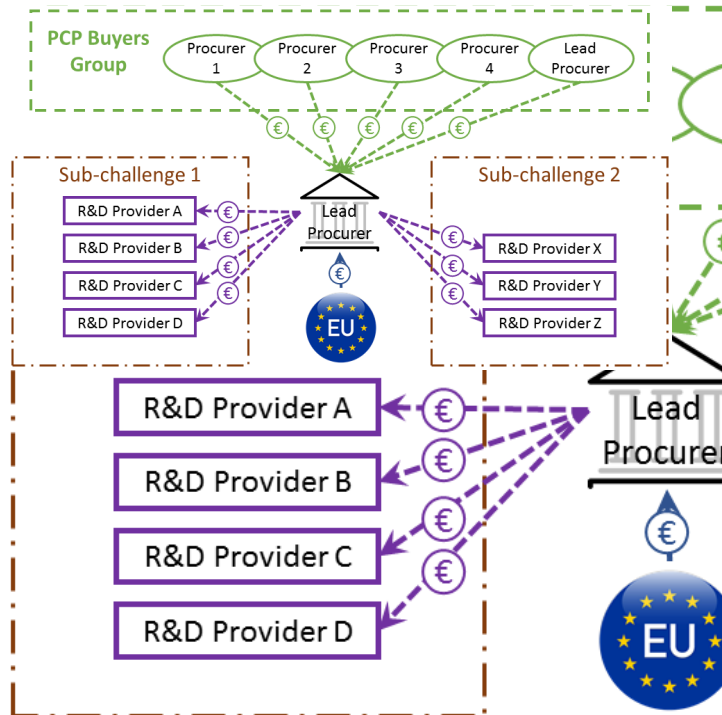


## Centralised

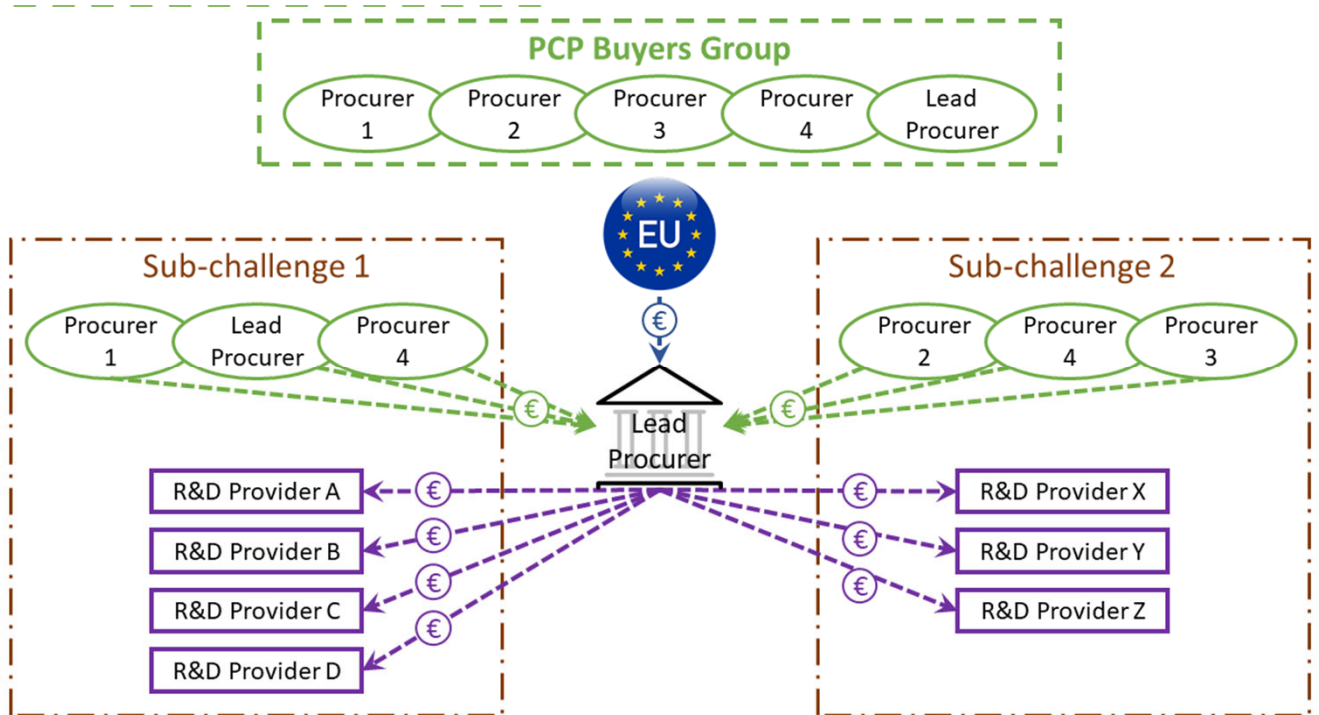


# Approach to Participation

## Simple



## Inclusive



# Concluding WP04

- Task 4.3

Add detail to the priority technology areas (Task 4.1)

- Task 4.4

Develop the approach to the delivery and operation of PCP programmes.

Define common processes for:

- Call release and publication
- Evaluation and selection of proposals
- Management of technology development programmes including stage gate methodology
- Intellectual property management
- Reporting and dissemination

Produce template call documents.

Completion expected  
July 2020



## Thank you for your attention!

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