MINISTÈRE DE L'ENSEIGNEMENT SUPÉRIEUR, DE LA RECHERCHE ET DE L'INNOVATION

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HORIZON 2020
LE PROGRAMME DE RECHERCHE ET D'INNOVATION DE L'UNION EUROPÉENNE

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RÉPUBLIQUE FRANÇAISE

Clean, affordable and secure energy

Programme du webinaire:

- Introduction
- Topic 2.1 – Matthijs Soede, DG RTD, CE
- Q&A
- Quelques projets financés
- Topic 2.2 – Giulia Melica, DG ENER, CE
- Q&A
- Quelques projets financés
- Conclusions

Animation: Enrico Mazzon et François-Xavier Testard Vaillant
PCN H2020 pour l'énergie

TOPIC 2.1 - DEMONSTRATION OF INNOVATIVE CRITICAL TECHNOLOGIES TO ENABLE FUTURE LARGE-SCALE DEPLOYMENT OF OFFSHORE RENEWABLE ENERGY TECHNOLOGIES (WITH THE POSSIBILITY TO ADDRESS ALSO HYDROGEN APPLICATIONS)

Matthijs SOEDE, Responsable des politiques

Unité « Planète Propre - Transition vers les Energies propres »
DG RTD, Commission européenne

H2020 Green Deal Call

The information in this presentation is not yet adopted and is not yet final.

WEBINAR 29-06-2020

European Commission

Introductory remark

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The European Green Deal a commitment for the European Union to become world's first climate-neutral continent

This "involves taking decisive action now. We will need to invest in innovation and research, redesign our economy and update our industrial policy".

- The European **Green Deal** p**rovides a roadmap with many actions** to boost the efficient use of resources by moving to a clean, circular economy; restore biodiversity and cut pollution.
- The Communication on the Green Deal is focussing on some areas, which need action now.

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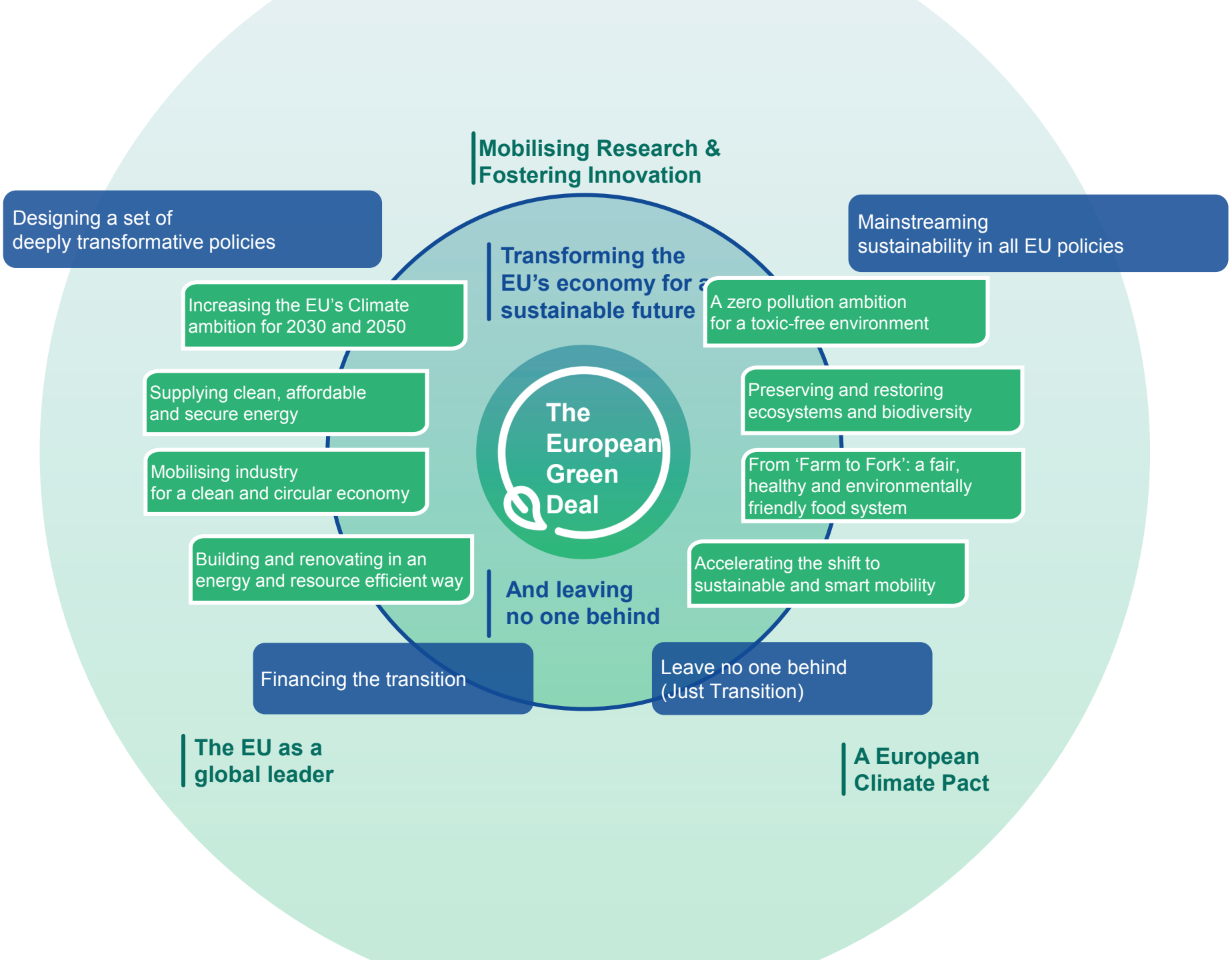
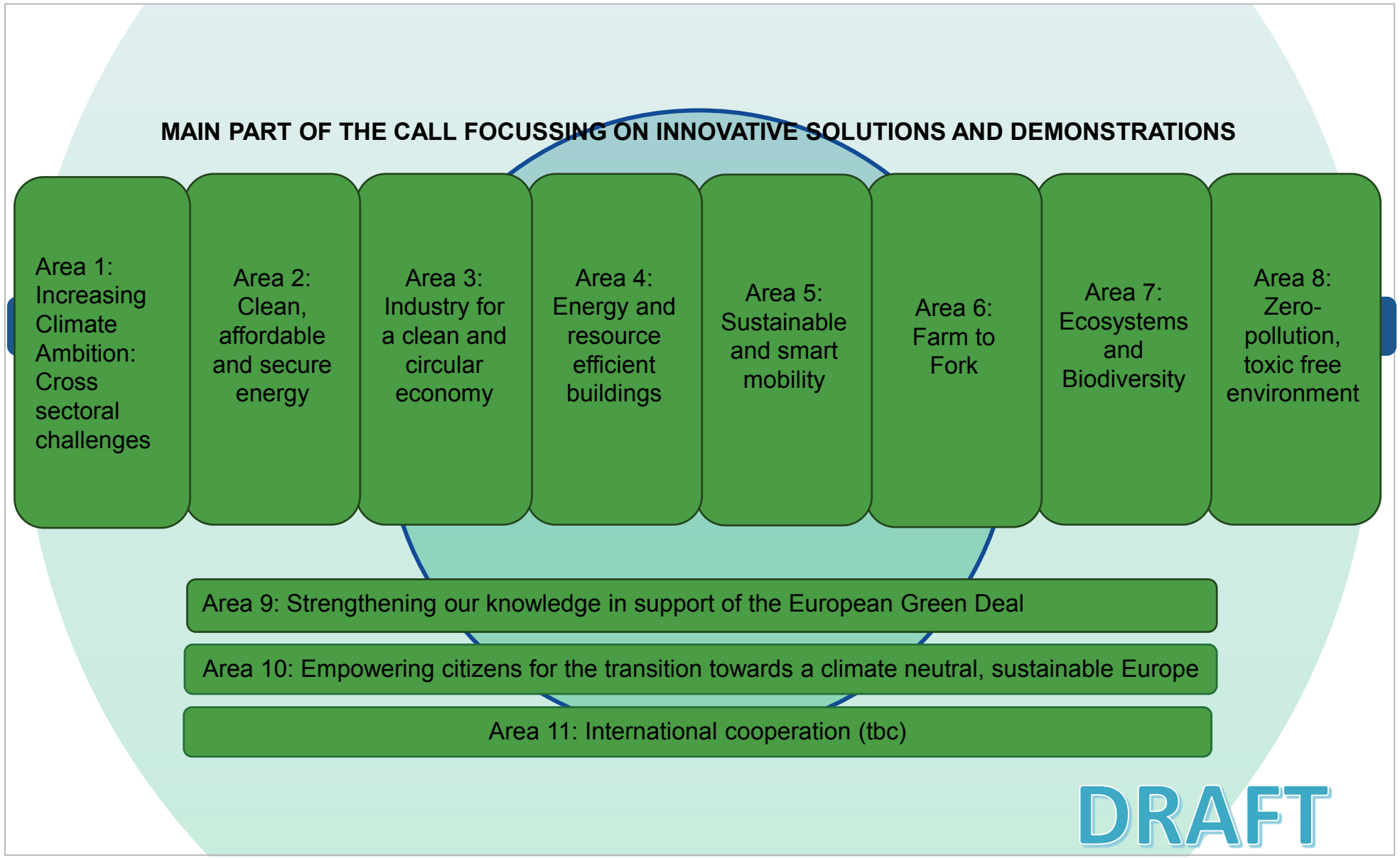

Mobilising Research & Fostering Innovation
Designing a set of deeply transformative policies
Mainstreaming sustainability in all EU policies
Transforming the EU's economy for a sustainable future
Increasing the EU's Climate ambition for 2030 and 2050
A zero pollution ambition for a toxic-free environment
Supplying clean, affordable and secure energy
Preserving and restoring ecosystems and biodiversity
The European Green Deal
Mobilising industry for a clean and circular economy
From 'Farm to Fork': a fair, healthy and environmentally friendly food system
Building and renovating in an energy and resource efficient way
Accelerating the shift to sustainable and smart mobility
And leaving no one behind
Financing the transition
Leave no one behind (Just Transition)
The EU as a global leader
A European Climate Pact

The European Green Deal Call



The European Green Deal Call

Area 1: Increasing Climate Ambition: Cross sectoral challenges	- Preventing and Fighting Wildfires - Towards climate –neutral and socially innovative cities - Demonstrating innovative solutions for resilience of regions to climate change
Area 2: Clean, affordable and secure energy	- Demonstration of innovative critical technologies to enable future large-scale deployment of offshore renewable energy technologies and their integration into the energy system. - Develop an demonstrate a 100 MW electrolyser upscaling the link between renewables and industrial applications
Area 3: Industry for a clean and circular economy	- Closing the carbon cycle to combat climate change: renewable energy driven reduction of Co2 using innovative catalytic materials and technologies - Demonstration of systemic solutions for the territorial development of circular economy

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Area 4: Energy and resource efficient buildings	-Zero emissions built environment – building and renovating in an energy and resource efficient way
Area 5: Sustainable and smart mobility	-Green ports and airports: green aviation and shipping
Area 6: Farm to Fork	-Testing and demonstrating high impact innovations to address food system challenges in a place-based context.
Area 7: Ecosystems and Biodiversity	-Restoring biodiversity and ecosystem sevices
Area 8: Zero-pollution, toxic free environment	-Mitigating the effects of persistent and mobile chemicals -Towards innovative regulation of chemical and pharmaceutical mixtures:

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Area 9: Strengthening our knowledge in support of the EGD	- Reinforced R&I capacities and services to address European Green Deal challenges - Developing end-user products and services for all stakeholders and citizens, supporting climate adaptation and mitigation - Towards a transparent & accessible ocean (a Digital Twin of the Ocean)
Area 10: Empowering citizens for the transition towards a climate neutral, sustainable Europe	- European capacities for citizen deliberation and behavioural change for the Green Deal - Empowering citizens to act on climate change through education, monitoring of their environmental impacts, and civic involvement
Area 11: International cooperation	- Accelerating demonstration of clean energy solutions in Africa and the Mediterranean

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The European Green Deal Call

Demonstration of innovative critical technologies to enable future large-scale deployment of offshore renewable energy technologies and their integration into the energy system.

European Commission

To decarbonise Europe, clean renewable power production must become the main source of energy, while keeping the stability and resilience of the EU Power System.

The Commission's long-term strategy, *A Clean planet for all*, identifies in offshore renewable technologies (power generation, infrastructure, storage/power to X) a key energy system for the Clean Energy Transition.

There is a need for more efficient, cost-effective, affordable and secure technologies using wind, solar, wave and/or tidal resources, considering the potential of the different European sea basins (Baltic Sea, North Sea, Atlantic Ocean, Mediterranean Sea and the Black Sea)

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The European Green Deal Call

Demonstration of innovative critical technologies to enable future large-scale deployment of offshore renewable energy technologies and their integration into the energy system.

Proposed activities:

Projects **shall demonstrate at sea** critical offshore renewable energy innovations considering the efficiency, reliability, sustainability and circularity that is needed in all areas of the offshore renewable energy system, notably:

- **Offshore renewable energy power generating systems**: innovative full scale integrated offshore (floating) wind, wave, tidal and/or solar systems, floating or fixed-bottom substructures, mooring and anchoring systems specifically conceived for floating offshore considering the varied subsea and metocean conditions.
- **Grid infrastructure**: real life demonstration of innovative Direct Current (DC), AC/DC hybrid technologies and systems as a supporting step towards large offshore DC, AC/DC hybrid grids (e.g. multi-vendor Multi-Terminal HVDC (MT HVDC) systems, grid forming converter, HVDC diode rectifiers, Modular Multilevel Converters (MMC), DC Circuit Breaker (DCCB); DC/DC converter and DC/power hub) and their control and management systems; for floating renewable energy technologies: innovative dynamic inter-device/inter-array cables and connections to converter stations at sea or offshore hubs.
- **Power to X /storage systems**: innovative offshore storage and/or power to X systems to maximise the use of offshore resources and increase the system resilience

Proposals shall address at least the offshore renewable power generating systems and the related energy system integration requirements, and may address grid infrastructure and/or power to X/storage systems. Multi-functional platforms can be considered.

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The European Green Deal Call

Demonstration of innovative critical technologies to enable future large-scale deployment of offshore renewable energy technologies and their integration into the energy system.

Proposals shall address also the following:

- Industrial design and manufacturing processes, circularity, scalability, installation methods, transport, operation & maintenance, supply chains and the related digital infrastructures.
- Regulatory, market and financial challenges.
- Marine spatial planning issues
- Projects are requested to demonstrate the technologies at sea while respecting existing environmental regulatory framework.
- Present an environmental monitoring plan to be implemented during the demonstration action.
- Knowledge sharing

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The European Green Deal Call

Demonstration of innovative critical technologies to enable future large-scale deployment of offshore renewable energy technologies and their integration into the energy system.

Impacts:

- on the future roll-out of large-scale deployment of offshore renewable energy, the market perspective.
- Contribution to the Sustainable Development Goals of the United Nations (in particular SDG 7 Affordable and Clean Energy and SDG 9 Industry, Innovation and Infrastructure.
- Increase incentives for investment and economies of scale in offshore bringing down costs and create new business models and services.
- Contribution to EU policies: European Green Deal, Circular economy, Clean Planet for all, ……

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The European Green Deal Call

Demonstration of innovative critical technologies to enable future large-scale deployment of offshore renewable energy technologies and their integration into the energy system.

Other:

- The project shall bring the demonstrated technologies to TRL 7.
- The Commission considers that proposals requesting a contribution from the EU of between EUR 10 to 40 million would allow the specific challenge to be addressed
- Available budget: EUR 80 (?) million
- Type of action: Innovation Action (IA)

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The European Green Deal Call

Demonstration of innovative critical technologies to enable future large-scale deployment of offshore renewable energy technologies and their integration into the energy system.

Publication call: September 2020

Deadline: December 2020/January 2021

Start Grant preparation: March/April 2021

Start projects: 1st January 2022

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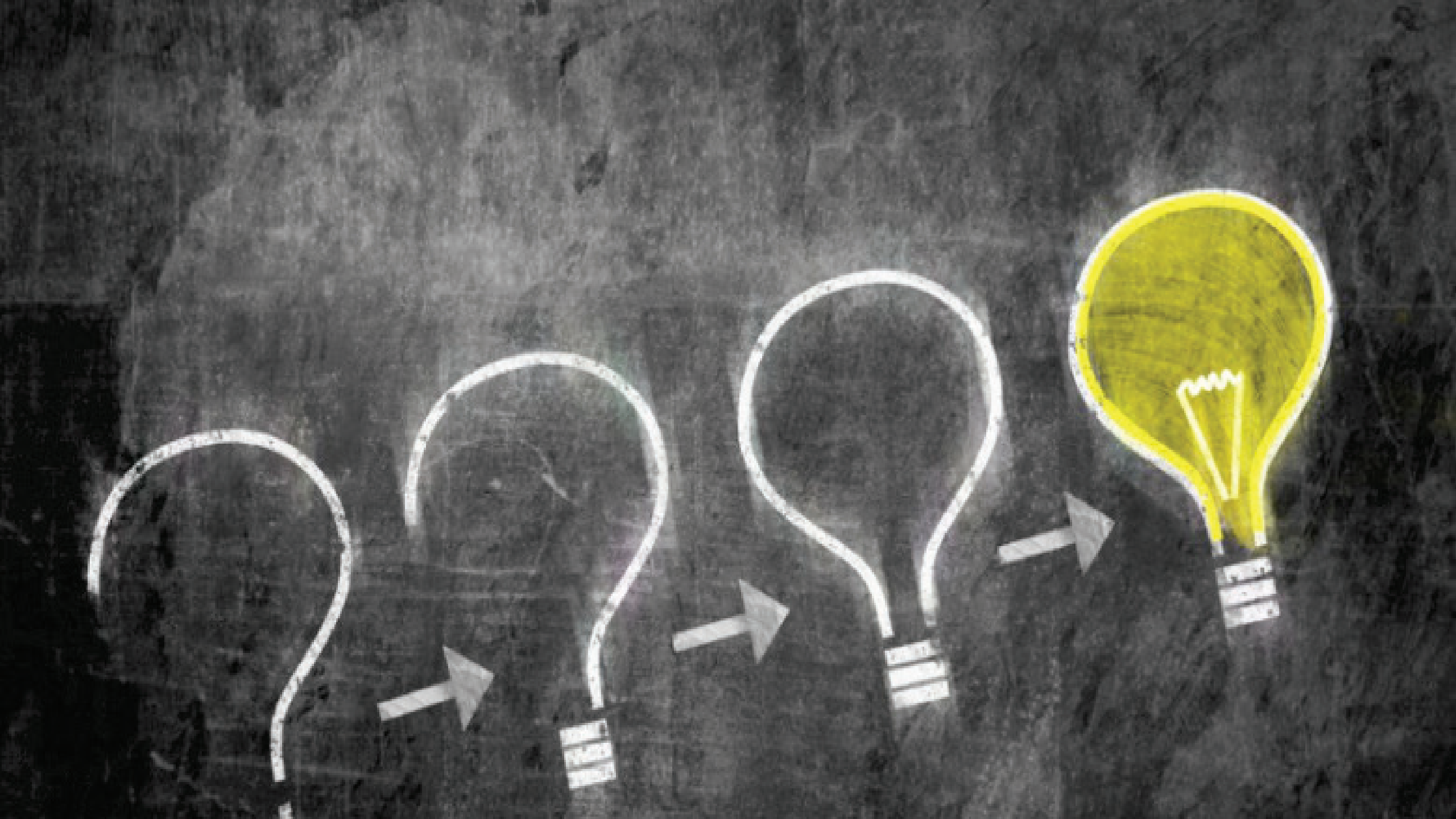

PROJETS DÉMO EN COURS SUR LES PLATES-FORMES EN MER

- **POSEIDON** : la société danoise Floating Power Plant A/S vise à industrialiser et commercialiser une plate-forme hybride qui associe énergies éolienne et houlomotrice. – **Coord**.: FLOATING POWER PLANT AS (DK)

- **FLOW** : l'objectif du projet est de valider en conditions opérationnelles une structure flottante destinée à accueillir une éolienne de 5MW (voire entre 8 et 10MW à plus long terme) en visant une réduction significative du LCOE. – **Coord.:** NAUTILUS FLOATING SOLUTIONS SOCIEDAD LIMITADA (ES)

- **FLOAWER** : Le projet FLOAting Wind Energy netwoRk (FLOAWER) permet à 13 chercheurs de bénéficier d'une formation interdisciplinaire visant à leur enseigner les techniques de construction de flotteurs pour l'éolien en mer. Cette formation conjugue performance technologique et réalisme économique. – **Coord**.: ECOLE CENTRALE DE NANTES (FR)

- **PivotBuoy** : le principal objectif du projet PivotBuoy est de réduire le LCOE de l'éolien flottant en validant une plate-forme innovante. Le projet entend ainsi réduire significativement non seulement le coût de la plate-forme elle-même mais aussi de ancrage, mais encore celui de l'installation, de l'exploitation et de la maintenance. – **Coord**.: EXPONENTIAL RENEWABLES SL (ES)

- **FloTEC** : Le projet FLOTEC entend démontrer la faisabilité d'installation marémotrices flottantes (turbines) en mettant en œuvre un prototype en vraie grandeur. – **Coord**.: ORBITAL MARINE POWER LIMITED (UK)

TOPIC 2.2 - DEVELOP AND DEMONSTRATE A 100 MW ELECTROLYSER UPSCALING THE LINK BETWEEN RENEWABLES AND INDUSTRIAL APPLICATIONS (IA)

Giulia MELICA, Gestionnaire des politiques

Assistante du Conseiller principal du Directeur Général,
DG ENER, Commission européenne

H2020 Green Deal Call

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Topic 2.2: Develop and demonstrate a 100 MW electrolyser upscaling the link between renewables and industrial applications

Webinaire de présentation du thème 2: Clean, affordable and secure energy

Monday, 29 June 2020

Giulia Melica

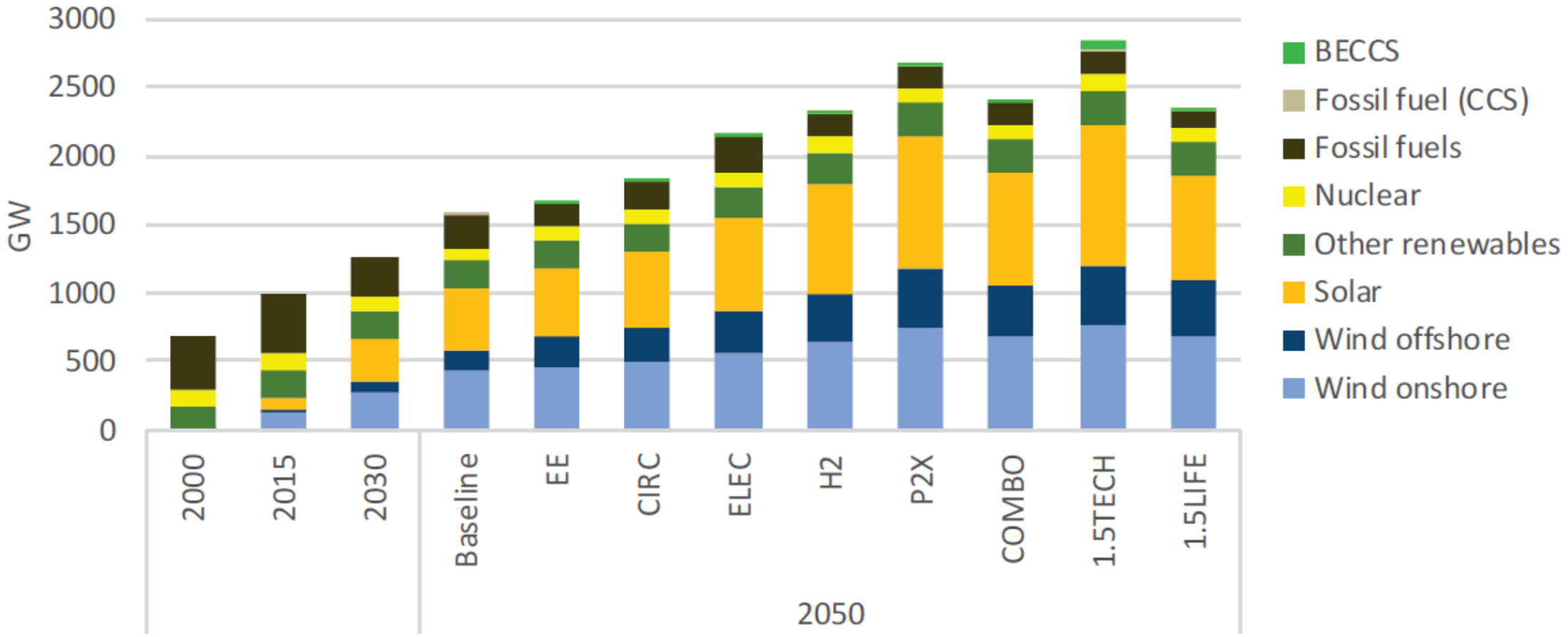
European Commission – DG Energy

Main strategies referring to hydrogen

- “A Clean Planet for All”[1]
- “The European Green Deal”[2]
- “New Industrial Strategy for Europe”[3]
- ‘Europe's moment: Repair and Prepare for the Next Generation’[4]
- Upcoming Energy System Integration and Hydrogen strategies

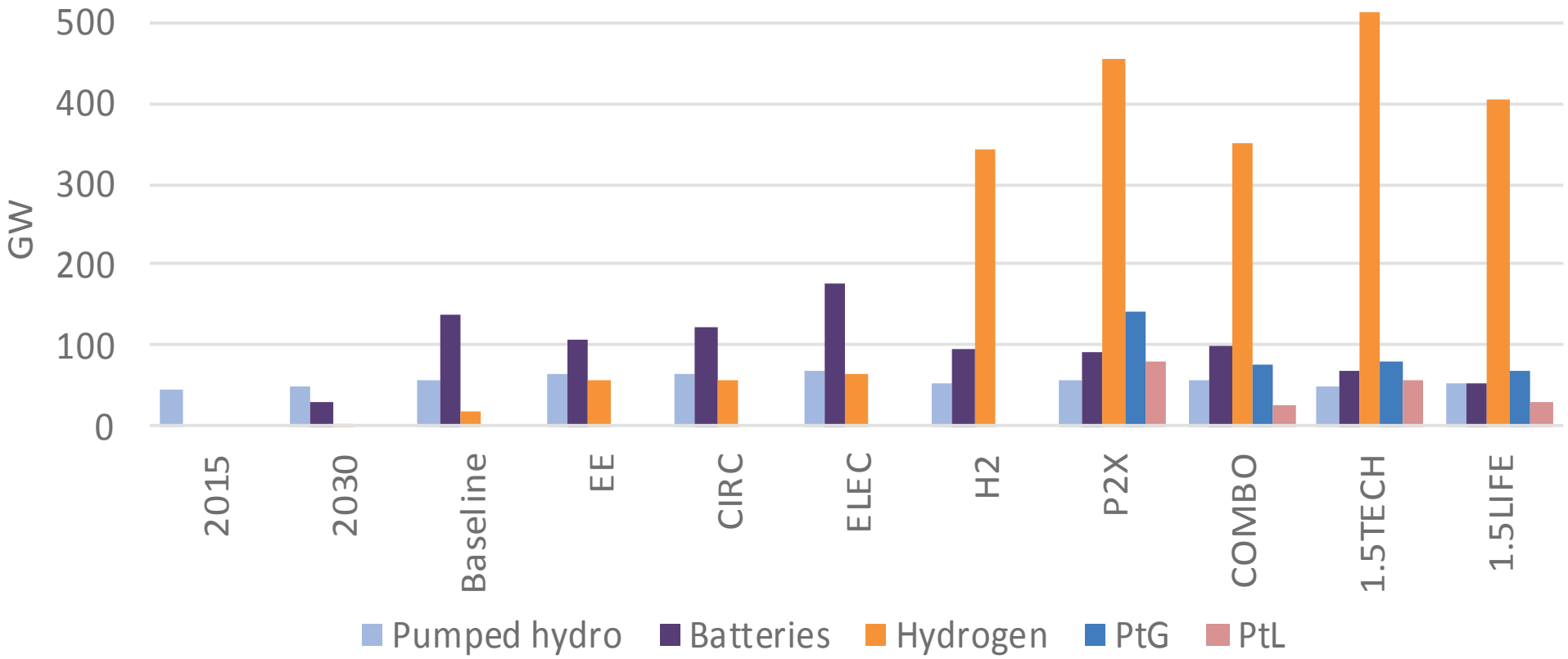
[1] COM(2018) 773
[2] COM(2019) 640 final
[3] COM(2020) 102 final
[4] COM(2020) 456 final

Power generation capacity in 2050



Source: In depth analysis in support of the Communication COM (2018) 773

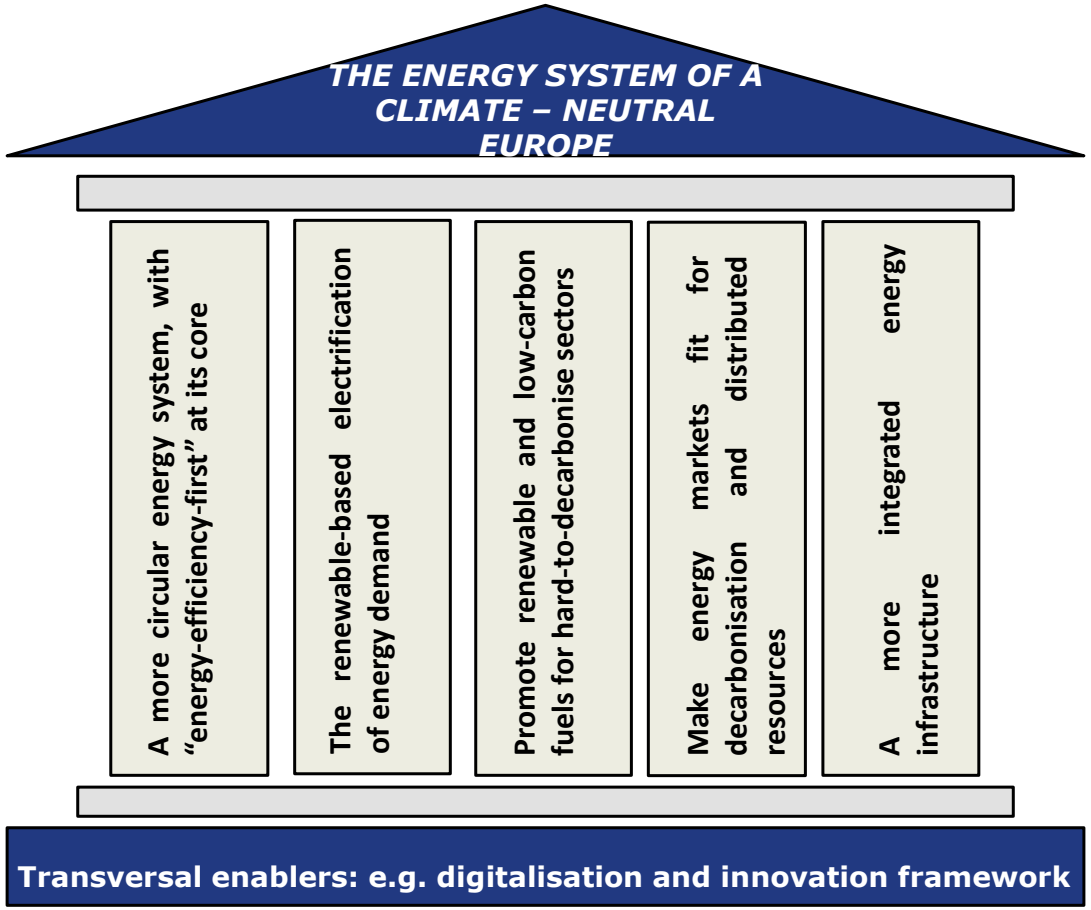
Storage capacity in 2050



Source: In depth analysis in support of the Communication COM (2018) 773

The Strategy for Energy System Integration

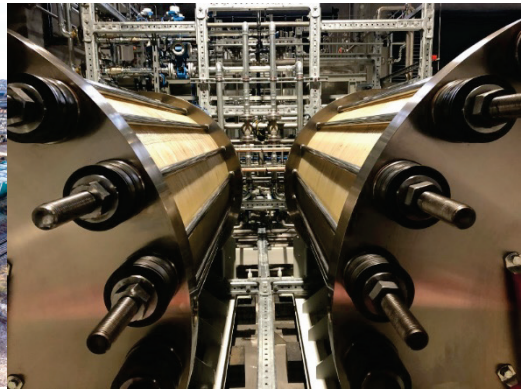
- An **integrated energy system** will be at the heart of **Europe's economic recovery post-COVID19**
- Energy system integration is **the most cost-effective pathway** to a deep decarbonisation of the energy system
- *Additionally*, energy system integration can support **EU leadership in the development of new clean technologies** and business models



The Hydrogen Strategy

- Hydrogen is particularly needed for **hard-to-decarbonise sectors,** such as high-temperature processes in industry or heavy-duty transport, where no alternatives are available, and could play an important role in **supporting a renewables-based electricity system**

- The **hydrogen strategy** will take a **full value chain approach** to underline how to upscale **demand and supply** of renewable hydrogen, how to mobilise MSs, regions and industry, how to advance the **regulatory framework** for infrastructure and markets, how to strengthen the **research agenda** and how to position Europe **internationally**

Towards GW-scale electrolysers

- By analysing eight EU decarbonisation scenario from the EC and other international organisation, the JRC found that by 2050 hydrogen production in Europe could be in the range of 270-3100 TWh. This would require **up to 900 GW of electrolyser capacity by 2050**, compare to less than 1 GW today.
- Electrolysers could be installed **next to existing demand centres** in larger refineries, steel plants, and chemical complexes. They would preferably be **powered directly from local renewable electricity** sources.

R&I on hydrogen

- **<u>Fuel Cells and Hydrogen Joint Undertaking:</u>**

– Finances R&D on FC and hydrogen with EU contribution of **EUR 646 million** from Horizon 2020 for 2014-2020.

– The EC proposed to have it continue under Horizon Europe, with a stronger focus on hydrogen **production, distribution and storage** next to selected **end-use applications** with focus on **integrating renewables and decarbonising other economic sectors**.

- **<u>Innovation Fund</u>** (DG CLIMA): at least EUR 10 billion

- **<u>IPCEIs</u>** (DG GROW)

The H2020 Green Deal call

- A direct contribution to the European Green Deal, this call responds to the need to **confront the climate crisis** and, at the same time, addresses the challenge of **aiding Europe's recovery**, contributing directly to the Recovery Plan for Europe.
- The call aims for **clear, discernible results in the short- to medium-term**, embedding them in a perspective of long-term change. Interventions are more targeted, resulting in fewer, but at the same time **larger and more visible actions,** with a focus on rapid **scalability, dissemination and uptake**.

100 MW electrolyser

Objective: demonstrate energy system integration through hydrogen: produce hydrogen from RES and use it in a commercial/industrial application (e.g. chemical or petrochemical industry, or other industries, mobility hubs)

Challenge:

- develop larger modules than the state of the art, with reduced balance of plant, managing efficiently the input power, the output hydrogen and oxygen streams, as well as the heat flows, while ensuring the reliability of the system and reducing the footprint through a more compact design
- develop a 100MW electrolyser system, which will be tested and demonstrated in real life conditions, providing grid-balancing services and supplying renewable hydrogen to a commercial/industrial application

NOTE: Funding rate is reduced **to 50%** (EU contribution: EUR 60 mln)

100 MW electrolyser - main activities

1. Develop larger modules with reduced balance of plant, managing efficiently the input power, the output hydrogen and oxygen streams and the heat flows, while ensuring the reliability of the system and reducing the footprint

2. Assemble the modules into a 100MW electrolyser system, test and demonstrate it in real life conditions, operating flexibly to harvest maximum renewable power and provide grid-balancing services, and supplying renewable hydrogen to a commercial/industrial application

3. Demonstration of the future economic viability of the technology depending on cost of electricity and hours of operation of the electrolyser

4. Assess the performance and the durability of the electrolyser operating dynamically and address potential safety issues

5. Evaluation of the environmental performance of the system and of other ecological and societal benefits along the value chain

100 MW electrolyser – additional activity

- **Cross border dimension and knowledge sharing within Europe**: as part of mandatory activities, organise 3 workshops, out of which at least 2 in European countries, outside of the beneficiary's main implantation, involving policy makers and energy stakeholders, to share knowledge on experience gathered and replication of experiences.
- Contribute to addressing common challenges, information (like reporting on impact indicators) and dissemination activities through **cooperation with other relevant projects** funded by the European Commission in the context of this call.

100 MW electrolyser – targeted impacts

1. Establish a European industry capable of developing a novel 100MW electrolyser using a European value chain
2. Increase the efficiency of the electrolyser reaching an energy consumption of 49 (ALK) to 52 (PEM) kWh/kg H2 at nominal power
3. Increase the current density to 0.5A/cm2 (ALK) or 3A/cm2 (PEM) and delivery pressure to 30 bar
4. Reduce the plant's footprint by 30% thanks to the larger modules and the plant layout as well as the higher current densities
5. Reduce the electrolyser CAPEX by 20% down to €480/kW and €700/kW for Alkaline and PEM electrolysers respectively
6. Improve the overall efficiency valorising also by-product heat and oxygen

Thank you

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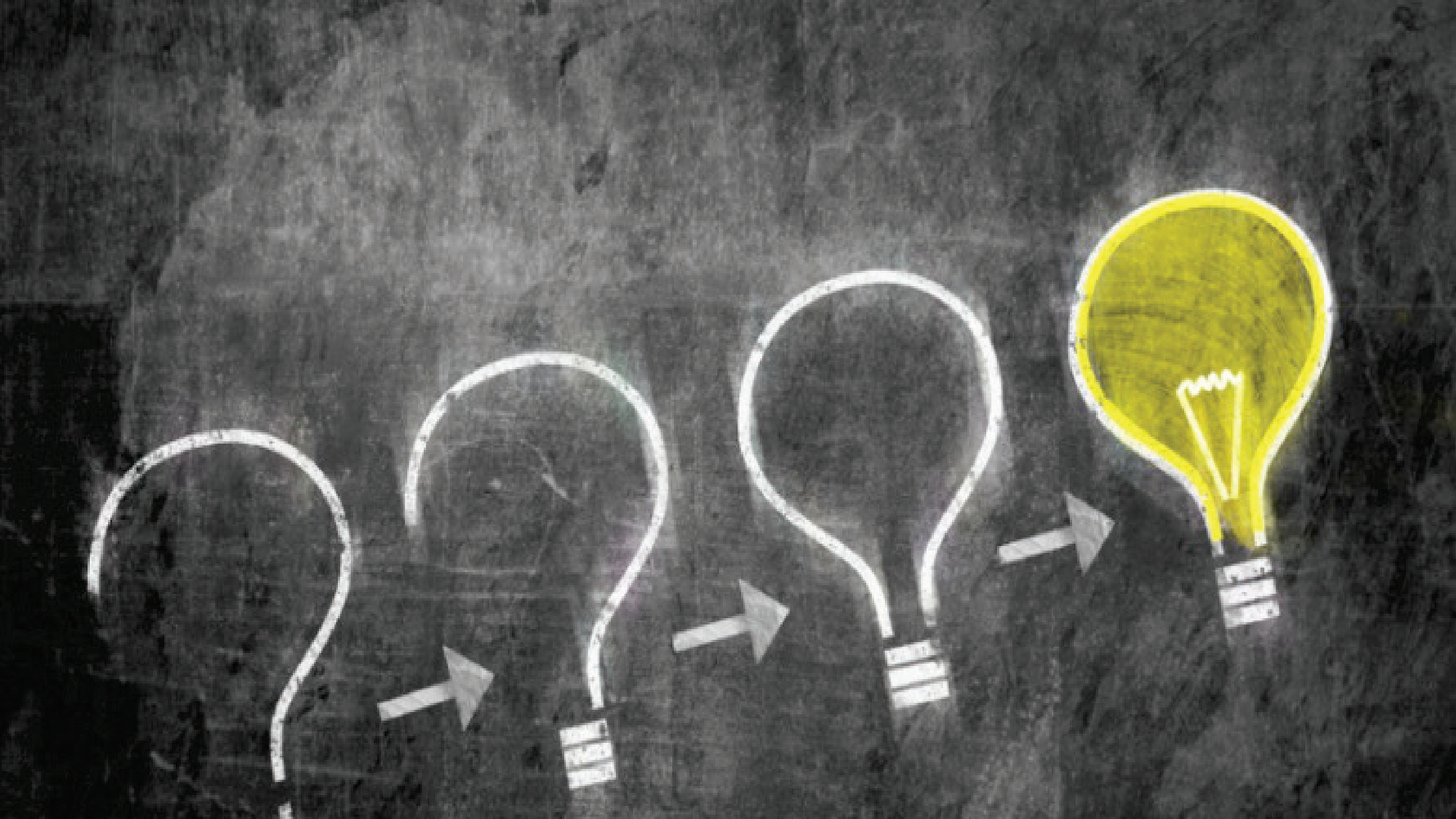

PROJETS DÉMO EN COURS SUR LES ÉLECTROLYSEURS

- **H2Future**: démo d'un électrolyseur **PEM** de **6 MW** (**Siemens**) pour la production d'**H2 vert** et la **fourniture de services d'équilibrage du réseau**. Il est installé à l'usine de **production d'acier** Voestalpine à Linz (AT) – **Coord**.: Verbund Solutions (AT)

- **Demo4Grid**: 2éme plus grand démo **PAE** d'UE d'une taille de **4 MW (IHT)**. Il fournit des **services d'équilibrage au réseau** + **H2 vert** pour des **utilisations industrielles et commerciales**. Il est installé sur le site de MPREIS à Völs (AT) – **Coord.:** Diadikasia Business Consulting (GR)

- **Refhyne**: le plus grand électrolyseur **PEM** au monde, d'une taille de **10 MW** (**ITM Power**), installé dans une **raffinerie** opérée par Shell Allemagne à Wesseling (GER) pour la production d'**H2 vert** + **services d'équilibrage au réseau** – **Coord**.: SINTEF (NOR)

- **Djewels**: le projet vise à améliorer la technologie **PAE** en vue de la prochaine génération de 100 MW. Le plus grand démo d'UE avec un élec. de **20 MW** (**McPhy** + **De Nora**) pour la production de **MeOH vert**. Il est exploité par Nouryon+GasUnie à Delfzijl (NL) – **Coord**.: Nouryon Industrial Chemicals (NL)

- **MultiPLHY**: 1er système au monde **EHT** basé sur les **SOEC** (**Sunfire**) à l'échelle de **2,6 MW.** Il sera installé dans la **raffinerie** de Neste Oil à Rotterdam (NL) pour produire de l'**H2 vert** – **Coord**.: CEA (FR)

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