

Draft proposal for a

# European Partnership under Horizon Europe

## Clean Energy Transition

Version 8 June 2020

### **Summary**

A transformative R&I Programme across Europe, the European Partnership for Clean Energy Transition will boost and accelerate energy transition in all its dimensions. It will enable joint R&I programmes from regional to national and global level, co-supported by industry, public organisations, research and citizens' organisations to make Europe a frontrunner in energy innovation and eventually the first climate-neutral continent. With an ambitious SRIA targeting 2030 it will address key challenges of energy transition with a clear output orientation and measurable impacts.

### **About this draft**

In autumn 2019 the Commission services asked potential partners to further elaborate proposals for the candidate European Partnerships identified during the strategic planning of Horizon Europe. These proposals have been developed by potential partners based on common guidance and template, taking into account the initial concepts developed by the Commission and feedback received from Member States during early consultation . The Commission Services have guided revisions during drafting to facilitate alignment with the overall EU political ambition and compliance with the criteria for Partnerships.

This document is a stable draft of the partnership proposal, released for the purpose of ensuring transparency of information on the current status of preparation (including on the process for developing the Strategic Research and Innovation Agenda). As such, it aims to contribute to further collaboration, synergies and alignment between partnership candidates, as well as more broadly with related R&I stakeholders in the EU, and beyond where relevant.

This informal document does not reflect the final views of the Commission, nor pre-empt the formal decision-making (comitology or legislative procedure) on the establishment of European Partnerships.

In the next steps of preparations, the Commission Services will further assess these proposals against the selection criteria for European Partnerships. The final decision on launching a Partnership will depend on progress in their preparation (incl. compliance with selection criteria) and the formal decisions on European Partnerships (linked with the adoption of Strategic Plan, work programmes, and legislative procedures, depending on the form). Key precondition is the existence of an agreed Strategic Research and Innovation Agenda / Roadmap. The launch of a Partnership is also conditional to partners signing up to final, commonly agreed objectives and committing the resources and investments needed from their side to achieve them.

The remaining issues will be addressed in the context of the development of the Strategic Research and Innovation Agendas/ Roadmaps, and as part of the overall policy (notably in the respective legal frameworks). In particular, it is important that all Partnerships further develop their framework of objectives. All Partnerships need to have a well-developed logical framework with concrete objectives and targets and with a set of Key Performance Indicators to monitor achievement of objectives and the resources that are invested.

Aspects related to implementation, programme design, monitoring and evaluation system will be streamlined and harmonised at a later stage across initiatives to ensure compliance with the implementation criteria, comparability across initiatives and to simplify the overall landscape.

In case you would like to receive further information about this initiative, please contact:

**Lead entity (main contact):**

Lisa Lundmark, Swedish Energy Agency, [lisa.lundmark@energimyndigheten.se](mailto:lisa.lundmark@energimyndigheten.se)

Michael Huebner , Austrian Federal Ministry of Climate Action, Environment, Energy, Transport, Innovation and Technology, [michael.huebner@bmk.gv.at](mailto:michael.huebner@bmk.gv.at)

Hans-Günther Schwarz, Austrian Federal Ministry of Climate Action, Environment, Energy, Transport, Innovation and Technology, [hans-guenther.schwarz@bmk.gv.at](mailto:hans-guenther.schwarz@bmk.gv.at)

**Commission services (main contact):**

DG R&I, Maria Getsiou, [Maria.Getsiou@ec.europa.eu](mailto:Maria.Getsiou@ec.europa.eu)

DG ENERGY, Alessia Clocchiatti, [Alessia.Clocchiatti@ec.europa.eu](mailto:Alessia.Clocchiatti@ec.europa.eu)

**Partnership sector in DG R&I** (overall policy approach for European Partnerships and its coherent application across initiatives), E-mail: [RTD-EUROPEAN-PARTNERSHIPS@ec.europa.eu](mailto:RTD-EUROPEAN-PARTNERSHIPS@ec.europa.eu)

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<https://expera.smartgridplus.eu/ExpertRegistration/ExpertSetPlan.aspx>

Key upcoming consultation/events: Kick-off meeting on the SRIA development, 26 May 2020.

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## List of Abbreviation

AC	Associated Countries (Countries associated to the R&I Framework Programme of the European Union)
BESTF	Acronym of ERA-NET Bioenergy Sustaining the Future (BESTF)
BIPV	Building-Integrated PV
CAPEX	Capital expenditures (expenditures creating future financial benefits for a company)
CCS	Carbon Capture and Storage
CCU	Carbon Capture and Use
CCUS	Carbon Capture, Use and Storage
CEF	Connecting Europe Facility
CEM	Clean Energy Ministerial
CET	Clean Energy Transition
CETP	Clean Energy Transition Partnership (Co-funded Partnership in Horizon Europe on Clean Energy Transition)
CO <sub>2</sub>	Carbon Dioxide
CSA	Coordination and Support Action (a funding instrument in the EU R&I Framework Programme)
CSLF	Carbon Sequestration Leadership Forum
CSP	Concentrated Solar Power (solarthermic power generation)
DG ENER	Directorate General for Energy of the European Commission
DG RTD	Directorate General for Research and Innovation of the European Commission
DHC	District Heating and Cooling
DUT	Driving Urban Transitions (one of the prospective co-funded partnerships under Horizon Europe)
EC	European Commission
ECES	IEA Technology Collaboration Programme on Energy Conservation through Energy Storage
EERA	European Energy Research Alliance
EIT	European Institute of Technology
ERA-LEARN	Online information platform on transnational R&I funding in Europe, funded by the European Commission)
ERA-NET	European Research Area Network (R&I funding network of MS/AC)
ERA-NET ACT	ERA-NET on Accelerating CCS Technologies
ERA-NET Co-fund	ERA-NET, where an overall percentage of all project funding budgets spent within the network is co-funded from H2020 budget
ERDF	European Regional Development Fund
ESFRI	European Strategy Forum on Research Infrastructures
ESIF	European Structural and Investment Funds
ETIP	European Technology and Innovation Platform
ETSAP	IEA Technology Collaboration Programme on Energy Technology Systems Analysis
FHC	Fuel Cells and Hydrogen
FO	(Research) Funding Organisation
GDP	Gross Domestic Product
GHG	Greenhouse Gas (name of an IEA TCP)
GSE	Geological Service for Europe (one of the prospective co-funded partnerships under Horizon Europe)
GWh	Gigawatt Hours (energy unit)

HE	Horizon Europe
HPT	IEA Technology Collaboration Programme on Heat Pumping Technologies
IC	Innovation Challenge (within Mission Innovation)
ICT	Information and Communication Technologies
IEA	International Energy Agency
IEA TCP	Technology Collaboration Programme (within the IEA)
IETS	IEA Technology Collaboration Programme on Industrial Energy-Related Technologies and Systems
IP	Implementation Plan (of one of the 14 Implementation Working Groups of the SET Plan)
IPCC	International Panel on Climate Change
ISGAN	International Smart Grids Action Network (a TCP within the IEA)
IWG	Implementation Working Group (within one of the SET Plan Actions)
JPI	Joint Programming Initiative
JPP	Joint Programming Platform
JTI	Joint Technology Initiative (name of funding instrument in FP7/H2020 to fund institutionalised PPPs)
JU	Joint Undertaking (name of funding instrument in FP7/H2020 to fund institutionalised PPPs)
KIC	Knowledge and Innovation Community (under the EIC)
kWh	Kilowatt Hours (a unit of energy)
LCOE	The levelized cost of energy, or levelized cost of electricity, is the net present value of the generated electrical energy over the lifetime of an electricity generating plant
LIFE	The LIFE Programme (French: L'Instrument Financier pour l'Environnement) is the European Union's funding instrument for the environment and climate action
MI	Mission Innovation
MoU	Memorandum of Understanding
MS	Member States of the European Union
MWh	Megawatt Hours (a unit of energy)
NECP	National Energy and Climate Plan
OPEX	Operational expenditure refers to expenses incurred in the course of ordinary business
P2P	Public-public partnership
PED	Positive Energy Districts (urban districts/neighbourhoods, which produce more energy than they consume)
PPP	Public-private partnership
PV	Photovoltaics
PVPS	Photovoltaic Power Systems (an IEA TCP)
R&I	Research and Innovation
RDD	Research, Development, and Demonstration
RDI	Research, Demonstration, and Innovation
RHC	Renewable Heating and Cooling
SDG	Sustainable Development Goals (adopted by the United Nations in 2015)
SET Plan	Strategic Energy Technology Plan of the European Union
SET-Plan SG	Strategic Energy Technology Plan Steering Group of the European Union
SHC	Solar Heating and Cooling
SNET	ETIP on Smart Networks for Energy Transition
solarPACES	IEA TCP on development and deployment of concentrating solar thermal technologies
SRIA	Strategic Research and Innovation Agenda
STE	Solar-thermal electricity
TCP	Technology Collaboration Programme (within the IEA)

ToR	Terms of Reference
TP	Technology Platform
TRL	Technology Readiness Level (an indicator of where a technology is located in its development along the innovation cycle)
VIPV	Vehicle integrated PV
ZEP	Zero Emissions Platform (an ETIP dedicated to CCUS)

# 1 Context, objectives, expected impacts

## 1.1 Context and problem definition

### 1.1.1 Policy Context on Energy Transition on national, European and global level

To achieve the ambitious goal of becoming a climate-neutral economy by 2050, Europe needs to launch transformative processes. All economic sectors will need to be scrutinised with regard to their impact on, and contribution to, the transformation of our energy system. Achieving this transition is one of the key factors in addressing the current climate crisis, one of the grand challenges of our time. With robust investment in innovation and technology development, however, the energy transition can be turned into an opportunity for growth and competitiveness.

The co-funded partnership on Clean Energy Transition (CETP) aims at addressing the challenge of a climate-neutral economy through R&I in clean energy technologies thus accelerating the clean energy transition. The CETP is embedded in and contributes to a wider national, European and global policy context and implementation instruments and contributes to their overarching goals (Figure 1).

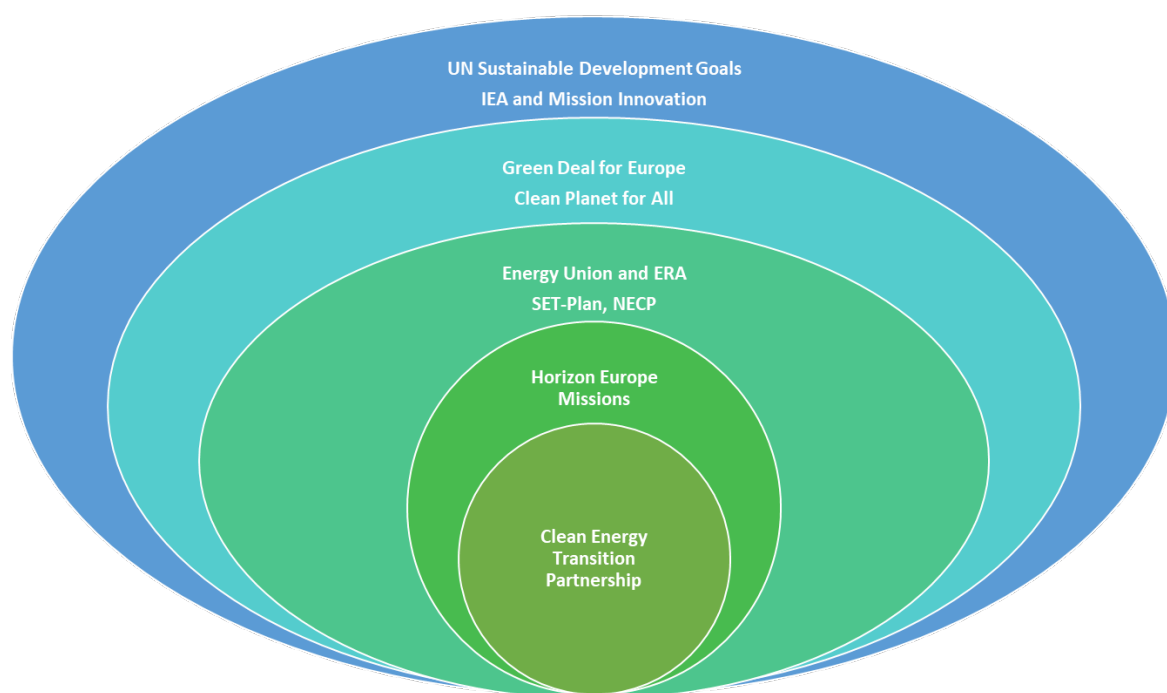


Figure 1: The Positioning of the CET Partnership in the wider policy context and respective instruments

## UN Sustainable Development Goals

The UN Sustainable Development Goals (SDG) are objectives defined on a global level. In 2015, the new Sustainable Development Agenda, with 17 global goals at its core, was adopted by 193 Member States of the United Nations. Activities in this partnership will contribute to several SDGs, with the most direct impact on SDG 7 ‘Affordable and clean energy’, SDG 9 ‘Industry, Innovation and Infrastructure’, SDG 13 ‘Climate Action’ and SDG 11 ‘Sustainable Cities and Communities’.



## The European Green Deal and the Clean Planet for All

In November 2018 the European Commission presented its long-term vision for a prosperous, modern competitive and climate-neutral economy by 2050<sup>1</sup>. And, with The European Green Deal<sup>2</sup> presented in 2019, the Commission President Ursula von der Leyen, made a commitment for the European Union to become the world's first climate-neutral continent (Figure 2).



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

*“For the generation of my children, Europe is a unique aspiration. [...] To match this aspiration with action, we must rediscover our unity and inner strength.” [...] “We will be a world leader in circular economy and clean technologies.”*

When presenting the Green Deal Commission President Ursula von der Leyen underlined that the EU is on track to meet its Paris Agreement goals and 2030 targets, but also recognised that we need to go further and faster.

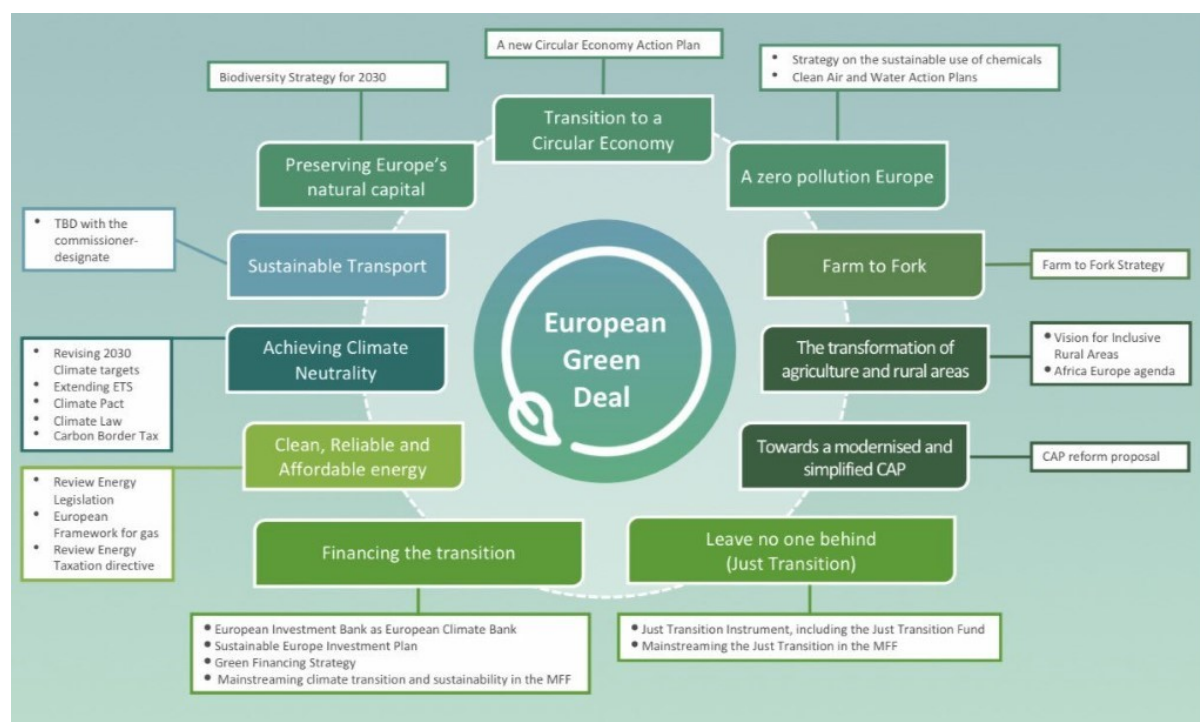


Figure 2: European Green Deal

To reach additional goals for reduction of greenhouse gases and other air emissions in the EU, a new decarbonised energy system largely based on renewables, energy and resource efficiency

<sup>1</sup> COM (2018) 773 - [A Clean Planet for all - A European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy](#)

<sup>2</sup> A Green Deal [https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal\\_en](https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en)  
Mission letter to Timmermans responsible for the Green Deal [https://ec.europa.eu/commission/sites/beta-political/files/mission-letter-frans-timmermans-2019\\_en.pdf?fbclid=IwAR3MP8zmxW1jBVJhtBUtP2PKkEct5ibFjKVJTCoaxgRX6thxcdsylvXhTPIk](https://ec.europa.eu/commission/sites/beta-political/files/mission-letter-frans-timmermans-2019_en.pdf?fbclid=IwAR3MP8zmxW1jBVJhtBUtP2PKkEct5ibFjKVJTCoaxgRX6thxcdsylvXhTPIk)

must be designed and deployed. The development of improved and new cost-effective technologies and solutions will be a main factor providing a viable option for decarbonisation<sup>3</sup>. For regions and industrial sectors that are still relying largely on fossil energy sources, change will be the most radical and they will have to be part of the transition efforts from the very start.

The European Green Deal will support a clean energy transition and will help accelerate the EU's industry transition to a sustainable model of inclusive growth. The clean energy transition is an opportunity to increase sustainable and job-creating economic activity. A European industry at the forefront of zero-emission technologies, sustainable products and services has a significant potential to increase economic value: developing and deploying them first in the European economy and through expanding presence and sales in global markets. The CETP will be a key element of the European Green Deal and will provide European industry with a unique chance to continue being an active partner in the clean energy transition. The CETP aligns with the vision of the EU of a climate neutral Europe in 2050<sup>4</sup> and the European Green Deal.

### **The European Research Area**

The European Research Area was launched in 2000 as a key concept for implementing the Lisbon strategy.<sup>5</sup> ERA implementation focuses on six priorities<sup>6</sup>. Among them a focus on optimal transnational cooperation and competition, including 'jointly addressing grand challenges' and 'research infrastructures' and international cooperation. Areas where the CETP through MS collaboration will support the ERA in its objectives. In its Conclusions of 30 November 2018, the Council invited the Commission to publish by mid-2020 a new ERA Communication for the period beyond 2020.<sup>7</sup> It may propose revised ERA policy priorities. This may also provide a renewed ambition for ERA as it now operates in a new environment of the UN SDGs.

### **The European Energy Union**

The "European Energy Union"<sup>8</sup> founded in 2015 stresses the need for a fundamental transformation of our energy systems towards a sustainable, low carbon and climate-friendly economy. At its centre are strong, innovative and competitive European companies, which provide technologies and services needed to deliver energy efficiency and low carbon technologies. A European labour force will have the skills to build and manage the energy systems of tomorrow. The European Union will thus become a leader in renewable energy, reducing its dependency on fossil fuels. It has committed to cut CO<sub>2</sub> emissions by at least 40% by 2030. Within the Energy Union narrative, the role of citizens is crucial to take ownership of the energy transition, benefit from new technologies and solutions to reduce their bills, participate actively in the market, all the while protecting vulnerable consumers. The EU is well placed to use its research, development and innovation policies to turn this transition into

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<sup>3</sup> *the process of replacing fossil carbon hydrates as resources for energy*

<sup>4</sup> [https://ec.europa.eu/clima/policies/strategies/2050\\_en](https://ec.europa.eu/clima/policies/strategies/2050_en)

<sup>5</sup> COM(2000) 6 final Towards a European research area, <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52000DC0006&from=EN>

<sup>6</sup> ERA Progress report 2018

<sup>7</sup> Doc 14516/18 <http://data.consilium.europa.eu/doc/document/ST-14516-2018-INIT/en/pdf>

<sup>8</sup> COM(2015) 80 final, *ENERGY UNION PACKAGE, A Framework Strategy for a Resilient Energy Union with a Forward-Looking Climate Change Policy*, Brussels, 25.2.2015

a concrete industrial opportunity. By mobilising up to 177 billion EUR of public and private investment per year from 2021, it will generate up to a 1% increase in GDP over the next decade and create 900,000 new jobs.<sup>9</sup>

The CETP partnership will support research and innovation activities in line with the fifth dimension of the Energy Union covering research, innovation and competitiveness. In doing so the CETP results will also contribute to all other dimensions of the Energy Union.

### **The European Strategic Energy Technology Plan (SET Plan)**

The European Strategic Energy Technology Plan<sup>10</sup> is the R&I pillar of the European Energy Union. It aims to accelerate the development and deployment of low-carbon technologies, improve new technologies and bring down their costs, by coordinating national research efforts and facilitating financing of innovation projects in the energy sector. The SET Plan promotes cooperation amongst European countries, companies, research institutions and the EC itself. It has put forward a specific vision for each technology area, so called Actions, through setting ambitious targets to be reached in the next decade(s). The SET Plan provides a platform to define common targets, align research agendas and coordinate with national programmes, resulting in a number of concrete partnerships, e.g. those based on Horizon 2020 ERA-NET co-fund actions.

Under the SET Plan, targeted Implementation Plans (IPs) in several technology areas have been developed. Representatives from Member States (MS) and Associated Countries (AC) (nominated by the SET-Plan Steering Group), from European stakeholder initiatives (e.g. EERA, ETIPS) and from the European Commission have agreed on important R&I targets. For each SET Plan Action, the IPs identify and prioritise research and innovation activities to be implemented in cooperation between SET Plan countries and relevant industrial and academic actors.

The CETP will build on the current IPs and act as an enabler for future development of the IPs and bring forward their execution by providing an effective framework for transnational cooperation across participating MSs and ACs.

### **National Energy and Climate Plans (NECP)**

The integrated National Energy and Climate Plans<sup>11</sup>, a new element of the transnational governance established with the Energy Union, cover a ten-year period and provide an overview of the current energy system and policy situation. They set out national objectives for each of the five dimensions of the Energy Union and corresponding policies and measures to meet those objectives, targeting a socially acceptable and just transition to a sustainable low-carbon economy. The fifth dimension of the Energy Union and the NECPs cover research, innovation and competitiveness and reflect national funding objectives and activities of MS. In the description of member states activities, a link is also made to participation in European and international collaboration.

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<sup>9</sup> COM(2016) 860 final, [https://ec.europa.eu/energy/sites/ener/files/documents/com\\_860\\_final.pdf](https://ec.europa.eu/energy/sites/ener/files/documents/com_860_final.pdf)

<sup>10</sup> <https://setis.ec.europa.eu/actions-towards-implementing-integrated-set-plan>

<sup>11</sup> <https://ec.europa.eu/energy/en/topics/energy-strategy-and-energy-union/national-energy-climate-plans#national-long-term-strategies>

In this regard, the CETP will be an enabler to achieve R&I objectives, providing a collaborative platform for MS, AC and third countries and support the implementation of all five dimensions of the Energy Union and the NECPs.

## **Horizon Europe**

The Clean Energy Transition Partnership is set out in the context of the Energy, Climate and Mobility Cluster of Horizon Europe, and will contribute to its objectives especially where the transition of the energy system is concerned. It will do so by mobilising and aligning national and regional R&I funding programmes. The CETP will also contribute to the following Horizon Europe Mission Areas: 1) ‘Adaptation to climate change including societal transformation’ and 4) ‘Climate-Neutral and Smart Cities’.

## **A comprehensive recovery plan in response to the Covid-19 crisis**

The joint statement of the Members of the European Council, adopted on 26 March, called for a coordinated exit strategy, a comprehensive recovery plan and unprecedented investment. It invited both the President of the European Council and the President of the Commission, in consultation with other institutions, especially the European Central Bank, to start work on a Roadmap to this end.<sup>12</sup> The European Council has agreed to work towards establishing a recovery fund. This fund shall be of a sufficient magnitude, targeted towards the sectors and geographical parts of Europe most affected, and be dedicated to dealing with this unprecedented crisis.<sup>13</sup> The CETP will follow the work on and future decisions on a European Recovery Fund in response to the Covid-19 crisis and reflect on potential actions and instruments decided by the EU and explore how the CETP can contribute to the implementation of the recovery plan.

### **1.1.2 Challenges for a holistic and sustainable energy transition**

#### *1.1.2.1 Problem definition*

On a European level, the energy transition is the largest and most important contribution to solving the climate crisis and becoming the first climate neutral continent. The pace of the energy transition needs to accelerate in order to meet these objectives. Path dependencies of the current fossil-based society and energy system creates many barriers for transitional change. Research and innovation play an instrumental role for breaking these barriers and enabling this acceleration. The main drivers to the CETP are:

### **Accelerating the pace of R&I**

The transition to a clean energy system requires an immense technological and societal shift. New energy technologies, sustainable solutions and disruptive innovation are critical to achieve the long-term objectives. Europe is a global leader in developing clean energy technologies, but to keep its competitive advantage, the EU significantly needs to increase the development and demonstration of next generation energy technologies. This challenge is beyond the means of individual Member States or the EU alone. Joint efforts in research and innovation that

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<sup>12</sup> <https://www.consilium.europa.eu/media/43384/roadmap-for-recovery-final-21-04-2020.pdf>

<sup>13</sup> Conclusions of the President of the European Council following the video conference of the members of the European Council, 23 April 2020 <https://www.consilium.europa.eu/en/press/press->

accelerate a clean energy transition are essential to achieving the European Green Deal objectives for several reasons<sup>14</sup>:

- Climate neutrality in 2050 will require additional investment: 175 to 290 billion euros a year. On the other side, it will drastically reduce our bill for fossil fuel imports, which today is 266 billion euros a year. This transition will dramatically change technology needs in the EU and world-wide.<sup>15</sup>
- Increased investments in R&I and the coordination of currently fragmented public and private innovation agendas will accelerate the transitional process.

A massive, coordinated research and innovation effort, built around a coherent strategic research and innovation agenda is key to enable the transition and make zero-carbon solutions largely available by 2030 in view of 2050 objectives.

### **A systemic approach to energy transition**

The CETP assumes a systemic perspective to develop its strategic research and innovation agenda and to support systemic change in the energy system. The energy system is a socio-technical system composed of a series of complex and intertwined elements: infrastructures, technologies, societal and behavioural aspects, economic and financial aspects, regulatory aspects. These are constantly changing and adapting.

The energy transition requires innovation in the entire system, not just in individual elements. Transformative research and innovation programmes should focus on mobilising the potential of system innovation to address the wide range of challenges and direct socio-technical systems change. In order to enable a smooth transition, approaches of different technology development efforts must be combined within a systemic view, exploiting sectoral integration aspects (such as interfaces to clean mobility, smart communities, energy-intensive industries and energy efficiency in the building domain), as well as trans-disciplinary approaches. This requires more cross-discipline and cross-thematic research and innovation.

Hence, essential to the transition is a holistic view of the energy system, considering all different aspects and actors, including cross-sectoral drivers such as digitalisation, circularity and sustainability as well.

### **A clean and sustainable energy system**

Modernisation and decarbonisation of the European economy requires significant investments. New solutions may initially cost more than established ones but development and innovation of solutions for the future will ultimately lead to industrial competitiveness and leadership; both prerequisites for sustainable jobs in the future. Also, options leading to a rapid transformation towards a circular economy and behavioural changes have the potential to reduce the need for additional investments. In the past ten years, new technologies such as in renewables, and energy efficiency have been developed and deployed, massively reducing the

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<sup>14</sup> [Ursula von der Leyen, „A Union that strives for more- my agenda for Europe”, POLITICAL GUIDELINES FOR THE NEXT EUROPEAN COMMISSION 2019-2024](https://ec.europa.eu/commission/sites/beta-political/files/political-guidelines-next-commission_en.pdf)  
[https://ec.europa.eu/commission/sites/beta-political/files/political-guidelines-next-commission\\_en.pdf](https://ec.europa.eu/commission/sites/beta-political/files/political-guidelines-next-commission_en.pdf)

<sup>15</sup> Long-term strategy: press conference by Maroš Šefčovič 2018-11-  
[https://ec.europa.eu/commission/presscorner/detail/en/SPEECH\\_18\\_6604](https://ec.europa.eu/commission/presscorner/detail/en/SPEECH_18_6604)



cost of the ecological transition. This shows that the transition towards clean energy is a sound economic investment strategy, both short term and long term.

The environmental sustainability issues in the energy system today focus largely on fossil fuels and the effect on climate change. It is important to remember that also the zero-carbon technologies affect the environment and use limited resources. Research and innovation are needed to avoid or minimise these effects so as not to create other environmental strains when we implement new solutions. This means that the energy system shall become more “circular” and have an efficient use of limited resources. Energy is not per se a limited resource in the zero-carbon energy system. The aim for development will be to substitute scarce materials for renewable or abundant ones and where finite resources are used to create circular material flows that limits the use of raw material. The transition of the energy system has to be sustainable in all aspects and this will therefore be an important component of the research and innovation priorities of the CETP. Apart from economic and environmental sustainability this also includes social sustainability.

### **A fair and inclusive energy transition**

The energy transition affects all of us, but we participate in it based on different conditions. Equal and inclusive participation that ensures energy security for all citizens is still a challenge within the energy transition. People and different groups in society have different prerequisites for participating in the transition and demonstrate differing behaviours, depending on, your gender, your living environment, your level of education and knowledge, ability to adapt to new solutions or technologies, and whether you are young or old. Women are underrepresented in the energy sector, and energy research rarely considers aspects of gender even though ideas and behaviour differ among genders. This brings forward a need to focus research and innovation on challenges related to a better use of resources in society, how different actors influence and participate in the transition, how to empower consumers and to create engagement, and how society can avoid an energy transition that will contribute to increased divisions in society.

### **International cooperation**

*“Sustainable energy innovation is at the heart of solving many of the world’s toughest challenges, and is the key to tapping the full potential of energy as a contributor to future growth and prosperity.”<sup>16</sup>*



*“The world can’t afford to wait the decades that it usually takes to develop promising technology, find investors, connect with governments willing to roll it out, and reach customers. Our goal is to bring ideas out of the lab and into the market much faster.”<sup>17</sup>*

Climate change is a global challenge where **worldwide collaboration is necessary** in order to bring solutions to Europe and the rest of the world. International collaboration may take many different forms, bilaterally or multilaterally where organisations like the IEA or initiatives such

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<sup>16</sup> White Paper *Accelerating Sustainable Energy Innovation*, World Economic Forum 2018  
<https://www.weforum.org/whitepapers/accelerating-sustainable-energy-innovation>

<sup>17</sup> Bill Gates, December 2017, presenting Mission Innovation at the One Planet Summit in Paris

as Mission Innovation, as well as individual other countries in Europe, regions like Africa, America or Asia are natural partners for joint activities.

#### *1.1.2.2 Areas to be addressed for clean energy transition*

The energy transition is a transition of a socio-technical system. Key enabling and disruptive technologies, and system innovation are essential for this transition. The Clean Energy Transition Partnership will address the following challenges.

***Development of clean and affordable energy production and conversion technologies*** is essential in enabling a wider systemic transition. To achieve cleaner, safer and more secure energy supply, the cost performance, sustainability and reliability of a broad portfolio of clean energy technologies and solutions must be improved. A lot of progress has been made over the last decades but the potential for further improvements is still huge. Research and innovation are needed for realising this potential and securing European leadership in the clean energy transition.

***A climate neutral, flexible and robust energy system*** ensures the energy supply required for the climate transition in all sectors of society as an enabler for the transition of the built environment, transport, industry and other sectors to clean, low carbon energy. Achieving the engagement of consumers and prosumers in appropriate demand-response mechanisms and its integration on the energy system is one important element. Research helps develop knowledge and competence for the ongoing transformation of the energy system and innovation helps develop new services and business models that enables the transition.

***Storage and its integration in the energy system*** - Achieving a zero CO<sub>2</sub> emissions energy system by 2050 will require the integration of many new energy solutions and ‘first of a kind’ technologies on all levels of the energy system. For example, to exploit the full potential of renewable energy sources, new, holistic solutions for energy storage are critical. As renewable energy sources are often variable, storage of surplus energy is crucial to provide peak load supply security. Inter-seasonal energy storage techniques will be key for the clean energy transition to succeed. Energy storage solutions are also needed to give flexibility and to cope with self-generation and consumption profile.

***Resource and energy efficiency and circular flows in the energy sector for an ecologically sustainable energy system*** - It is important that the emerging new system is resource-efficient, both from an ecological and economic standpoint, and that a broad perspective on sustainability and resource efficiency is considered. Research and innovation on end of life, second life and recyclability management of components and subsystems of the energy system is crucial. Substitution of limited resources and circular material flows are essential for avoiding creating new unsustainable systems in the future.

***A just and inclusive energy transition*** - The energy system is created by and for people, and people are driving the changes to the energy system that are now under way. The emerging system has to meet the needs of different parts of society, in different geographical locations (urban and rural) and different groups need to be given the opportunity to take part in the transition. It is essential to focus research and innovation on the interaction between technologies, infrastructure systems, urban systems and the people in society in which the solutions will exist.

***Sector integration and coupling*** - contributing substantially and effectively to the development of a zero-emission energy system is not possible without integration of different energy technologies and sector coupling for the decarbonisation of mobility, buildings, industry, agriculture in a specific environment. Looking beyond one’s own sector and one’s own community is key to realise the energy transition. There is a need to test and innovate at a cross-sectoral, systemic level to enable the clean energy transition.

**Digital transformation** is a key enabler for the energy transition towards a decarbonised, secure and resilient energy system. There is a strong need to promote and accelerate the introduction of opportunities arising from the digital transformation for a sustainable energy transition and societal development. The implementation of interoperability for seamless integration of technologies is crucial. As with the digital transformation of other areas, there are not only many opportunities but also many challenges for the energy transition. Research and innovation will help prepare for the challenges and capitalise on the opportunities.

The CETP will work to overcome the challenges via a joint, shared, international approach, engaging a wide variety of stakeholders. It aims to provide a platform that makes research results available for all stakeholders and supports capacity building in areas, where key stakeholders (“need owners”) require specific resources. By doing this, R&I investments as well as other investments in relation to the deployment of clean energy technologies result in outcomes that stand a much better chance of being implemented.

### *1.1.2.3 Building on the experience and outcomes of previous R&I partnerships*

The Co-funded Partnership on Clean Energy Transition builds upon the work of the SET-Plan Implementation Working Groups, their Implementation Plans and related earlier/running co-funded actions between SET Plan countries and the European Commission, e.g. ERA-NETs<sup>18</sup> and the Joint Programming Initiative Urban Europe.

Under Horizon 2020 a total of 11 ERA-NET Co-fund actions in the energy domain have been implemented, directly addressing the SET Plan priorities to boost competitiveness in low-carbon energy technologies.

These energy ERA-NETs cover the SET Plan Actions such as concentrating solar power/solar thermal electricity, photovoltaic, deep geothermal systems, offshore wind, ocean energy, smart solutions for energy consumers, smart cities and communities, energy systems, renewable heating and cooling, renewable fuels & bioenergy, and carbon capture, utilisation and storage.

All the areas currently covered by the ERA-NETs are integrated in the scope of the CETP as supporting technologies that will contribute to the energy transition. Some of these areas also have strong links to other proposals for Partnership Programmes under Horizon Europe (see links to other partnerships in Section 2.2.3), and the CETP will establish suitable interfaces towards those Partnerships.

The CETP will learn from past experience of all ERA-NETs, in particular aiming to:

- overcome the weaknesses related to fragmentation of the actions and silo mentalities; underspending on the one hand and unnecessary duplication of managing structures on the other;
- leverage the strength in terms of mobilisation of public and private investment; directionality and additionality; engagement of industry and namely SMEs; sound management practices and
- use existing well-functioning structures to kick-start the collaboration.

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<sup>18</sup> SOLAR-ERA.NET Cofund 2, CSP ERA-NET, GEOTHERMICA, DEMOWIND 1 & 2, Ocean ERA-NET Cofund, ERA-NET Smart Cities, ERA-NET PED, ERA-NET Smart Urban Futures, ERA-NET Sustainable Urbanisation - Global Initiative, SMARTGRIDPLUS (SG+), SG+RegSys, ERA-NET SG+Digit, BESTF2, BESTF3 and ACT ERA-NET



During the further development of the implementation structure of the CETP all ERA-NETs, especially the coordinators, are envisaged to share good practices with the entire CETP. A number of ERA-NETs have established good practices worth replicating at the level of the CET. Good practices cover collaborative ways of working, governance structures, resource allocation and funding, programme planning including prioritisation of research and innovation needs, call management, project monitoring, community building and international collaboration (with the IEA and Mission Innovation challenges).

## **1.2 Common vision, objectives and expected impacts**

SET Plan Actions will need to raise and coordinate planned R&I funding, in particular from public sources, as well as step up efforts for their respective implementation plans. The CETP will address this need and foster cooperation of national programmes by initiating transnational joint calls and other multilateral R&I funding activities. This will include projects, selected from joint calls for proposals, as well as ways to increase their impact by putting them in a supportive framework of additional activities (see Section 3 for proposed activities of the CETP).

### **1.2.1 Vision**

#### **Vision of the Clean Energy Transition Partnership:**

The Clean Energy Transition Partnership is a transformative Research and Innovation Programme across Europe boosting and accelerating energy transition in all its dimensions. It enables energy transition from regional to national and global level, co-transformed by industry, public organisations, research and citizens organisations to make Europe frontrunner in energy innovation and implementation by becoming the first climate-neutral continent.

The Clean Energy Transition Partnership aligns fully with the vision of the EU of a climate neutral Europe in 2050<sup>19</sup> and the European Green Deal<sup>20</sup>.

### **1.2.2 Objectives, outputs and expected impacts**

The Clean Energy Transition partnership will accelerate the transition towards a zero-carbon, flexible, sustainable, reliable and affordable energy system and its clean technologies through targeted transnational research, innovation and demonstration actions. The proposed partnerships will boost the energy transition and action will go beyond joint calls for building a European knowledge community on energy transition and inspire policies for implementation. The proposed transformative intervention logic (Figure 3) shows the problems addressed by CETP, the general and specific objectives of CETP, and how they will be met by specific inputs and activities. The intervention logic also shows expected outputs, outcomes and impacts of CETP.

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<sup>19</sup> [https://ec.europa.eu/clima/policies/strategies/2050\\_en](https://ec.europa.eu/clima/policies/strategies/2050_en)

<sup>20</sup> [https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal\\_en](https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en)

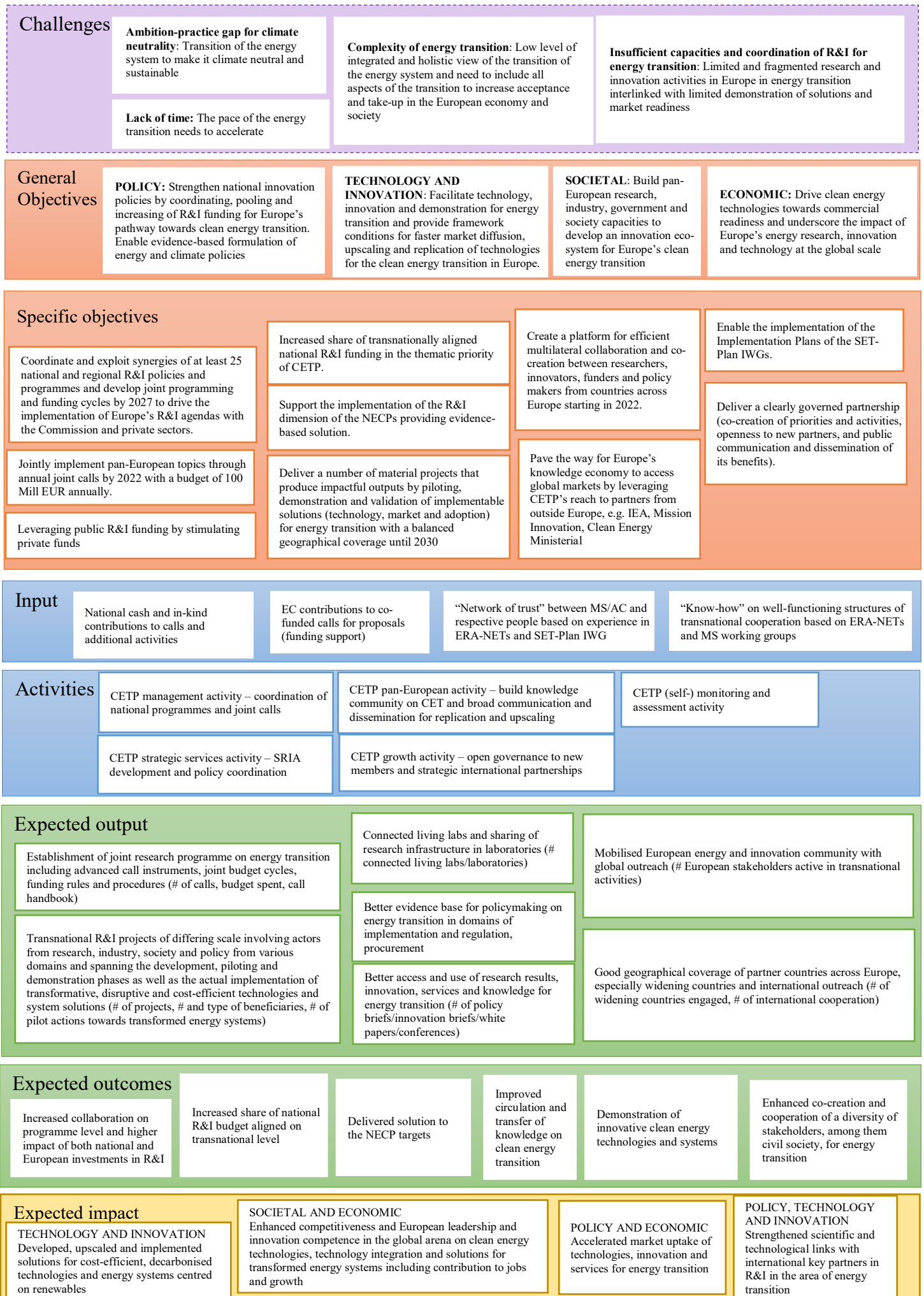


Figure 3: Intervention logic of the transformative CET Programme

National cooperation within the CETP will deliver more value than MS and AC could achieve by acting individually. As R&I policies and activities in one country affect others, cooperation in the CETP is almost a natural consequence.

### **CETP contribution to higher level policy goals**

CETP outputs, outcomes and impacts contribute to overarching European and global policy goals (Table 1).

<b>Policy</b>	<b>Related policy issues</b>	<b>CETP Contribution</b>
<b>Sustainable Development Goals</b>	SDG 7 (Affordable and clean energy) and SDG 13 (Climate Action).	CETP with all its activities will contribute to multiple SDG 7 and SDG 13 (see expected impact of CETP)
<b>Mission Innovation (MI)</b>	MI is a global initiative working to accelerate clean energy innovation. MI members are committed to increase public and private funding and to promote international collaboration.	MI works to promote collaboration among its members by fostering international partnerships. Funding opportunities are sponsored by MI members (including the EC); CETP will contribute to MI funding mechanisms to increase international collaboration with MI partners which are not MS or AC.
<b>IEA</b>	Advocacy of energy and energy innovation policies that advance reliability, affordability, and sustainability of energy (with a particular focus on renewables, energy efficiency, demand-side management, and critically clean energy technologies.	CET partners represent their countries as leaders of the IEA’s Committee on Energy Research and Technology and its constituent Working Parties. There is a mutually beneficial relationship derived from sharing and exchanging data and analysis related to energy and energy innovation policies. CETP’s program owners and managers deploy resources to fund CETP’s emerging knowledge community (topical, cross-cutting and overarching) participation in the IEA’s Technology Collaboration Programme network. The outcome is a stronger, unified presence in the IEA and cooperation with regions outside Europe.
<b>European Green Deal</b>	The European Green Deal is one of the EU policy priorities communicated in the Political Guidelines for the European Commission 2019 – 2024.  Pillars: A zero pollution Europe; Clean, Reliable and Affordable energy; Achieving Climate Neutrality.	Expected outputs of R&I activities and additional activities to increase impact of R&I in CETP contributes the following three pillars: A zero pollution Europe; Clean, Reliable and Affordable energy; Achieving Climate Neutrality. Next to the European Green Deal, CETP also aims towards strengthen European competitiveness in the energy transition on global level and therefore contributes to “A stronger Europe in the world” (another EU priority).
<b>European Research Area</b>	Coordination of national programmes	By coordinating national R&I programmes and establishing a joint call programme, the CETP will increase the share of coordinated national R&I budgets in the energy area by 2030. An increased collaboration at programme level across Member States and Associated Countries will help increase the impact of both national and European investments in research and innovation. This is a

		significant contribution to strengthening the European Research Area.
<b>Energy Union</b>	The Energy Union strategy has five mutually reinforcing and closely interrelated <i>dimensions</i> designed to enhance energy security, sustainability and competitiveness, among them Research, Innovation and Competitiveness.	R&I in CETP aims to accelerate energy system transition across all European countries by developing pilots, demonstrations but also validated solutions. Additional activities of the CETP (knowledge community across Europe, coordination with energy implementation policies, national impact networks) will create a strong and lasting impact of R&I activities and beyond.
<b>NECPs</b>	The Regulation on the governance of the energy union and climate action (EU)2018/1999 emphasises the importance of meeting the EU's 2030 energy and climate targets and sets out how EU countries and the Commission should work together, and how individual countries should cooperate, to achieve the energy union's goals. The governance mechanism is based on integrated national energy and climate plans (NECPs) covering ten-year periods starting from 2021 to 2030.	R&I is a key pillar to implement the 2030 Energy Union strategy with the 5 <sup>th</sup> dimension linked to the SET Plan and CETP. The CETP will support and contribute to implementation of the Research & Innovation pillar of the NECPs and inform the other pillars of the NECPs of necessary research & innovation needs and provide solutions for MS to reach the objectives set out in other pillars.
<b>SET-Plan</b>	Over the last decade, the Strategic Energy Technology Plan (SET Plan) has built platforms to align research and innovation agendas in dedicated areas stimulating SET-Plan countries to coordinate national programmes and to pool funding across borders.	Given the scale of the research and innovation investments needed for energy transition, this leverage effect on public and private funding towards joint research and innovation activities in support of the clean energy transition will be intensified by the proposed partnership. The proposed co-funded partnership would deepen the trans-national integration in thematic areas of joint interest.
<b>Horizon Europe (HE)</b>	Main objective of Horizon Europe, and in particular its second Pillar is <i>to generate knowledge, strengthen the impact of research and innovation in developing, supporting and implementing Union policies and support the access to and uptake of innovative solutions in European industry, notably in SMEs, and society to address global challenges, including climate change and the</i>	The CETP, included in <b>Cluster 5, 'Climate, Energy and Mobility'</b> , will contribute to the aim of Cluster 5 and the main objective of HEU. It impacts on the direction of energy transitions by making energy technologies and systems cleaner, climate- and environment-friendly, smarter, safer, and more resilient, inclusive, competitive and efficient. R&I in CETP will heavily influence the speed at which the energy transition can take place, directly affecting the associated costs, impacts and co-benefits, such as better air quality, increased employment, sustainable resource management and reduced dependency on fossil fuels, which is one of the main aims of the Cluster 5. CETP will also stimulate business to develop, scale-up and commercialise innovative solutions.

	<p><i>Sustainable Development Goals.</i></p> <p><b>Cluster 5, ‘Climate, Energy and Mobility’</b> aims to mitigate climate change while improving the competitiveness of the energy and transport industries as well as the quality of the services that these sectors bring to society.</p>	<p>It will play a vital role, in combination with other interventions, for creating new solutions and fostering innovation for energy transition.</p>
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Table 1 Contribution of the CETP to overarching policy goals

### 1.2.3 Links to other partnership candidates and Union programmes

#### Links to other partnership candidates

The Clean Energy Transition Partnership Programme falls under **Cluster 5 Climate, and Energy and Mobility** in the Pillar II on Global Challenges and European Industrial Competitiveness in Horizon Europe. However, the CETP is also expected to build interlinkages with the following other clusters:

- 4) Digital, Industry and Space and
- 6) Food, Bio economy, Natural Resources, Agriculture and Environment,

Additional thematic links to the following proposed **European Partnership areas** and to other European Union programmes are likely and complementarities/synergies/interfaces will be discussed in the future (Figure 4, and Tables 2 and 3). Thematic interfaces as well as complementarities in technology readiness levels (TRL) are potential entry points of discussions. The Clean Energy Transition Partnership will establish practical working relations with other Partnerships, so that complementarities and synergies in proposed annual plans are discussed on a regular basis.

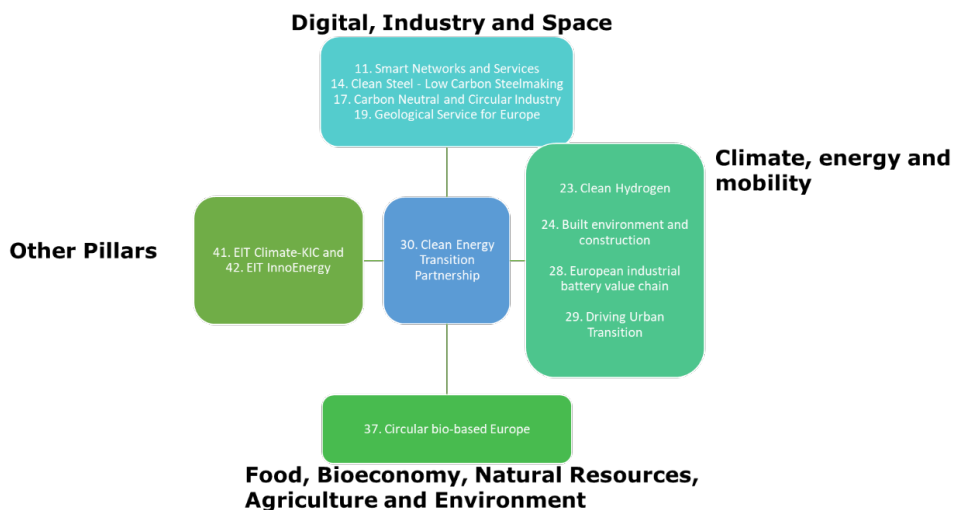


Figure 4: Link to other partnerships

Other Partnerships	Interface	Interface in detail	CETP focus
<b>11. Smart Networks and Services (co-programmed)</b>	Services and networks on smart grids	The digital transformation and the digital infrastructure under focus in the Smart Networks and Services partnership is one of the key enabling solutions for the energy transition. The next-generation digital infrastructure provides the prerequisites to build new services for a decarbonised, secure and resilient energy system. Common areas of interest include: Services based on the next generation of digital infrastructure, interoperability, energy efficiency and security.	CETP will focus on the interconnections between the IT and the energy sectors. The goal is to bring these sectors together in common projects within the common areas of interest.
<b>14. Clean Steel - Low Carbon Steelmaking (co-programmed)</b>	Electrification, Carbon capture utilisation and storage, energy storage	Electrification and hydrogen are the key components for the transition of the steel industry towards clean steel. This transition of the European steel industry will open up several interesting interfaces with the energy system transition. The steel industry will become a new major consumer of electricity which has to be provided in a reliable way at competitive prices. Together with the use of hydrogen in the process this also opens new opportunities for energy storage and flexibility in the electricity system. Carbon capture and storage is a fall back option for carbon neutral steelmaking.	The areas “A climate neutral, flexible and robust energy system” and "Storage and its integration to the energy system” are at the centre of the CETP. The steel industry is an important consumer of energy services that needs to be involved. There are also connections between CCUS applications in the industry and energy sectors.
<b>17. Carbon Neutral and Circular Industry (co-programmed)</b>	Electrification, Carbon capture, utilisation and storage, energy storage	Electrification of industrial processes will be one of the key solutions for the Carbon Neutral and Circular Industry as a whole. Reliable and competitive energy and opportunities for energy storage and flexibility are therefore important interfaces for this partnership as well. Carbon capture, utilisation and storage is also common interface. In addition, the different technologies needed for the clean energy transition are produced by the industry. The sustainability of the energy transition is therefore reliant upon the “Carbon neutral and circular industry”.	The areas “A climate neutral, flexible and robust energy system” and “Storage and its integration to the energy system” are at the centre of the CETP. The industry is an important consumers of energy services that needs to be involved. There are connections between CCUS applications in the industry and energy sectors. Circular flows in the energy sector is one of the topics of CETP.



Other Partnerships	Interface	Interface in detail	CETP focus
<p><b>19. Geological Service for Europe (co-funded) (might take shape as a CSA, too)</b></p>	<p>Subsurface use for energy purposes: geothermal, energy storage, CO<sub>2</sub> storage</p>	<p>The role of the subsurface in the energy transition will be significant. The Partnership ‘Geological Service for Europe’ (GSE) provides key advice and data services. The Partnership will focus on resources, climate change, safety/security and ‘digital twins’/subsurface models. The interface between GSE and CETP is mainly in the climate change area. Subthemes are geothermal energy and heat and cold storage; subsurface energy storage; CCS; nuclear waste storage (not in CETP); seabed knowledge for offshore wind; and exploration and production impacts e.g. induced seismicity. Also, the area ‘digital twin’ has a significant relevance. Without a profound understanding and modelling capabilities for the subsurface, we will not be able to optimise subsurface-related clean energy technologies.</p>	<p>CETP focus will be on the innovation of the energy technologies and the integration in the energy system, whereas the Geological Service for Europe Partnership focuses on understanding the subsurface.</p>
<p><b>23. Clean Hydrogen Europe’ (co-programmed or Art. 187)</b></p>	<p>Using renewable energy for clean hydrogen production  Using hydrogen as an energy vector to increase system flexibility in smart grids</p>	<p>Hydrogen and associated technologies such as fuel cells are an important part in the decarbonisation of the society. Hydrogen is also a versatile energy carrier that can be used in many ways in the energy system, industrial processes, as well as in the transportation and building sectors. Hydrogen production provides an important opportunity for energy storage and flexibility in an energy system based on a large share of cheap and variable renewable electricity. It is also an energy vector that can create system integration and sector coupling between electricity, heat and gas sectors and increase the system flexibility.</p>	<p>CETP includes system related aspects of clean hydrogen, but it does not include the development of the hydrogen technologies themselves.</p>

Other Partnerships	Interface	Interface in detail	CETP focus
<b>24. Built environment and construction (co-programmed)</b>	Energy efficiency buildings/districts	Buildings are becoming a centrepiece of a future, decentralised and flexible energy system. No longer only a consumer of energy services, they will also be able to provide different services to the energy system, such as production of electricity and heat and different flexibility services.	CETP includes system related aspects of the built environment and the energy sector, as well as development of energy technologies for production and use.
<b>28. European industrial battery value chain (co-programmed)</b>	Increasing grid flexibility	Batteries is a key enabling technology for the electrification and the clean energy transition. Batteries can provide many system services to the electricity system and will help with many aspects related to grid stability and the integration of variable renewable energy.	CETP includes system related aspects of batteries related to the energy system and the different services batteries can provide to the energy system, but it does not include the development of battery technologies themselves.
<b>29. Driving urban transitions to a sustainable future (DUT) (co-funded)</b>	Positive energy blocks and districts, integration of energy systems in urban systems	Energy transitions are one of the priority areas for driving urban transitions to a sustainable future. Cities are a hub in the energy system. Not only because they consume two-thirds of the world's energy but also because they can provide smart system solutions where energy generation, efficiency and storage, sector integration and other services create flexibility in the energy system. This is well described in the Positive Energy Districts (PED) sub-programme within DUT where the focus is shifted from the buildings towards neighbourhoods.	CETP focus on the development of energy technologies and system innovations. There is a clear interface with DUT when it comes to the application of energy technologies and systems into the urban context. Regular exchange between the partnerships is important and joint activities on common topics are welcome (e.g. joint calls on selected topics to integrate issues related to energy technologies and systems into the urban context or joint workshops to connect the communities, also with regard to the impact energy technologies or energy transitions have on other sectors and areas, in particular mobility and circular economy).



Other Partnerships	Interface	Interface in detail	CETP focus
<b>37. Circular bio-based Europe (co-programmed)</b>	bioenergy	Bioenergy is one important solution to decarbonising the energy system. Bio-based fuels and waste is used for producing electricity and heat and it provides an energy storage and is a good compliment in a system based on large shares of variable renewables. Combined heat and power plants in district heating also provides a sector coupling between heat and electricity. The use of bioenergy in combination with carbon capture and storage in industrial and energy processes is a good opportunity to generate negative emissions by removing carbon dioxide from the atmosphere.	CETP includes the use of bio-based fuels and waste in the energy sector and bioenergy with carbon capture and storage.
<b>41. EIT Climate KIC</b>		EIT Climate-KIC is a Knowledge and Innovation Community (KIC), working to accelerate the transition to a zero-carbon economy. EIT Climate KIC is one of the prime activities of the European Institute of Innovation and Technology, EIT. Growth, competitiveness and innovation capacity are keywords.	CETP focuses on research and innovation, while the EIT Climate KIC focuses on training, innovation and business creation activities.
<b>42. EIT InnoEnergy</b>		EIT InnoEnergy aims to accelerate sustainable energy innovations. EIT InnoEnergy is one of the prime activities of the European Institute of Innovation and Technology, EIT. Growth, competitiveness and innovation capacity are keywords.	CETP focuses on research and innovation, while the EIT InnoEnergy focuses on training, innovation and business creation activities.

Table 2 Description of link to other partnerships

## Links to other European Union programmes<sup>21</sup>

EU programme	EU programme focus	Relation to Horizon Europe and CETP
<b>European Regional Development Fund (ERDF)</b>	<p>The ERDF focuses amongst others on the development and strengthening of regional and local research and innovation ecosystems and industrial transformation through smart specialisation. Synergies can be envisaged for developing solutions, technology transfer and industrial R&amp;I capacities.</p> <p>It also supports the objective of a ‘greener, low-carbon transitioning towards a net zero carbon economy and resilient Europe’ that opens possibilities to deploy solutions developed in the context of the partnership in the public and private sector across Europe.</p>	<p>As a first step, it is important that that respective countries/regions have identified energy transition as a priority in their smart specialisation strategy. Funding may take different forms, pending on the outcomes of negotiations – in the form of bringing national co-funding to the partnership or sequential/ complementary funding of activities (e.g. to support take-up of results). Synergies may be also upstream where ESIF investments support capabilities for participation</p> <p>Support activities for co-ordination between national implementation of ERDF funding and CETP (streamlined/aligned programming) may provide a bridge between smart specialisations strategies and thematic objectives of the ERDF and the CETP SRIA and the dissemination and market uptake of CETP results through ERDF.</p>
<b>Connecting Europe Facility (CEF)</b>	<p>The CEF supports the large-scale roll-out and deployment of innovative new technologies and solutions in the fields of transport, energy and digital physical infrastructures, in particular those resulting from the Framework Programmes for research and innovation. CEF investments fill the missing links in Europe's energy, transport and digital backbone.</p>	<p>Results from CETP will inform the CEF on innovative new technologies in energy ready for large-scale roll-out. The large-scale support for energy infrastructures in Europe will help motivate innovations within the scope of CETP and Horizon Europe, and take those projects to the next phase.</p>
<b>InvestEU</b>	<p>InvestEU will provide out blended finance for innovators, characterised by a high level of risk and for which the market does not provide when relevant viable and sustainable financing.</p>	<p>InvestEU will target innovative companies that may take the results of CETP funded research and innovation projects to the next stage.</p>

<sup>21</sup> COM(2018) 435 final ANNEXES 1 to 5, [https://eur-lex.europa.eu/resource.html?uri=cellar:b8518ec6-6a2f-11e8-9483-01aa75ed71a1.0001.03/DOC\\_2&format=PDF](https://eur-lex.europa.eu/resource.html?uri=cellar:b8518ec6-6a2f-11e8-9483-01aa75ed71a1.0001.03/DOC_2&format=PDF)

<b>Innovation Fund</b>	<p>The Innovation Fund will specifically target innovation in low-carbon technologies and processes, including environmentally safe carbon capture and utilisation that may contribute substantially to climate change mitigation, as well as products substituting carbon intensive ones, and to help stimulate the construction and operation of projects that aim at the environmentally safe capture and geological storage of CO<sub>2</sub> as well as innovative renewable energy and energy storage technologies;</p>	<p>The Innovation Fund may support the demonstration phase of the research and innovation projects supported under CETP and take its project developments to the next phase.</p>
<b>Programme for Environment and Climate Action (LIFE)</b>	<p>LIFE standard action projects will support the development, testing or demonstration of suitable technologies or methodologies for implementation of EU environment and climate policy, which can subsequently be deployed at large scale, funded by other sources, including by the Horizon Europe.</p>	<p>LIFE will continue to act as a catalyst for implementing EU environment, climate and relevant energy policy and legislation. LIFE will be a natural forum for the market uptake, dissemination and support for applying and implementing results of CETP funded research and innovation projects. LIFE may also take on board experience and new knowledge in terms of non-technological challenges (policy, regulatory and capacity building related etc.) which are resulting from CETP funded research and innovation projects.</p>

Table 3 Link to other EU Programmes

### 1.2.4 Necessary R&I investments

Within the SET-Plan Implementation Plans (IPs) an estimation on R&I (public and private) has been developed according to the relevant SET-Plan Actions.

Table 4 reports the investment of R&I funds for each SET-Plan Action that will be addressed by CETP. In total the relevant IPs expect EUR 14,304 million in R&I Investments, of which EUR 6,285 million are sourced from national public R&I funds, EUR 3,059 million from European public R&I funds and EUR 4,961 million privately.

The CETP aims to align and coordinate national R&I funds for joint topics of interest (see specific objectives). CETP intends to align and coordinate 563 Mill EUR of national funds (Table 5), in other words **the CETP will coordinate about 10% of the national public R&I in the relevant SET-Plan Actions**. CETP intends to align and coordinate EUR 563 million of national funds (Table 5), in other words **the CETP will coordinate about 10% of the national public R&I in the relevant SET-Plan Actions**.

in million EUR				
	EU R&I funds	National R&I programmes	Private R&I funds	Expected investments in R&I activities in the IPs
<b>Solar Photovoltaics (PV) IP</b>	30	430	70	530
<b>Concentrated Solar Power / Solar Thermal Electricity (CSP/STE) IP</b>	5	95	100	200
<b>Offshore Wind Energy IP</b>	375	446	268	1.089
<b>Deep Geothermal Energy IP</b>	15	342	456	813
<b>Ocean Energy IP</b>	410	422	412	1.243
<b>Energy Systems IP (4)</b>	1.000	1.000	2.500	4.500
<b>Energy Efficiency in Buildings IP (5)</b>	335	400	365	1.100
<b>Renewable Fuels and Bioenergy IP (8)</b>	590	1.150	590	2.330
<b>Carbon Capture Utilisation and Storage</b>	300	2.000	200	2.500
<b>In total</b>	<b>3.059</b>	<b>6.285</b>	<b>4.961</b>	<b>14.304</b>

Table 4 R&I investments reported in the SET-Plan Implementation Plans of relevant Actions for the CETP  
Source: European Commission (2018): SET Plan delivering results: The Implementation Plans.

Table 5 shows that the share of **nationally coordinated R&I budgets in the relevant SET-Plan Actions will increase by 100% (double) through CETP**, rising from EUR 230 million to at least EUR 580 million.

in million EUR		
CETP Thematic Priorities	Indicative national budgets in CETP 2021-2027	National budgets in energy related ERA-NETs 2013-2020
Solar PV	67	
CSP	50	
Wind	not yet known	37
Geothermal Energy	53	41
Ocean Energy	not yet known	18
Integrated Regional Energy Systems	70	56
Heating and Cooling Transition	80	
Bioenergy	not yet known	15
Carbon Capture Utilisation and Storage	150	87
Digital Transformation	60	
Inclusive Energy Transition/Socioeconomics and Governance of the energy transition	not yet known	
Storage Solutions	50	
<b>In total</b>	<b>Indicatively 580</b>	<b>230</b>

Table 5 Indicative national R&I Investments in CETP according to thematic priorities. Indicative national budgets demonstrate a steady shift of national funds (Table 4) towards CETP's transnational deployment.  
Source: SET-Plan (2019): EC SET-Plan Partnerships 2018

CETP expects to stimulate R&I investments of the private sector by a range of 30-60% of the public funds mobilised through CETP. The non-R&I related public and private investments on Clean Energy Transition stimulated by the CETP cannot be estimated for the time being as well as the share of CETP calls that will not be co-funded. The total investments needed in the Clean Energy Transition are challenging for the EC, but also for the MS/AC. A joint effort should be undertaken to come to a shared view on total investments required.

### 1.2.5 Transformative changes in the R&I ecosystem

The Clean Energy Transition Partnership programme is a research programme leading to highly transformative outcomes stimulating fundamental change in the R&I ecosystem. The clean energy transition is of central importance for a sustainable and resilient future. Clear commitment and targeted efforts are needed to achieve a system transition at a truly grand scale and with immediate action by different actors of society. Innovation is pivotal to transform the energy system. However, delivering change that is transformative is still a challenge. The role

of intermediary organisations to contribute to the delivery of energy transition seems to be key<sup>22;23</sup> as they can move innovation in niches to a broader scale. An intermediary organisation can have one or more of the following roles:

- broker and facilitator of joint visions and communities for innovation;
- translator and enabler for learning, replication and upscaling;
- provider of room of experimentation in niches and for extending niches

### **Transformative changes in the energy system (socio-technical system)**

The energy system is a socio-technical system. Socio-technical systems have deeply intertwined technological (e.g. physical infrastructure) and social elements (e.g. governance arrangements). A socio-technical systems perspective highlights that both dimensions evolve together to address specific societal needs, such as mobility, sanitation or energy. Changes in the socio-technical landscape can be achieved through the processes of learning by experimentation of new socio-technical solutions/configurations occurring in niches. Innovation occurring within niches needs then to be extended to change the regime. Changes on the landscape level create pressure on the regime and opens windows of opportunity for niche innovation<sup>24</sup>.

Change is transformative, when dominant rule sets, visions, norms, routines and capacities that underpin dominant practices in socio-technical systems are changed<sup>25;26</sup>. Such changes in fundamental rules will involve different stakeholders.

### **Transformative R&I Programmes as intermediaries towards system transition**

Changes for socio-technical transitions can be triggered and accelerated through intermediary organisations as part of the sustainability transition policies orchestrating a network of diverse actors, activities and resources and create momentum for change. Intermediary organisations can intermediate between innovative practices in niches and dominant practices in socio-technical regimes<sup>27</sup>. Such organisations are particularly important in transformative change processes because system change is a multi-actor and multi-scale process, which requires strong intermediary action<sup>28</sup>. As such, intermediary actors are important and active agents of change. For system transition there is an explicit call for a stronger role of intermediaries to close the intermediation gap.

### **Role of CETP in transformative system change**

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<sup>22</sup> Wolfram, M.; Borgström, S., & Farrelly, M. (2019). Urban transformative capacity: From concept to practice. *Ambio*, 48, 437-448.

<sup>23</sup> Kivimaa, P., Boon, W., Hyysalo, S., & Klerkx, L. (2019). Towards a typology of intermediaries in sustainability transitions: A systematic review and a research agenda. *Research Policy*, 48(4), 1062-1075.

<sup>24</sup> Geels, F.W. & Schot, J. (2007). Typology of sociotechnical transition pathways. *Research Policy*, 36, 399-417.

<sup>25</sup> Ghosh, B. & Schot, J. (2019). Towards a novel regime change framework: studying mobility transitions in public transport regimes in an Indian megacity. *Energy Research & Social Science*, 51, 82-95.

<sup>26</sup> Schot, J. & Kanger, L. (2018). Deep transitions: Emergence, acceleration, stabilization and directionality. *Research Policy*, 47(6), 1045-1059.

<sup>27</sup> Kivimaa, P., Boon, W., Hyysalo, S., & Klerkx, L. (2019). Towards a typology of intermediaries in sustainability transitions: A systematic review and a research agenda. *Research Policy*, 48(4), 1062-1075.

<sup>28</sup> Fischer, L.B. & Newig, J. (2016). Importance of actors and agencies in sustainable transition: a systematic exploration of the literature. *Sustainability*, 8(5), 476

CETP takes on the role of an intermediary for transformative system change. It intermediates between research and innovation for the energy transition based on bottom-up developed research projects and dedicated activities to generate highest impact of research outputs towards upscaling, replication and mainstreaming to change regulations and routines in the energy system on a broad scale to make it cleaner. CETP will align and strengthen the European network of research funding organisations to jointly promote and fund clean energy transition across Europe, bringing together industry, research organisations, public utilities and citizen organisations to build a European community for energy transition, support the research and innovation ecosystem and reach out to a wider public to increase impact. Collaborative efforts in research and innovation at the European level for a clean energy transition will contribute to development and excellence. It will help identify areas and activities where joint activities will bring leverage effects and be more efficient than single country or bilateral ones. It will also contribute to better cooperation between national and regional R&I policies and energy policies (e.g. NECP) for a clean energy transition.

In order to be that transformative system change programme, CETP follows high-level principles for jointly funded projects and additional activities:

- *Problem orientation* - Address a key challenge from a practical side to implement change in the energy system
- *Stakeholder empowerment* - Actively engage and empower entities that seek a solution to a specified need (problem), these can for example be energy utility providers, building owners, local/regional authorities, regulators, technology providers etc. throughout the project (in a leading role starting from project development)
- *Innovation orientation* – Conduct research and innovation activities that demonstrate how changes can work in practice and support capacity building
- *Output orientation* - Deliver clear and useful outputs and solutions that stimulate clean energy transition
- *Transnational benefit* – Projects add value and are of mutual benefit to all partners in the different countries
- *Replication orientation* – Design actions in a way that replication potential is key from the very beginning

### **1.2.6 Exit strategy**

The networks of Member States and Associated Countries that join the CETP partnerships (e.g. Joint Programmes, ERA-NETs) have already established a governance system that allowed self-sustainability for the core operations (e.g. non-co-funded calls). The management of the network is financed mainly by national in-kind contributions, allowing the operation of a basic infrastructure. This shows that prior to Horizon Europe self-sustainability of networks of MS/AC has already been realised and supports the idea that this cooperation will continue also beyond Horizon Europe.

While the partnership and co-funding of the EC will lead to a step-up in ambition and merge existing networks into one partnership, hence widen the portfolio of activities and extend management capacities, the CETP maintains the modus operandi of national financial and in-kind contributions towards the partnership.

The planned co-funding from Horizon Europe for the partnership will be phased out after the end of Horizon Europe. However, as the partnership supports research and innovation activities that are fully in line with MS/AC policies, the partnership will be relevant to MS/ACs beyond Horizon Europe. This is already demonstrated in a range of technology specific ERA-NETs. There is no reason today to suppose that energy innovation will no longer be a strategic field after the lifetime of the Horizon Europe phase of the partnership.

A sustainability plan for CETP beyond 2027 will be developed in the partnership (see Section 3.1 – core activities). The sustainability of the partnership will put the European added value through transnational coordination at the core. One important benefit from the partnership will lie in stakeholder platforms, which will have formed through the work of the joint calls and joint actions. The Management Board (see Section 3.3 on Governance Structure) will discuss and agree on the sustainability plan. The following elements are cornerstones of the sustainability plan:

- 1. Build structures for stakeholder involvement and evidence for decision making**
  - 2022+: Structures for citizen involvement, stakeholder consultation, capacity building for need/problem owners and replication of results
  - 2022+: Regular monitoring, self-evaluation/self-assessment of the CETP to collect evidence for action and decisions for a sustainability plan
  - 2025: Potential external strategic evaluation taking into consideration models to share the burden of the coordination of the CETP.
- 2. Continue screening and identification of trends and needs in clean energy transition and joint interests of MS/AC**
  - 2026: Horizon scanning activity to identify new trends, developments and needs for the clean energy transition
  - 2026: Preparatory activity to identify joint interest and priority of MS/AC for continuation of the partnership beyond 2027 and ensure buy in from MS/AC for such a partnership
  - 2027: Development and approval of a SRIA 2.0. of the CETP for continued cooperation of MS/AC
- 3. Self-organised decision-making structures**
  - 2025+: Development and continuation of self-organised structure for decision making and new funding mechanisms
- 4. Continuous strategic cooperation with the EC to ensure complementarity**

### **1.2.7 Strategic Research and Innovation Agenda (SRIA)**

The CETP aligns with the vision for the European Commission ‘Energy Union’, ‘Clean Planet for All’ and the ‘Green Deal’. The CETP will reach its specific objectives by implementing an ambitious SRIA for the period up to 2030 and with a forward-looking vision to 2050. The SRIA will have thematic priorities and activities that address key challenges for the energy transition with clear output orientation and expected measurable effects within the next 10 years thus contributing to the change of the energy system. The SRIA will be the result of an inclusive and participatory process, already ongoing, involving all main interested stakeholders, as described hereinafter.



### 1.2.7.1 SRIA background

The development of content for the SRIA has started with the gathering of input through online meetings arranged by the Chair of the SET-Plan IWG 4 (Smart resilience and Secure Energy System) between November 2019 and January 2020. Several groups of actors were invited for discussion on the CETP; European Commission services, SET-Plan Steering Group, SET-Plan Implementation Working Groups, ongoing ERA-NETs and representatives of EERA and ETIPs.

The Strategic Research and Innovation Agenda (SRIA) will partly be based on the SET-Plan Implementation Plans that have been agreed by the SET-Plan Steering Group. In preparation for the first draft of the CETP, SET-Plan Implementation Working Groups and ongoing ERA-NETs were asked to provide input for the integration of thematic priorities in the CETP to ensure alignment with priorities described in SET-Plan IWG Implementation Plans and activities that ERA-NETs intend to continue in the future. The following draft thematic priorities (Figure 5) have been proposed by MS/AC (see tables in Annex 1)<sup>29</sup>. These will form the basis for the SRIA thematic priorities.

- Integrated regional energy systems (including energy communities)
- Storage Solutions
- Innovative renewable energy technologies
  - Bioenergy
  - Concentrated Solar Power/Solar Thermal Electricity
  - Geothermal
  - Ocean
  - Solar Photovoltaics
  - Wind
- Heating and Cooling
- Carbon Capture Use and Storage
- Digital Transformation (cross-cutting area for thematic priorities)
- Inclusive energy transition (cross-cutting area for thematic priorities)

The CETP envisages a SRIA to cover the above-mentioned thematic priorities and connect them to the areas to be addressed for achieving clean energy transition (Section 1.1.2.2). The SRIA will have an overarching logic as well as thematic priorities, which are expected to guide the choice of topics to joint calls.

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<sup>29</sup> (status April 2020)

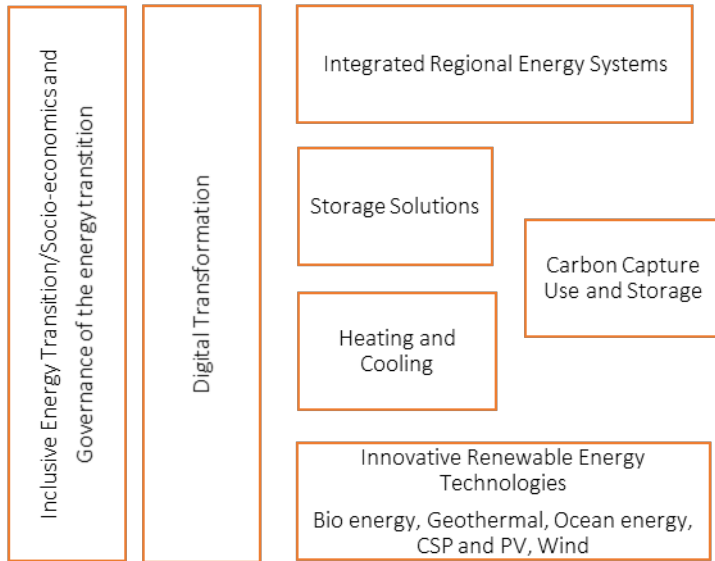


Figure 5: Proposed thematic priorities of CETP

#### 1.2.7.2 SRIA process for development

Development of the CETP SRIA will continue during 2020 and will be broad, open and inclusive to all relevant and interested stakeholders (Figure 6). An online kick-off meeting is planned for May 2020. At the kick-off meeting the CETP will present the process to develop the SRIA, the mode of expected involvement of stakeholders, how stakeholders can participate in providing input to the SRIA and the milestones to be reached.

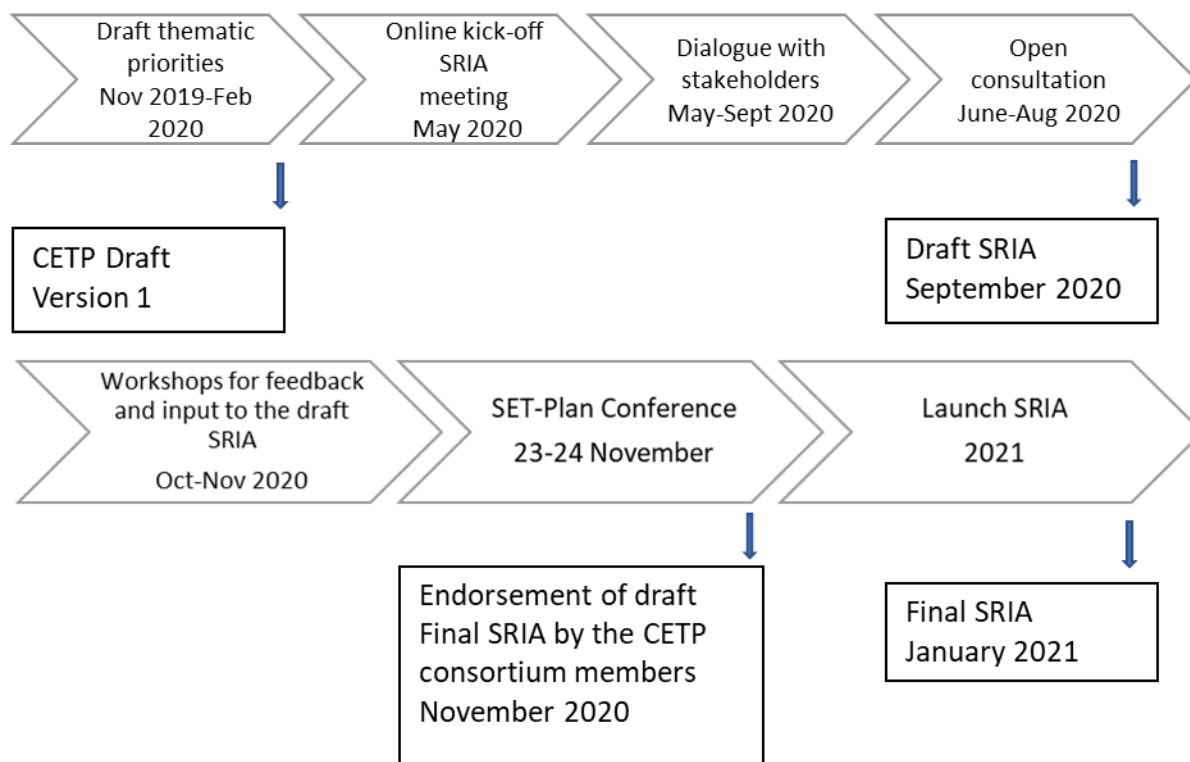
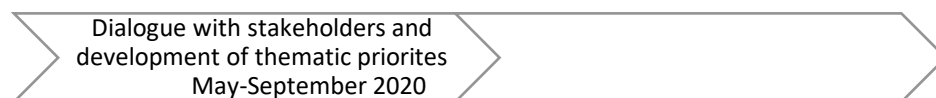


Figure 6: SRIA Process for CETP

### 1.2.7.3 Strategic dialogue with stakeholders and development of the thematic priorities of the SRIA



Strategic dialogues with the SET-Plan Implementation Working Groups (including its members from MS/AC, EERA and ETIPs) and members of running ERA-NETs are planned between May and September 2020. The aim is to learn from the IWGs and the ERA-NETs on the research needs in the dedicated thematic priorities, on experiences to implement joint calls and on supporting additional activities. The inclusion of IWGs and ERA-NETs ensures the link to national priorities and budgets for energy R&I. This exercise will take place through a written process as well as specifically dedicated online meetings per respective thematic area. The further development of thematic priorities will include expected technological developments, identification of cross-cutting aspects (including aspects of digitalisation, circularity and competitiveness) and proposed thematic priority related additional activities to increase effect and impact of the thematic priority.

### 1.2.7.4 Open consultation



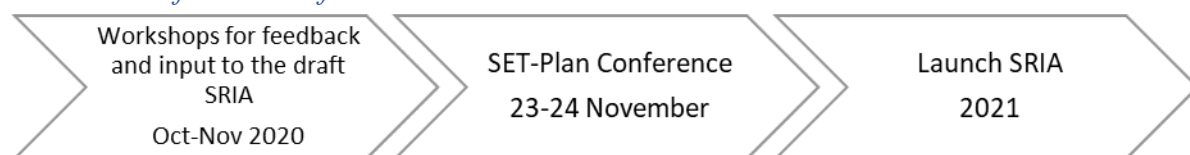
An open consultation for the development of the CETP SRIA will cover proposed thematic priorities for technological development, cross-cutting aspects and proposed thematic priority related additional activities. The draft proposal for the establishment of the CETP describes the policy context and the areas to be addressed to develop the CETP (Chapter 1.1.2.2). The open consultation will be conducted in written form through an online survey, online meetings as well as dedicated dialogues with MS/AC through the SET-Plan Steering Group.

**Stakeholder involvement.** The consultation will be open to anyone who wishes to take part. In particular, the following groups will be invited to respond to the written and online consultation:

- SET-Plan Steering Group,
- SET-Plan Implementation Working Groups,
- ERA-NET members
- EERA Joint programme representatives
- ETIPs
- the NECPs Technical Working group,
- the Managing Authorities for the ESIF,
- Member States (via the contact points for the Shadow Committee for Horizon Europe) and Associated Countries
- contact points for other proposed Horizon Europe partnerships and NCP network
- chairs of corresponding international initiatives such as IEA Technology Collaboration Programmes and Mission Innovation Challenges.

This will give input to where the CETP may contribute; the overall landscape of energy R&I in Europe and internationally, expected R&I needs and where additional activities and funding is particularly needed. The consultation may also give input to ways of collaboration among the CETP initiative and other similar ones (international, European or national).

#### *1.2.7.5 Draft version of the SRIA*



The draft SRIA is expected to be presented in September 2020. Input and feedback collected in October and November 2020 will lead to a draft final SRIA to be presented in the context of the 2020 SET-Plan Conference in Berlin 23-24 November. During this revision period, the CETP will arrange dedicated workshops for a broad range of stakeholders for feedback to the draft SRIA in order to receive feedback for the draft final SRIA. The draft final SRIA is expected to be endorsed by the CETP consortium members in November 2020 and the final adoption of the SRIA, by the CETP consortium members, is expected in the beginning of 2021.

#### *1.2.7.6 Monitoring and revision of SRIA and CETP*

The CETP will perform a monitoring and impact assessment exercise (Figure 7) to track progress towards objectives, impacts and key performance indicators (according to Annex III, Monitoring criteria for European Partnerships). Monitoring of the partnership programme will take place on three levels:

- **Monitoring of the objectives of the SRIA**
- **Monitoring of CETP activities** (as a means to implement the SRIA) will deliver information whether the activities work effectively in the direction of output and outcomes
- **Monitoring of calls for proposals and projects** will be provided to gain information on the performance of the call programme and projects towards the programme objectives

Assessing impacts of the CETP and the underlying activities is relevant to:

- Assess the effectiveness of the co-funded partnership approach
- Assess the effectiveness of implementation activities in the direction of output and outcomes and gain information for refinement of the interventions
- Support exploitation and valorisation of results of CETP

Monitoring and impact assessment will include in detail:

- Development of a monitoring and self-evaluation concept including indicator development based on the intervention logic for all levels
- Development of an implementation plan of the monitoring and self-evaluation including roles for monitoring, tasks, tools and deliverables
- Pilot-testing and set-up of the monitoring process including tool adaptation/generation, responsible parties, engage projects in the process, generation of interfaces (e.g. to EC tools, ERA-LEARN, website), development of high-quality reports (public and/or private)
- Provision of information on CETP performance and results to disseminate knowledge, mobilisation of stakeholders and increase of impact of CETP

In the next phases this framework will be aligned and streamlined along the requirements of the Horizon Europe monitoring and reporting for European Partnerships.

On the level of projects and joint calls, CETP will provide information according to common standards of the EC on individual projects funded by the partnerships, e.g. the data on proposals, selected projects, their outcomes and results. CETP will develop/adjust a central IT tool to provide this information according to common data standard given by the EC.

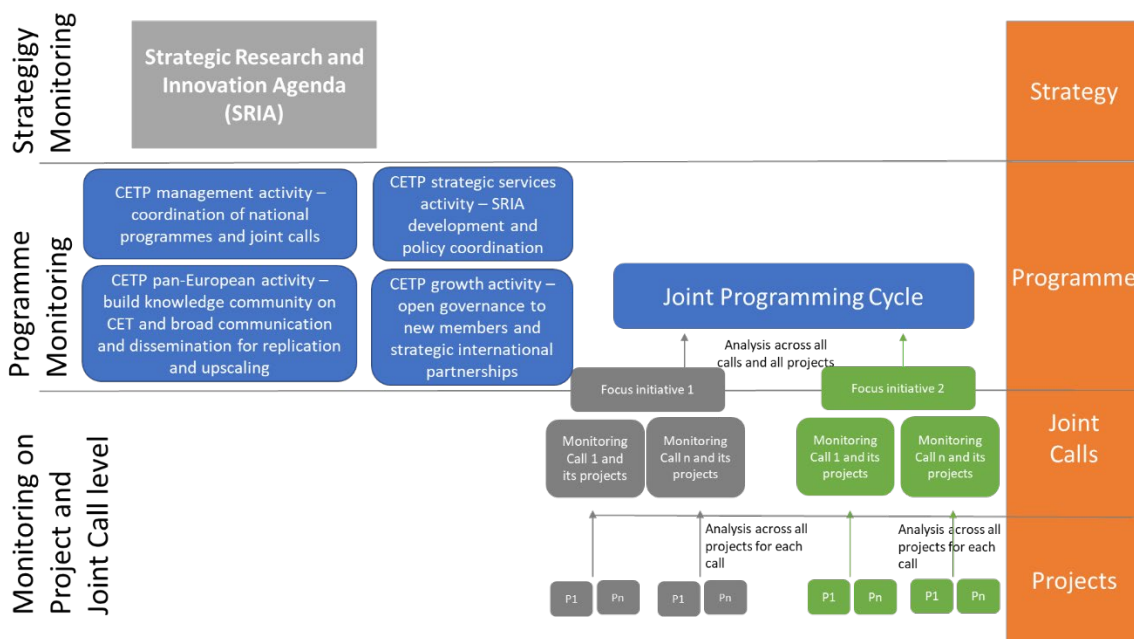


Figure 7: Monitoring and Impact Assessment of CETP

### 1.3 Necessity for a European Partnership

#### 1.3.1 Addressing the objectives of Horizon Europe more efficiently

The clean energy transition is an enormous challenge for European society and economy affecting every citizen, all industries, and many aspects of our society and everyday life. Europe needs speed and mass in the energy transition progress. It is evident that we can move faster by joining forces to accelerate energy research and innovation. Progressing together saves time.

The collaboration in this partnership will accelerate the progress of the Union as well as the progress of the participating MS/ACs and regions through a common understanding of challenges, areas to be addressed and activities to support energy research and innovation that will accelerate the clean energy transition. This is because all parties bring together their knowledge, priorities and resources, based on their energy policies and energy research and innovation policies in the SRIA. This allows the CETP to act on the joint priorities of the MS/ACs and the European Commission.

**CETP will contribute to the following strategic objectives of Horizon Europe<sup>30</sup>:**

- 1) to strengthen the EU's scientific and technological bases;
- 2) to boost Europe's innovation capacity, competitiveness and
- 3) to deliver on citizens' priorities and sustain our socio-economic model and values.

<sup>30</sup> European Commission (2019): Horizon Europe [https://ec.europa.eu/info/sites/info/files/research\\_and\\_innovation/strategy\\_on\\_research\\_and\\_innovation/presentations/horizon\\_europe\\_en\\_investing\\_to\\_shape\\_our\\_future.pdf](https://ec.europa.eu/info/sites/info/files/research_and_innovation/strategy_on_research_and_innovation/presentations/horizon_europe_en_investing_to_shape_our_future.pdf)

**CETP will contribute to the following operational objectives of Horizon Europe<sup>31</sup>:**

- reinforcing the link between research, innovation and, where appropriate, education and other policies, including complementarities with national and regional and EU research and innovation policies and activities
- supporting the implementation of Union policy priorities including in particular the sustainable development goals and the Paris Agreement
- strengthening the gender dimension across the programme
- increasing collaboration links in European research and innovation and across sectors and disciplines, including social sciences and humanities
- strengthening international cooperation e.g. by liaising with Mission Innovation initiatives
- attracting talent, training and retaining researchers and innovators in the European Research Area, including through mobility
- fostering open science and ensuring visibility to the public and open access to scientific publications and research data, including appropriate exceptions
- encouraging exploitation of R&I results and actively disseminating and exploiting results, in particular for leveraging private investments and policy development
- improving the relationship and interaction between science and society, including the visibility of science in society and science communication, and promoting the involvement of citizens and end-users in co-design and co-creation processes and
- stimulating R&I activities in SMEs and the creation and scale-up of innovative solutions.

It is important to recognise that CETP will strengthen the work on joint priorities, but will also allow for joint work on technologies and issues that are important for a subset of European countries and regions (for example ocean energy). Joining the interests of a subset of MS/ACs and a flexible approach to participation will allow for a faster transition here, too, while the mainstream will evidently be the joint priorities of the majority of MS/ACs and the Commission.

The CETP will provide a forum for collaborative work and activities for countries as well as stakeholders that would most likely otherwise not be available. This is particularly important in areas where no country by itself would be able to manage the work necessary and where collaboration is seen as essential in terms of pooling resources.

The work in the partnership will be firmly based on national/regional R&I funding programmes and other relevant instruments, which have a clear relationship with the respective national/regional energy transition priorities and NECPs. This adds significant budgets to the available funding of the Horizon Europe programme alone. The budget spent on energy R&I in MS/ACs in 2018 is approximately 80% of the European total public funding, while the European Commission - in itself the biggest single funder of energy R&I in Europe - makes available the remaining 20% according to IEA statistics (all energy research topics). There is

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<sup>31</sup> [http://www.europarl.europa.eu/doceo/document/TA-8-2019-0396\\_EN.pdf](http://www.europarl.europa.eu/doceo/document/TA-8-2019-0396_EN.pdf)

an obvious benefit when MS/ACs funds are utilised in a coordinated way, in order to achieve a higher efficiency for Europe in joint RD&I projects on a European scale.

The CETP will pool resources (public funding and in kind) from more than 20 countries and national research funding organisations adding to the funding from the EC and the private sector. In addition, it will reach out to international organisations and third countries to align priorities and carry out joint calls for proposals and additional activities.

Joining and aligning the strengths of national funding schemes was clearly also the strategy of the ERA-NETs in Horizon 2020. But the CETP will create additional value: importantly, the partnership can and will put an increased focus on international collaboration on pilots and demonstrations and showcasing solutions. This shift is timely and realistic, because of the urgency of the energy transition, and also because the CETP builds on established trust and positive examples of collaboration that are the results of the Horizon 2020 ERA-NETs and Joint Programming Platforms.

At the same time, the impact of the activities of the CETP will have a close link to what is needed at a national/regional level. The national/regional R&I funding programmes are based on national and regional priorities. The national funding programmes speak the languages of their stakeholders, which facilitates the communication and lowers the entry barrier, and may also provide an easier way for stakeholders to collaborate compared to carrying out an application and project under the regulations for Horizon Europe. The supporting activities that CETP envisages are very much geared towards maximising impact of funded projects and establishing a stakeholder family. This will also contribute to the national NECPs.

The Strategic Research and Innovation Agenda (SRIA) also sets CETP apart from the Horizon 2020 ERA-NETs. The SRIA will define a single programme of activities addressing the broad challenge for the clean energy transition for Europe to be effective by 2050. The SRIA will put all SET Plan priorities and SET Plan Implementation Working Plans into the joint perspective of this ambitious target. This will provide better choices for the allocation of funding.

### **The CETP is needed for**

- addressing the clean energy transition in a coordinated and planned way and in cooperation with activities:
  - under Horizon Europe (Missions, Partnership Programmes, Clusters and other EU Programmes)
  - under national and regional R&I programmes
  - under national energy policies (e.g. NECP)
  - under international R&I funding collaboration beyond Europe
  - other European financial programmes (Innovation Fund, Invest-EU, EDRF, LIFE)
- identifying where MS/AC benefit from collaboration and where synergies create added value and hence close the gap between strategic and operational work



- building capacities in all countries with special support for widening the participation of countries
- providing a forum for multilateral coordination of joint processes and providing a portfolio of instruments and tools for collaborative actions
- creating enabling conditions for reaching impact through creation of shared evidence and experience, and through the alignment of implementation efforts
- building transnational thematic communities;
- strengthening exploitation and mainstreaming; and offering a forum for stakeholder engagement
- lowering the entry barrier for European actors to participate in European and global cooperation
- Europe being a hub for international cooperation on clean energy research and innovation
- supporting harmonisation and connection on a European level to support system change that happens at local and regional level;
- supporting the development of disruptive technological innovation and key enabling technologies as well as system innovation involving the entire innovation ecosystem
- lowering the barrier to reach market uptake of low carbon technologies by developing their suitability to a climate neutral and smart energy system and
- showing global leadership in collaboration towards the clean energy transition

The CETP generates added value by:

- pooling and upscaling of national R&I funding for clean energy transition, which otherwise would not be available
- continuing collaborations that build upon earlier experiences and trust created among funding agencies in MS/ACs
- providing opportunities for key R&I or implementation players on both regional and national levels to participate in joint projects following a competitive process with a lower entry barrier than regular Horizon Europe calls, with the possibility for
  - smaller consortia
  - different kind of partners
  - simplified application process
  - easier way for project partners to entry into international collaboration
- mobilising national activities and communities and interconnection on transnational level.
- embedding specific challenges on regional/national levels so facilitate demand driven activities.
- involving MS/ACs representatives in the management leading to more hands-on knowledge and experience about national strategic priorities and stakeholders in other countries.
- aggregating, analysing and sharing of evidence/results from the transnational projects stemming from the CETP. Different approaches from different parts of the EU lead to insights into what works within all of Europe. Results of projects and additional activities can also inform on standardisation and other barriers and decisions

- networking and matchmaking as well as co-creation at different levels of the CETP will result in knowledge-sharing and development of new ideas

### **1.3.2 Necessary, meaningful and efficient collaboration with MS/AC**

An important factor of alignment on European level will be driven by the shared experience of national/regional programme owners and managers in the governance structure of the multi-annual Clean Energy Transition Partnership programme. This governance structure will be fit-for-purpose and is described in detail in Section 3.3.1.2.

The aim of the partnership will evidently be to run calls and activities that cover the whole spectrum of the SRIA. However, the partnership will kick-start its activities by building on the strengths of existing collaborations, as described above. This will lead to a smooth transition between the R&I funding networks under H2020 and the CETP. Most importantly, this will provide predictability for businesses and researchers that want to develop their innovations with the help of public R&I funding.

The CETP will be of a scale and span that will help Europe realise its ambition to become the world's first carbon neutral continent. The innovations that will be developed will be crucial for our continent to successfully tread that unknown ground.

## **1.4 Partner composition and target group**

### **1.4.1 Partner composition**

As a co-funded partnership, the core group (the signatories of the Grant Agreement) have decision power on strategy and budgets of energy related national and regional R&I programmes. The CETP specifically addresses a spectrum of national programme owners and managers that fund strategic research, innovation and demonstration activities under optimal conditions to address the strategic priorities on the appropriate technology readiness level. Currently, 23 countries intend to join the partnership (Table 6).

The organisational structure of the CETP caters to the requisite flexibility to accommodate different partners to arrange their participation in joint calls and activities, and to invite other organisations to take part in co-funded calls of the partnership. It also allows for the involvement of appropriate administrative units and experts of the participating programme owners and managers in the full range of topics and activities. The deep connections with policy-making levels, like the SET Plan Steering Group, the NECP expert group, the Horizon Europe Climate, Energy and Mobility Programme Committee and existing ERA-NETs or Joint Programming Platforms, enable a more integrated flow of decisions at national levels. CETP has access to all European Union countries and interested countries and will have an open-door policy to those MS/AC and where suitable to 3<sup>rd</sup> countries who are not founding partners (see Section 2.4).

### **1.4.2 Indication of interests to become partner of CETP**

Table 6 displays the indication of interests of programme owners and managers of MS/AC to become partners of the CETP: 25 countries with 38 programme owners and programme managers are interested in the CETP. Among the 25 countries, ten widening countries (40%)

are interested in CETP (CZ, EE, HR, LT, LV, PL, PT, RO, SI, TR). The interested countries are spread across Europe and a broad geographical coverage and balance is reached.

The indicated national budget sums to 472-512 Mill. Euro (Status April 2020). However, national budgets from seven countries are still missing owing to domestic procedures (CZ, EE, ES, HR, FR, LU, PT and RO).

Discussions continue to engage additional MS/AC to become partners of the CETP apart from those listed in the table below (Cyprus, Belgium Brussels region, Bulgaria, Greece, Hungary, Israel, Malta, Slovakia, UK). Discussions on engaging additional partners shall also include possible regional research funding organisations.

Country	Programme Owner/Programme Managers (could be more than one per country)
<b>AT</b>	Austrian Federal Ministry of Climate Action, Environment, Energy, Transport, Innovation and Technology (BMK) Austrian Research Promotion Agency (FFG)
<b>BE</b>	Flanders Innovation and Entrepreneurship (VLAIO) and The Research Foundation – Flanders Public Service of Wallonia (SPW)
<b>CH</b>	Department of the Environment, Transport, Energy and Communications DETEC Swiss Federal Office of Energy SFOE
<b>CZ</b>	Ministry of Industry and Trade
<b>DE</b>	Project Management Juelich (PTJ)
<b>DK</b>	Danish Energy Agency
<b>EE</b>	Estonian Research Council
<b>ES</b>	Centre for the Development of Industrial Technology (CDTI) Agencia Estatal de Investigación (AEI)
<b>HR</b>	Ministry of Environment and Energy
<b>FI</b>	Ministry of Economic Affairs and Employment Business Finland
<b>FR</b>	Ministry for an Ecological and Solidarity Transition Ministry of Higher Education, Research and Innovation
<b>IE</b>	Sustainable Energy Authority of Ireland (SEAI)
<b>IT</b>	Ministry of Education, University and Research (MIUR) Ministry of Economic Development + possibly other ministries
<b>IS</b>	National Energy Authority of Iceland (NEA) The Icelandic Centre for Research, rannís
<b>LT</b>	Ministry of Energy of the Republic of Lithuania
<b>LU</b>	
<b>LV</b>	Ministry of Education and Science of the Republic of Latvia State Education Development Agency (VIAA)
<b>NL</b>	Ministry of Economic Affairs and Climate Netherlands Enterprise Agency (RVO)
<b>NO</b>	Ministry of Petrol and Energy in Norway Research Council of Norway (RCN)
<b>PL</b>	National Centre for Research and Development (NCBR) Ministry of Science and Higher Education (MNiSW) Ministry of Climate (MK)
<b>PT</b>	Foundation for Science and Technology (FCT) Directorate General for Energy and Geology (DGEG)

<b>RO</b>	Executive Agency for Higher Education, Research, Development and Innovation Funding (UEFISCDI) Ministry of Education and Research
<b>SE</b>	Swedish Energy Agency
<b>SI</b>	Ministry of Infrastructure
<b>TR</b>	The Scientific and Technological Research Council of Turkey (TUBITAK)

Table 6 Indication of interests to participate in CETP by programme owners and managers

### 1.4.3 Envisaged target groups/stakeholder community

The target group for the partnership is at two levels; the policy level, for which the CETP is an instrument to better reach its objectives; and the stakeholder level, where actors from e.g. industry, research performing organisations, public utilities, civil society etc. become involved in the partnership through funded projects and participation in additional activities.

Among the envisaged target groups at policy level are R&I programme owners and managers in all European countries, or even beyond, who are formal partners of the CETP and coordinate part of their national strategies and budgets through the CETP. Another target group at policy level are policy makers for implementation and market policies and programmes that enable the energy transition (e.g. policy makers responsible for NECP). They will be targeted by additional activities. It is foreseen that SET-Plan Steering Group will be a valuable interface with different sectorial ministries.

To achieve the objectives and impacts of the CETP will cooperate closely with stakeholder networks. The stakeholder target group is the energy sector at large to be mainly addressed at the level of problem/need owners, defined as anyone who qualifies as a (co-)investor in the energy transition. Prominent examples are energy-related utilities, network operators, or public or private bodies responsible for the energy infrastructure. The partnership will fund relevant research, innovation and demonstration projects, but will also develop a range of other tools and activities that will help stakeholders to implement the clean energy transition. Additional stakeholders research organisations and relevant private sector actors, who develop innovations that will have a real impact for Europe. The identified potential stakeholder network comprises:

- European Technology and Innovation Platforms: Deep Geothermal, Renewable Heating and Cooling, Wind, Photovoltaics, Smart Networks for Energy Transition, Bioenergy and Zero Emission Platform.
- European Energy Research Alliance: Joint Programmes on CCS, Bioenergy, Geothermal, Smart Energy Systems etc.
- Horizon Europe Partnerships of Smart Networks and Services; Clean Steel – Low Carbon Steelmaking; Carbon Neutral and Circular Industry; Clean Hydrogen Europe; European Industrial Battery Value Chain; Driving Urban Transitions to a sustainable Future; Circular bio-based Europe etc.
- Associations and networks of energy related research and industry: European Turbine Network; European Heat Pump Association; European University Association etc.

Within the SET-Plan Implementation Working Groups, both target groups (policy and stakeholders) are already cooperating and co-creating (e.g. research performing organisations, business associations, need owners and policy makers).

#### **1.4.4 International Cooperation**

In addition to European partners, CETP is open for international participation on all levels. Many MS/AC and also the European Commission are involved in the various IEA TCPs and Mission Innovation challenges. Based on the previous experiences, the CETP envisages that there can be joint calls with Mission Innovation partners depending on the added value of the collaboration for the objectives of partnership. For example, there has been successful cooperation with the US Department of Energy in the ERA-NETs ACT and GEOTHERMICA which in the case of the former (ACT) has been expanded to include the Canadian province of Alberta. Furthermore, India has been involved in the Smart Energy System ERA-NET Call Topic in 2019. Both countries are parties of related Mission Innovation challenges. Where interests coincide, there is value in collaboration with of international partners (UK, China, USA, Canada etc.) in selected joint calls and in selected joint activities. There are also experiences of international collaboration with 3rd countries through bilateral MS/AC.

## 2 Planned Implementation

### 2.1 Activities

#### 2.1.1 Implementation Structure of CETP

The CETP will be implemented through a programme management structure, which revolves around the central activities of the partnership. A number of de-centralised activities, which mirror the thematic priorities, will complement these activities. Central activities of CETP focus on the development and implementation of the partnership's strategy and in the coordination of joint calls. In addition, the partnership will set up stakeholder platforms or gatherings of a wider audience. This will enable the programme management to connect research communities and their facilities, and to engage in capacity building with specific audiences and disseminate the evidence created through the transnational projects. These additional activities will enable the growth and recognition of stakeholder community for the clean energy transition. Dissemination of results from joint thematic calls, the demonstration of the added value to members of the CETP is expected to lead to membership growth and growing international outreach.

We will build on good and established practices from 8 energy-related ERA-NETs. On this basis, the CETP envisages the continuation and progressive integration of knowledge on how to implement a transnational programme management structure. This has the potential to bring about a step-change in building an effective and efficient network of topical programme owners and managers.

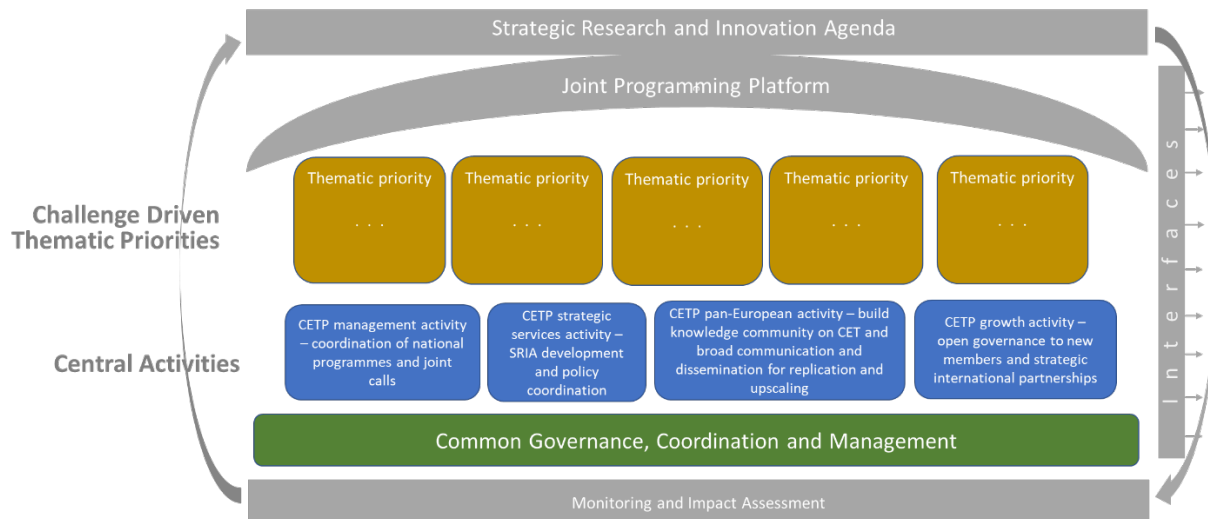


Figure 8 Draft Implementation structure of CETP

Accordingly, the following portfolio of central activities is proposed for the implementation of the CETP.

The **CETP management activity** owned by the Management Board translates choices aligned with the SRIA into annual and bi-annual operational activity and work plans (joint

programming cycle, coordination of co-funded and non-co-funded calls; operationalising the calls, explore different type of R&I calls and other instruments).

This activity drives the additionally and directionality of the CETP and transforms the cooperation of MS/AC and, where beneficial, 3<sup>rd</sup> country energy research programme owners and managers.

The **CETP strategic services activity** ensures the relevance and pertinence of the Strategic Research and Innovation Agenda for MS/AC. This activity oversees the alignment of CETP with relevant Horizon Europe initiatives and facilitates the interaction among CETP thematic priorities. A process will be developed that manages the identification and maturation of MS/AC-driven new thematic priorities. This activity also includes the development of a sustainability plan beyond Horizon Europe (Section 2.2.6).

This activity will maintain a close dialogue with different European Commission Services, the Horizon Europe programme committee(s), co-ordinators of other relevant Horizon Europe Partnerships and members of Horizon Europe's mission boards the CETP to ensure close collaboration and avoid unnecessary duplication of its activities.

CETP partners in this activity are likely to be representatives of national governments and agencies that have seats in Horizon Europe programme committees and in the SET-Plan Steering Group, and are closely connected to national administrative units that coordinate participation in European partnerships.

The **CETP pan-European activity** coordinates and facilitates a stakeholder community for clean energy technology across the CETP thematic priorities. This central activity coordinates the overall CETPs interactions with relevant research infrastructures and facilitates the collaboration of nationally important clean energy validation sites (living labs and major laboratories). Similarly, the activity will include interactions with other Horizon Europe partnerships (identified in 2.2.3). Where needed, the activity will cooperate with European Research Infrastructure Consortia (e.g. EU-SOLARIS, ECCSEL, EPOS) and develop specific CETP infrastructure (e.g. digital collaboration platforms).

This central activity also includes the coordination of timely dissemination and exploitation of CETP outputs and outcomes; as well as input into the evidence-based development of various governmental policy domains (research and innovation, market diffusion/support policies, and where possible general energy and climate policy). Much of the evidence will be based on outputs of the CETP thematic priorities.

The **CETP growth activity** focuses on the membership growth of the CETP; the outreach and involvement with 3<sup>rd</sup> country programme owners and managers, and multilateral schemes such as the IEA Technology Collaboration Programmes and the Mission Innovation initiative.

The **CETP (self-) monitoring and assessment activity** implements an information system that captures progress and outputs, and to the extent possible outcomes from research and innovation projects that have been launched in joint calls (be they co-funded or not). This activity will interact closely with the CETP pan-European activity to ensure the use of

communication and dissemination channels established there. The monitoring and assessment activity will also provide data and analysis that CETP countries may require to measure the usefulness and added value of the CETP.

According to Section 2.2.7 the CETP will address challenge driven thematic priorities (Figure 8). Each thematic priority has its own challenges, which need to be addressed by dedicated additional activities. These so-called decentralised activities will be complementary to the central activities, which will aim for a step-change by building on effective and efficient networks of topical programme owners and managers.

Each of the CEPT thematic priorities will interact with respective central activities. The thematic priorities will have a chance to propose calls that can justify co-funding (a process to establish which type of call will be co-funded, needs to be also developed by the CETP management activity).

The CETP's de-centralised activities are essentially thematic networks of programme managers who will continue to collaborate in thematic priorities (Annex 1) as defined by the existing ERA-NETs and those thematic priorities that will be defined in future. The "bottom-up" thematic priorities have proven successful in identifying common research and innovation needs and addressing those through joint calls (co-funded and not co-funded) and accompanying additional activities to increase impact of joint projects. Those successes have forged strong and durable networks of thematic programme managers across Europe.

### **2.1.2 Complementarity**

A close dialogue will be followed with various European Commission services, the Horizon Europe programme committee(s) and the co-ordinators of relevant Horizon Europe Partnerships and members of Horizon Europe's mission boards. The CETP aims to ensure close collaboration and avoid duplication of its activities. Complementarity will be ensured within the CETP strategic services activity.

### **2.1.3 Synergies**

The highest decision-making body of the CETP will be the Management Board (see Section 3.3 on Governance) consisting of the national delegates of the participating countries. Delegates would typically represent national programme owners from energy/research ministries. In this way, the CETP will be able to ensure a continuous dialogue with key national programmes. The Strategic Board will enable a dialogue with the European Commission on links to other EU programmes. Through the Advisory Group, a dialogue on interfaces to other partnership programmes is envisaged.

## **2.2 Resources**

### **Investment levels in the thematic priorities of CET by CETP countries during past years**

Table 7 provides an overview of investment levels in energy-related ERA-NETs in the past. The table presents how much funding from the European Commission (EC) and national sources has been allocated to energy-related ERA-NETs (with relevant themes that will be



continued in this partnership) and how much has been actually spent by end of 2018. Additionally, the table displays how much private R&I was mobilised.

Theme	Allocated budgets in Mill. EUR		Spent budgets in Mill. EUR		
	EC funds	national funds	EC funds	national funds	private funds
<b>Renewables (Solar-ERA.NET1/2, DemoWind1/2, GEOTHERMICA, OCEANERA-NET)</b>	47,4	94,9	21,7	43,3	110,1
<b>Energy system (SmartGridPlus, SGplusRegSys)</b>	25,9	56,2	8,5	17	16
<b>Bioenergy (BESTF3)</b>	7,5	15,3	2,1	3,4	0
<b>Carbon Capture and Storage/Use (ACT)</b>	12,8	97	11,9	24,1	14
<b>Sum of funds</b>	<b>93,6</b>	<b>263,4</b>	<b>44,2</b>	<b>87,8</b>	<b>140,1</b>

Table 7 Overview of funds allocated and spent in Horizon 2020 in million Euros (Source: SET PLAN PARTNERSHIPS (2019)).

The programme owners and managers in each ERA-NET also spent additional resources for the coordination and management of the ERA-NETs.

#### *Example GEOTHERMICA*

Based on previous experience, it is safe to say that the overall work in the Consortium in the course of the implementation of the CETP will need several millions of in-kind and in-cash contributions. For example, GEOTHERMICA has an annual in-cash implementation budget of roughly EUR 400,000 for coordination and work package leadership. In addition, programme manager have decided on fair and equitable in-kind contributions by each of the 17 partners whose combined annual value amounts to a total of EUR 300,000 for each of the initial 5 years of the GEOTHERMICA partnership.

#### *Example Energy Systems*

The ERA-NET SmartGridPlus has coordination and work package leadership costs amounting to EUR 3 million over 5 years (EUR 600,000 per year) that partners have committed to. This is 7-10% of the call budget. On top of that, the partners delivered additional in-kind contributions through participation of meetings, administering project contracts and project controlling.

CETP partners will cover its coordination costs and, as part of the exit strategy, will endeavour to share it beyond the Horizon Europe phase. CETP will build on experience and practices to generate a budget for coordination and out-of-pocket costs, such as expert panel meetings.

## Planned investments to implement CETP

For the implementation of the CETP the two main sources of funding (Table 8) are MS/AC and the EC. First, the MS/AC will make financial contributions to joint projects. This part of the investment in CETP will be formalised in the Grant Agreement. Second, MS/AC will participate in CETP through in-kind contributions, in terms of human and financial resources to coordinate and manage the CETP and its activities. This part of the investment will be formalised in the CETP's Consortium Agreement.

Source of funding	Financial contribution to joint projects (cash)	Contribution to the coordination of CETP
<b>MS/AC partners of CETP</b>	National R&I budgets for joint projects	Human and financial resources for the coordination of the partnership
<b>EC</b>	EC co-fund for joint projects	-
<b>Contract</b>	Grant Agreement	Consortium Agreement

Table 8 Sources of funding for CETP

## Financial contribution to joint projects by MS/AC and the EC

Table 9 provides an overview of the indicative national financial budgets pledged for the duration of the CETP by interested countries, in total and averaged annually. In total at least EUR 500 million in national contributions are expected (on average, at least EUR 70 million per year).

Assuming that the EC provides 50% of the national R&I investments as EC Co-fund, the EC will provide at least EUR 250 million for the CETP (on average, about EUR 35 million per year).

In total, the partnership will invest at least EUR 750 million (2021-2030) in joint projects (spending about € 75 million per year until 2030).

Country	Programme Owner/Programme Managers (could be more than one per country)	Indicative national budget in Mill EUR (2021-2027)	Indicative national budget in Mill EUR annually
<b>AT</b>	Austrian Federal Ministry of Climate Action, Environment, Energy, Transport, Innovation and Technology (BMK) Austrian Research Promotion Agency (FFG)	40	5.7
<b>BE</b>	Flanders Innovation and Entrepreneurship (VLAIO) and The Research Foundation – Flanders Public Service of Wallonia (SPW)	10,5	1.5
<b>CH</b>	Department of the Environment, Transport, Energy and Communications DETEC Swiss Federal Office of Energy SFOE	35	5

<b>CZ</b>	Ministry of Industry and Trade		
<b>DE</b>	Project Management Juelich (PTJ)	60	8.6
<b>DK</b>	Danish Energy Agency	21	3
<b>EE</b>	Estonian Research Council		
<b>ES</b>	Centre for the Development of Industrial Technology (CDTI)		
	Agencia Estatal de Investigación (AEI)		
<b>HR</b>	Ministry of Environment and Energy		
<b>FI</b>	Ministry of Economic Affairs and Employment	50	7.14
	Business Finland		
<b>FR</b>	Ministry for an Ecological and Solidarity Transition		
	Ministry of Higher Education, Research and Innovation		
<b>IE</b>	Sustainable Energy Authority of Ireland (SEAI)	2,5	
<b>IT</b>	Ministry of Education, University and Research (MIUR)	30	4.3
	Ministry of Economic Development + possibly other ministries		
<b>IS</b>	National Energy Authority of Iceland (NEA)		
	The Icelandic Centre for Research, rannís	5-10	0.7 – 1.4
<b>LT</b>	Ministry of Energy of the Republic of Lithuania	0,3	0.04
<b>LU</b>			
<b>LV</b>	Ministry of Education and Science of the Republic of Latvia	6-9	0.86 – 1.3
	State Education Development Agency (VIAA)		
<b>NL</b>	Ministry of Economic Affairs and Climate	105 – 140	15 – 20
	Netherlands Enterprise Agency (RVO)		
<b>NO</b>	Ministry of Petrol and Energy in Norway		
	Research Council of Norway (RCN)	30-40	4.3 – 5.7
<b>PL</b>	National Centre for Research and Development (NCBR)	16	2.3
	Ministry of Science and Higher Education (MNiSW)		
	Ministry of Climate (MK)		
<b>PT</b>	Foundation for Science and Technology (FCT)		
	Directorate General for Energy and Geology (DGEG)		
<b>RO</b>	Executive Agency for Higher Education, Research, Development and Innovation Funding (UEFISCDI)		
	Ministry of Education and Research		
<b>SE</b>	Swedish Energy Agency	43,3	6.2
<b>SI</b>	Ministry of Infrastructure	11	1.6
<b>TR</b>	The Scientific and Technological Research Council of Turkey (TUBITAK)	7	1
<b>In national budgets</b>		<b>472 - 523</b>	<b>67 - 75</b>
<b>EC Co-fund</b>		<b>250</b>	<b>35</b>
<b>Total</b>		<b>750</b>	<b>106</b>

Table 9 Indicative national financial budgets for joint projects (in total and annually)

### Additional contribution to CETP coordination from MS/AC

The core budget for coordination and the additional activities of the partnership programme will be contributed by the signatories of the Grant Agreement, i.e. the countries, which are partners of the CETP. The respective size of their contributions may be determined on participation in different parts of the partnership programme.

For the realisation of the partnership, the following national in-kind resources and commitments are required and will be discussed with all interested consortium partners in CETP:

- **Financial commitments and in-kind contributions to the governance structure:**  
These commitments entail the participation at Management Board (2 meetings per year for 2 days) and a more operational Implementation Group meetings (5 meetings per year to coordinate the development of the joint calls). In addition, participation in other CETP related meetings such as conferences, project meetings and stakeholder meetings. Each partner will likely host at least one of the CETP meetings. These commitments include in-kind contributions in terms of costs for meeting venues, catering, human resources (time) and financial resources (travel costs).

Another high-level contribution is the secondment of personnel by CETP partners to the Implementation Group. This includes the secondment of experts from “lead entities” to host “thematic priorities” and lead “work packages on specific activities”. This secondment includes direct costs in terms of personal (time) and travel and material costs. In addition, further direct costs are expected for communication, for attending events and for sub-contracting thematic experts as well as their travel costs.

- **In-kind contributions to the joint calls:**  
This includes the in-kind contribution to manage calls, including the coverage of personnel costs for the call coordination and management and project contracting and controlling on national level. Usually, costs for administration of projects on national level amount to 3-4% of project budgets.
- **Efforts for national coordination:**  
CETP partners are expected to commit to resources to ensure the promotion of joint activities, mobilisation of relevant stakeholders, fostering impact creation and implementation of results on the national/local level. Furthermore, these efforts should provide for the organisation of national/regional/local events and the alignment with national strategies and priorities.

This financing model has been applied in previous ERA-NETs/Joint Programmes to ensure the maintenance of a management structure that coordinates the portfolio of activities and run some basic infrastructure, such as websites, promotion and communication material, coverage of expert travels or hosting events.

All members of the Management Board of the partnership will be asked to fulfil their roles as delegates as an in-kind contribution. Approximately 3-4 person months/year are projected per partner organisation. In addition, the financial needs to operate the partnership will depend on the amount of funding for calls executed through the partnership.

The indicative budget is also based on prior experience in the operation of ERA-NETs and Joint Programming Platforms. In summary, the CETP aims to limit coordination and management costs to 5-10% of the total CETP budget.

## **2.3 Governance**

### **2.3.1 Governance structure**

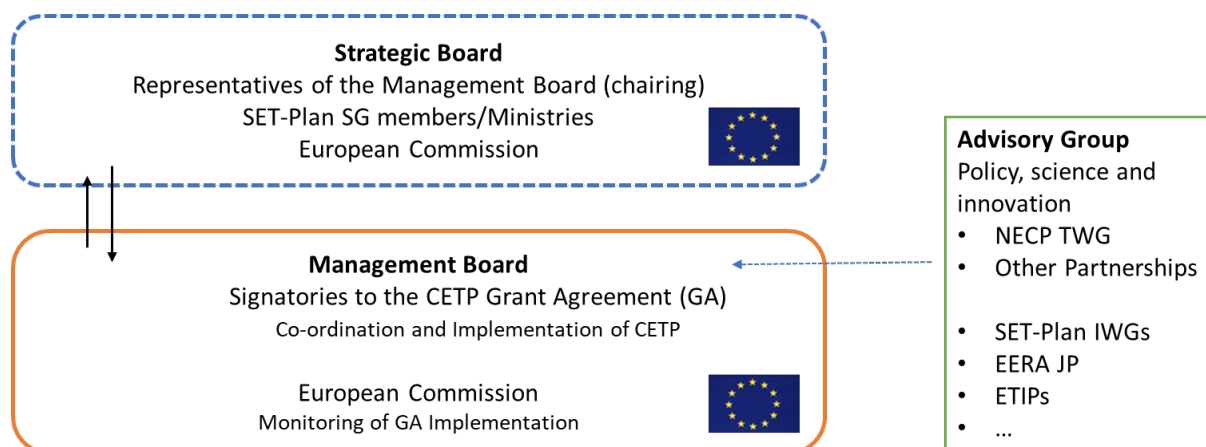


Figure 9: Proposed Governance Structure for CETP

The CETP will operate in a complex environment characterised by regional, national and transnational interests complemented by those of the European Commission.

The governance structure is divided in two parts, external and internal. The division lays out the distribution of roles and responsibilities. In the following the members and responsibilities of the different boards is described. The different external functions (dotted lines) provides advice and recommendations whereas the internal function takes decisions.

### External Governance

The aim of the **external governance** is to ensure that key stakeholder groups are appropriately consulted, their advice is incorporated, their endorsement received, and a common sense of purpose established with a clear understanding of the various roles and responsibilities. While there is a structured relationship with the bodies that constitute the external governance, they do not have any directive role to the decisions that are taken within the CETP.

**The Strategic Board** will *advise on and give its endorsement to the strategic issues of the CETP such as annual work programmes and budget and inform on the connection to the EU and national policies, priorities and budgets.* The annual work programmes will include the planning for joint calls and strategic additional activities.

Members of the Strategic Board are:

- **delegates representing the signatories of the CETP** (representing national and regional programme owners and programme managers) providing a link between the Strategic Board and the Management Board
- delegates of the SET-Plan Steering Group/**ministries** to ensure a close link to national policies, priorities and ensure funding commitments
- relevant **European Commission services** will have a seat in the Strategic Board to ensure close coordination to the EU research and innovation landscape, EU policy initiatives, other parts of Horizon Europe and other EU funding instruments
- delegates of the SET-Plan Steering Group

### Internal Governance, management and implementation of the CETP

The **internal governance** of the consortium will provide an efficient structure to ensure a timely and impactful execution of the CETP. It will include the decision making, management and coordination of the CETP and its different parts. This covers the preparation of the draft annual work plan, including joint calls and strategic additional activities and receiving policy

as well as scientific and innovation advice from external actors. An internal governance structure will be formed around a coherent framework aligned with the thematic priorities in the SRIA.

The **Management Board** of the CETP consortium will be the ultimate decision-making body of the CETP. It will be responsible for any decisions on strategic and operative levels. It will be responsible for the adoption of the SRIA and its updates, the adoption and allocation of resources provided by the consortium for the execution of the activities in the annual work programme, i.e. the entire scope of the CETP including all thematic priorities. Members of the Management Board will be the signatories to the CETP Consortium Agreement (representatives of national ministries and national and regional programme owners and programme managers with decision making power on strategy and budget). The Management Board provides a mandate for its representatives for discussions in the Strategic Board. The chair of the Management Board will be duly elected by its members. The Management Board will meet regularly.

The coordination of the consortium will support the Management Board. Co-ordination will be provided at different levels and through different constellations. On an overarching level the coordination team of the entire partnership programme, will report to the Management Board. The partners of CETP will take responsibility for the preparation and coordination of the activities which will be reported to and endorsed by and the Management Board. In addition, there will also be teams linked to the Implementation Group, which will organise the co-ordination and management of individual thematic priorities and calls. There will also be coordination of supporting strategic additional activities and between calls and the additional activities.

The Implementation Group, at the core of the CETP will support the Management Board. Its members are national programme managers participating in joint calls. The Implementation Group will prepare for discussions and decisions of the Management Board. It will have an operative role in preparing the annual work programmes, carry out the joint calls (co-funded and non-co-funded) and provide additional activities in different areas (to a variable geometry). All partners of CETP who work on implementation of joint calls will part be of this group. As the different calls and activities in the CETP go back to different practices of ERA-NETs, the CETP will continue working with current ERA-NET coordinators and use the good practises from current ERA-NETs and aim for an alignment of call and monitoring procedures across all CETP and its different calls. There will be coordinators for each thematic priority, with a role similar to the role of ERA-NET Co-fund coordinators, who are responsible for the implementation and management of joint calls within their thematic priority. The details and decisions for all calls topics and texts will be managed by the participating partners in each specific call. The coordinator of the Implementation Group and coordinators of thematic priorities will constitute the core team to implement the joint calls.

A stakeholder community for the CETP will be based on existing knowledge communities built by the ERA-NETs. It consists of partners active in the projects, but also a wider stakeholder community. It will contribute to new projects and synergise the results of existing projects and learning experiences for their use in adoption, markets, upscaling and replication.

## External advisory services to the CETP

The integration of the CETP into the energy research and innovation eco-system of the consortium will be facilitated at a range of levels and through varying constellations. The partners of the CETP will take responsibility for the preparation, coordination and implementation of the activities seeking advice from national policy makers in the SET-Plan Steering Group and the Technical Working Group of the National Energy and Climate Plans. The partners of the CETP will also seek input from the Implementation Group, from coordinators of thematic priorities, from SET-Plan Implementation Working Groups and stakeholders such as the EERA and ETIPs.

An **Advisory Group** will be established to provide

1. **Policy advice.** and guidance on the direction of the CETP and the annual draft work plans. Members of the Policy advisory sub-group could<sup>32</sup> include members of the NECPs Technical working group, representatives from other Horizon Europe Partnership Programmes but also regional and national policy makers not yet partners of the CETP.
2. **Scientific and innovation advice** through an informal dialogue with European and national stakeholder groups. Input would be sought for supporting among other things the periodical revision of the SRIA when necessary and input to the thematic priorities. Members of the scientific advisory sub-group could be members from the *SET-Plan* Implementation Working Groups (IWGs primarily national programme owners) with their members of Energy Technology Innovation Platforms and EERA Joint Programme Initiatives or other relevant groups. Membership will require active participation.

### 2.3.2 Involvement of the Commission Services

The European Commission Services have already been involved in the preparation of the CETP through presentations and discussions between November 2019 and January 2020. The European Commission services have also arranged two co-creation workshops for the CETP in January and February 2020. Invited parties to these workshops were members of the SET-Plan Steering Group and national contact points listed for the CETP with the European Commission. The EC will contribute in a reviewing role to the development of the draft partnership proposal.

The European Commission services will be invited to be part of the external governance structure of the CETP with a seat in the CETP Strategic Board. Here it will provide advice and guidance to the CETP work plans and activities, providing a link to overall European energy and research policy as well as the implementation activities of the Horizon Europe Cluster 5 as well as other parts of Horizon Europe including the overview of other partnership programmes.

The European Commission will also have a role in monitoring the CETP implementation of the Grant Agreement.

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<sup>32</sup> To be further agreed with DG ENER



## 2.4 Openness and transparency

### 2.4.1 Involvement

The CETP will strive to get all MS/AC and interested third countries on board. The clean energy transition is a priority for all of Europe, and the creativity and determination of businesses and researchers from all European countries are needed to develop the technologies and the market solutions that we need. The CETP is co-created by the programme owners and managers in interested MS and AC and a range of European Commission Services. Similarly, the SRIA of the CETP will be co-created by the MS and AC, ERA-NETs, stakeholders in the SET-Plan IWGs and the SET-Plan Steering Group (see Section 2.2.7 on SRIA Process and Section 2.4.2 on Openness regarding common vision).

From the inception of the CETP, the core group has communicated with the entire SET-Plan community to inform and encourage potential new entrants. The establishment of the CETP started with a dialogue between European Commission services and MS/AC at SET-Plan meetings in the beginning of 2019. Further discussions have since taken place through gathering of input at online meetings arranged by the chair of the SET-Plan IWG 4 (Smart resilience and Secure Energy System) between November 2019 and January 2020. Several groups of actors were invited for discussion on the CETP; European Commission services, SET-Plan Steering Group, SET-Plan Implementation Working Groups, ongoing ERA-NETs and representatives of EERA and ETIPs. In the first quarter of 2020, the European Commission services arranged two co-creation workshops for the CETP in January and February 2020. The continued process in preparation of the CETP and the SRIA will aim to keep the process open and inclusive.

A significant number of countries have already been able to make a statement on an indicative potential budget for the CETP – so the CETP can make a start (see Section 1.4 on Partner Composition and Section 2.2 on Resources). There will be a targeted effort to include additional countries in the CETP and raise the budget between the publication of this outline description (April 2020) and the envisaged submission of the Partnership proposal (early 2021). As the outlines of the activities and the financial implications become clearer, it will be easier for countries to commit.

Currently, the CETP is biased towards Northern, Western, Southern and Central European countries. The Partnership will strive for the SRIA to be inclusive, to also consider the clean energy transition for the Eastern part of the continent. The CETP will consult with all SET-Plan Steering Group delegates to make sure that the basis is broad. Interested countries that as of today are not a member of any ERA-NET include Latvia and Lithuania.

After the formal start of the CETP, regional and national governments that are not a part of the consortium remain highly welcome. The CETP envisages that the annual work programme with the planned joint calls and the planned joint activities will be a good instrument to invite countries to join the CETP. If new entrants join formally, they will be eligible for the Cofund if they are a programme owners or manager of MS/AC.



It is very important that the priorities and the call topics are sufficiently inclusive and relevant, and have a realistic level of financial ambition for a diverse group of countries. Also, the calls will be designed in a way to encourage businesses and research organisations from all participating countries to submit proposals. Expanding the geographical scope of projects between the first and second stage has been done with some success in previous ERA-NETs and some creativity towards this inclusiveness will be part of the partnership's approach to growth. However, the focus on inclusiveness of the calls does not preclude targeted calls by smaller subsets of countries.

The CETP will also forge links with international partners, e.g. through involvement in various IEA TCPs and in Mission Innovation challenges or through bilateral agreements between the CETP and 3<sup>rd</sup> countries. The CETP envisages that international partners participate in many calls, but there is also a possibility for international partners to join just one or a few specific calls or joint activities. The CETP envisages that international partners participate in many calls, but there is also a possibility for international partners to join just one or a few specific calls or joint activities. International partners should always be national or regional governments or funding organisations. They can participate in the CETP on an equal footing but will not be beneficiaries of funds appropriated by Horizon Europe (i.e. co-funding). International partners that intend to participate in numerous calls may enter the Consortium Agreement. Alternatively, MoU on a call basis has worked well in previous ERA-NET calls. The CETP will have a pragmatic approach. For detailed information see Section 2.4.4. on international coordination.

#### **2.4.2 Openness and transparency regarding common vision**

The development of the SRIA (see Section 1.2.7 SRIA development) is a strategic and crucial process to determine the priorities of the CETP and promote alignment across Europe. As the SRIA will provide the framework for the joint calls and the joint activities, the partners will make sure that there is sufficient overlap between the strategic needs of the MS/AC and the SRIA. At the same time, the SRIA should reflect the state-of-the-art understanding of the research needs for the years to come. Such real needs do matter, even though they might not have an impact on the availability of funds within the next annual work programme of the partners in CETP.

In order to optimise the input to the SRIA process but retain the decision power at governmental institutions and funding organisations, the CETP will hold a consultation round where stakeholders and potential new partners can review and comment on the SRIA draft document. This consultation round will be broadly communicated through relevant networks such as the SET-Plan's energy research and innovation community in Europe.

## Annex 1 Thematic priorities – currently for information purposes only

The input to the following thematic priorities is **under** development (status April 2020) and these thematic priorities will be challenged and connected to the overarching aims during the development of the SRIA. The input highlights those areas where MS/AC propose to work together in the CETP.

Indications for interested MS/AC and objectives are based on participation and discussions in existing SET-Plan Implementation Working Groups (IWGs) and existing ERA-NETs. Further discussions on the SRIA and the thematic priorities will refine their content and direction.

INTEGRATED REGIONAL ENERGY SYSTEMS	Lead entity and MS/AC
<p>Regional and local energy systems and networks are composed of locally and regionally available energy sources, built infrastructure, specific production and consumption characteristics as well as user and consumer structures from different sectors, including the transportation system. They have an important role to play in reaching the energy union targets. They are part of the living environment of citizens, including, in some cases, highly ambitious clean energy goals of specific communities and regions. They provide appropriate services to consumers, customers and citizens as well as to the overall European energy system to help ensure the security of supply, maximise the primary energy efficiency and deliver a high share of renewable energy. Local and regional energy systems will have to cope with a fundamental transformation in the coming years, responding to actual drivers such as the increasing uptake of new and improved technologies for decentralised energy systems, the boosting digitalisation and associated business models as well as current societal trends.</p> <p>Energy Communities are integral part of the energy systems.</p>	<p>BMK, AT Swedish Energy Agency, SE</p>
Interested entities, MS/AC (one or more per MS/AC)	Indicated Budget 2021-2027
<p>AT, BE, CH, DE, DK, ES, FR, IL, IT, NO, PL, SE, TR, UK</p>	<p>70 M€</p>
Existing initiatives that the priority builds upon	
<ul style="list-style-type: none"> <li>• SET-Plan Implementation Working Group 4</li> <li>• ERA-Net Smart Energy Systems</li> </ul>	
Connection to other international initiatives	
<ul style="list-style-type: none"> <li>• Involved in development of the Implementation Plan IWG 4: ETIP SNET, ETIP RHC, ETIP PV, ETIP Deep Geothermal.</li> <li>• (Bilateral talks with ETIP Batteries on opportunities for collaboration)</li> <li>• Started “Joint Implementation Working Group” with SET-Plan IWG 3.1 (Standards and Interoperability), SET-Plan IWG 3.2 (Cities and Communities) and IWG 5 (Buildings)</li> <li>• Started collaboration with PV ERA-Net</li> <li>• IEA TCP DHC, IEA TCP ISGAN are connected as Associated Partners</li> </ul> <p>MI Challenges (Smart Grids), IC7 (Heating and Cooling of Buildings), IC8 (Hydrogen) are involved in MI Calls.</p>	
Short term objectives and activities 2-3 years	
<ul style="list-style-type: none"> <li>• Transnational RDD projects of differing scale resulting from the EC co-funded joint call involving national, regional and local actors from various domains (e. g. power, heat, agriculture, mobility) and spanning the development, piloting and demonstration phases as well as the actual implementation of innovative solutions. Additional projects will result from an additional joint call.</li> </ul>	

- Practice oriented solutions within all projects shall address the Three Layer Research Model (technology, market and adoption) as well as the 3 Dimensions of Integration (cross sectoral, regional development, smart energy system) and involvement of a significant number of SMEs, crafts and start-ups with a minimum of one in each project.
- Institutionalised cooperation between actors on different governance levels in pioneer regions across Europe, which have delivered successful and highly ambitious pilots resulting in well described and demonstrated innovative business processes providing services for utilities, enterprises, prosumers and end users.

#### Long term objectives and activities 4-6 years

- Sustainable transnational cooperation of funding institutions and increased alignment of RDD and deployment programmes throughout Europe, thereby increasing the prominence of regions that are developing the technologies and services needed to reach the goals of the European Energy Union
- Accelerating deployment of the latest resource-efficient and decarbonising energy system solutions by creating new business models as well as bridging multiple governance levels and thus strengthening Europe's competitiveness in global markets
- Well established open and harmonised marketplaces that allow for seamless access of (new) market players both in the energy domain and its supply industry (including SMEs and crafts), thereby contributing to substantial progress in growth and creation of jobs in Europe
- Increased confidence of policy makers, regulators and utilities in the security and cost effectiveness of new solutions for energy supply that rely on distributed, renewable energy sources and a new market design, providing the right signals to enterprises and investors.
- Paving the way for European know-how and solutions towards the global markets by leveraging on RDD collaboration. Maintaining to organise collaboration with partners from outside Europe, e.g. in the framework of Mission Innovation

DIGITAL TRANSFORMATION	Lead entity and MS/AC
<p>Digitalisation of energy systems and networks in designing, implementing and testing of interoperable technical and business services for energy systems, unleashing the potential of digital transformation supporting the energy transition towards a Decarbonised, Secure and resilient System also including aspects of social and economic sustainability. This includes:</p> <ul style="list-style-type: none"> <li>• technical operation: ICT support for automation and technical control of grid, generation, consumption and storage devices</li> <li>• business operation: innovative ICT means for managing the businesses of system operators and utilities</li> <li>• market operation: ICT based platforms and transaction mechanisms to trade energy, power and flexibilities</li> <li>• communication: apps and web-based tools to inform and integrate consumers in the future energy system</li> </ul>	<p>BMK, AT Swedish Energy Agency, SE</p>
Interested entities, MS/AC (one or more per MS/AC)	Indicated Budget 2021-2027
<p>AT, BE, CH, DE, ES, FI, IE, IT, LV, NO, PL, SE, RO, TR, UK, Nordic Energy Research</p>	<p>60 M€</p>
Existing initiatives that the priority builds upon	
<ul style="list-style-type: none"> <li>• SET-Plan Implementation Working Group 3.1 and 4</li> <li>• ERA-NET Smart Energy Systems</li> </ul>	
Connection to other international initiatives	
<ul style="list-style-type: none"> <li>• ETIP SNET</li> <li>• IEA TCP/CEM initiative ISGAN,</li> <li>• IEA TCP Users,</li> <li>• IEA TCP 4E</li> <li>• IEA HPT</li> <li>• IEA ECES</li> <li>• Mission Innovation challenges 1, 2, 7, 8, MI Calls connecting to Mission Innovation</li> <li>• ...</li> </ul>	
Short term objectives and activities 2-3 years	
<ul style="list-style-type: none"> <li>• Maintain a joint programming initiative of ambitious national and regional RDD funding programmes from 15 European and associated countries in order to support the designing, implementing and testing of technical and business services for digital energy systems and solutions.</li> <li>• Coordinate national and regional RDD budgets of 20 Mio. EUR to finance transnational projects to support the implementation of relevant European RDD agendas (i.e. the European SET-Plan)</li> </ul>	

- Establish transnational innovation ecosystems, sharing development and test facilities to develop scalable, customisable and replicable solutions, applicable from local through interregional and up to global level, making effective use of the opportunities provided by digitalisation to power the energy transition
- Enhance interoperability of solutions by enabling collective interoperability testing with a variety of developers, producers and providers of solutions, supporting the practical implementation of common standards, interoperability profiles and reference architectures
- Initiate co-creation processes, aligning the R&I knowledge with new innovation approaches from the digitalisation sector and start-ups as well as simulating the creation of digital energy solutions building on available ICT platforms and tools
- Initiate co-creation processes supporting the development of need driven implementation environments on regional and local levels, link innovators to local innovation forces, need owners, potential adopters, procurers and buyers, as well as to follow up funders and financiers with close to market thinking.
- Organise a knowledge community together with experts from the resulting transnational projects, practitioners from different regions as well as the European innovation initiatives of the SET-Plan in order to share best practise, provide programming and governance guidance, increasing confidence to demonstrate and exploit new solutions and business opportunities
- Expand the existing Joint Programming Platform Smart Energy Systems with new partners and by piloting new ambitious strategic elements and stimulate their uptake.
- Transnational RDD projects of differing scale resulting from the EC co-funded joint call, involving actors from various domains in digitalisation and energy (e. g. digitalisation, ICT, power, heat, agriculture, mobility) and spanning the development, piloting and demonstration phases as well as the actual implementation of innovative solutions.
- A Transnational Validation Ecosystem of existing and upcoming living labs from various countries, allowing start-ups and innovative companies to test their solutions in different environments.
- A European Collaboration Platform for Interoperability Testing, providing a testing- support platform and organising at least two pilots “Connectatons”, where companies from various countries will test their equipment and solutions.
- An Associated Partner Network of public funders together with intermediaries towards local and regional business clusters, regional development and energy agencies, operators of public and private infrastructure like energy networks or buildings, ICT platform providers, start-up supporters, follow-up financiers and investors in various countries
- A Knowledge Community involving practitioners and researchers from transnational projects, national and European projects, as well as policy makers and programme managers

#### Long term objectives and activities 4-6 years

- Sustainable alignment of RDD and deployment programmes throughout Europe, coordinated by the EU SET-Plan, resulting in transnational cooperation of funding institutions and companies as well as living labs, thereby increasing the prominence of various regions that are developing the technologies and services needed to reach the goals of the European Energy Union
- Accelerated development and uptake of latest digital innovation and solutions in for resource-efficient and de-carbonising energy systems by creating new business models as well as

bridging multiple governance levels and thus strengthening Europe's competitiveness in global markets

- Well established open and harmonised marketplaces that allow for seamless access of (new) market players both in the digital and energy domain (including SMEs, start-ups and crafts), thereby contributing to the understanding and utilisation of digitalisation as an enabler for the energy transition as well as to substantial progress in growth and creation of jobs in Europe
- Increased confidence of policy makers, regulators and utilities in the security and cost effectiveness of new solutions for energy supply, that utilise digital solutions in order to integrate a broad variety of technologies, distributed and renewable energy sources as well as enabling a new market design and by that providing the right signals to enterprises and investors.
- Paving the way for European know-how and solutions towards the global markets by leveraging on RDD collaboration. Maintaining to organise collaboration with partners from outside Europe, e.g. in the framework of Mission Innovation

STORAGE SOLUTIONS	Lead entity and MS/AC
<p>Achieving a largely decarbonised energy system by 2050 will require the integration of many new energy storage solutions. For this to be possible it will be necessary both with radical improvement of existing technologies as well as development and maturing of new ‘first of a kind’ technologies.</p> <p>This thematic priority focuses on the development of integrated storage systems and will support solutions answering to various identified sub-challenges within this area. This includes sustainable, integrated storage solutions for both short- and long-term storage within technical areas such as:</p> <ul style="list-style-type: none"> <li>• Electrical storage</li> <li>• Electrochemical storage</li> <li>• Material storage</li> <li>• Thermal storage</li> <li>• Mechanical storage</li> </ul> <p>Although the focus evolves around various technologies the challenges to be addressed will also have to cover extensive work on regulatory and marketplace related topics as well as social and environmental sustainability.</p>	<p>BMK, AT Swedish Energy Agency, SE</p>
<p><b>Interested entities, MS/AC (one or more per MS/AC)</b></p> <p>AT, BE, CH, DE, DK, FI, HR, IL, IT, PL, RO, UK, SE, TR Nordic and Baltic Region, India</p>	<p><b>Indicated Budget 2021-2027</b></p> <p>50 M€</p>
<p><b>Existing initiatives that the priority builds upon</b></p>	
<ul style="list-style-type: none"> <li>• SET-Plan Implementation Working Group 4</li> <li>• ERA-NET Smart Energy Systems</li> </ul>	
<p><b>Connection to other international initiatives</b></p>	
<ul style="list-style-type: none"> <li>• ETIP SNET</li> <li>• ETIP Batteries</li> <li>• European battery Alliance</li> <li>• Mission Innovation challenges 1, 2, 7</li> <li>• IEA HPT</li> <li>• IEA ECES</li> </ul>	
<p><b>Short term objectives and activities 2-3 years</b></p>	
<ul style="list-style-type: none"> <li>• Maintain a joint programming initiative of ambitious national and regional RDD funding programmes from European and associated countries in order to support the designing, implementing and testing of new holistic solutions for energy storage.</li> </ul>	



- Coordinate national and regional RDD budgets to finance transnational projects to support the implementation of relevant European RDD agendas (i.e. the European SET-Plan)
- Organise a knowledge community together with experts from the resulting transnational projects, practitioners from different regions as well as the European innovation initiatives of the SET-Plan in order to share best practise, provide programming and governance guidance, increasing confidence to demonstrate and exploit new solutions and business opportunities
- Expand the existing Joint Programming Platform Smart Energy Systems with new partners and by piloting new ambitious strategic elements and stimulate their uptake.
- A Knowledge Community involving practitioners and researchers from transnational projects, national and European projects, as well as policy makers and programme managers

#### Long term objectives and activities 4–6 years

- Sustainable alignment of RDD and deployment programmes throughout Europe, coordinated by the EU SET-Plan, resulting in transnational cooperation of funding that contribute to the development of sustainable, integrated storage solutions for both short- and long-term storage within areas such as: Electrical storage, Electrochemical storage, Material storage, Thermal storage, Mechanical storage.

Accelerated development and uptake of latest innovative and resource efficient business models for profitable energy storage solutions.

- Well established open and harmonised marketplaces that allow Improved materials and systems engineering that resolve key technology cost and performance challenges of known and emerging storage technologies.
- Increased confidence of policy makers, regulators and utilities in the security and cost effectiveness of new solutions for storage technologies with a significant improvement on the reduction of capital cost, increasing system efficiency and extension of life cycle over the state of art performance.
- Validated the safety, reliability, and performance and focused on degradation and failure mechanisms and their mitigation, accelerated life testing and monitoring
- Paving the way for European know-how and solutions towards the global markets by leveraging on RDD collaboration. Maintaining to organise collaboration with partners from outside Europe, e.g. in the framework of Mission Innovation

Strong synergies to be harnessed by coordination with the thematic priority on "Innovative renewable energy technologies: geothermal energy"

Orkustofnun (OS), IS  
Netherlands Enterprise Agency  
RVO, NL

Keywords: Geothermal energy, thermal storage, energy system, renewable heat, heating and cooling, seasonal supply, collective systems

At the core is innovation and demonstration for the transition of the heating and cooling supply of energy intensive city districts, greenhouse farming areas and industrial sites, including seasonal storage. The focus is on collective systems. The activities will be kicked off with collaboration on geothermal energy and seasonal thermal storage for large-scale/collective systems, building on the strong existing collaboration in GEOTHERMICA. However, the scope will expand as time progresses and more entities contribute to this theme with funding and complementary innovation and demonstration priorities. We will exercise great care to avoid duplication with the storage thematic priority.

Such additional priorities could include, but are not limited to: System efficiency and heat pumps, hybrid systems, smart networks, and other sources of renewable heating, cooling and thermal storage, such as ambient heat, solar thermal, etc.

For geothermal energy collaboration will include the entire chain, from new concepts in integrating geothermal heating and cooling in the energy system, to innovations directed at more efficient exploration or more efficient resource development and operation.

#### Interested entities, MS/AC (one or more per MS/AC)

Indicated Budget 2021-2027

CH, BE, DE, DK, ES, FI, FR, GR, HU, IE, IT, IS, NL, NO, PL, PT, RO, SE, SI, TR  
USA

80 M€ (with EC Co-fund 120 M€) excl. Co-fund).

#### Existing initiatives that the priority builds upon

- SET-Plan IWG Deep Geothermal
- ERA-NET GEOTHERMICA

In 2016, the European Commission published 'An EU Strategy on Heating and Cooling'<sup>33</sup>. This document recognises that "Heating and cooling consumes half of the EU's energy [...]. Developing a strategy to make heating and cooling more efficient and sustainable is a priority for the Energy Union".

<sup>33</sup> <https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1572863800135&uri=CELEX:52016DC0051>

### Connection to other international initiatives

- Horizon Europe proposed partnership programmes in “Sustainable, Smart and Inclusive Cities and Communities” and “European Geological Service”. Some synergies may be exploited in connection with the “Safe and Sustainable Food System for People, Planet and Climate” and the “Build environment and construction” partnerships.
- SET-Plan Implementation Working Group 5.2 EE Buildings/Cross cutting heating and cooling technologies for buildings and 3.2 Positive Energy Districts
- IEA TCP Geothermal
- IEA HPT
- IEA ECES
- Mission Innovation Challenge 7
- IRENA Global Geothermal Alliance
- The International Partnership for Geothermal Technologies
- IEA’s Energy Technology Network hosting TCPs for the whole collective heating and cooling topic, for example Energy Technology Systems Analysis (ETSAP TCP); Industrial Energy-Related Technologies and Systems (IETS TCP); District Heating and Cooling including Combined Heat and Power (DHC TCP); Energy Storage (ECES TCP); Solar Heating and Cooling (SHC TCP); and Bioenergy (Bioenergy TCP).

### Short term objectives and activities 2-3 years

Showcasing potential solutions is a priority, together with further development of the constituent components for climate-neutral future heating and cooling systems; including thermal storage, integration of renewable sources in existing networks; and hybridisation:

- 25 Cities of clean heat in 2025. Major cities in the EU are planning to convert their heat generation to geothermal, e.g. Munich, Berlin, Utrecht, Heerlen (minewater), Geneva, Malmö etc.; and there are existing showcases as well e.g. Reykjavik, Paris. Support and showcase these systems and concepts; support and showcase relevant heat storage concepts incl. digitisation for smart integration; etc.
- 25 Cities of clean heating and cooling in 2025. Major cities in the EU have or have planned district heating and cooling systems. Support and showcase various innovative concepts;
- 25 Industrial sites and/or greenhouse farming areas of clean heating and cooling in 2025. For example, Johnson&Johnson in Flanders, which will be converted to geothermal;
- Improve cost performance and reliability of technologies and components for clean heat supply and clean heat storage

### Long term objectives and activities 4-6 years

- Demonstrate the technical and economic feasibility of geothermal heating, cooling and high-temperature storage in a flexible heating system; cover 5% of demand in Europe by 2030 and 25% by 2050.
- Further cost reduction and enhanced integration with other energy vectors will be the focus as well. Also, as the collaboration establishes itself further, the scope will expand as more entities contribute to this theme with funding and complementary innovation and demonstration priorities.

- The opportunities that arise from the transition of the heating and cooling sector to achieve negative emissions.
- The development of concepts for the link between supply and demand across the energy system, linking heating, cooling, electricity, hydrogen and their supply and demand etc.

CARBON CAPTURE USE AND STORAGE	Lead entity and MS/AC
<p><i>Key words describing the thematic priority</i>            CCS, CCUS, CCU, climate neutrality, climate mitigation, negative emissions, carbon dioxide removal, hydrogen, resilient energy system.</p> <p>CCUS is essential to the climate-neutrality goal of Europe. The IPCC 1.5 degrees report makes it very clear that CCUS must be part of an affordable and socially acceptable energy transition.</p> <p>Not only are CCUS technologies essential for mitigation primarily those connected to hard-to-avoid emissions particularly in power and industry sectors. But the thematic priority addresses aspects related to CCS, CCU, negative emissions (such as bio-energy facilities or direct air capture coupled with CO<sub>2</sub>-storage), and the application of CCUS to industry.</p> <p>In some countries CCS also has a role to play in hydrogen production from fossil energy and renewable energy carriers (blue and green hydrogen) as well as blue power production (parallel to blue hydrogen), and thus is important for a robust and resilient energy system.</p>	<p>The Research Council of Norway (RCN), NO</p>
Interested entities, MS/AC (one or more per MS/AC)	Indicated Budget 2021-2027
<p>CH, DE, DK, ES, FI, FR, GR, HR, IE, IT, NL, NO, PL, RO, SE, TR, UK</p> <p>Nordic Energy Research</p> <p>USA, Canada (Province of Alberta)</p>	<p>120-150 M€. With EC top-up 200 M€</p>
Existing initiatives that the priority builds upon	
<ul style="list-style-type: none"> <li>• SET-Plan Implementation Working Group 9 CCUS</li> <li>• ERA-NET ACT</li> <li>• ETIP ZEP</li> <li>• EERA</li> <li>• IEA Secretariat's CCUS unit</li> <li>• IEA TCP GHG</li> <li>• The Carbon Sequestration Leadership Forum CSLF</li> <li>• Mission Innovation</li> </ul>	
Connection to other international initiatives	
<ul style="list-style-type: none"> <li>• Horizon Europe proposed partnership programmes “Clean Hydrogen”, “Carbon Neutral and Circular Industry”, “Clean Steel – Low Carbon Steelmaking”, “European Geological Service” and “Circular bio-based Europe”</li> <li>• The EU Innovation Fund</li> <li>• IEA TCP GHG</li> </ul>	

- Clean Energy Ministerial initiative on CCUS

### Short term objectives and activities 2-3 years

The objectives of the thematic priority CCUS is to continue with the coordinated R&D transnational funding scheme that will lead to CCUS technology ready for commercialisation. With targets such as:

- Develop energy efficient CO<sub>2</sub> capture technologies with low CO<sub>2</sub> abatement cost.
- Establish knowledge to support safe CO<sub>2</sub> transport by ship or pipelines.
- Ensure safe and optimised CO<sub>2</sub> storage by developing improved methods for site selection, site characterisation, CO<sub>2</sub> injection, and monitoring and site closure.
- Establish the foundations for a network of storage and flexible integrated storage solutions, where appropriate.
- Demonstrate the potential of CCU for climate mitigation.
- Demonstrate the versatility of CCUS technologies to achieve negative emissions.

Once established, the thematic priority CCUS will provide measurable targets for deployment of CCUS (e.g. number of pilots, building clusters, activities in various countries, timeframe etc.)

### Long term objectives and activities 4-6 years

- Demonstrate the whole CCS-chain and actively contribute to full scale CCUS projects.

GEOTHERMAL ENERGY	Lead entity and MS/AC
<p><i>Strong synergies to be harnessed by coordination with the thematic priority on "Heating and cooling transition".</i></p> <p>Key words: Geothermal energy, power, heat, subsurface storage (heat, power, gas)</p>	<p>Orkustofnun (OS), IS BFE, CH</p>
Interested entities, MS/AC (one or more per MS/AC)	Indicative Budget 2021-2027
<p>BE, CH, DE, DK, ES, FI, FR, GR, HR, HU, IE, IT, IS, NL, NO, PL, PT, RO, SE, SI, TR USA</p>	<p>53 M€ (With EC Co-fund 80 M€)</p>
Existing initiatives that the priority builds upon	
<ul style="list-style-type: none"> <li>• ERA-NET GEOTHERMICA</li> </ul>	
Connection to other international initiatives	
<ul style="list-style-type: none"> <li>• Horizon Europe proposed partnership programmes "Sustainable, Smart and Inclusive Cities and Communities", "European Geological Service", "Safe and Sustainable Food System for People, Planet and Climate" and the "Build environment and construction"</li> <li>• IEA TCP Geothermal</li> <li>• International Partnership for Geothermal Technologies</li> </ul>	
Short term objectives and activities 2-3 years	
<ul style="list-style-type: none"> <li>• Developing novel exploration and development concepts for a wide range of geothermal play types.</li> <li>• Key technology advances needed to be made, that enable reaching the long-term objectives and activities.</li> </ul>	
Long term objectives and activities 4-6 years	
<ul style="list-style-type: none"> <li>• Increase geothermal reservoir performance through sustainable reservoir management practices and reduce power consumption related to field and facilities operations to less than 10% of gross energy generation by 2030;</li> <li>• Improve the overall geothermal energy conversion efficiency, including bottoming cycle, of geothermal installations at different thermodynamic conditions by 10% in 2030 and 20% in 2050;</li> <li>• Ensure production costs (CAPEX and OPEX) of geothermal energy plants in favourable locations are below 10 €/kWh<sub>el</sub> for electricity and 5 €/kWh<sub>th</sub> for heat by 2025; identify and advance on cost reduction path when developing novel geothermal resources, and/or from hybrid solutions which couple geothermal with other renewable energy sources.</li> </ul>	

- Demonstrate the technical and economic capability of innovative exploration methods and tools to increase the rate of success of finding a commercially viable, greenfield geothermal reservoir by 20% in 2025 and 50% in 2030 compared to 2015;
- Reduce the unit cost of drilling (€/MWh) by 15% in 2025, 30% in 2030 and by 50% in 2050 compared to a regional 2015 benchmark;
- Demonstrate co-benefits of geothermal energy: energy, CO<sub>2</sub> and other storage concepts; load-following capabilities of geothermal power plants to respond to variable grid demand; production of rare elements and materials from geothermal brines, and so on.



**OCEAN ENERGY**

Lead entity and MS/AC

The specific challenges, drawing on FOs priorities, recommendations from the Ocean Energy Forum Strategic Roadmap and TP Ocean Strategic Research Agenda are:

- Demonstration and validation in test sites/real sea environment of ocean energy technologies and operations.
- Improving and demonstrating the reliability, survivability and performance of ocean energy devices, systems and components.
- Development of tools for validation, optimisation and improvement of performance.
- Contributing to significant cost reductions.
- Evaluating and optimising the environmental, economic and social impact of ocean energy technologies.
- Resource evaluation and the assessment of its impact on reliability, survivability and performance.
- Stimulating a dedicated installation, operation and maintenance value chain.
- Standardisation of solutions and manufacturing and installation techniques

Ocean energy installations are growing but still few compared to other renewable energy resources. The technology is also behind some of the other renewable energy technologies such as wind which is important to consider. There is a need to continue developing ocean energy technologies within the next years, however there are also projects focusing on system integration and what system services that ocean energy can contribute to (not only LCOE). Ocean energy can also provide a niche in the energy system where other resources are less accepted.

Interested entities, MS/AC (one or more per MS/AC)

Indicated Budget 2021-2027

**Existing initiatives that the priority builds upon**

- SET-Plan Implementation Working Group Ocean
- ERA-NET OCEANERA-Net
- ERA-NET Co-fund OCEANERA-Net

**Connection to other international initiatives**

- Horizon Europe proposed partnership programmes “A climate neutral, sustainable and productive Blue Economy”
- IEA TCP Ocean Energy Systems

**Short term objectives and activities 2-3 years**

(SET-Plan IWG)

#### Technical Actions

- Tidal energy – assist technology development and knowledge building up to TRL6
- Tidal energy – support system demonstration in operational environment and knowledge building in the TRL 7-9 categories.
- Wave energy – support technology development, system demonstration and knowledge building up to TRL6
- Wave Energy – encourage and support device and system demonstration at early demonstration array scale up to TRL 7- 9.
- Collaborate in the areas of installation, logistics and infrastructure

Co-ordinate the development of standards and guidelines for wave technology evaluation and LCoE analysis.

#### Financial Actions

- Investigate the potential for creation of an Investment Support Fund for ocean energy farms: EU and National Authorities should collaborate in order to create a Fund providing flexible capital, and enabling further private capital to be leveraged
- Progress the creation of an EU Insurance and Guarantee Fund to underwrite various project risks: This would be targeted at the first ocean energy projects to cover risks such as availability, performance, unforeseen events, failures, etc. Consider the provision of a common reserve fund available to multiple projects in the initial farm or plant roll-out, to spread the risk and reduce the cost of providing guarantees.

Support the development of a collaborative procurement model adaptation of the "Wave Energy Scotland" approach for wave energy development at EU Level using pre commercial procurement or similar.

#### Environmental Actions

- Collaboration on the development of certification and safety standards for the development, testing, deployment of ocean energy devices,

Continue the de-risking of environmental consenting through an integrated programme of measures and through promoting open data sharing.

#### Objectives:

- Bring ocean energy to commercial deployment,
- Drive down the levelised cost of energy (LCoE),

The LCoE for tidal stream energy should be reduced to at least 15 ct€/kWh in 2025 (and 10 ct€/kWh in 2030). Wave energy technology should follow the same pathway through convergence in technology development and reach at least the same cost targets maximum 5 years later than tidal energy: 20 ct€/kWh in 2025, 15 ct€/kWh in 2030 and 10 ct€/kWh in 2035.)

- Maintain and grow Europe's leading position in ocean energy and
- Strengthen the European industrial technology base, thereby creating economic growth and jobs in Europe and allowing Europe to compete on a global stage.

### Long term objectives and activities 4-6 years

The objectives and activities for ocean energy is probably around the same for 2-3 years to 4-6 years (several goals until 2030). Some activities for the long term probably have higher TRL than in the short term.

SOLAR PV		Lead entity and MS/AC
Solar power generation, photovoltaics		
Interested entities, MS/AC (one or more per MS/AC)		Indicative Budget 2021-2027
AT, BE, CH, CY, ES, FR, DE, GR, IL, IT, NL, PL, PT, SE, TR, UK		PV 67 M€ (with EC Co-fund 100 M€)
Existing initiatives that the priority builds upon		
•		
Connection to other international initiatives		
<ul style="list-style-type: none"> <li>• Horizon Europe proposed partnership programmes Built Environment and Construction, Sustainable, Smart and Inclusive Cities and Communities, Batteries, the European Institute of Innovation and Technology (EIT) Raw Materials</li> <li>• ETIP PV, The European Technology &amp; Innovation Platform Photovoltaics</li> <li>• ETIP SNET, ETIP Smart Networks for Energy Transition</li> <li>• IEA TCP PVPS</li> </ul>		
Short term objectives and activities 2-3 years		
<p>The overarching goals are to re-build European technological leadership in the sector by pursuing high-performance PV technologies and their integration in the European energy system and to bring down the levelised cost of electricity from PV rapidly and in a sustainable manner to allow competition in electricity markets all over Europe. This will be achieved by:</p> <ul style="list-style-type: none"> <li>• Major advances in efficiency of established technologies (Crystalline Silicon and Thin Films-c-Si and TFs) and new concepts;</li> <li>• Further reduction of the cost of key technologies;</li> <li>• Further enhancement of lifetime, quality and sustainability;</li> <li>• Building-Integrated PV (BIPV) through the establishment of structural collaborative innovation efforts between the PV sector and key sectors from the building industry;</li> <li>• Major advances in manufacturing and installation.</li> </ul>		
Long term objectives and activities 4-6 years		
<p>While the five topics mentioned under short term objectives remain valid, targeting for further increasing the key performance indicators of each of these topics, more long term objectives also include enabling mass realisation of (near) zero energy buildings with BIPV; achieving high levels of PV penetration in electricity grids through advanced grid management techniques, digitalisation and optimised storage and/or power-to-x capabilities; and realising solutions for vehicle integrated PV (VIPV).</p>		
Comments		

PV enters rapidly into the energy system as a whole. Energy system integration of PV therefore becomes a key focus, addressing the interaction with the different sectors of power, heat and cold, built infrastructure, transport and in the longer-term chemicals and fuels. Beyond the further reduction of costs, subjects such as quality and reliability, lifetime, sustainability and socio-economic aspects represent important areas to secure.

CSP/STE (Concentrated Solar Power/Solar Thermal Electricity)	Lead entity and MS/AC
<p>Concentrated Solar Power/Solar Thermal Electricity technologies can contribute significantly to the transformation of the European energy system by providing an important share of dispatchable renewable electricity and by providing flexibility and dispatch capacity and using intrinsic thermal energy storage capacity. CSP/STE facilitates the integration of variable renewables and contributes to system adequacy and security of supply. Optimal solar resources in Southern Europe thus can well complement other renewables whose optimal resources are in other regions of Europe.</p> <p>This thematic priority on CSP/STE's will drive and improve its value proposition by advancing its "innovative research, industrial research and demonstration, and innovative market uptake programmes" as agreed upon by a wide range of active stakeholders in the CSP/STE innovation and value chain, and specified in the SET-Plan CSP/STE Implementation Plan.</p> <p>Although the focus lies primarily on various technologies, there are also challenges to be addressed in the integration of CSP/STE in a resilient energy system to be characterised by a high share of renewable power. It will also have to cover work on regulatory and marketplace related topics as well as social and environmental sustainability.</p>	
Interested entities, MS/AC (one or more per MS/AC)	Indicated Budget 2021-2027
BE, CH, DE, ES, NO, TR, IT, FR, PL, PT, GR	50 M€
Existing initiatives that the priority builds upon	
<ul style="list-style-type: none"> <li>• SOLAR ERA NET (1 and 2),</li> <li>• CSP ERA NET</li> </ul>	
Connection to other international initiatives	
<ul style="list-style-type: none"> <li>• ESFRI – EU-SOLARIS aims to coordinate and reinforce research and technology development (R&amp;D) capabilities and efforts in Concentrating Solar Thermal technologies in European Research Centres, along with those from the neighbouring countries, in order to foster the technological development of the Industry. ESFRI – EU-Solaris is a recognised, unique distributed research infrastructure for CSP/STE technologies. The thematic priority has an opportunity to harness the ESFRI – EU-SOLARIS' multilateral and bilateral cooperation network in the MENA Region, United States, China, Australia, African countries and South-America to extend its reach.</li> <li>• IEA TCP SolarPACES supports collaboration to advance the development and deployment of concentrating solar thermal technologies. From a system perspective, concentrating solar power (CSP) offers significant advantages. With built-in thermal storage, CSP can improve</li> </ul>	

the flexibility and stability of power systems, provide dispatchable electricity and help integrating more variable renewables.

#### Short term objectives and activities 5 years

Short-term: > 40% cost reduction by 2025 (from 2013) translating into:

- Supply price < 10 c€/kWh for a radiation of 2050 kWh/m<sup>2</sup> /year (conditions in Southern Europe)<sup>34</sup>
- Modular, scalable Central Receiver Plants, particularly the multi-tower design approach
- Main systems of a commercial central receiver plant using molten salt (i.e., the solar field, storage systems, solar receivers, control and monitoring, and steam generating systems) as well as operation and maintenance issues (self-calibrating heliostats, on-line solar flux measurements systems and so on).
- New working fluids for temperatures higher than 600°C including proper thermal storage materials for such temperatures.
- Innovative solar field configurations (i.e. heliostat fields merging different types of heliostats, large heliostat fields with several towers, innovative line-focus concentrators with significant cost reduction)
- Cost reductions for thermal energy storage: cost engineering, material development and testing, system and subsystems design, plant scheme performance analysis, subsystems construction and testing, and demonstrator in a range of environments.
- Design of scaled-up, open or pressurised volumetric receiver (50-100 MW thermal) and optimisation of the receiver design for increased efficiency, improved transient behaviour and longevity of >40 years
- Advanced heat transfer fluids for linear focusing CSP/STE technologies achieving working temperatures higher than 400°C in a power plant of at least 5 MW capacity.

#### Long term objectives and activities 4-6 years

Longer-term: development of the next generation of CSP/STE technology

- Central receivers suitable for higher solar fluxes (>1MW/m<sup>2</sup>)
- Power block equipment for sCO<sub>2</sub>
- Demonstration of competitive concepts for production and storage of clean fuels produced with electricity
- Development of an optimised supercritical steam turbine and optimised steam turbine technologies for CSP
- New materials for T>1000°C
- Design, develop and field test of volumetric receivers at 1000 °C
- Design, develop and test of advanced hybrid concepts of solar thermal power plants with solar fuels
- Modular and scalable thermal energy storage concepts and materials for T>800°C

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<sup>34</sup> provided that 30 GW STE plants are installed at that time at world level

WIND ENERGY	Lead entity and MS/AC
<ul style="list-style-type: none"> <li>• Management, prediction and repairing of Erosion</li> <li>• Improvement of measurements in complex conditions (i.e. high turbulence, vertical component, complex terrains).</li> <li>• Optimised prediction of wind generation based on Big Data techniques</li> <li>• Connect existing and new European offshore wind demonstration opportunities, exchange knowledge and facilitate the acceleration of cost reducing innovative technologies to commercialisation.</li> <li>• Wind Turbine blades technology and components. Segmented blades. New materials and EM stealth coating materials</li> <li>• Offshore floating turbines</li> <li>• Structures and foundations.</li> <li>• Meteorological measurement and prediction techniques.</li> <li>• Wind farm control.</li> <li>• Grid Integration. Multiterminal networks. Ancillary services. Wind energy dispatchability. Hybridisation</li> <li>• Operation and maintenance. Automated NDT inspection techniques.</li> <li>• Techniques for installation and dismantling. Crane-less solutions for erection ultra-tall wind turbines and replacement and assembly of large components.</li> <li>• Offshore Validation methods and certification</li> <li>• RECYCLING</li> </ul>	
<b>Interested entities, MS/AC (one or more per MS/AC)</b>	<b>Indicated Budget 2021-2027</b>
NL, BE, DE, DK, ES, EE, FR, IT, NO, PL, TR, UK	
<b>Existing initiatives that the priority builds upon</b>	
<ul style="list-style-type: none"> <li>• SET-Plan IWG WIND</li> <li>• ERA-NET DEMOWIND and DEMOWIND II</li> </ul>	
<b>Connection to other international initiatives</b>	
<ul style="list-style-type: none"> <li>• IEA TCP Wind</li> <li>• ETIP-WIND</li> </ul>	
<b>Short term objectives and activities 2-3 years</b>	
<ul style="list-style-type: none"> <li>• Reduce the levelised cost of energy (LCoE*) at final investment decision (FID) for fixed offshore wind by improvement of the performances of the entire value chain striving towards zero subsidy cost level for Europe in the long term.</li> </ul>	



- Develop cost competitive integrated wind energy systems including substructures which can be used in deeper waters (>50m) at a maximum distance of 50 km from shore with a LCoE\* of less than 12 ct€/kWh by 2025, striving towards cost competitiveness

#### Long term objectives and activities 4-6 years

Develop cost competitive integrated wind energy systems including substructures which can be used in deeper waters (>50m) at a maximum distance of 50 km from shore with a LCoE\* of less than 9 ct€/kWh by 2030, striving towards cost competitiveness

BIOENERGY AND RENEWABLE FUELS	Lead entity and MS/AC
<p>Synthetic liquid fuels and/or hydrocarbons and blending components via gasification</p> <ul style="list-style-type: none"> <li>• Bio-methane from biomass via gasification and synthetic gaseous fuels</li> <li>• High-efficiency heat and power generation via gasification of biomass</li> <li>• Bioenergy carriers via other thermochemical processes (e.g. pyrolysis, torrefaction)</li> <li>• Ethanol and higher alcohols from lignocellulosic feedstock via fermentation</li> <li>• Renewable hydrocarbons through biological and/or chemical synthesis from biomass containing carbohydrates</li> <li>• Bioenergy carriers from CO<sub>2</sub> and sunlight through microorganism-based production and upgrading into fuels and valuable bio-products</li> <li>• Renewable hydrogen production</li> </ul>	FI
<b>Interested entities, MS/AC (one or more per MS/AC)</b>	Indicated Budget 2021-2027
FI, IT, FR, AT, BE, CY, DE, ES, NL, PT, SE, TR	
<b>Existing initiatives that the priority builds upon</b>	
<ul style="list-style-type: none"> <li>• SET-Plan IWG BIOENERGY AND RENEWABLE FUELS</li> <li>• ERA-NET BEST I II III</li> </ul>	
<b>Connection to other international initiatives</b>	
<ul style="list-style-type: none"> <li>• IEA TCP Bioenergy</li> <li>• ETIP RHC</li> <li>• ETIP BIOENERGY</li> <li>• JTI-FCH</li> </ul>	
<b>Short term objectives and activities 2-3 years</b>	
<p>Renewable Fuels for Sustainable Transport</p> <ol style="list-style-type: none"> <li>1. Improve production performance <ol style="list-style-type: none"> <li>a. <u>Advanced Biofuels</u> By 2025, obtain total production of 25 TWh (2,15 Mtoe) advanced biofuels</li> <li>b. <u>Other renewable liquid and gaseous fuels</u></li> </ol> </li> <li>2. Improve GHG savings</li> </ol>	

- a. The greenhouse gas emission saving from the use of biofuels shall be calculated in accordance with Article 7d(1) of the same Directive and should be at least 60% of the 40% target in 2030

### 3. Reduce Costs (excluding taxes and feedstock cost)

- a. Reduce cost for end biofuel products
- -Liquid or gaseous advanced biofuels by thermochemical or biochemical processing: <50 €/MWh in 2025 e.g. at least by 30% from 2020 levels
  - -Algae based advanced biofuels <70 €/MWh in 2025 e.g. at least by 50% from 2020 levels
- b. Reduce cost for renewable liquid and gaseous fuels
- Other renewable liquid and gaseous fuels excluding renewable hydrogen: at least by 50% from 2020 levels (<50 €/MWh)
  - Renewable hydrogen: <7 €/kg by 2025 (electrolysis, reforming, ...)
  - Bioenergy
    - Reduce conversion system costs for high efficiency (>70% based on net calorific value of which >30% electrical) large scale biomass cogeneration of heat and power by 20% in 2025
  - Intermediate Bioenergy Carriers
    - Improve performance and reduce cost (excluding taxes and feedstock cost) for intermediate bioenergy carriers (before further processing to final bioenergy products)
    - Liquid and gaseous intermediate bioenergy carriers by thermochemical or biochemical processing: <20 €/MWh in 2025 for e.g. pyrolysis oil; <40 €/MWh in 2025 for higher quality, e.g. microbial oils
    - Solid intermediate bioenergy carriers by thermochemical or biochemical processing (e.g., bio-char, torrefied biomass, lignin pellets): <10 €/MWh in 2025 compared to present levels.

#### ACTIVITIES:

- Develop and demonstrate advanced liquid and gaseous biofuels through biochemical / thermochemical/ chemical conversion from sustainable biomass and/or from autotrophic microorganisms and primary renewable energy
- Develop and demonstrate other renewable liquid and gaseous fuels (excluding hydrogen) through thermochemical/ chemical/ biochemical /electrochemical transformation of energy neutral carriers with renewable energy.
- Reduce the cost of production of renewable hydrogen from water electrolysis and renewable electricity and develop synthetic fuels from green hydrogen and captured CO<sub>2</sub>
- Develop high efficiency large scale biomass cogeneration of heat and power
- Demonstrate high efficiency large scale biomass cogeneration of heat and power
- Develop and demonstrate solid, liquid and gaseous intermediate bioenergy carriers through biochemical / thermochemical/ chemical conversion from sustainable biomass

#### Long term objectives and activities 4-6 years

##### Renewable Fuels for Sustainable Transport

Improve production performance

- Advanced Biofuels  
By 2030, improve net process efficiency of conversion to end biofuels products of up to 30% compared to present levels, with simultaneously reducing the conversion process costs
- Other renewable liquid and gaseous fuels  
By 2030, improve net process efficiency of various production pathways of advanced renewable liquid and gaseous fuels<sup>11</sup> of at least 30% compared to present levels  
By 2030, for renewable hydrogen production by electrolysis improve net process efficiency to reach 70%.
- Improve GHG savings  
  
The greenhouse gas emission saving from the use of biofuels shall be calculated in accordance with Article 7d(1) of the same Directive and should be at least 60% of the 40% target in 2030
- Reduce Costs (excluding taxes and feedstock cost)
- Reduce cost for end biofuel products  
Liquid or gaseous advanced biofuels by thermochemical or biochemical processing: <35 €/MWh in 2030 e.g. at least by 30% from 2020 levels  
Algae based advanced biofuels <35 €/MWh in 2030 e.g. at least by 50% from 2020 levels
- Reduce cost for renewable liquid and gaseous fuels  
Renewable hydrogen:<4 €/ kg by 2030 (electrolysis, reforming, ...)

#### Bioenergy

- Reduce conversion system costs for high efficiency (>70% based on net calorific value of which >30% electrical) large scale biomass cogeneration of heat and power by 50% in 2030
- Improve performance and reduce GHG emissions by increasing efficiency: Obtain net efficiency<sup>14</sup> of biomass conversion to intermediate bioenergy carriers of at least 75% by 2030 with GHG emissions reduction of 60% from use of all types of intermediate bioenergy carrier products<sup>15</sup> resulting to a contribution to at least 4% reduction of the EU GHG emissions from the 1990 levels.
- Intermediate Bioenergy Carriers
- Improve performance and reduce cost (excluding taxes and feedstock cost) for intermediate bioenergy carriers (before further processing to final bioenergy products)
- Liquid and gaseous intermediate bioenergy carriers by thermochemical or biochemical processing: <10 €/MWh in 2030 for e.g. pyrolysis oil; <30 €/MWh in 2030 for higher quality, e.g. microbial oils
- Solid intermediate bioenergy carriers by thermochemical or biochemical processing (e.g., bio-char, torrefied biomass, lignin pellets): <5 €/MWh in 2030 compared to present levels.

#### ACTIVITIES:

- Develop and demonstrate advanced liquid and gaseous biofuels through biochemical / thermochemical/ chemical conversion from sustainable biomass and/or from autotrophic microorganisms and primary renewable energy

- Develop and demonstrate other renewable liquid and gaseous fuels (excluding hydrogen) through thermochemical/ chemical/ biochemical /electrochemical transformation of energy neutral carriers with renewable energy
- Reduce cost of production of renewable, green hydrogen from water electrolysis and renewable electricity and develop synthetic fuels from green hydrogen and captured CO<sub>2</sub>
- Develop high efficiency large scale biomass cogeneration of heat and power
- Demonstrate high efficiency large scale biomass cogeneration of heat and power
- Develop and demonstrate solid, liquid and gaseous intermediate bioenergy carriers through biochemical / thermochemical/ chemical conversion from sustainable biomass