Incentivizing Carbon Dioxide Removal Technologies

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ERCST

Roundtable on
Climate Change and
Sustainable Transition

Structure of the meeting

ERCST will start the session with a presentation, covering:

1. the role of Carbon Dioxide Removal Technologies (CDRTs);
2. overview of some key CDRTs;
3. envisaged role of CDRTs in key strategies and forward-looking scenarios;
4. elements of potential mechanisms and frameworks to incentivize CDRTs;
5. outstanding issues

This presentation will be followed by a round of initial remarks from selected stakeholders

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What are CDRTs?

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- **Definition of carbon dioxide removal according to the IPCC**:

  "Carbon dioxide removal (CDR) refers to the process of removing CO2 from the atmosphere. Since this is the opposite of emissions, practices or technologies that remove CO2 are often described as achieving 'negative emissions'. The process is sometimes referred to more broadly as greenhouse gas removal if it involves removing gases other than CO2. There are two main types of CDR: either enhancing existing natural processes that remove carbon from the atmosphere (e.g., by increasing its uptake by trees, soil, or other 'carbon sinks') or using chemical processes to, for example, capture CO2 directly from the ambient air and store it elsewhere (e.g., underground). All CDR methods are at different stages of development and some are more conceptual than others, as they have not been tested at scale."

- Difference between:
  - **Natural carbon sinks (e.g. role of trees and forests)**
  - **CDR as a result of chemical/technical processes**

- For the purpose of this presentation, we will treat both methods as Carbon Dioxide Removal Technologies (CDRTs).

Carbon neutral or negative emissions?

- CDRTs can either contribute to capture the emissions produced from an on-site point source, or directly remove emissions from the atmosphere: **difference between carbon neutral technologies and negative emissions technologies**.

- Carbon Neutral: refers to trying to balance a measured amount of carbon released with an equivalent amount sequestered through an on-site capturing intervention. This is the case of CCS accompanying the burning of fossil fuels.
- Negative Emissions: refers to the use of technologies the objective of which is the large-scale removal of carbon dioxide from the atmosphere, regardless of the point source of emissions. These technologies contribute to having gross negative emissions.

Why are CDRTs important?

- Most climate scenarios limiting global warming to <2°C use CDRTs to some extent, in order to neutralise emissions from sources for which no mitigation measures have been identified and, in most cases, also to achieve net negative emissions to return global warming to 1.5°C following a peak *(IPCC 1.5°C Report).*
- CDRTs are mentioned in **Article 4.1 of the Paris Agreement**: 'In order to achieve the long-term temperature goal set out in Article 2, […] balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century […]'.
- Also the European Commission (EC) "A Clean Planet for all" communication, expects a significant contribution of CDRTs towards the goal of achieving carbon neutrality in Europe by 2050.

Way forward for CDRTs

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- CDRTs will be needed to:
  a) **decarbonise hard to abate sectors, when abating emissions is uneconomical** (e.g. sectors that are hard to electrify and/or sectors with process emissions).
  b) **achieve net-zero emissions, compensating for 'unavoidable emissions'** which cannot be easily captured at the point of emission (e.g. certain agricultural emissions).

- However, large-scale deployment of technologies that can remove CO2 from the atmosphere have so far fallen short of expectations. Many challenges remain, from an economic, environmental and technical viewpoint, as well as in terms of social acceptability.

- Furthermore, some warn that CDRTs should be seen as a '**backstop for challenging abatement**', rather than a "**panacea**" that can replace immediate efforts to cut emissions (Oldham, 2019).

- In the quest to move towards a net-zero society, **what enabling frameworks could be designed to incentivise CDRTs?**

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Overview of some key CDRTs

Types of CDRTs available:

- bioenergy production with carbon capture and storage (BECCS);
- afforestation and reforestation (AR);
- land management to increase and fix carbon in soils;
- carbon capture and geological storage (CCS), or reuse of CO_2 to produce synthetics fuels and plastics (CCU), storing the CO_2 after use (CCUS);
- direct capture of CO_2 from ambient air (DAC), with CO_2 storage (DACCS) or utilisation;
- enhanced weathering (mineral carbonation);
- ocean alkalinisation and ocean (iron) fertilization.

- **Difference between CDRTs which serve multiple purposes (e.g. emissions abatement and generation of carbon neutral energy carriers as in the case of BECCS) and CDRTs only reducing emissions (e.g. DACCS).**
- **Some of these CDRTs raise questions of scalability and costs, as well as long-term sustainability and carbon sequestration.** E.g.: impact on sea life from large-scale ocean alkalinisation?

Overview of some key CDRTs

Afforestation and reforestation (AR):

- Absorbing CO2 through plant growth. A recent study by ETH Zurich indicates that *'around 0.9 billion hectares of land worldwide would be suitable for reforestation, which could ultimately capture two thirds of human-made carbon emissions'* (excluding cities or agricultural areas).
- Challenges: costs (estimated at $300bn in the ETH study); access to land and land use (forests vs. farm land vs. pasture land); issues with reliability of long-term carbon sequestration from forests, given that AR has no direct role in the decarbonisation of economic activities.

Land management to increase and fix carbon in soils:

- Soils are a major carbon reservoir containing more carbon than the atmosphere and terrestrial vegetation combined (FAO, 2017). Soil organic carbon (SOC) is dynamic, however, and anthropogenic impacts on soil can turn it into either a net sink or a net source of GHGs. **Soil management practices** should therefore **increase carbon sequestration in soils**, while **preventing carbon loss** through mineralisation or decomposition of soil organic matter.
- Challenges: financial, technical/logistical, institutional, knowledge and socio-cultural barriers; uncertainties on measurement and verification of sequestration; permanence of the sequestered carbon in soils; issues related to soil degradation as a result of anthropogenic activities (e.g. degradation of agricultural land).

Overview of some key CDRTs

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Carbon capture and geological storage (CCS):

- *Carbon capture and geological storage (CCS) is a technique for trapping carbon dioxide emitted from large point sources such as power plants, compressing it, and transporting it to a suitable storage site where it is injected into the ground* (European Commission).
- The CCS chain consists of three parts: **capturing** the carbon dioxide; **transporting** the carbon dioxide; and securely **storing** it underground in depleted oil and gas fields or deep saline aquifer formations.
- CCS is a technology which is required for the functioning of many CDRTs (DACCS, CCUS, BECCS), and it is also used in the process of reforming natural gas into the so-called 'blue hydrogen'.
- Challenges: CCS is sometimes contested, on the basis that as a standalone technology it does not achieve negative emissions, (at best) it is carbon neutral. Some analysis also cast **doubts on the risks of leakage or damage to human health or the environment**, as well as on the potential to generate **carbon lock-in (?)**.

Carbon capture utilisation and storage (CCUS):

- Use of captured CO2 as a resource to create valuable products or services, storing the CO2 in excess in underground geological formations. Many industrial sectors have limited competitive alternatives to CCUS (e.g. 2/3 of emissions from cement production are process emissions, and CCUS represents the most competitive option to decarbonise – IEA 2019).
- Challenges: carbon lock-in; capital costs; although the components of the CCS chain are all known and deployed at commercial scale, integrated systems are unproven at a larger scale.

Overview of some key CDRTs

Bioenergy production with carbon capture and storage (BECCS):

- Use biomass as feedstock to generate bioenergy (e.g. biomass to power or biomass to fuel), capturing the CO2 produced and storing it underground. Many existing scenarios expect BECCS to have a prominent role among CDRTs: according to the IPCC 1.5°C scenarios, **median removal by BECCS is estimated at 12Gt of CO2 per year by 2100** (1/4 of current emissions).
- <u>Challenges</u>: emissions of the biomass supply chain are unclear (growing, processing, transporting); issue of land productivity and use; competition for land with food production; costs and scale-up challenges; soil health, biodiversity, water use.

Direct capture of CO2 from ambient air with storage (DACCS):

- Directly filtering CO2 from ambient air, without relying on photosynthesis, and subsequent underground storage with CCS technologies. This technology can be deployed also in non-productive lands in combination with RES, in the proximity of storage sites. According to some researchers, **DACCS might be cheaper than tackling hard-to decarbonise sectors**. The captured CO2 could also be utilised as a resource, for instance in the context of greenhouses to boost crop yields (e.g. Climateworks' first commercial plant near Zurich).
- <u>Challenges</u>: high energy consumption combined with limited or no secondary output (compared to BECCS or CCUS); costs and upscale issues. According to research published in Nature Communication, DACCS would need up to ¼ of global energy supplies in 2100.

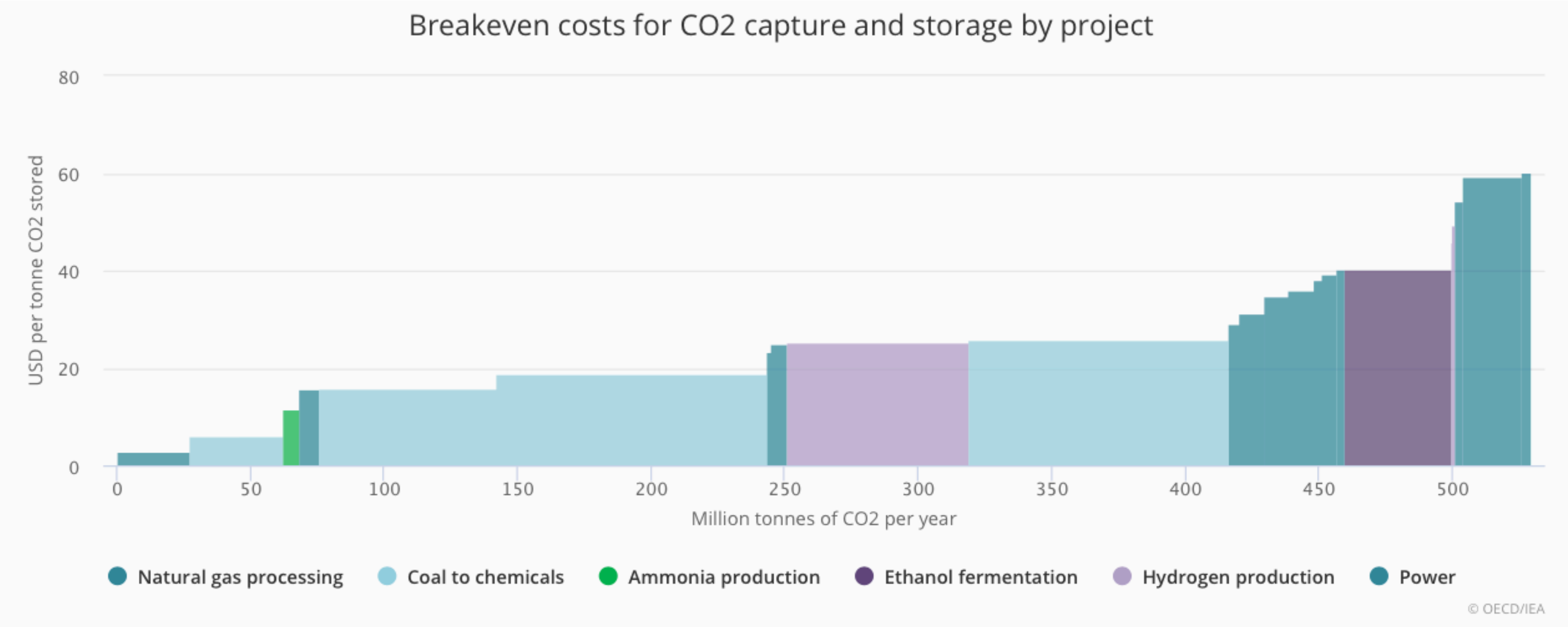
State of play of different CDRTs

- **BECCS**
  - annual capture potential: between 0.5 and 5 billion metric tons
  - current estimated cost of capture: between **$60 to $250** per metric ton
- **afforestation and reforestation**
  - annual capture potential: between 0.5 and 3.6 billion metric tons
  - current estimated cost of capture: between **$5 to $50** per metric ton
- **soil carbon sequestration**
  - annual capture potential: up to 5 billion metric tons
  - current estimated cost of capture: between **$0 to $100** per metric ton
- **DACCS**
  - annual capture potential: between 0.5 and 5 billion metric tons
  - current estimated cost of capture: **$200 and $600** per metric ton

Sources: IPPC 1.5°C Report, Environmental Research Letters, Quartz

CCUS – estimated cost of capture

- IEA analysis (2019) suggests that a commercial incentive of **40 USD per tonne of CO2** could trigger investment in the capture, utilisation and storage of up to 450 million tonnes of CO2 globally.



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Role of CDRTs in different energy outlooks: IPCC Report

Envisaged role of CDRTs in key strategies and forward-looking scenarios.

- A number of high profile scenarios and pathways, discussed below, propose that unless there is a marked increase of viable CDRTs, the Paris Agreement goals will not be reached.

IPCC 1.5°C Report

- The IPCC 1.5°C Report highlights how CDRTs are employed in all scenarios that envision being consistent with limiting global warming to 1.5°C. The level of carbon dioxide removal needed is estimated to be between **100–1000 GtCO2** over the 21st century (as a reference, total **EU** emissions in **2017** were **4.32 GtCO2-eq**).
- CDR would be used to compensate for residual emissions and, in most cases, achieve net negative emissions to return global warming to 1.5°C following a peak in emissions.
- The report highlights all possible CDR measures, from afforestation and reforestation, land restoration and soil carbon sequestration, BECCS, DACCS, enhanced weathering and ocean alkalinisation.
- However, these measures differ widely in terms of maturity, potential, cost, risk, co-benefits and trade-offs. As yet, only a few published pathways include CDR measures other than afforestation and BECCS. This highlights the need for further deep discussion on CDRTs.

European Commission: “A Clean Planet for All”

- The EC’s “**A Clean Planet for All**” (COM(2018) 773) communication document sets out a **strategic long-term vision for 2050**, using 7 key building blocks (i.e. sectors and technologies). The document seeks to pave the way for the EU’s commitment to lead in global climate action and present a vision for achieving net-zero GHG emissions by 2050.
- CDRTs are mentioned and featured prominently throughout, such as CCU, and the last block features CCS directly: “Tackle remaining CO2 emissions with carbon capture and storage” (EC, 2018).
- The in-depth analysis accompanying the communication features 8 possible long-term strategic scenarios for decreasing emissions. Two of the scenarios are in line with the 1.5°C goal: **1.5LIFE and 1.5TECH**. Both of these scenarios feature CDRTs prominently in their projections.

EC “A Clean Planet for All” – 1.5LIFE

- The 1.5LIFE scenario assumes a marked difference in lifestyle, leading to **more sustainable lifestyles**, along with EU business and consumption patterns moving towards a more **circular economy**.
- These changes include a continuation of the trend by EU consumers towards **less carbon intensive diets**, a **sharing economy in transport**, **limited growth in air transport** and more **rational use of energy** for heating and cooling.
- The scenario also sees a decrease in fossil fuel-fired capacity in the total power mix. For example, gas-fired capacities (natural gas and/or biogas) decrease from **220 GW** in **2015** to **100 GW** in 2050 the **1.5LIFE scenario**. Of the remaining **100 GW** capacity, approximately **30%** will be in combination with **CCS**.
- **The envisioned amount of total carbon captured through CDRTs is 281 MtCO2 per year by 2050**.
- It also addresses the issue of emission abatement by focusing more on demand-side measures, as well as increased use of the **LULUCF sink**, which the scenario projects to absorb **464 MtCO2** per year by 2050.
- “The land use, land use change and forestry (LULUCF) sector covers the emissions of biogenic and removals of atmospheric carbon through land use activities related to forest, cropland, grassland and wetland management, or resulting from land use change between these managed lands.” (EC, 2018)

EC "A Clean Planet for All" – 1.5LIFE

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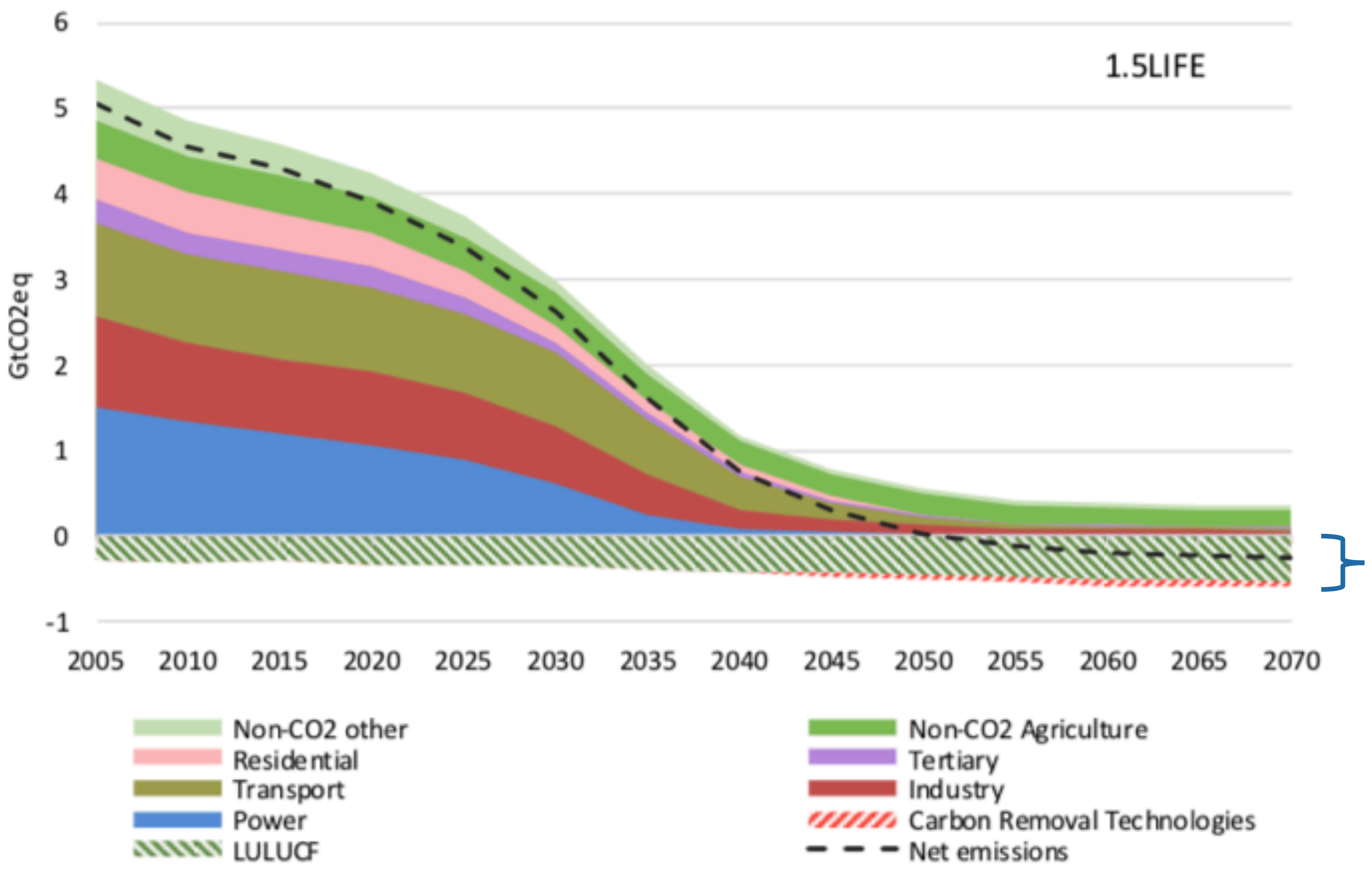

EC “A Clean Planet for All” – 1.5TECH

- 1.5TECH features both **BECCS** and **DACCS** in order to remain within the **1.5 °C goal**. It aims for a further increase in the contribution of all technology options, and relies the most on the deployment of BECCS in order to reach **net zero emissions in 2050**.
- 1.5TECH assumes limited additional incentives to improve the land use sink. Instead, it focuses on **technical solutions** to achieve net-zero GHG emissions. It increases CCS in order to drastically lower the remaining emissions.
- Out of all 8 scenarios outlined the European Commission, **1.5TECH relies on CDRTs the most: 606 MtCO2 captured per year by 2050**, as can be seen in the next slide.
- 1.5TECH also focuses less on the use of the **LULUCF sink**, for which the scenario projects a net absorption of **317 MtCO2** per year by 2050.

EC “A Clean Planet for All” – 1.5TECH

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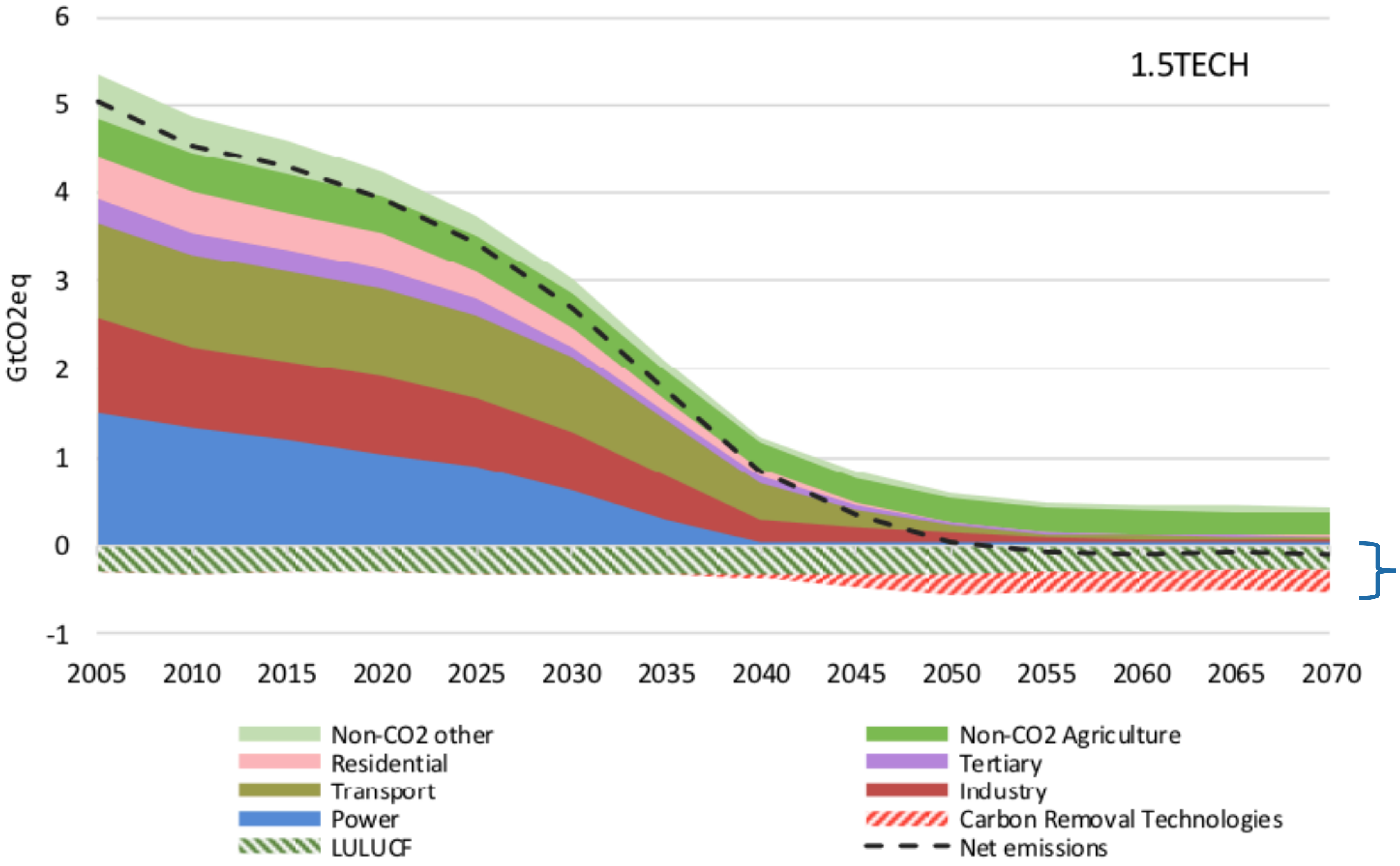


Additional energy outlooks featuring CDRTs

IEA Sustainable Development Scenario (World Energy Outlook 2018)

- In relation to clean energy generation, the **current existing capture capacity** for **CCUS** is at **2.4 MtCO2 per year,** with 2 large scale-CCUS power projects in operation at the end of 2018 (Petra Nova, Texas, USA and Boundary Dam, Canada).
- The **SDS** envisions **CCUS** to capture **350 MtCO2 per year** by 2030, eventually increasing to a capture capacity **4x** that amount with approx. **1,400 MtCO2** by the year 2040.
- The IEA highlights how there is currently a wide gap between the existing capacity for CCUS and the capacity projected in the SDS, concluding that this technology is not on track to reach these projections.

Additional energy outlooks featuring CDRTs

BP Energy Outlook 2019

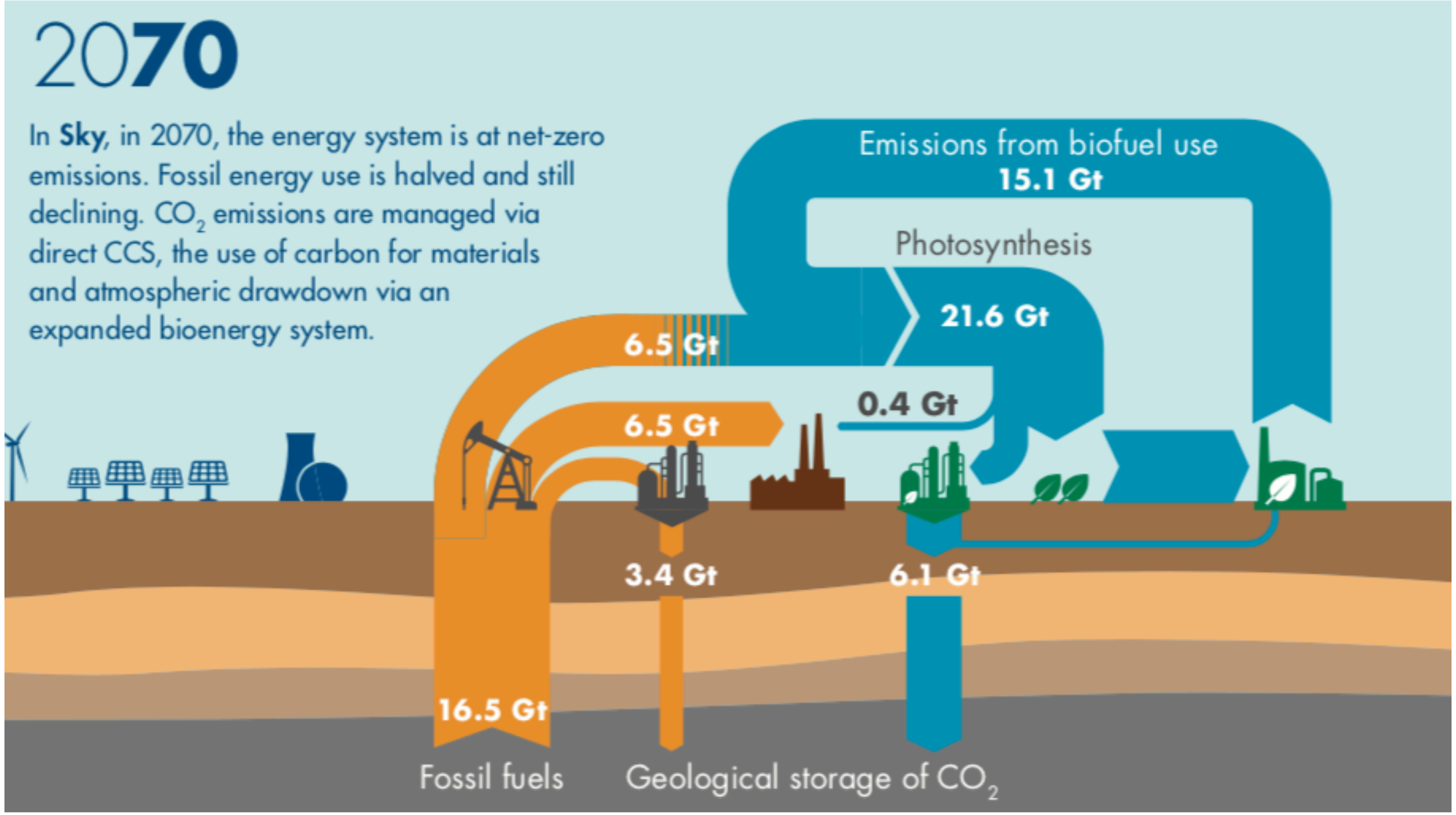
- Features a marked increase for **CCUS**, with nearly 50% of gas-fire generation supported by CCUS, which is seen as a more viable option due to the lower carbon content in gas.
- This is also along with other negative emissions technologies and projects such as BECCS and direct air capture, although specific figures not provided.
- The following scenarios features the use of CCUS with varying degrees by 2040 in BP's energy outlook.
    1. The **Rapid Transition scenario, features CCUS the most heavily**, with CCUS used in both power and industry and captures almost **4.5 Gt of cumulative CO2 emissions between 2017 and 2040.**
    2. In the **Lower Carbon Power scenario** CCUS captures **2.8 Gt of cumulative CO2 emissions by 2040**.
    3. In the **Lower-Carbon Industry and Buildings scenario** reductions in emissions are made in the industrial sector through accelerated efficiency gains and the increased use of CCUS to approx. **2 Gt of cumulative CO2 emissions by 2040**.

Additional energy outlooks featuring CDRTs

Shell Sky Scenario 2018

- Envisions the energy system to be at net-zero emissions by 2070, with fossil fuel use for energy decreasing by 50% and continuing to decrease.
- CO_2 emissions are managed through CCS, CCUS and "atmospheric drawdown via an expanded bioenergy system."
- The rest of the emissions which cannot be mitigated are estimated to be at **16 Gt CO_2 per year** under the Sky scenario, but this will be balanced by removals through sinks, such as **BECCS**.
- Other vital sinks would be through large-scale reforestation, with the rate of deforestation reaching a net-zero balance by 2070.
- The Sky scenario also envisions cooperative mechanisms within the Paris Agreement as incentivising private sector investment in CDRTs, along with carbon pricing pushed by governments through "taxes, levies and market mechanisms".

Shell Sky Scenario 2018



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Technological, environmental and economic challenges: a breakthrough a long time coming

Why have CDRTs not been picked up at a larger scale in Europe so far?

- The EU has tried to promote negative emissions technologies in Europe, through mechanisms such as the **NER 300 programme** and the inclusion of some CCS/CCUS projects in the list of **Projects of Common Interest** (PCIs).
- However, the **rise of cheap renewables, coupled with concerns over the environmental impacts of technologies like CCS, partially decreased the incentives for companies to invest strongly in CDRTs**.
- Low price of carbon on the EU ETS also failed to provide a price signal for investments in CDRTs.
- **The technology has thus far been plagued with a multitude of barriers** – technical, economic, social acceptability, institutional, and regulatory.
- Some EU Member States are particularly supportive of CDRTs, notably the **UK**, the **Netherlands**, as well as EEA-countries such as **Norway**.

Existing frameworks to promote CDRTs: EU legislation

- The European Union (EU) Directive 2009/31/EC "On the Geological Storage of Carbon Dioxide" (**CCS Directive**) aims at removing barriers to geologic storage while creating an "enabling framework" for CCS, under which CCS could proceed in a way that protects the environment and is effective at reducing emissions. The **main focus** of the Directive is to **create a framework for exploration and storage permits**, setting security standards for the transport network and storage sites.

- The revised EU ETS Directive includes CCS explicitly in its Annex 1, as part of the activities covered by the Directive. **Article 49 of Commission Regulation** 601/2012 on **Monitoring and Reporting** (MRR) of greenhouse gas emissions under the EU ETS stipulates that:

> ***The operator shall subtract from the emissions of the installation any amount of CO2 originating from fossil carbon in activities covered by Annex I to Directive 2003/87/EC****, which is not emitted from the installation, but transferred out of the installation to any of the following:*
>
> *(a) a capture installation for the purpose of transport and long- term geological storage in a storage site permitted under Directive 2009/31/EC;*
>
> *(b) a transport network with the purpose of long-term geological storage in a storage site permitted under Directive 2009/31/EC;*
>
> *(c) a storage site permitted under Directive 2009/31/EC for the purpose of long-term geological storage.*

Existing frameworks to promote CDRTs: EU legislation

The revised EU ETS directive also introduced the Innovation and Modernisation funds.

- The **Innovation Fund** has the explicit aim to help finance CC(U)S projects, among others. However, it will be organised around multiple calls for proposals over the coming decade. As each individual call will have to stipulate which type of projects/sectors can apply, it is difficult to say at this point to what extent CCS/CCUS will be covered.
- The **Modernisation Fund** does not explicitly aim at financing CDRTs; however, CDRTs should be eligible to apply as 'non-priority' projects. Since only up to 30% of the Fund can be spent on these type of projects, and the selection procedure is more weary than for priority projects, it is uncertain how much funding would be available for CDRTs. Moreover, Member States can choose how it spends its share of the Fund, and so far no Member States has explicitly stated interest in funding such projects.

Existing frameworks to promote CDRTs: the example of Norway

- Norway has been very active in the support of CDRTs, especially with regard to financing CCS projects and promoting R&D.
- **The Norwegian Government's strategy for green competitiveness, published in 2017, includes CCS as part of the 'infrastructure for green solutions**'. The strategy points out that:

  The Government's ambition is the construction of at least one full-scale CCS facility by 2020, and the roadmap from the process industry highlights CCS as an essential basis for achieving the sector's zero-emission ambition for 2050 while at the same time doubling production levels .

- The Norwegian government supports the entire innovation cycle through dedicated programs for research, development and demonstration. The **main purpose** is to generate learning that is relevant for future projects, both in Norway and globally, and to **bring the costs of CCS technologies down.**
  - Climit programme: supports CCS research and demonstration projects. It has delivered more than 260 projects across the CCS chain.
  - Norway is also developing a full value chain demonstration project for CCS. The project is exploring options to capture CO2 from two existing industrial sources – a waste to energy plant and a cement plant. The CO2 will be transported by ship to a CO2 hub on the west coast, and sent through a pipeline to a geological storage on the Norwegian Continental shelf. The project is on track for an investment decision in 2020/2021.

Existing frameworks to promote CDRTs: the example of the Port of Rotterdam

- **The Port of Rotterdam (NL) has declared in 2017 its intention to work towards a CO2 neutral port by 2050** – goal of reducing emissions by 49% by 2030 compared with 1990 levels, and preferably by 55%; goal of reducing emissions by 95% by 2050.
- This strategy will be implemented through different development programmes, including: economy with biomass as raw material; energy efficiency; alternative fuels; large scale electrification; renewable energy; circular economy; energy infrastructure.
- Among the energy infrastructure projects, one featuring CDRTs technologies, and specifically CCUS, is the **Port of Rotterdam CO_2 Transport Hub & Offshore Storage** (Porthos) **project**. This is **financed by three public shareholdings**: Port of Rotterdam Authority, Gasunie, and EBN.
- The Porthos project aims at **capturing the CO2 generated by industry in Rotterdam's port area, and store it in empty gas fields in the North Sea seabed**. A share of the CO_2 will also be sourced to the greenhouses of the province of South Holland.

Existing frameworks to promote CDRTs: the example of the UK

- In the UK, the **H21 North of England project aims at converting 3.7 million UK homes and businesses from natural gas to (blue) hydrogen** to reduce carbon emissions – reforming natural gas to hydrogen through CCS.
- The project is lead by gas distributers Northern Gas and Cadent, in partnership with the Norwegian energy company Equinor.
- H21 North of England proposes conversion to begin in 2028, with the goal of providing for **deep decarbonisation of heat, as well as transport and power generation**.
- **The UK Government** has expressed its endorsement for the potential of hydrogen, and has **invested over £60m for research into conversion technology as part of its modern industrial strategy**.

Existing frameworks to promote CDRTs: the example of Puro marketplace

- **Puro is the first marketplace in the world to offer verified CO_2 removals**. It is a voluntary market mechanism, and aims at stimulating CO_2 removing operations by revenue from certificates.
- Puro offers **verified and tradable CO_2 Removal Certificate (CORC) representing one ton of CO_2** actually and factually removed for long term, with guaranteed 50+ years storage duration.
- At the moment, **CORCs are issued for three long-term CO_2 removal methods at an industrial scale: biochar, carbonated building elements,** and **wooden building elements**.

Existing frameworks to promote CDRTs: the examples of LCFS and 45Q incentives

- **California's Low Carbon Fuel Standard (LCFS) Program** is one of several programmes designed to reduce greenhouse gas (GHG) emissions in California. LCFS has been in place since 2007, and it applies to fuels used for transportation.
- **The goal of the LCFS is to reduce the carbon intensity of the California transportation fuel pool by 10% by 2020, compared to a 2010 baseline**.
- Functioning: fuels that have a carbon intensity lower than the target established by California Air Resources Board (CARB) generate LCFS credits. Those fuels in the transportation fuel pool with carbon intensities higher than the target generate deficits. A fuel producer with deficits must have enough credits through generation and acquisition to be in annual compliance with the standard.
- **In September 2018, the CARB voted to incorporate a CCS Protocol into the regulation, which allows CCS projects to be included as a means of reducing fuels' carbon footprint, generating LCFS credits.**

- Other US federal incentives to CDRTs: the **45Q production tax credits for carbon capture projects** (including DAC, BECCS, and CO2 use – up to $50/ton CO2 for storage, $35/ton CO2 for beneficial reuse)**.**

What new frameworks could be designed to promote CDRTs, both at the European and international level?

Possible frameworks to promote CDRTs in the EU energy transition

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Options for enabling mechanisms at the EU level:

- EU ETS – while the ETS rewards underground storage in the case of CCS, CCU is not similarly incentivised, as companies must still surrender ETS allowances when using captured CO2 in infrastructure materials, e-fuels production, and industrial applications (IOGP, 2019). This could be changed, provided that CCU projects are subject to a lifecycle analysis and clear carbon accounting rules. Similar incentives could be explored with regard to other CDRTs.
- Innovation and Modernisation Funds – the higher the price of EUAs, the more resources available to (potentially) finance CDRTs. Is there room to design tailored call for proposals for CDRT projects?

Possible frameworks to promote CDRTs in the EU energy transition

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Options for enabling mechanisms at the EU level:

- EU industrial policy strategy – in May, the European Council called on the European Commission to present a new industrial strategy for the EU towards 2030 by the end of 2019. Emphasis was put on the energy transition of energy-intensive industries, and the role of low-carbon technologies. **What role for CDRTs?**
- Common Agricultural Policy (CAP) – the negotiations on the MFF will impact the overall budget available for the CAP. It is not yet clear what will be the role of the CAP towards the promotion of CDRTs and/or the decarbonisation of the agriculture sectors. **How to promote land management practices for Carbon Dioxide Removal? What possibilities to expand the incentives to afforestation as part of the EU forestry strategy?**
- National Energy and Climate Plans (NECPs) – final NECPs are due on 31 December 2019. Should the European Commission push Member States to consider options and strategies to **incentivise the deployment of CDRTs as part of the NECPs?**

Possible frameworks to promote CDRTs at the international level

Article 5 of the Paris Agreement

- In 2018, **FAO** reported that approximately **1/3** of countries employing **REDD+** included the enhancement of forest carbon stocks.
- In **Article 5 of the Paris Agreement** there is a clear push for continued momentum behind **REDD+** projects, along with overall mitigation in the land-use sector.
- Nearly all major forest countries (by forest area, deforestation rate or restoration potential) have included forest-related mitigation targets in their NDCs, albeit with varying levels of ambition.
- In 2018, **77 % of NDCs** contained actions in **LULUCF**, with some including **REDD+** actions, to achieve mitigation contributions (this is second only to the energy sector), and **agriculture** is referenced in **73 % of all NDCs**.

Possible frameworks to promote CDRTs at the international level

Article 6 of the Paris Agreement

- When looking at the possibility of **financing CDRT projects through Article 6**, CCS projects under Article 6 have already garnered a significant amount of discussion and attention.
- One past major development in international law and regulation in this area, was the **inclusion of CCS** in the **Clean Development Mechanism (CDM)** under the UNFCCC's Kyoto Protocol as a **legitimate project activity**, although as yet there are no active CCS projects under the CDM.
- Attention has been placed on the possibility of introducing CCS projects under Article 6 concentrating on two main factors: the **difference in geographic distribution** of CO2 storage sites, and the resultant **difference in distribution needs and demand.**

Possible frameworks to promote CDRTs at the international level

Article 6 of the Paris Agreement

- Therefore, moving forward, consideration could be towards **including a multitude of CDRT projects and activities under Article 6, so that they can count towards countries reaching their NDCs**.

  - How would this look under Article 6?
  - How can CDRTs through cooperative approaches be best adapted for tackling these remaining emissions?
  - What legal barriers would need to be overcome?
    - e.g. 1972 London Convention, 1996 London Protocol and 1992 OSPAR Convention.

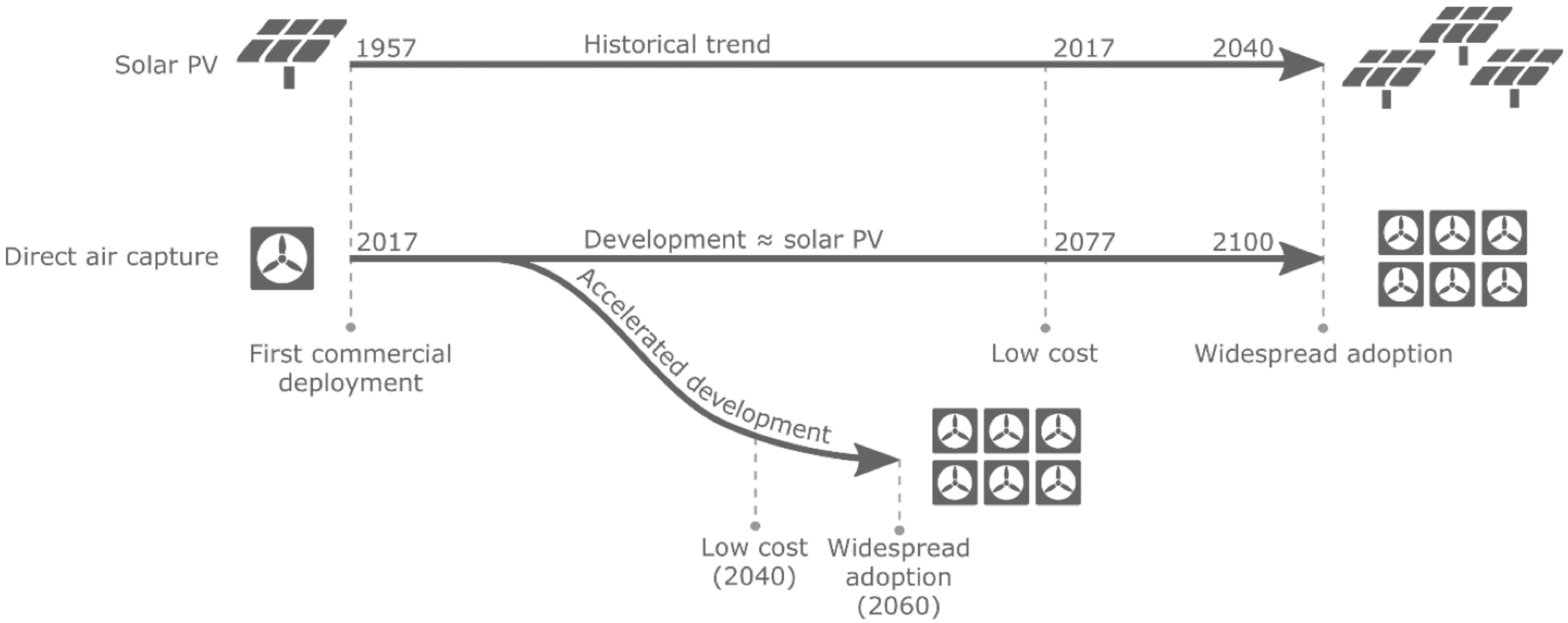
Structure of the meeting

ERCST will start the session with a presentation, covering:

1. the role of Carbon Dioxide Removal Technologies (CDRTs);
2. overview of some key CDRTs;
3. envisaged role of CDRTs in key strategies and forward-looking scenarios;
4. elements of potential mechanisms and frameworks to incentivize CDRTs;
5. **outstanding issues**

Outstanding issues

- Clash with needed and actual timeline for upscaling CDRTs:



Outstanding issues

- Continued emissions and future projected emissions vs. the actual and potential absorption capacity of CDRTs?
- Difficulty of predicting residual emissions. How much, if any will there be?
- Risk involved: can CDRTs be deployed at the scale needed?
- How to overcome the barriers faced by CDRTs? Legal and regulatory, policy, economic, technical, institutional and public acceptance?
- What incentives are relevant/needed for your sector for promoting CDRTs?
- How should the success of CDRTs projects be measured in your view?

End of presentation