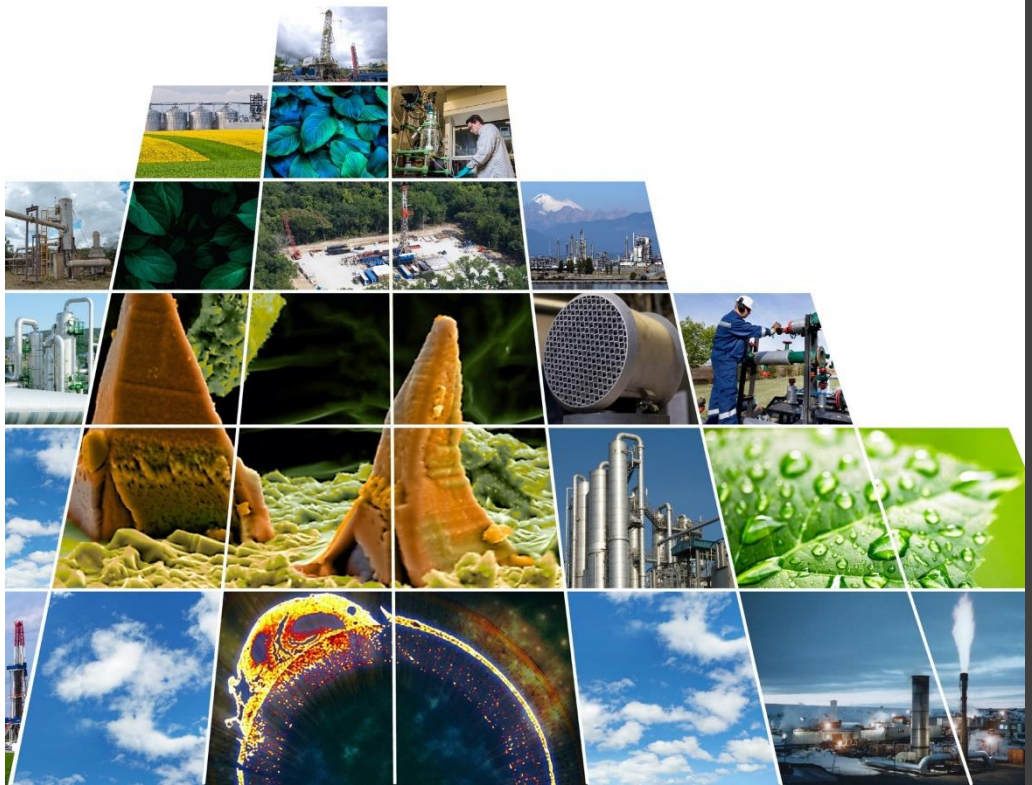
carbon sequestration leadership forum

2021 Carbon Sequestration TECHNOLOGY ROADMAP



The new CSLF Technical Roadmap

Lars Ingolf Eide, Norway

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Hosted by Norway
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Background for update of the 2017 CSLF TRM

- Several documents that emphasise the importance of CCUS have been issued;
- A large number of reports and peer reviewed articles have been published;
- The interest in CCUS has shifted from pure technology development to integration, scaling-up, utilisation issues; as well as CO_2 removal
- Clean hydrogen has emerged as an important factor to reduce CO_2 emissions.
- Governments are ready to invest in CCUS, as seen in the United Kingdom, Norway, the Netherlands and other countries.

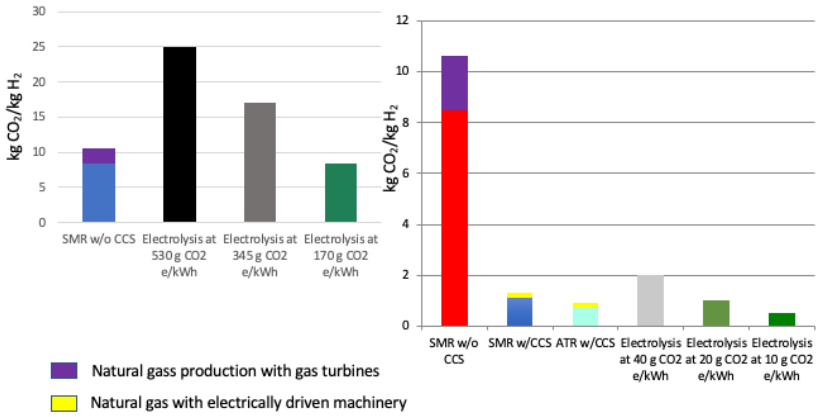

Figure 3.3. Carbon footprint of alternatives way to produce hydrogen.

What's new in the 2021 TRM

- Time horizons have changed from 2025 and 2035 to 2030 and 2050, following the international trend for climate ambitions.
- Targets more qualitative than exact quantitative
- Section 2 has been updated with new scenarios form IEA.
- Other changes are found in the definitions of CCS, CCU and CCUS for consistency with IEA.
- Chapter 3:
  - Updated on sections on power, industry and RD&D
  - Expanded on sections on hydrogen with CCUS, CO_2 hubs, industrial CCUS and CO_2 utilisation
  - A new section on negative emission technologies (NETs) has been added.
- Policy and incentives section has been expanded
- Some relevant national CCUS strategies added as appendix

Main findings of the Technology Roadmap 2021

1. Many countries have reported ambitious plans to achieve new net zero emissions targets. However, analyses by the United Nations in February 2021 show that the world was not on track to reach the targets of the Paris Agreement of keeping the anthropogenic temperature rise to well below 2°C, and preferably close to 1.5°C, by the end of the 21st century.
2. Carbon capture, utilisation and storage, or CCUS, will be required to meet the targets of the Paris Agreement.
3. CCUS is proven technology, and there has been progress in many aspects of CCUS since the TRM 2017.
4. The deployment of CCUS lags behind what is required even in the scenarios of IPCC and IEA with highest ambitions on the implementation of other sustainable measures.

Main findings of the Technology Roadmap 2021

- The CSLF Technical Group stresses the challenging deployment pathway for CCUS in the coming decades, based on IEA Sustainable Development Scenario (SDS), which gives net zero emissions by 2070:
  - By 2030: The isolation from the atmosphere by CO_2 capture and storage should have increased by a factor of 10 – 15 from the 2020 level of 40 Mt CO_2 per year;
  - By 2050: The isolation from the atmosphere by CO_2 capture and storage should have increased by a factor of 100 or more from the 2020 level of 40 Mt CO_2 per year.
- Net zero emissions by 2050 will require around 40% higher numbers

Recommendations

Technology development, innovation and cost reduction

- Investing heavily in transformational RD&D to:
  - Reduce capture costs by 25% from the 2020 benchmark;
  - Bring enabling and emerging capture technologies to Technology Readiness Level 7 or above (pilot and demonstration scales);
  - Reduce storage monitoring and verification costs by 25% relative to 2020;
  - Mature sustainable utilisation and negative emission technologies to meet a low-carbon or “green” standard ;
  - Develop novel, emerging and enabling technologies along the whole CCUS chain;

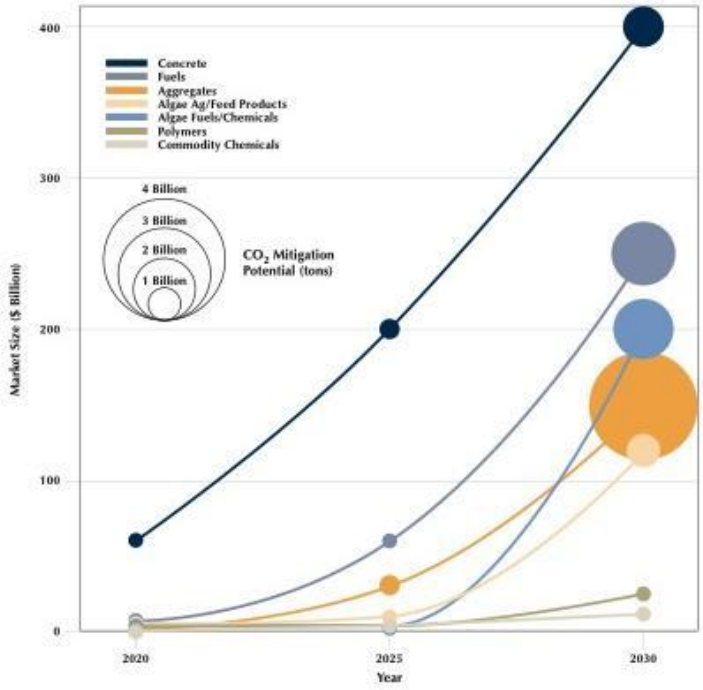

Figure 3.9: Market Size and GHG Mitigation Potential for selected CCU sectors (Source: Carbon Utilization. C2ES); 2019)

Recommendations

Technology development, innovation and cost reduction

- Making investments in public-private partnerships or projects that continue to develop and mature promising utilization technologies;

- Continuously transfer knowledge from existing large-scale projects to new projects.

Recommendations

Strategic build-out of CCUS projects and hubs

- Bring to operation all projects under development today, or an equivalent volume of carbon capture capacity;
- Rapid identification, planning and build-out of strategic power and industrial CO_2 capture clusters, to ensure a 10-fold increase of industrial production facilities and power and heat plants;
- Continue to identify and mature hubs
- Implementing CCUS at a substantial fraction of fossil fuel hydrogen production facilities;
- Ensuring that sufficient CO_2 storage sites be characterized and developed, and necessary permits obtained.

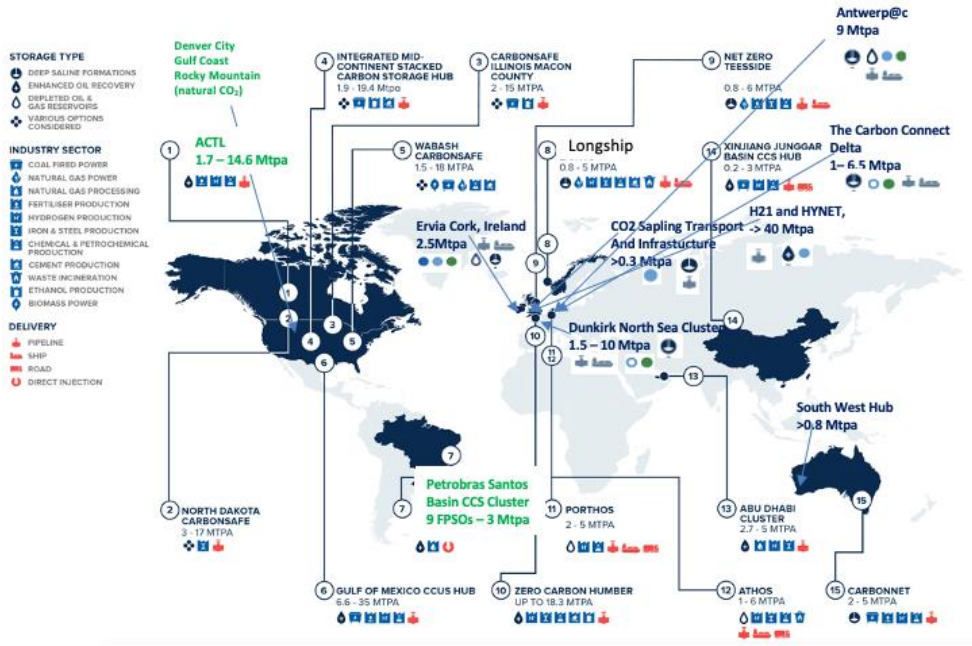

Figure 3.6. Hubs in operation (green) and planned as of November 2020. Numbered hubs from GCCSI (2020), with courtesy GCCSI. Additions by CSLF

Recommendations

Development of strategy, policy, legal and financial frameworks

- Implementing policies to mitigate the impacts of climate change
- Ideally defining the role that CCUS can hold in a portfolio of responses;
- Developing national or regional CCUS strategies and implementation plans;
- Developing incentive frameworks, business models and risk-sharing mechanisms that will enable CCUS projects to be financeable;

Recommendations

Development of strategy, policy, legal and financial frameworks

- Implementing legal, regulatory and accounting frameworks to ensure safety and environmental integrity of CCUS;
- Implement frameworks to enable cross-border transport of CO_2 for storage purposes.
- Communicating the importance of CCUS;
- Sharing of best practices to foster cost reduction and to help countries and industries accelerate CCUS investment.

Recommendations

The CSLF Technical Group invites all its members, Clean Energy Ministerial Members, and all other relevant countries, as well as industry and the financial sector, to join forces to work together to achieve rapid and tangible progress on the above pathway.

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