ZEP Advisory Council 51

5th July 2017

Agenda Item 9: Network Policy and Economics

9.a. Network Policy and Economics Update

Appended to this paper is an update for the ZEP Network Policy and Economics

9.b. Energy Intensive Industries and CCU Policy report

Appended to this paper is the Energy Intensive Industries and CCU Policy report

9.c. EPS and Capacity Markets paper

Appended to this paper is the EPS and Capacity Markets paper

European Zero Emission Technology and Innovation Platform

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Agenda Item 9.a: Network Policy and Economics update

Co-chairs: Lamberto Eldering (Statoil), Angus Gillespie (Shell), Jonas Helseth (Bellona)

Position papers have now been agreed and published on the Energy Union Governance proposals and the proposal to include CCU fuels in the revised Renewable Energy Directive.

A date for the next Network meeting has not yet been set but will be discussed with the co-chairs after the AC meeting. It is expected that the meeting will be held after the summer break in September.

Temporary Working Group Projects of Common Interest

The Commission has now published the list of the 4 projects which have applied for PCI status. The TWG has fulfilled its original terms of reference, and the work programme completed. A summary report of the group's work and findings will now be prepared for future reference.

The European Commission has recently appointed Trinomics consultants (previously Triple-E, also contracted as part of the consortium to review the CCS Directive in 2015) to undertake an expert review of the TEN-E regulation, prior to a public consultation taking place later in the year. NWPE has submitted a response to an initial questionnaire sent to the Secretariat, and has indicated willingness to participate in planned stakeholder workshops (dates yet to be confirmed).

The review exercise will provide a good opportunity to highlight the challenges associated with assessing potential CO_2 PCIs under a framework established for established infrastructure projects should as gas and electricity. In this regard, there may be an opportunity to propose changes to the TEN-E regulation to make it easier for CCS projects to apply for PCI status in the future.

Temporary Working Group Policy and Funding

- Unspent NER300 funds and the ETS Innovation Fund

ZEP expects that Member States will shortly vote/ratify proposals to reallocate the first tranche of unspent NER300 funds to the Cleaner Transport Facility and InnovFin EDP. This could see an additional €550m becoming available across the two instruments, which will be amended to enable CCS projects to apply. The second tranche of funding is still expected to be carried over to the new Innovation Fund, depending on the outcome of the ongoing ETS trilogue negotiations.

Following requests from stakeholders, including ZEP, the Commission held a workshop on CCS in the context of the new Innovation Fund on the 29th May, which was attended by NWPE co-chairs; Lamberto Eldering and Jonas Helseth, and the Secretariat. A final event was held on the 12th June,

with Luke Warren from the Secretariat representing the platform in a panel discussion on renewable energy, storage and CCS.

- EPS and EU Capacity Markets

Stale Aakenes (Gassnova) agreed to chair a piece of work providing ZEP's assessment of the proposals on an EPS in EU Capacity Markets. The draft ZEP position paper was approved by the ACEC due to the need to distribute to the ITPE Committee ahead of the publication of their draft report on the Commission's recommendations on 10 July. The paper is appended to this paper.

Temporary Working Group – Energy Intensive Industries and CCU Policy

Chair: Rob van der Meer (HeidelbergCement)

ZEP's position paper on CCU in the RED was approved and distributed in March 2017. It was agreed that this would be followed with a more in- depth report, to be submitted to the AC for approval in June. A draft report is appended to this paper for comment from the AC, after which a concluding chapter will be added before seeking final approval.

Energy Intensive Industries and CCS/CCU – Potential, challenges, risks

Executive summary

Capture of carbon emissions from Energy Intensive Industries (EEIs) for utilization in new products is increasingly seen as a key tool for addressing industrial carbon emissions in Europe.

Achieving the targets from the Paris agreement for Europe will require EIIs to reduce their emissions significantly further than the levels committed to in the sectoral Low Carbon Economy Roadmaps for 2050, published in 2012/13 (before the COP21 in 2015). Although electrification of processes can reduce CO_2 emissions, in sectors with process CO_2 emissions not resulting from fossils fuels the abatement potential is limited. Therefore electrification of the traditional combustion processes in EIIs would need to be combined with capture of the remaining process emissions to meet the required level of decarbonisation.

The conclusion of this paper is that of the CO_2 emissions that will need to be captured, only a small portion will be converted in new CCU products. We assume that 9 – 20% of total captured emissions from EIIs will be converted, corresponding to 40 – 120 Mtons/a, competing in a market with CO_2 from other sources. As a result, it becomes clear that a more significant part of the captured emissions from energy intensive industries will have to be geological stored. Based on current product portfolio of the energy intensive sectors that would correspond to 360 – 540 Mtons/a.

The economic assessment of these conclusions indicates that a focus on CCU based on short- term financial benefit to EIIs will lead to a further delay of implementation of CCS. This will damage the chances of being able to capture and store emissions at scale in the time required to meet Paris agreement targets of below 2 degrees of warming.

The conclusion is that the current CCU focus will inevitably result in the Paris agreement targets in 2050 not being achieved.

CCU and CCS classification

Carbon Capture and Storage (CCS) is the capture of CO_2 and the permanent geological storage of that CO_2 underground. Carbon can be safely stored onshore or offshore, the latter having a positive effect on public acceptability. ZEP reports from recent years have identified that :

1. The geological storage of CO_2 is inevitable for energy intensive industries and other sectors in the EU28 to be able to achieve the current ambition level of the EU for climate change or to achieve the objectives of the Paris Agreement of December 2015 (*references to be added*).

2. Further reductions, e.g. to achieve the intention expressed in the Paris Agreement to go well beyond the 2 degrees scenario will even more strengthen the role of CCS in the carbon abatement needed in the EU.

3. The trajectory for CCS projects can and will last several decades and that therefore to achieve the objectives of the Paris Agreement and the EU can only be achieved when energy intensive industries are provided opportunities to access large-scale storage soon. (*references to be added*).

Carbon capture followed by *something*

Geological storage is one option for carbon capture. With CCS, the CO_2 is permanently sequestered and will not return into the atmosphere. Of course, guarantees must be given that the CO_2 sequestration is permanent and cannot be reversed by accident or on purpose.

However geological storage is not the only option proposed for CO_2 in the current debate on climate change abatement. Several other options are indicated with capitals after CC like

- U for Utilization,
- UF for coversion in fuels,
- R for Reuse, and
- V for Valorization.

Classes of CCU

Given the breadth of technologies and processes covered by the term CCU, it is necessary to evaluate different technologies, processes and projects on a case-by-case basis to determine their relative value in terms of CO_2 abatement and tackling climate change. A breakdown of CCU technologies into subsidiary types, technologies and processes is needed, supported by a robust assessment of the counterfactual in each instance.

A key component of the assessment of CCU classes will be the time period in which it is likely or even sure that the captured CO_2 will be released in the atmosphere. This is necessary to ensure that emissions reductions across the whole energy system, e.g. in relation to the EU's contribution towards the Paris Agreement, are delivered and that climate finance is not used to support technologies that do not lead to verified avoided emissions. ZEP recommends that a classification system is developed, incorporating a so-called "**Sink Factor**", to indicate the proportion of CO_2 that is permanently abated in line with climate objectives (climate effective storage), as proposed is our recent ZEP position paper.

As part of a robust assessment of each CCU project, careful consideration must be given to the counterfactual scenario and whether the CCU product substitutes a pre-existing CO_2 neutral product. In this context, special attention is needed for CO_2 that is used for producing food or feed. Some products of CCU will be used as food for people, or feed for animals, which can replace traditional bio-materials that are seen as CO_2 neutral, in some cases. It should be noted that, aside from CO_2 abatement, products derived from anthropogenic CO_2 can, in some instances, contribute to the replacement, at least partially, of the same or similar products made by a conventional process and therefore yield benefits in terms of the conservation of resources.

A key indicator for the assessment of the CCU classes is the time period in which it is likely or even sure that the captured CO_2 will be released in the atmosphere. We have identified for four classes fo CCS and CCU, ranging from permanent to short term sequestration.

Table 1. Indicative applied sink factor to different types of CCU and CCS

	Sequestration period of CO_2	Use of materials in which CO_2 is captured	Indicative Sink Factor	Examples
Bio-CCS	Permanent	Permanent storage, no use	>100%	Provided the biomass involved is sustainably sourced, the capture and storage of biogenic CO_2 from any industrial bio-conversion or combustion process can yield negative emissions
CCS	Permanent	Permanent storage, no use	100%	
Enhanced Oil Recovery	Depending on project: permanent	Can be permanent storage, depending on project	95 – 100%	
CCU				
• Long term	> 100 years	Building materials	40 – 75%	Olivine
• Medium term	10 – 100 years	Building materials	40 – 75%	Carbon8, Blueplanet, Solida, CarbonCure
• Short term	< 10 years	Fuels, feedstock, food, lightweight building materials, plastics	0 – 10%	Biofuels, methane, methanol, micro algaes, formic acid, bioplastics.

For CCU we see three classes:

1. *Long term*
   The first class of technologies will sequester the captured CO_2 into materials that will be used over a very long term, likely more than 100 years, such as the mineralisation in olivins. Key is that the materials produced with the captured CO_2 are not to be changed during the normal lifetime and use of these materials.
2. *Medium term, covering a period between 10 and 100 years for the release.*
   For the second class of technologies the normal sequestration time is above 10 and below 100 years, indicating that the CO_2 is sequestered in materials that in the longer term will on purpose (e.g. by incineraton) or from itself separate into the original components.
   The CCU technologies from this medium term CCU-class will solve the problem for today,

but not forever. That means that in future solutions have to be found for these materials, but at this moment the application of these technologies lead to reduction of CO_2 emissions to the atmosphere.

3. *Short term, covering a period of sequestration less than 10 years*
   Nearly immediate release covering a period of maximum 10 years of sequestration of the captured CO_2 in another material is covered in this short term CCU-class. For the conversion of CO_2 into materials with a relative short life span like fuels, food, feed etc., the technology is to be seen as reuse of the CO_2. The advantage of the implementation of the CCU technologies in this class is that for these materials the original carbon (from fossil fuels, or from minerals, or others) is used two times or even more often, which results at the end in less CO_2 emissions on global scale. That is especially advantageous for the cases that the C or CO_2 is to be used in the process anyhow, e.g. carbon in steel production.

Advantages of the classification of CCU technologies

The classification of CCU technologies in relation to the expected timeframe of the release to the atmosphere of the captured CO_2 is needed because this classification gives clarity to each technology in discussions around climate change abatement. The classification is associated with a so called Sink Factor, as the proportion of CO2 that is permanently abated in line with 2 degree objectives (climate effective storage).

It is often mentioned (*include references*) that CCU will contribute to the Circular Economy, by using the fossil carbon two or more times. The question posed by this paper is whether this carbon recycling should be classified as CCU. The disadvantage is that the reuse of C or CO_2 could contribute to a lock-in of carbon use in sectors where other options exist or are being developed. It is also apparent that C or CO_2 recycling can only be done at the cost of (fossil or renewable) energy input, due to the law of conservation of energy which states that the total energy of an isolated system remains constant.

The role of electrification in decarbonising EU industries

Wider electrification of the economy, such as electromobility along with the smart and flexible use of variable renewable electricity has the potential greatly reduce fossil fuel use and CO_2 emissions. The wide scale electrification of large European industries such as steel and cement manufacture will not provide deep emissions costs in all sectors and will place infeasibly large demands on renewable electricity. A comparative assessment of the electrical energy requirements and CO_2 abatement potential of the following major industrial electrification routes has shown that relying on electrification alone is not an achievable decarbonisation pathway for European industrial production.

Although electrification can reduce CO_2emissions, in sectors with process CO_2 emissions not resulting from fossils fuels the abatement potential is limited. Manufacturing sectors such as cement and aluminium will not reduce emissions substantially through greater electrification alone. CO_2 transport and storage networks will be required for deep CO_2 reductions.

Box 1 – Example of electrification of cement industry

Providing the thermal energy requirements of a cement manufacture process with renewable electricity would reduce fossil fuel use, but would not reduce the majority of the CO_2 emissions from the manufacturing process. A reference cement plant producing 1 million tonnes cement a year would consume approximately 1TWh of electricity, equivalent to ~250,000 homes (Figure). Applied to all EU cement production, the cement sector would require the equivalent of all electricity produced in Poland today. Alternatively, converting CO_2 from the sector to synthetic diesel transport fuels (CCUF) would increase electricity consumption by six times again, and would displace industrial CO2 emissions to the transport sector.

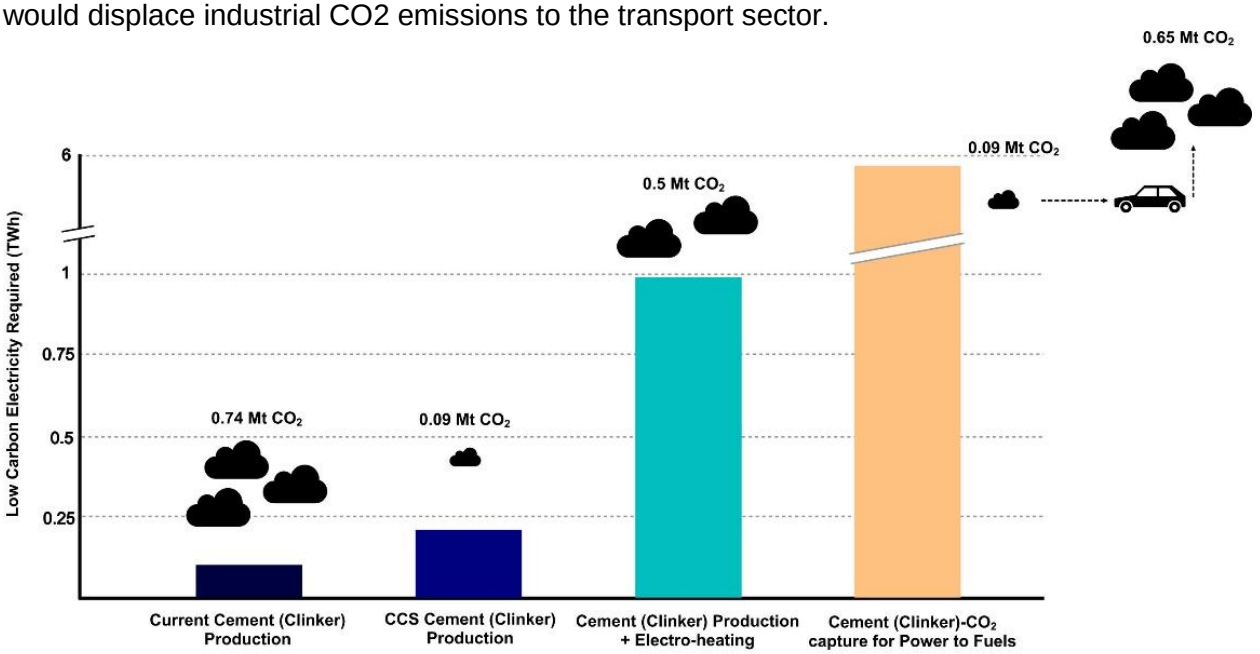


Figure 1 ***Reference cement production facility of 1 million tonnes per annum.***
Comparing the electricity requirements and CO_2 reduction of Carbon capture and storage, electric heating, CO_2 conversion via power to fuels.

For Cement production, as with other sectors with non-fossil CO_2 emissions, CCS provides greater CO_2 emissions reductions at a fraction of renewable electricity resources. Wide

deployment of CCS in the EU cement sector requires development to begin on an extensive CO_2 transport and storage infrastructure, ultimately capturing and storage 100 million tonnes of CO_2 per annum.

Box 2 – Example of electrification of steel production

Steel mills are large and centralised, with a handful of integrated plants in Europe. The result of electrifying any single integrated steel plant will be a very large localised increase in electricity consumption. A reference integrated steel mill producing 7 million tonnes of steel a year with electrolysis of hydrogen for direct reduction and electric arc furnace would consume approx. 37 TWh of renewable electricity per annum. A single steel production site would consume as much electricity as 9 million European households or the total electricity demand of greater London[1]. Increasing electricity demand so dramatically from a single consumer in a small area would test the feasibility of both the electrical grid and renewable generation to meet the additional supply. Electrifying all new EU steel production would have a dramatic effect on electricity consumption and demand for renewable electricity resource; electricity demand would be equivalent to the total current generation of 19 EU member states. An electrolysis hydrogen based EU steel sector would monopolies some 50% of the total wind energy resource potential of the North Sea, renewable energy that is also required for the electrification in other sectors such as electromobility and residential heating and cooling. CO_2 capture and use of CO_2 from an integrated steel mill to synthetic diesel transport fuels increased electricity requirement even further.

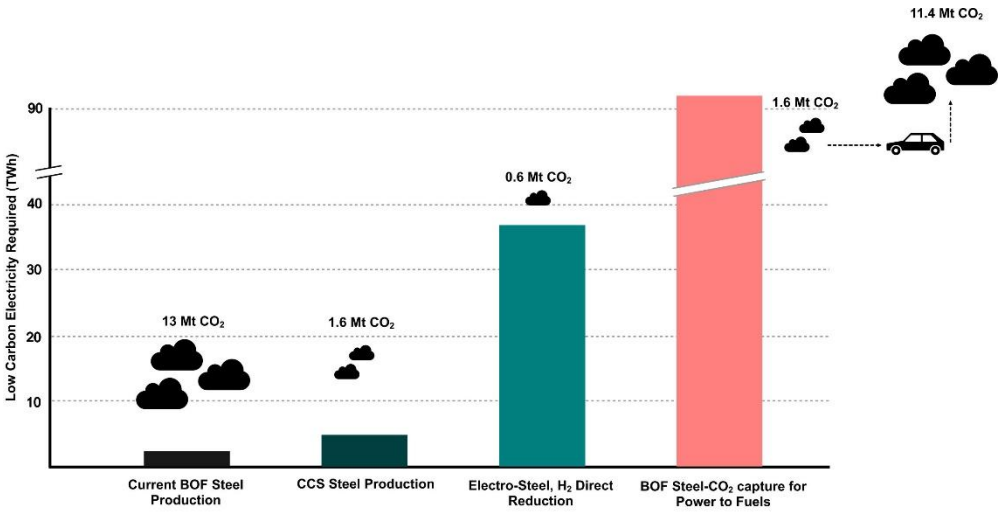


Figure 2 ***Reference integrated steel production facility of 7 million tonnes per annum****. Comparing the electricity requirements and CO_2 reduction potential of Carbon capture and storage, Hydrogen direct reduction, CO_2 conversion via power to fuels.*

[1] Total greater London electricity demand in 2015 was 39.65 TWh. https://data.london.gov.uk/dataset/electricity-consumption-borough

Reliance on electrification for decarbonisation of steel production in Europe will place massive, potentially unfeasible demands on transmission grid strengthening and increased renewable electricity generation. Added to this is the requirement to redevelop all blast furnace integrated steel manufacture facilities. Large scale CO_2 transport and storage infrastructure will be a required element in achieving deep cuts in the European steel sector.

Box 3 – How much North Sea is needed for steel production?

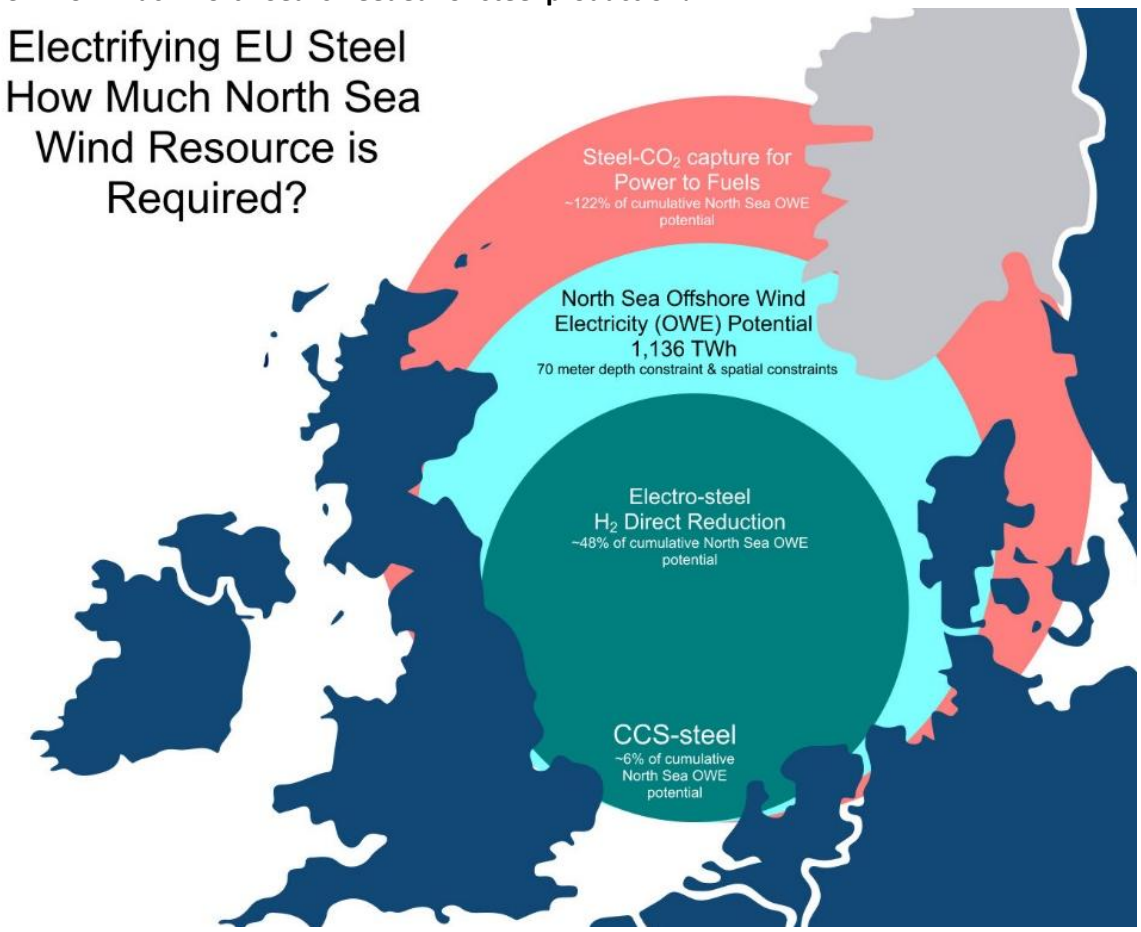


Figure 3 North Sea offshore wind electricity (OWE) potential, 132,000 km^2 with 1,136 TWh (Cameron, et al., 2011). Comparison of electricity requirement for EU low carbon steel manufacture with CCS, electrolysis of hydrogen and direct reduction, CO2 conversion via power to fuels. Producing new electro-steel in Europe at current production volumes would monopolise almost 50% of the total practical renewable wind electricity potential of the North Sea. Production of power to fuels of EU new steel CO2 would exceed all North Sea offshore wind generation potential.

Conclusions

1. The shift from traditional cement and steel production to electrical production in combination with the conversion of process CO_2 emissions in "biofuels" will result in an explosion of electrical energy consumption without a significant net reduction of CO_2 emissions in Europe.
2. Conversion of all cement and steel production plants in EU will need an unrealistic amount of wind generation.

Decarbonisation roadmaps for European Energy Intensive Industries

Starting point: Historical Industrial roadmaps for 2050

Responding to a request by the European Commission in its 2011 "Roadmap for moving to a competitive low carbon economy in 2050", European Energy Intensive Industries produced a set of sector- specific decarbonisation Roadmaps to 2050[1][2][3][4]. From these the following conclusions can be drawn.

1. Three sectors dominate in terms of emissions; steel, cement and chemicals. The emissions from the pulp and paper sector are significantly smaller, but are included here to account for the four largest CO_2 emitting industries.

2. Energy Intensive Industries, while being heavy emitters, are also crucial to decarbonisation of Europe as a whole. For example it is estimated that 100Mt of steel will be needed to meet demand for wind turbines in Europe to 2050[5]. The cement industry roadmap highlights that cement's thermal mass properties make it a high performing material for construction of energy efficient buildings compared to alternatives[6].

3. Energy Intensive Industrial emissions demonstrate a clear downward trajectory, but the industry roadmaps also demonstrate the continuation of this trend will require implementation of both solutions that are known but currently not cost effective, and technologies that are not yet ready for deployment at scale. The former includes deep decarbonisation of the power system, maximized deployment of (for example) fuel switching and energy efficiency measures, and significant if not complete decarbonisation of the transport system. The latter includes CC[U]S, which will be crucial for these sectors to progress much beyond a 50% reduction on 1990 level emissions.

[1] The role of Cement in the 2050 Low Carbon Economy (European Cement Association, 2013)
[2] European chemistry for growth (Cefic, 2013)
[3] Investing in Europe for Industry Transformation (CEPI, 2015)
[4] A steel roadmap for a low carbon 2050 (EUROFER, 2015)
[5] MANUFACTURING OUR FUTURE: INDUSTRIES, EUROPEAN REGIONS AND CLIMATE ACTION (Bellona, 2016)
[6] The role of Cement in the 2050 Low Carbon Economy (European Cement Association, 2013)

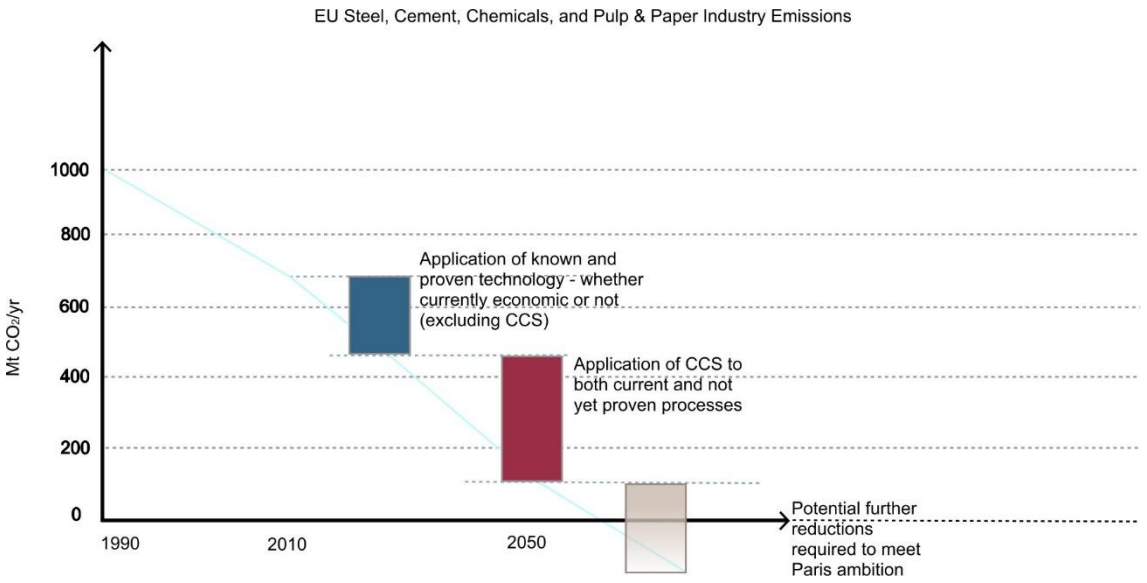


Figure 4 Combination of 4 Energy Intensive Industry roadmaps indicating the three levels of carbon reductions mentioned. The first bloc is based on application of known and proven technology without CCS. The main part has to come from future developments. Remaining is the "unsolved" bloc in the roadmaps 2012/2013.

Box 4 – Example of potential emission reductions in cement industry
The cement industry Roadmap estimates that a 32% emissions reduction on 1990 levels can be achieved through decarbonisation of power and transport, more efficient plant, fuel switching and use of new materials, such as novel cements. Further reductions will require either CCUS or a yet unproven breakthrough technology, the inclusion of which could lead to an up to 80% reduction in emissions from cement.[7]

Paris: current roadmaps are not ambitious enough

In order to reach 'Paris-level' commitments, i.e. below 2 degrees warming, the Commission estimates an 83 to 87% emissions reduction will be required in industry by 2050[8]. The IEA estimates in its most recent Energy Technology Perspectives report that a below- 2 degree scenario will require deployment of CCS at capture rates above 90%, as well as a significant amount of negative emissions from bioenergy with CCS (BECCS).The report concludes that in a below 2 degree scenario 55% of steel and cement production is equipped with CCS, resulting in 1 007 million tonnes of CO_2 being captured annually in 2060 from these sectors alone.[9]

A recent study of the potential uses for CCU that lead to permanent carbon abatement concluded that CCU is likely to be able to account for around 9% of the total carbon that needs to be sequestered to 2050. Of this, 8% was projected to be used for Enhanced Oil Recovery (EOR). [10]

Given the high levels of carbon sequestration needed to achieve significant levels of decarbonisation within Energy Intensive Industries, provision of both infrastructure and market

[7] Ibid.
[8] Roadmap 2050 (EU Commission, 2011)
[9] Energy Technology Perspectives (IEA, 2017)
[10] The role of CO2 capture and utilization in mitigating climate change (Dowell et.al., *Nature Climate Change*, 2017)

structures to enable deployment of CCS within these industries is crucial. As individual companies operating in these sectors do not have the expertise or currently the incentive to build transport and storage (T&S) infrastructure[11], policy will need to be developed to build publically available T&S which industrial emitters will be able to use via a “pay-at-the-gate” arrangement. It should be emphasized that focusing on CCS as the dominant route to enable the levels of sequestration required does not exclude emitters from choosing to sell CO_2 for use where there are opportunities to do so. However, as outlined in other areas of this report, any application for CCU must have a high sink factor to be comparable to the carbon abatement potential of CCS.

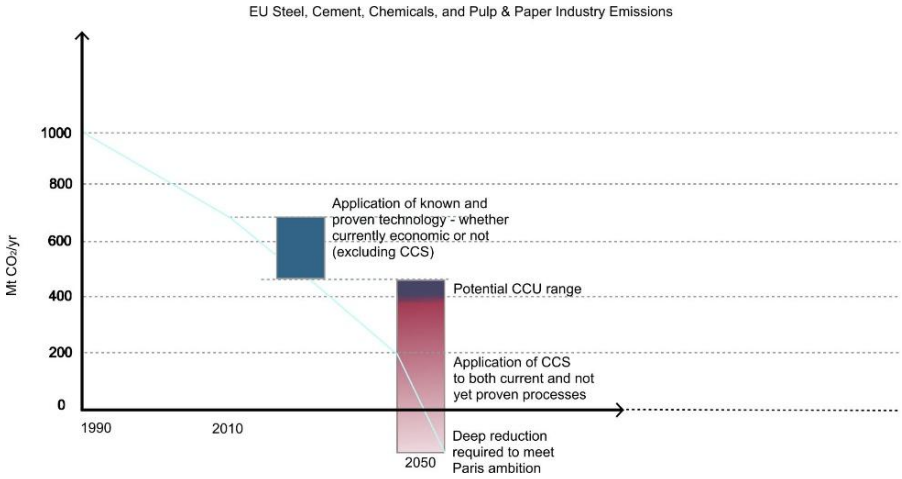


Figure 5 Potential in the Energy Intensive Industries within the Paris agreement target setting indicates that more emissions reductions are needed by CCS/CCU then before.

<u>Conclusions</u>

1. Energy Intensive Industries are facing a huge challenge in achieving the Paris agreement targets for 2 degrees or beyond. Solutions have to be found in combinations of significant improvements and CCS/CCU.
2. The volume of CO2 to be captured via CCS/CCU is nearly double the levels committed to in the roadmaps 5 years ago: 400 – 600 Mtons/a.
3. Potential for CCU applications ranges from 9% upto 20% of the total CCS/CCU volume, covering from 40 – 120 Mtons/a CO2.
4. CCS will have to cover from 360 – 540 Mtons/a of emissions of EIIs in Europe.

[11] MANUFACTURING OUR FUTURE: INDUSTRIES, EUROPEAN REGIONS AND CLIMATE ACTION (Bellona, 2016)

Economics of CCS and CCU

As long as the price of European Union Allowances (EUAs) remains low, industries that are able to extract value from CO_2 utilisation may be willing to purchase CO_2 at a price that is higher than that of EUAs. If that price were high enough to justify investment in CO_2 capture, CCU would be financially viable, In such circumstances it should be expected that all captured CO_2 would be sold for utilisation and not permanently stored, thus leading to limited carbon abatement. It is possible that under these circumstances no investment in CO_2 transport and storage would occur, delaying the development of CO_2 clusters and sufficient CO_2 storage capacity which are essential for decarbonisation and the long- term competitiveness of European EIIs.

There is also potential for CCU to undermine the ETS, if emitters included in the ETS were to choose to sell CO_2 to users outside the ETS instead of sequestering it permanently due to the higher price being offered for CO_2 utilisation. For instance, this could be the case if CO_2-to-fuel technologies made it possible to create “low-carbon” fuels that still led to tailpipe emissions from road transport.

If the price of EUAs increases to a higher rate than that which CO_2 users are willing to pay, the balance would flip in favour of CCS; emitters with the option to permanently store their CO_2 in dedicated storage sites would be able to claim the full carbon abatement and the relative cost avoidance, potentially determining the end of a competitive model for CCU. This outcome is necessary to reach EU emission reduction targets, but detracts from a long- term business model for CCU.

In conclusion, although CCU could provide the financial incentive required for investment in capture, and may therefore be considered a proxy for later deployment of CCS, the long-term economics of CCU and CCS may not be aligned. Crucially, the financial trade-off is determined by the relative value of EUAs and of the price that CO_2 users are willing to pay. To that extent, CCU and CCS constitute imperfect substitutes. In that respect, the risk exists that a lock-in with CCU occurs which then in turn hinders further investment into CCS. The elasticity of CCU with respect to the price EUAs is greater than that of CCS due to its high upfront (fixed) investment cost.

<u>Financeability</u>

Despite the CCUS sector’s significant growth potential, a number of challenges currently hinder private investment. Above all, the low price of EU emission allowances (EUAs) offers limited motivation for investment in capture, meaning that Energy Intensive Industries will prefer to pay for their emissions unless additional revenue streams can be found. Because of the uncertainty around future CO_2 volumes, investment in CO_2 storage is also restrained, leading to a “chicken-and-egg” situation where neither party is willing or able to make the first move. Further interdependencies between the various parts of the business chain add individual project risks that cannot adequately be managed by project developers and warrant intervention from government and independent regulators.

Furthermore, the fact that Energy Intensive Industries operate in global, highly-commoditised markets, means that it may not be possible to for them to extract value from any investment in CO_2 capture, since the increase in production cost could not be passed on to consumers.

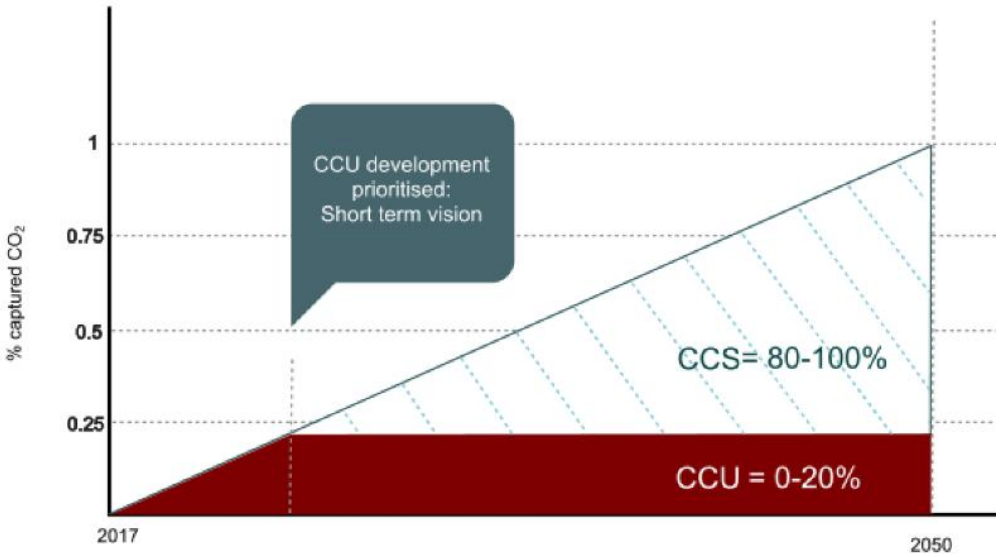
Solutions to the challenges outlined above hinge on increased political certainty and regulatory stability. If these are addressed, investors could be convinced of the market opportunity and thus

choose to participate in future projects. Crucially, government funds are required in the short- to medium-term to complement the EUA sales revenues.

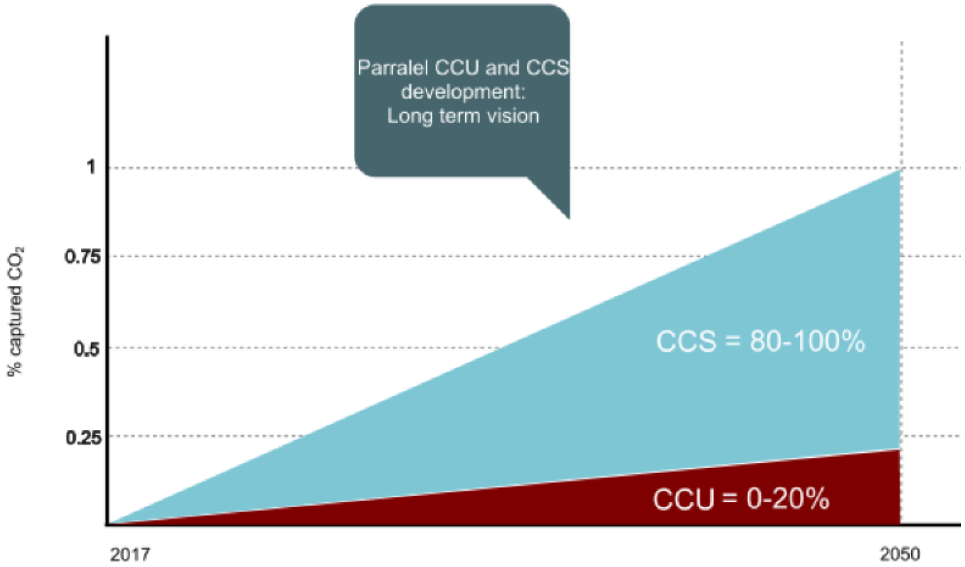
It is in this context that it is possible to understand the synergies between CCU and CCS: by providing revenues independent of the EUA price, CCU can enable investment in the capture of small CO_2 volumes and de-risk the integration of capture with industrial process, with a view to then scale-up the capture operations when permanent CO2 storage is available. By the same token, CCU-related revenues can help to co-finance the transport and storage infrastructure and to reduce the counterparty default to which the storage operator is exposed – a risk that can be further minimised if the CO_2 is pooled via a cluster set-up, rather than from single emitters.

Conclusions

1. The current development of CCS and CCU under market conditions will deliver emissions reductions in the CCU part of the portfolio until the markets of CCU products are filled.



2. Relying on market conditions alone will delay and even prevent further progress on emissions reductions beyond the economical feasible conditions for CCU.
3. Achieving the Paris agreement targets inevitable need implementation of CCS at the same time as CCU, to accommodate future limitation on further implementation of CCU.



4. The EUA price is not a driver for the development of CCS and only a limited driver for the development of CCU in Europe.

Conditions for success of CCU and CCS

The implementation of Carbon Capture projects faces complex challenges in finance, technological development and commitments to carbon reduction.

Economic and technical feasibility

Changes in processes and products will only happen when economically and technically feasible. The key barrier for implementation of certainly CCS and some CCU projects is that they will not result in economically feasible business cases. In other words, there is limited or no added value (as sum of the values from profit and/or savings or other perspectives) for the involved companies.

The second key barrier is that technologies are often not available at scale. Condition for this is that the support for innovation in the processes and products is enhanced by the government(s) and project developers and that the climate for innovation in the EU has to be improved.

Competition

It is fundamental that all materials that will be used in the EU in the future will be treated in the same way, independent of the production country and type of material. Imports from non- or less-carbon constrained countries, even within the EU, should be subject to appropriate constraints to ensure a level playing field, with a view to protect vanguard decarbonising industry players. To this end the whole life cycle of products have to be assessed.

Regulation and permitting

Innovation is only possible when there is room, of course within boundaries, to innovate. There is very little or no public support, legislatively or financially, for developing onshore storage in EU to enable deep industrial decarbonisation.

Opportunities

Policy recommendations

June 2017

ZEP comment on the Commission's proposal for a regulation of the European Parliament and of the Council on the internal market for electricity – the "winter package" (2016/0379)

ZEP welcomes the Commission's proposal to introduce design principles for capacity mechanisms as described in the winter package in article 23. ZEP particularly welcomes point no 4 which states that "Generation capacity emitting 550 gr CO_2/kWh or more shall not be committed in capacity mechanisms 5 years after the entry into force of this Regulation", and similar for "generation capacity for which a final investment decision has been made after [OP: entry into force]". Our view is that by setting a 5 year trajectory for an emissions performance standard, this proposal will assist asset planning and reduce the risk of future stranded assets. The proposal may also give a valuable (long-term) signal of the need for CCS in the power sector. However it is important to highlight that emissions performance standards alone will not drive sufficient carbon reduction to meet Europe's targets and will not drive CCS without complementary instruments and policies.

As outlined by the European Environment Agency in its recent report "Transforming the EU power sector: avoiding a carbon lock-in"[1], it is expected that there will be overcapacity of both gas and coal power plants in Europe in the coming decade, and that the degree of overcapacity will vary between different regions. Therefore, the impact of design principles will also differ from region to region according to the composition of a country's power mix over time.

We believe that the limit of 550 g/kWh proposed by the Commission would primarily drive fuel switching from coal to gas, and is unlikely to drive CCS in the coming decade. This conclusion is supported by ZEP's modelling on various support mechanisms for CCS in 2013[2].

To be a driver for CCS, a lower limit of grams CO_2 per kWh combined with a comprehensive framework of measures to support investments in CCS would be needed. Such measures include a strategic CCS plan as outlined in the ZEP note "An Executable Plan for enabling CCS in Europe"[3], specifically;

- Decouple the capture of CO_2 from transport and storage
- Develop CCS in phases through (expanding) infrastructure hubs
- Make sufficient funding available and create robust mechanisms to commercialise CCS , and
- Engage MS on their 2030 emissions reduction plans, in particular on the need for CCS to achieve these targets, and whether said plans are compatible with the long-term emission reduction trajectory toward 2050

We would finally like to comment that any emissions performance standard for practical reasons should be based on the average emissions during operating hours. To allow for safe and effective operations there might be instances when CO_2 emissions temporarily exceed the proposed gr CO_2/kWh limit through no fault of the operator and with no intention of financial gain.

Based the above we therefore recommend that the Commission;

a) Evaluate the impact of lowering the limit of CO_2 per kWh in the article and

b) Incorporate a comprehensive set of financial and regulatory measures to underpin the emissions performance standard, to enable CCS to deliver carbon reduction at the level required to meet Europe's climate change targets.

[1] Transforming the EU power sector: avoiding a carbon lock-in (EEA, 2016)
[2] ZEP Modelling: Recommendations for transitional measures to drive deployment in Europe: http://www.zeroemissionsplatform.eu/downloads/1413.html
[3] ZEP Executable Plan: http://www.zeroemissionsplatform.eu/library/publication/255-executableplan.html

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