ZEP Advisory Council 51

5th July 2017

Agenda Item 11: ERG update

11.a ERG Update

Appended to this paper is an update for the ZEP External Relations Group.

11.b ZEP Draft Narrative

Appended to this paper is the updated ZEP Draft Narrative.

The AC are invited to approve the final draft new ZEP narrative.

11.c ZEP Clean Hydrogen concept note

Appended to this paper is a concept note developed by Weber Shandwick for the Clean Hydrogen Workshop.

11.d Summary of external engagements

The secretariat has taken part in two meetings:

- **12th June**: Final event of the *Finance for Innovation: Towards the ETS Innovation Fund* workshops
- **15th June**: Meeting with ENTSO-E

A verbal summary of these meetings will be given at the AC meeting.

ZEP Advisory Council 51

5th July 2017

Agenda Item 11.a: ERG update

ERG co-chairs: Mark Downes (Shell), Jonas Helseth (Bellona)

Dissemination of ZEP reports

Since the last AC meeting, the Platform has published the following reports:

- Market Economics 5 (ME5) – This report was launched alongside the 2017 European Parliamentary Hearing on CCS on the 23rd March. A number of meetings took place around this launch, including meetings between Graeme Sweeney, the Temporary Working Group chair Charles Soothill, key EU officials and journalists.

- Commercial Scale Feasibility of Clean Hydrogen – This report was published on the 25th April, alongside a number of media activities including a press release. This date was chosen in order to coincide with a scheduled debate on Electricity Market Reform (EMR) proposals taking place the same day. It is also proposed to hold a workshop in June with the aim of disseminating the information and recommendations of the report to key EU stakeholders.

- Fast Track CO_2 Transport and Storage for Europe – This report was published on the 12th June on the same day as the final event of the Innovation Fund workshops. ZEP released a joint press release commenting on the event and the launch of the report.

Draft new ZEP narrative

The ACEC has provided comments on the draft new ZEP narrative and the narrative was also discussed on the last ACEC call (30th May). The ACEC agreed that CCS costs data should be included in the new narrative.

The draft new narrative has now been updated with final comments and CCS costs data from the 2011 ZEP report *The Costs of CO_2 Capture, Transport and Storage*. The final draft new narrative can be found as pre-read 11.b.

The AC are invited to approve the final draft new ZEP narrative.

Clean Hydrogen workshop

The Clean Hydrogen report was formally launched on the 25th April. As part of the dissemination plan, it has been proposed to host a workshop. The Secretariat is moving forward with discussions regarding a Commission official host, date and venue. An updated concept note from Weber Shandwick can be found as pre-read 11.c.

The ERG held a call on the 2nd June where the workshop was discussed. It was noted that the issue of hydrogen has some sensitivities in the Commission and beyond and it was therefore agreed to postpone the workshop to September to allow for more preparation. In particular it was suggested to reach out to the Fuel Cells and Hydrogen Joint Undertaking (FCH JU) for a meeting. It was also suggested to consider participation of OEMs in the workshop and to ensure feedback on the workshop design from Charles Soothill.

With regard to the hydrogen op-ed, the ERG agreed that this should also be delayed for the time being, given the sensitivities.

ZEP Narrative
Weber Shandwick

April 2017

The proposed storyline

KEY MESSAGE DASHBOARD:

- The objective agreed in Paris to keep global warming to well below 2 °C and pursue efforts to limit the increase to 1.5 °C has generated a renewed momentum for CCS to be a part of the energy technology portfolio. We need all the low carbon technologies we can get to achieve this objective. The good news is that the roll-out of CCS in Europe is progressing, with a range of projects in the Netherlands and Norway, and new projects continue to be launched around the globe. CCS technology is ready for deployment and the long term business case has been made, but more needs to be done in order to fully reap the benefits of CCS in the future. Long term thinking and timely action are of the essence.
- **CLIMATE:** CO_2 transport networks and permanent CO_2 storage will be required in Europe to deeply decarbonise industry, leverage the potential of low cost clean hydrogen to reduce emissions across the heat, power and transport sectors, remove CO_2 from the atmosphere through negative emissions (through the combination of sustainable biomass and CCS - bioCCS or BECCS), and decarbonise remaining fossil fuel electricity generation. All of these activities will be crucial to reach the well below 2 °C objective and pursue efforts to limit the increase to 1.5 °C. This objective makes CCS an indispensable (not optional) component of achieving economy wide deep decarbonisation cost-effectively. Without CCS it will not be possible for the EU to reach its long-term goal of reducing CO_2 emissions by 80-95% in 2050.
- **INDUSTRY:** Energy-intensive sectors such as steel and cement face great challenges and opportunities in meeting the EU's climate objectives for industry. These sectors accounted for a quarter of EU CO_2 emissions in 2010 and many cannot meet their climate objectives without CCS. ZEP's analysis shows that delaying CCS deployment to 2035 would cost power and industry sectors an extra €200 billion to reach the EU's 2050 target. At the same time, ZEP's analysis shows a strong business case for CCS, with the value of CCS for the EU exceeding €1 trillion between now and 2050 and more than €50 billion per year thereafter. CCS will enable companies in these sectors to access new economic models which can safeguard jobs and boost their global competitiveness, whether in terms of use, infrastructure connections or CO_2 storage.
- **SOCIETY:** A fully-fledged CCS infrastructure brings societal benefits at regional and local level, while safeguarding vital European industries. It has the potential to drive decarbonisation across the energy and resource system and boost economic prosperity at the same time. Low carbon industrial clusters can connect to regional CO_2 hubs via national and cross-border CO_2 transport and storage infrastructure, creating sustainable economic zones in Europe, which in turn generate new jobs across the economy
- **CONCLUSION:** Projects are marching ahead, and there are now 38 large-scale CCS projects in operation or under construction globally. For Europe to take the global lead on CCS technology

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innovation and deployment, we need to take action now. We need a policy framework that incentivises the capture and storage of CO_2 and facilitates an environment in which follow-on projects and investments can develop. Above all, we need to put in place the investment and financing models to realise the cross-border transport and storage infrastructure that facilitate future hubs.

THE NARRATIVE:

The context

The agreement in Paris to keep global warming to well below 2 °C and pursue efforts to limit the increase to 1.5 °C has generated a renewed momentum for CCS to be a part of the energy technology portfolio. We need all the low carbon technologies we can get to achieve this goal. The good news is that the roll-out of CCS in Europe is progressing, with a range of projects in the Netherlands and Norway, and new projects continue to be launched around the globe. But more needs to be done to fully reap the benefits of CCS in Europe in the future. Long term thinking, collaboration among industry stakeholders and national or regional governments, and timely action are of the essence.

International and European stakeholders are increasingly recognising the essential role of CCS in bringing about sustainable growth in the future. Yet emitting CO_2 into the atmosphere is currently much cheaper than storing it safely underground. We need to change this situation and enable CCS to provide decarbonised and accessible power, heating and transportation for our citizens, as well as economic prosperity for our industrial centres. This requires us to embed CCS in EU policies to ensure a long-term vision to 2050, including concrete measures to ensure the timely deployment of this indispensable technology.

CCS and climate - CCS is necessary for Europe to achieve its climate goals

CCS is an essential component of cost-effective economy wide decarbonisation, while at the same time providing major opportunities to boost the competitiveness of Europe's economies. CCS is the only technology which can deliver substantial emissions reductions from industrial applications as well as enabling decarbonised fossil fuels to be used for power and heat generation. (5) The International Energy Agency (IEA) projected that a least-cost 2°C pathway requires the capture and storage of close to 4,000 million tonnes of CO_2 per year in 2040. (3) The Intergovernmental Panel on Climate Change (IPCC) meanwhile stated that achieving 450 parts per million of CO_2 in the atmosphere by 2100 (equal to the 2°C pathway) without CCS would lead to a mitigation cost increase of 138%. (2) And the IEA Energy Technology Perspectives 2017 report concludes that CCS will need to make up 32% of the extra effort to move from a 2°C scenario to well below-2°C. (4) This shows that a 1.5 ˚C pathway will be even more challenging and expensive without CCS.

Besides CCS for industry, the technology also has major potential for innovative applications. It is for example widely recognised that clean hydrogen can play a key role in the energy transition. Low cost clean hydrogen can be leveraged to reduce emissions across the heat, power and transport sectors.

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Hydrogen can be produced through electrolysis or the application of CCS on natural gas to hydrogen production units. ZEP's research shows that, depending on location specifics, clean hydrogen (CCS on natural gas) is currently capable of delivering the same hydrogen cost as that projected to be achieved by the renewables route in 10 to 25 years. Moreover, clean hydrogen can play a major role in ensuring the future security of electricity supply by guaranteeing resource adequacy through sufficient generation and flexibility. A major advantage is that hydrogen can be stored more easily than electricity, neutralising the intermittency problems of wind and solar energy production. (23) Furthermore, the natural gas infrastructure that feeds the hydrogen production can also act as a significant energy store.

CCS can also boost optionality in Europe's energy system, as well as providing net negative emissions, which will be necessary should we overshoot 2 ˚C. In fact, CCS and renewables are not in competition but complement each other. On the one hand, CCS facilitates the integration of renewables with near zero CO_2 backup power. This complements capacity factors for solar and wind relating to the realistic limit for their deployment per country on a land-use basis. (22) On the other hand, sustainable use of Biomass/Biofuels combined with CCS is needed for negative CO_2 emissions. CCS for example delivers 12% of cumulative emissions reductions needed by 2050 in the IEA's 2DS scenario, a substantial part of which is negative emissions from sustainable Bio-CCS (BECCS). (5) The United Nations Environment Programme (UNEP) actually found that practically all scenarios to limit warming to 1.5 °C by 2100 exceed the limit throughout the century before falling below it. (16)

As it stands, meeting the Paris goals will be a major challenge. With the current Intended Nationally Determined Contributions (INDCs) under the Paris Climate Agreement we will exceed this limit significantly, implying a massive emissions gap (13). This makes CCS a critical component for the world and the EU to achieve long term climate goals. Long term thinking and timely action are essential if we want CCS to play its part in the decarbonisation of Europe and enable it to lead globally in CCS innovation and deployment.

CCS and industry - CCS is necessary to decarbonise and protect energy intensive industries

The lack of CCS puts the long term sustainability of Europe's vital industries at risk. Energy-intensive sectors such as iron and steel, chemicals and cement, which accounted for a quarter of EU CO_2 emissions in 2010, cannot meet their climate objectives without CCS. (8) To realise the global warming objective agreed in Paris, Europe's industrial CO_2 emissions will need to fall even faster and further than previously foreseen, while preventing carbon leakage caused by industries moving to countries with less ambitious climate policy. (5) CO_2 transport networks and permanent CO_2 storage will be required in Europe to deeply decarbonise industry, pursue the commercial scale deployment of low cost clean hydrogen, remove CO_2 from the atmosphere through negative emissions, and decarbonise remaining fossil fuel electricity generation. (24)

A 'Market Maker' approach could be an effective and cost-efficient mechanism for accelerating the adoption of CCS technologies in these sectors and the deployment of the CO_2 infrastructure. Market

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makers, either a state-owned or regulated private entity, can develop this necessary infrastructure, collect CO_2 from power and industrial facilities for transport and storage, and take the operational storage risk needed to safeguard the CCS value chain. In this innovative model, the price may be set by the regulator, or alternatively be established/agreed through a commercial tender procedure. The CO_2 will naturally be collected from emitters near the transport and storage infrastructure, covering a mix of CO_2 sources to encourage adoption, innovation and cost reduction. (18) An example where this model could be implemented is hydrogen production equipped with CCS in low carbon industrial clusters - where several large users for hydrogen can co-exist. In addition to a Market Maker, this will require collaboration along the clean hydrogen value chain and local clusters for synergies with CCS. (23) To realise the benefits of hydrogen, it is important that Governments and the European Commission work with stakeholders to understand the steps necessary to realise hydrogen markets in the industry, transport, heating and cooling sectors.

Through the CO_2 infrastructure, CCS can safeguard and boost the global competiveness of Europe's industries by enabling companies to reduce their CO_2 cost-effectively and creating new commercial opportunities by accessing new economic models, whether in CO_2 use, infrastructure connections or storage. Developing CO_2 gathering networks and clusters, linked to CO_2 storage hubs, is the lowest cost route to sustainable growth. (9) CCS is therefore essential for the long term sustainability of Europe's industry, but key enabling projects are needed to kick-start the wider roll-out of CCS in Europe. Realising this potential can only be done through close collaboration between different private sector players, including sharing projects to reduce financial risks, and with national or regional governments.

CCS and society - A fully-fledged CCS industry brings major societal benefits at regional and local level

Because of the share of GDP and the jobs they provide, preserving our energy intensive industries and reindustrialising Europe has become an important EU objective - the European Commission has previously set a target to boost the share of the industrial sector in EU GDP to 20% by 2020. The sector's relevance for Europe's continued prosperity is beyond doubt – for example in 2013 these industries employed approximately 1.3 million people (14).

To safeguard their long term sustainability in a carbon constrained world, sustainable industrial clusters should be able to connect to regional CO_2 hubs via national and cross-border CO_2 transport and storage infrastructure. This allows such industries to reconcile continued growth with cutting carbon emissions and transform into drivers of sustainable economic zones. Developing such low-carbon zones can also generate new jobs across the economy. ZEP's own modelling shows that deploying CCS in Europe will create and secure an estimated total of 330.000 jobs in fuel supply, CCS equipment manufacture, plant operation and CO_2 storage facility operation.

Norway and the Netherlands are already pursuing a hubs and clusters strategy to allow this reconciliation of growth and emissions cuts. Together with industrial partners, Norway is developing an industrial CCS cluster to decarbonise cement and chemicals production, and generate energy from waste. Norway is also

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mapping safe and long-term storage spaces, which could be connected with other point sources around the North Sea basin. In its new climate plan, the Dutch government identified ROAD as a vital first step towards an international CCS network. These types of enabling projects are necessary to achieve larger scale in the future. The Port of Rotterdam for example has the potential to become a North Sea hub for CO_2 transport, receiving CO_2 from across Northwest Europe to dispatch to offshore stores. (9)

But time is of the essence. Post-demonstration costs of CCS range from €70/MWh (coal-CCS) to €95/MWh (gas CCS) and these costs must come down quickly to ensure that CCS is competitive with other low-carbon technologies in the late 2020s. (26) Investment in European CO_2 transport and storage infrastructure must start now in order to deploy CCS widely from 2025 – a delay of even 10 years will cost power and industry an extra €200 billion to reach the EU climate targets. It will also result in a forced doubling of the annual CCS deployment rate for power, which is unrealistic given supply constraints for the delivery of power plants, CCS infrastructure and the necessary skills. (8)

Conclusion - Action is required for CCS to succeed in Europe

CCS is already a reality. 38 large-scale CCS projects are either in operation, under construction or in various stages of development planning around the world. Furthermore, there are many hundreds of pilot, demonstration-scale projects and other CCS initiatives currently being pursued. (6) While Europe is lagging behind other parts of the world, the Zero Emissions Platform is working with several European countries and other stakeholders in a 'Temporary Working Group' under the EU's Strategic Energy Technologies Plan (SET-Plan) to deliver on the SET-Plan actions agreed for CCS and Carbon Capture and Utilisation (CCU). Together they agreed to present an implementation plan in the first half of 2017, translating commitments into concrete actions.

To realise the roll out of CCS across Europe, we need a **policy framework that creates the conditions for private companies to invest in the capture and storage of CO_2**. Member States should be required to consider CCS as part of their national energy and climate plans under the EU Energy Union governance process. They should ensure that their targets and measures are in line with the EU 2050 Roadmap, as there are multiple decarbonisation pathways. As part of their national plans, Member States should be encouraged to look for decarbonisation solutions at a regional level, linking countries with limited accessible CO_2 storage capacity to those that do have storage opportunities. (18)

This is however only feasible if we **put in place the right financing models** needed to drive the regional and cross-border infrastructure that enables CO_2 hubs and realises cost reductions. The EU ETS should remain the central tool of EU climate policy, but the CO_2 price is too low and will likely remain so through the 2020s to drive the necessary investments in CCS. ZEP's analysis shows that this price would need to reach €35/tonne of CO_2 for CCS to become commercial and cost-competitive with unabated power plants. (26) Transitional measures are therefore vital to cover the incremental costs of early deployment projects which can enable the wider roll-out of CCS in Europe. This includes creating fit-for-purpose funding for CCS infrastructure development through the proposed Innovation and Modernisation Funds, regional and

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structural funds, Horizon 2020 and potential Projects of Common Interest (PCIs) under the Connecting Europe Facility (CEF). In fact, the first proposals for CO_2 transport projects have been submitted to the 2017 PCI list. The Innovation Fund could also be used to finance the market makers which can trigger early development of large-scale CO_2 storage. (18)

We know that CCS is indispensable for Europe to achieve its climate goals, that it is the only decarbonisation option for most energy intensive industries, and that it brings benefits to society. We also know that CCS can enable clean hydrogen on a large scale, which can help decarbonise the heat and transport sectors, and that it is a key technology to achieve negative emissions in the future. It is clear that we need the right financing mechanisms to build the regional and cross-border CO_2 infrastructure necessary to realise sustainable industrial zones in Europe. We must now act realistically, collaboratively, and – above all – immediately to ensure that CCS becomes a key enabler of sustainable growth in Europe. To ensure that Europe meets its long term climate targets, remains competitive internationally and becomes the global leader in CCS technology innovation and deployment.

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Technical Workshop on Commercial Scale Clean Hydrogen and CCS

Weber Shandwick – Updated Concept note

19 May 2017

Introduction and rationale

As part of our work for SESZEP to support the delivery of a Horizon2020 project 'Support to Energy Stakeholders of the Zero Emission Platform 2016 – 2017', Weber Shandwick has prepared the event concept below. The event seeks to contribute to ZEP's objective to "*Establish the technology actions and integrated commercial and policy framework by 2020 required to fully exploit the potential of CCS for reaching the EU's 2050 target*".

As part of achieving SESZEP's key deliverable 'D3.3. Disseminate the knowledge developed by the Networks and TWGs through external workshop events', this concept outlines the strategic approach to the organisation of a 'Technical Workshop on Commercial Scale Clean Hydrogen and CCS'. The event is part of a wider effort to promote commercial scale clean hydrogen and CCS, which is composed of the following three pillars of activities:

- Launch of ZEP's *'Commercial scale feasibility of Clean Hydrogen'* report
- Technical Workshop on Commercial Scale Clean Hydrogen and CCS
- Political engagement to explain and promote clean hydrogen and CCS

It is widely recognised that hydrogen has the potential to decarbonise a number of different industries including transport and play a key role in the energy transition. A recent resurgence of interest in hydrogen technologies and applications shows its continued promise, even though commercial scale deployment has been lacking. This topic may be another useful method to leverage new interest and support, given the potential relevance of hydrogen across a number of key policy areas.

The workshop would take place against the background of the legislative discussions around the European Commission's Clean Energy Package. Of particular relevance in this context are two proposals: the legislative proposal on electricity market reform (EMR) and the Communication on accelerating clean energy innovation. It also taps into the ongoing discussions concerning the re-use of unspent NER300 money under InnovFin and the European Clean Transport Facility (ECTF).

The workshop also aims to increase understanding of the potential of hydrogen and CCS across the Commission and more widely in the EU institutions.

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Recommended approach

Event synopsis:

It is clear that clean hydrogen has a prominent role to play in Europe's energy transition. At the same time, this potential can only be realised through coherent regulatory and financial support measures. This will require ZEP to engage around the aforementioned policy initiatives published as part of the Clean Energy Package. As a priority, it requires awareness raising within the European Commission.

A concrete opportunity has emerged as the Commission has decided to transfer the unspent NER300 money to InnovFin and the Clean Transport Facility. It is of vital importance that clean hydrogen with CCS, including in the decarbonisation of transport, is supported in an effective and flexible manner. While hydrogen projects are in principle eligible for funding under both EIB-led financing programmes, the modalities may require change to ensure effective project funding for hydrogen with CCS.

Full recognition of hydrogen's potential remains lacking. Through an informal workshop ZEP can, in its capacity as technical advisor to the European Commission, provide the necessary technical understanding to key decision makers.

Focus of the event:

- Outlining the role of CCS in achieving clean hydrogen and the role clean hydrogen can play in decarbonising the EU power, transport and heating sector.
- Reviewing policies and support mechanisms– InnovFin and Clean Transport Facility – to promote the production of clean hydrogen and create economically viable clean hydrogen projects
- Promoting collaboration along the clean hydrogen value chain and local clusters for synergies with CCS as part of a wider CO_2 transport and storage infrastructure in Europe.

Goals:

- Amplify ZEP's efforts to give technological advice and disseminate knowledge to key EU stakeholders – ensure that stakeholders within the Commission fully understand the potential of CCS and hydrogen and allow space for in-depth discussion.
- Widen ZEP's EU policy portfolio, beyond the traditional policy areas, to broaden support for CCS among key EU stakeholders, including building relationships with key stakeholders in the hydrogen space (e.g. ENTSO-e, transport sector).
- Promote clean hydrogen as a vital contribution to Europe's clean energy transition and build links with the hydrogen community.

Practical (TBD):

We would foresee the event to take the format of a technical workshop, providing a platform for informal dialogue around clean hydrogen and how to realise its potential.

- **Timing:** The workshop would last between 1.5 and 2 hours and take place in June or early July.
- **Location:** Aim for the workshop to be hosted by the Commission.

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- **Host:** Aim for leading Commission official (e.g. Moedas Cabinet/ Canete Cabinet) to be the sponsor for the event in order to help convene the key Commission officials
- **Set-up:**
  - Intro by ZEP on the wider context (5 mins)
  - ZEP to present the clean hydrogen report (15 mins)
  - Initial comments from Hydrogen Europe and the Commission (5 mins each)
  - Q&A/ moderated discussion (1 hour)
- **Speakers:**
  - Dr Graeme Sweeney, ZEP Chairman
  - Speaker from TWG membership that contributed to ZEP's clean hydrogen report
  - Tudor Constantinescu, Principal Advisor to the Director General, DG ENER (Or the key Commission sponsor)
  - Spokesperson from Hydrogen Europe
- **Audience (30-40 pax):**
  - Key European Commission officials across DGs CLIMA, ENER, GROW, RTD and REGIO
  - Poss. MEP assistants involved in the key dossiers
  - Member States' attaches working on the innovation file and the EMR
  - Key hydrogen stakeholders (e.g. ENTSO-e, Hydrogen Europe, Fuel Cells and Hydrogen Joint Undertaking)

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