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From source to use: the role of fossil fuels in delivering a sustainable energy future

Revised recommendations of the United Nations Economic Commission for Europe to the United Nations Framework Convention on Climate Change on how carbon capture and storage in cleaner electricity production and through enhanced oil recovery could be used in reducing greenhouse gas emissions

Prepared by the Group of Experts on Cleaner Electricity Production from Fossil Fuels

I. Introduction

1. This document has been prepared by the Group of Experts on Cleaner Electricity Production from Fossil Fuels following an extended consultation process. A longer supporting background document is under preparation. The recommendations contained in this document are submitted to the Committee on Sustainable Energy for its consideration. The recommendations relate to how Carbon Capture and Storage (CCS) and CCS for Enhanced Oil Recovery (EOR) should be treated in a Post-Kyoto Protocol Agreement.

2. Following due consideration, the Committee is requested by the Group of Experts to endorse the recommendations with a view that they then be transmitted by the Executive Secretary of the United Nations Economic Commission for Europe (ECE) to the United Nations Framework Convention on Climate Change (UNFCCC).

II. ECE Recommendations to UNFCCC on how CCS and CCS for Enhanced Oil Recovery should be treated in a Post-Kyoto Protocol Agreement

3. The policy architecture under the United Nations Framework Convention on Climate Change (UNFCCC) is under discussion. It is expected that parties will adopt a legally binding instrument no later than 2015 for application from 2020. The mechanisms could provide an important source of financing and technological learning to support uptake of carbon capture and storage (CCS¹).

4. This document has been prepared by the United Nations Economic Commission for Europe's (ECE's) Group of Experts on Cleaner Electricity Production from Fossil Fuels. It offers recommendations to the UNFCCC on how CCS and CCUS (Carbon Capture Use and Storage, including CCS for enhanced recovery of hydrocarbons) can positively contribute to net climate change mitigation outcomes as part of the policy portfolio established to support the post-2015 instrument.

5. According to most internationally credible projections and forecasts, fossil fuel use will grow significantly by mid-century. Even if Western Europe and North America reduce their fossil fuel consumption, fossil energy use in the rest of the world will expand. Fossil fuel-related carbon dioxide (CO₂) emissions reached 32 GtCO₂/year in 2010, which contributed more than 65 per cent of total anthropogenic greenhouse gas (GHG) emissions (49 GtCO₂/year). Without additional efforts to decouple the growth in GHG emissions from growth in global population and economic activity, emissions levels will continue to grow.

6. Without additional emissions mitigation efforts, global mean surface temperatures are expected to increase between 3.7 and 4.8°C by 2100 compared to pre-industrial levels. Scenarios in which atmospheric concentration levels of CO₂eq are kept to about 450 ppm by 2100 are consistent with keeping global temperature rise below 2°C relative to pre-industrial levels. Such scenarios require substantial cuts in anthropogenic GHG emissions by mid-century through large-scale changes in energy systems and improved land use and sea management. These scenarios are characterized both by global GHG emissions that are 40-70 per cent lower in 2050 than in 2010 and by emissions rates that drop to zero or less by 2100, which would require more rapid improvements in energy efficiency and tripling or quadrupling the share of zero and low carbon energy supply (including renewables, nuclear energy and fossil energy with CCS, or bioenergy with CCS (BECCS) or other carbon dioxide removal technology) by 2050. Scenarios in which GHG emissions reductions exceed those required to keep the temperature rise below 2°C could only be achieved if BECCS using sustainably produced feedstocks and afforestation is deployed widely by the second half of the century.

7. If the world is to succeed in constraining CO₂ emissions to levels consistent with a less than 2°C rise in global temperatures, then CCS will need to contribute about one-sixth of needed CO₂ emission reductions in 2050, and 14 per cent of the cumulative emissions reductions between 2015 and 2050 compared to a business-as-usual approach. It is the only technology option other than energy efficiency and shifting the primary energy mix to lower carbon fuels that can deliver net emissions reductions at the required scale. Given the rapid growth in energy demand in developing countries over this period, the largest deployment of CCS will need to occur in non-OECD countries. On the other hand, the

¹ The technically correct expression is “CO₂ capture and storage”, but because the expression “carbon capture and storage” is widespread and well-known it will be used in this report.

OECD countries will need to show leadership in validating the technologies with both research and development and commercial-scale demonstration and assisting in deploying them at scale. By 2050, non-OECD countries are expected to account for 70 per cent of the total cumulative mass of captured CO₂. Given the magnitude of CO₂ emissions from coal and natural gas-fired electricity generation, the greatest potential for CCS is in the power sector. However, CCS is not only about electricity generation. Around 45 per cent of the CO₂ captured between 2015 and 2050 in the 2°C scenario is from industrial applications that cannot be replaced by renewable technology. In this scenario, between 25 per cent and 40 per cent of the global production of steel, cement and chemicals would have to be equipped with CCS by 2050.

8. CCS has a vital role to play as part of an economically sustainable route to deep emissions cuts. Making CCS technology available as a viable de-carbonisation policy option will require further fully-integrated, large demonstration projects representing the range of technologies – these are needed urgently – and global CO₂ storage levels of at least one billion tonnes per year by 2030 need to be in place, as set forth in the most recent IEA CCS roadmap, and more thereafter. Delivering such an outcome will require collective commitment by governments and industry alike to fund CCS demonstration projects and development efforts in power and industrial applications at levels commensurate with the required abatement outcomes. This commitment will require that a significant share of global funds allocated to clean energy be allocated to CCS. Such outcomes also depend on careful alignment of public funding commitments and enduring economic incentives that can stimulate commercially attractive industry investment. The nexus of commitments and incentives needs to be put in place immediately. Ensuring the availability of CCS will require regulatory and legislative support at all levels of government and international cooperation at project level. Particular attention should be given to permitting environmentally-sound technical solutions and safe geological storage siting that create conditions for public acceptance.

9. There is already a growing commercial market for using captured CO₂ for enhanced oil recovery (EOR). Enhancing oil recovery will replace more costly recovery but not add to the overall emissions levels if framework conditions are established to regulate emissions at the point of use. There is also basic research exploring concepts for chemical conversion of CO₂ into products that serve as long term storage or other immobilisation of carbon. Selling captured CO₂ provides revenues to help partly overcome the relatively higher costs and financial risks associated with nascent CCS projects. The ECE considers that captured emissions of CO₂ from fossil fuel use that are used for enhanced hydrocarbon recovery and verified as not having been released to the atmosphere should be fully accounted for in the post-Kyoto Protocol agreement. If the 2015 agreement did not recognise verifiable and enduring net mitigation outcomes of CCUS, either through the avoidance of an emission liability under a cap and trade regime, through the generation of a tradable offset instrument under baseline and credit arrangements, or through making it eligible to receive climate funding assistance, then this could represent a serious barrier to realising the global mitigation potential of CCS/CCUS by further impairing a nearer-term business case. CCUS, when properly performed, is a technical solution to CO₂ storage that satisfies near-term energy and business model needs. Further, national greenhouse gas inventories CO₂ emissions at the point source of emissions, not the embedded emissions of the primary fuel sources. This implies that no distinction should be made between fuels produced using EOR and those not using EOR.

10. All of these points are elaborated in the attached document. Drawing on the analyses and assessment of its Group of Experts on Cleaner Electricity Production from Fossil Fuels, ECE recommends that the following elements be considered in the post-Kyoto Protocol agreement:

Public Policy Parity

11. CCS mitigation has been formally adopted as an environmentally sound technology within the Kyoto Protocol to the UNFCCC as well as made an eligible project level activity within its associated carbon markets and funding arrangements (including the Green Climate Fund). These outcomes must be preserved in a post-Kyoto international agreement. The verifiable net mitigation outcomes of CCS and CCUS projects should be accounted for in the post-2015 agreement in a manner that avoids emissions liabilities under any future cap and trade regime, generates a tradable offset instrument under any future baseline and credit arrangements, and/or is eligible to claim climate funding assistance².

12. Noting that the current policy setting for CCS is insufficient to support commercial development, it is critical that national and international policies on CCS/CCUS activities have parity with other no carbon/low carbon technologies regarding their climate mitigation potential commensurate with the state of technological and infrastructure development.

13. Knowledge-sharing regarding CCS/CCUS deployment is valuable and should be encouraged (subject to the terms of international agreements covering intellectual property rights and any future international agreements addressing climate-related issues).

14. A post-Kyoto international agreement should accept a broad array of fiscal instruments to encourage CCS/CCUS, but the selection of instruments should not be mandated but rather left to the discretion of national governments. The instruments also should accommodate the learning that will take place as successful early projects guide policy on how to design smart incentives.

15. Other instruments that national governments may choose to deploy to encourage CCS/CCUS until carbon is properly and adequately priced could include measures (such as preferential dispatch or contracts for differences) that affect how CCS plants are operated in their electricity systems.

16. Public-private partnerships should be encouraged and decisions left to national governments as to how best encourage these arrangements in their jurisdiction.

17. A post-Kyoto international agreement must recognize that capturing and storing CO₂ from all industrial sectors will be essential to reach climate goals. Cement, steel, chemicals, refining and transportation are among many sectors that must be addressed in a manner similar to how energy production, transportation, distribution and utilization are addressed and in a way that assuages concerns about effects on international competitiveness.

Government Support for Global Demonstration Projects

18. CCS/CCUS deployment will accelerate if governments work together to financially sponsor demonstration projects. An international agreement should allow for and encourage joint venture projects, particularly between developed and developing nations. A framework should be established to recognize these projects and prescribe how a sharing of benefits can be achieved³.

19. Recognising that the appropriate treatment of intellectual property rights can be an important factor in achieving effective knowledge sharing, a framework should include a

² CCUS projects may reproduce and circulate some of the injected CO₂. Permanent storage is nevertheless achieved and can be full assessed at project completion.

³ Article 4 2(a) of the Convention provides for this.

work stream combining inputs from national governments, appropriate international bodies and other interested stakeholders to address the specific intellectual property issues involved at the earliest possible stage.

20. Governments should establish incentives to develop alternative, cost-effective applications involving captured carbon dioxide that result in emissions reduction and its permanent isolation from the atmosphere and oceans. Governments should remove disincentives such as legislation that imposes excessive long-term liabilities for storage operators following cessation of operations (while developing alternative best practice guidance approaches that satisfy both safety and environmental concerns).

Investments in Developing Countries

21. Developed country investment in developing countries can take many forms. The agreement should be flexible to accommodate a broad variety of mechanisms including:

- (a) Foreign direct investment.
- (b) Development assistance efforts.
- (c) Follow-on to the Clean Development Mechanism that recognizes CCS and CCUS⁴.
- (d) Sharing emission credits.
- (e) Recognizing the role of regional development banks and rewarding national governments for financing projects through regional development banks.
- (f) Recognizing the role of the World Bank Group and recognizing national government contributions to financing projects through World Bank facilities.

Role of the United Nations as a Governor and Enabler of Progress

22. A post-Kyoto international agreement could be a major opportunity to give appropriate treatment to CCS, CCUS and carbon capture and transportation for enhanced oil recovery. It is crucial that CO₂ injected into reservoirs for enhanced hydrocarbon recovery be treated as storage if the CO₂ is stored permanently. Measurement, reporting, and verification will be needed to establish that the CO₂ is permanently stored. Properly addressing CCS/CCUS in an international agreement may be one of the few strategies to enable progress toward rapid deployment of CCS as an important part of global carbon dioxide emission reduction activities.

23. ECE can help develop and promote any international standards required for the efficient achievement of CCS and CCUS.

24. Public outreach and communication is a determining factor for the future of CCS, and the UNFCCC should consider outreach and communication regarding CCS as a carbon dioxide emissions reduction strategy. Coordination should occur between UNFCCC and other United Nations organizational units, with multilateral government organizations; and with multi-national non-governmental organizations.

⁴ FCCC/KP/CMP/2011/10/Add.2; Decision 10/CMP.7: Modalities and procedures for carbon dioxide capture and storage in geological formations as clean development mechanism project activities.

25. CCS developments need to be monitored and tracked globally. Best practice guidance on CCS should be developed and disseminated. UNECE has the capacity and capability to help develop norms and standards, including best practice guidances, while offering a neutral and transparent platform.
