



Carbon Capture and Storage Bulletin

A Summary of the High-level Conference on Fighting Climate Change with Carbon Capture and Storage (CCS)

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SUMMARY OF THE HIGH-LEVEL CONFERENCE ON CARBON CAPTURE AND STORAGE: 27-28 MAY 2009

The High-level Conference on Fighting Climate Change with Carbon Capture and Storage (CCS) took place in Bergen, Norway from 27-28 May 2009. The conference sought to provide an arena for high-level policy makers and other key stakeholders to discuss concrete experiences, priorities, ideas and initiatives to achieve a comprehensive global approach for delivering climate solutions.

The event began on Wednesday morning, 27 May, with an excursion for ministers to the CCS facility at the "Sleipner" platform in the North Sea. This was followed by a high-level opening session hosted by Norway's Prime Minister, Jens Stoltenberg, and a dialogue between ministers. The high-level session was followed by a gala concert coordinated by the Norwegian Foreign Ministry and the 57th Bergen International Festival.

On Thursday, 28 May, experts from business, research and development groups and non-governmental organizations met throughout the day to discuss key aspects of CCS.

At the close of the conference, Jonas Gahr Støre, Norway's Minister of Foreign Affairs, presented a Chair's summary of the meeting. The summary concluded that: a comprehensive approach to reduce CO2 emissions must include CCS; CCS can play a key role in the transition to a low emission society; more large-scale demonstration plants, more research and development (R&D) and a major scaling-up of present CCS efforts are needed; stimulating framework conditions are necessary to encourage wide-scale capture and storage; transport and storage projects must minimize the risk of negative impacts to the environment, health and safety; private sector companies have a particular role to make CCS commercially viable; CCS must be made accessible to developing countries; and CCS should feature in discussions at the UN Copenhagen Climate Change Conference in December 2009 and in other relevant fora.

A BRIEF HISTORY OF CO2 CAPTURE AND STORAGE UNDER THE UNFCCC

CCS involves separation of CO2 from industrial and energy-related sources, its transportation to a storage location and its long-term isolation from the atmosphere. Although CCS can be implemented mainly by applying known technology developed for other purposes, its potential role in tackling climate change was not recognized as early as some other mitigation options.

In response to an invitation from the seventh Conference of the Parties to the UN Framework Convention on Climate Change (UNFCCC COP 7) in 2001, the Intergovernmental

Panel on Climate Change (IPCC) decided in 2003 to commence work toward a Special Report on CCS. This Report, along with a Summary for Policymakers, was released after the latter was approved by the IPCC's Working Group III in September 2005.

At the first Conference of the Parties serving as the Meeting of the Parties to the Kyoto Protocol (COP/MOP 1) in late 2005, parties adopted decision 1/CMP.1. This decision requested the UNFCCC Secretariat to organize a workshop to consider CCS as a clean development mechanism (CDM) project activity, taking into account issues relating to project boundary, leakage and permanence. The COP/MOP also requested the CDM Executive Board to consider proposals for new methodologies for CCS and to make recommendations to COP/MOP 2 in November 2006.

At COP/MOP 2, parties adopted decision 1/CMP.2 on further guidance under the CDM. In this decision, the COP/MOP requested the UNFCCC's Subsidiary Body for Scientific and Technological Advice (SBSTA) to prepare recommendations on CCS in geological formations as CDM project activities for consideration by COP/MOP 3, with a view to taking a decision at COP/MOP 4. The COP/MOP also requested inputs on a number of issues related to: long-term physical leakage (seepage) levels of risks and uncertainty; project boundary issues (such as reservoirs in international waters, several projects using one reservoir) and projects involving more than one country (projects that cross national boundaries); long-term responsibility for monitoring the reservoir and any remediation measures that may be necessary after the end of the crediting period; long-term liability for storage sites; accounting options for any long-term seepage from reservoirs; criteria and steps for the selection of suitable storage sites with respect to the potential for release of greenhouse gases; potential leakage paths and site characteristics and monitoring

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methodologies for physical leakage from the storage site and related infrastructure; operation of reservoirs (for example, well-sealing and abandonment procedures), dynamics of CO₂ distribution within the reservoir and remediation issues; and any other relevant matters, including environmental impacts.

At SBSTA 27, which took place alongside COP/MOP 3 in December 2007 in Bali, Indonesia, parties considered the public call for comments, the in-session workshop report and the Executive Board's recommended list of proposed methodologies. In its conclusions, the SBSTA, *inter alia*: requested the Secretariat to prepare a synthesis report of previous submissions for consideration at SBSTA 28; invited submissions by parties; and requested the Secretariat to prepare another report to be considered by SBSTA 29.

At SBSTA 28 and SBSTA 29, which took place in June and December 2008 respectively, parties could not agree to the SBSTA conclusions, and deferred consideration of this issue to the next SBSTA session in June 2009. In its decision 2/CMP.4 on the report of the CDM Executive Board, the COP/MOP asked the Board to assess and report back to COP/MOP 5 in 2010 on the implications of the possible inclusion of CCS in geological formations as CDM activities.

REPORT OF THE MEETING

The High-level Conference on Fighting Climate Change with Carbon Capture and Storage (CCS) officially opened on Wednesday, 27 May, with a video presentation featuring statements from international experts framing the various low carbon technologies needed to mitigate climate change.

Norway's Prime Minister Jens Stoltenberg then welcomed participants to Norway, noting that Bergen was selected as the venue for this meeting because of its proximity to the Sleipner and Mongstad facilities which are leading the way for CCS technology. He urged that all available solutions should be taken into consideration in combating climate change, as no single method will suffice. He highlighted the challenge facing the world to decouple emissions from the increasing energy needs of a growing global population, noting the need to shift towards low-carbon societies. Noting that the Sleipner facility, which has been in operation over 13 years, has successfully demonstrated that CO₂ can be stored safely, he said the question remains how to make CCS more commercially viable.

Prime Minister Stoltenberg also stressed that, while the use of renewables will increase in the coming years, it will still take time to move away from fossil fuels. In this regard, he said that CCS has the potential in the interim to limit fossil fuel emissions. He said it was significant that the ministers present covered numerous sectors, as CCS technologies would need to be accepted in sectors other than energy and the environment. He commended other recent initiatives to promote CCS, and highlighted the building of a CCS test center in Mongstad, which he said would be used to test and demonstrate CCS technology and lower the risks for new projects. He said Norway would contribute €140 million for CCS projects in new EU member States. With the UN Copenhagen Climate Change Conference approaching, he said CCS must be accepted and demonstrated to be safe as soon as possible.

Rajendra Pachauri, Chair of the Intergovernmental Panel on Climate Change (IPCC), stressed the urgency of the climate change challenge and the need to employ a vast range of technologies. Referring to the 450 parts per million (ppm) targets presented in the IPCC's Fourth Assessment Report, he said that by 2015 global CO₂ emissions were required

to peak, and to decline thereafter. He stated that the IPCC's stabilization scenarios could be achieved using a portfolio of technologies, and that good policies and incentives were required to implement them. He noted that the "right" price of carbon was critical to the introduction of low carbon technologies. He added that few other options exist to mitigate the CO₂ emissions from the continuing use of coal, and that power generation facilities hold the greatest potential for capturing emissions. He said that although vast geological storage potential existed, further studies were needed.

Pachauri said a clear vision for the future was required, as well as policies to achieve this vision. Regarding the costs of CCS, he said they range from 0.01 to 0.05 US cents per kilowatt hour (kWh), that they can be absorbed, are comparable to other technologies, and would be viable with a carbon price of US\$15 to US\$75 per ton of CO₂. He noted that storage costs were low compared to capture costs, and said these costs would reduce over time.

Nobuo Tanaka, Executive Director, International Energy Agency (IEA), said the IEA has already conducted analyses for reaching the 450ppm CO₂ scenario by 2050, and CCS was needed to reach this goal. He emphasized the need for a range of technologies, including energy efficiency, renewables, CCS and nuclear. Highlighting the scale of the problem, he said that attaining the 450ppm target would require 20 new nuclear plants, 18,000 wind-powered turbines, and 30 CCS plants every year from now until 2030.

He said CCS faces a number of challenges, including public resistance and the "not in my back yard" view. He said politicians must be convinced to continue supporting energy projects even in light of the current financial crisis and the projected decline in power consumption in 2009.

He said the Group of Twenty (G20) Leaders stimulus package was not sufficient to achieve a 450ppm target and questioned whether we were ready to reduce emissions by 50% by 2050.

Moderated by Nik Gowing of the BBC, a conversation between Pachauri and Tanaka ensued. Gowing asked Pachauri if there was convergence or divergence on the use of CCS. Pachauri said not enough had been done to communicate the importance of CCS to a wider audience. He said governments must realize that technologies such as CCS will be commercial soon and agreed with President Obama's approach to revitalizing the economy in a way that would create green jobs.

Tanaka expressed his strong belief that CCS was a crucial technology for climate change, and said that Copenhagen will be a "litmus test" for the technology, arguing that CCS should be included in the CDM for the technology to be more widely accepted.

Gowing asked Pachauri to respond to concerns that CCS technology has not been proven. Pachauri said large scale demonstrations of this technology were needed to prove and improve the technology. Such actions, he said, would reassure the public about CCS's viability.

Tanaka said the IEA had been tasked by the Group of Eight Industrialized Countries (G8) to identify and report on the implementation of 20 projects between the period 2010-2020.

In a video message, German Chancellor Angela Merkel emphasized the challenge of low carbon economic growth and stated that CCS is a key technology for the future. She said CCS will play a major role in providing the international community with sustainable and climate-friendly energy.

LEADERSHIP PANEL

The High-level Leadership Panel on “Climate change-technology part of the answer,” was moderated by the BBC’s Nik Gowing.

GENERAL REMARKS ON CCS: David Thompson, Prime Minister of Barbados, said his country believed in a realistic, strategic portfolio of approaches that need to be implemented simultaneously. He stressed the importance of technological investments that focus on safe, appropriate and cost-efficient renewable sources of energy. He said Barbados was skeptical of CCS, particularly in relation to safety issues, but said the technology should not be discounted from the overall approach.

Andris Piebalgs, European Commissioner for Energy, outlined the EU’s climate policy framework, which addresses the need for a comprehensive, ambitious mechanism for achieving emission reductions, particularly in the coal and gas sectors. On CCS, he said its commercialization would be driven by the price of carbon, particularly through emissions trading systems. He outlined the European Commission’s directive on geological storage, which addresses growing public safety concerns, but stressed that CCS presents no danger to public health. He said the EU aims to establish 12 large-scale CCS demonstration projects by 2015 and highlighted the need to address logistical issues, particularly transportation and appropriate storage facilities.

Su Wei, Director-General of China’s National Development and Reform Commission (NDRC), said while CCS was one possible option, it cannot be deployed at present. He stressed the importance of focusing on energy efficiency, conservation and renewables. He urged a focus on CCS risks, such as safety and leakage, as well as capture and technological costs, and the energy consumption required for the capture process. He cautioned against creating competing technological priorities, but expressed interest in international CCS research and development cooperation.

Suwit Khunkitti, Thailand’s Minister of Environment, said CCS technologies were still immature, their cost high, and that there is a need to first prove and then commercialize CCS. He said Thailand was focusing on green investments in the supply and demand side, energy efficiency improvements, and aggressively promoting biofuels and renewables. He further stressed the need for appropriate technology choices in developing countries.

Maria van der Hoeven, Minister of Economic Affairs of the Netherlands, said that while CCS is going to be important, it will not save the world and should not be seen as a “silver bullet.” She stressed the need to reduce, use and store CO₂ as the preferred approach. Noting that the first demonstration projects were underway, she underscored the importance of public acceptance, adding that only when the safety issues are “beyond doubt” would permits be granted for CCS projects. She noted the need for more on-shore storage demonstration projects, particularly in the industrial sector.

Phyllis Yoshida, US Deputy Assistant Secretary for International Energy Cooperation, said science and technology must provide new and better choices, and supported a diversified portfolio approach that considers country- and province-specific issues. She recalled the President Obama’s recent commitment to invest in clean energy technologies, noting that new energy initiatives received the largest part of the recently adopted stimulus package.

Lord Hunt, UK Minister of State, Department of Climate and Energy, said the UK’s shift to a low carbon economy was based on energy efficiency, renewable energy and nuclear power. He outlined the UK’s competition for a scaled-up CCS demonstration project, and said up to three more large-scale demonstration plants would soon be built. He said any new coal investments larger than 300MW must be able to demonstrate emissions reductions using CCS. He said commercializing and deploying CCS widely would require regulatory and financial mechanisms.

German Parliamentary Secretary of State, Mike Müller, said low carbon growth could be achieved only if ecological issues are not sidelined by the current global economic crisis, and if the economy shifts away from traditional energy supply systems. While noting that Germany has three CCS projects, he said end-of-pipe technologies are not always compatible with the energy efficiency revolution. He also cautioned that the effectiveness of CCS storage has been overestimated. He said CCS costs are higher than those of energy efficiency and renewable energy, and stressed that restructuring the energy system was a better alternative than CCS. While expressing some skepticism about CCS, he said Germany would still explore CCS and other alternatives.

Canada’s Environment Minister, Jim Prentice, outlined his country’s goal of cutting emissions 20% by 2020 and 60% by 2050. He said this would require a massive transformation of technologies, and that CCS was a critical component. He stressed the value of a global policy framework and clear leadership, as well as a sound regulatory framework, and a cap-and-trade system. He said Canada would tie new coal-powered plants to CCS standards, and stressed the need to resolve legal and public safety issues.

Rachmat Witoelar, Indonesia’s Minister of Environment, expressed concern that, given high costs and lack of capacity, developing countries are not part of the CCS initiative. He said the best way to sequester carbon is to “kick the CO₂ habit” and explained that Indonesia is investing in a new energy mix to reduce fossil fuel reliance. He said Indonesia was working with contractors on gas projects in Papua Province to introduce CCS technologies.

Italy’s Environment Minister, Stefania Prestigiacomo, said CCS was an important part of the technological innovation process needed to develop low carbon technologies. She said Italy would implement at least one large-scale project as part of the EU’s CCS plans. Reporting on the previous week’s Major Economies Forum in Paris, France, she detected an emerging agreement on the elements of a technology platform, with CCS as one of five key low-carbon technologies. She stressed that, while science was an important element in the CCS debate, the legal basis was equally important, particularly in addressing questions of liability and safety.

Chantal Jouanno, France’s Minister of State Responsible for Ecology, outlined the French plan for a new green deal. She said technology was half of the solution, with changes in lifestyle and consumption habits the other half. She said France would increase research funding by over €1 billion over the next three years, as well as implementing three demonstration projects over the next five years. She underscored the importance of a carbon price. She informed participants about a new international commission, chaired by Amartya Sen and Joseph Stiglitz to develop new economic development indicators.



Abdelaziz Belkhadem, Algeria's State Minister and Personal Representative of the Head of State, said many developing countries believe technology solutions have not been adequately integrated into the development process. He said this would lead to disincentives for developing countries to engage in voluntary emission reduction projects.

Martin Ferguson, Australia's Minister for Resources and Energy underscored the need for increased involvement and investment from the business sector. He called for an end to the "senseless debate" on nuclear versus renewables, stressing emissions cuts across all energy sources. He supported international cooperation and coordination, and sharing information on research and development. He also outlined the work of the International Institute on CCS established by the Australian Government.

On the Norwegian experience of risk and public perception, Prime Minister Stoltenberg said CCS was not controversial in Norway and there were few concerns over public safety and leakage. He attributed this in part to CCS projects being based off-shore.

Responding to these speeches, Rajendra Pachauri concurred that neither CCS nor any other technology should be seen as a "silver bullet." He suggested building public confidence in CCS and called for more investments and projects to bring down costs, as well as more public information and clarity on risks. He supported a new metric for assessing economic welfare, arguing that GDP was a flawed measure for assessing economic growth.

Nobuo Tanaka noted the emerging consensus that addressing climate change requires both private and public sector involvement, as well as the active participation of developing and developed countries. He urged greater global cooperation to ensure coordination and cooperation on all technologies. He added that developing country participation, particular by coal-reliant countries, was crucial.

GROWTH DILEMMA: Following the general remarks, participants discussed whether there was a contradiction between economic growth and climate protection. European Commissioner Andris Piebalgs said people in some nations were not ready to accept CCS, and underground on-shore storage may not be the best option. He suggested building pipelines and storage facilities away from communities. He also said Copenhagen needs to provide a comprehensive solution, including on the carbon price. Minister Rachmat Witoelar of Indonesia stressed the need for "give and take" between developed and developing countries, noting that the bridge between the two groups is technology transfer, finance and capacity building.

Minister Jouanno of France said there was no need to choose between a new development model and climate change. The UK's Lord Hunt reiterated the "Stern case" that the economic costs of inaction or delayed action was much higher than the costs of early action. He said if the international community failed to invest in new technologies now, they would be locked into carbon-based technologies for the long-term. He urged decision makers to put "their money where their mouths are."

China's Su Wei said there was no conflict between climate protection and economic growth, stressing that climate action provides opportunities for growth. He cautioned that CCS may lead to conflicting technological priorities. For developing countries, he said the priority remains economic development and poverty eradication, but cautioned that since CCS was

a future option, its early deployment and associated high cost may prejudice economic growth. He urged a focus on the utilization of captured CO₂ before storage, the so-called "carbon capture, utilization and storage approach."

Prime Minister Thompson of Barbados said it was not possible to separate social and environmental indicators from economic growth, and stressed that sustainable development was not possible without economic growth. Minister Ferguson of Australia said it was possible to achieve strong economic growth while protecting the environment, but cautioned against focusing the investment debate only on the electricity sector to the detriment of other sectors. Minister Prentice of Canada said this process was a "marathon and not a sprint," and called for balanced investment decisions.

Parliamentary Secretary of State Müller reiterated Germany's ambitious goal of a 40% reduction, but stressed that only those countries who adopt an ecological structure for economic growth will emerge as strong economies. Algeria's Minister Belkhadem said developed countries were historically responsible for the climate problem and called for recognition of the needs and priorities of both developed and developing countries.

Thailand's Minister Khunkitti underscored the need to upgrade production processes, ensure international cooperation on technology transfer, and use the economic downturn to introduce new green incentives, such as Thailand's "more green, less tax" approach. He said appropriate technologies need to be deployed and financed, and stressed the "no aid, but trade" approach.

Prime Minister Stoltenberg said the international community should not rely on a permanent economic crisis to resolve the climate challenge. He highlighted the importance of increasing economic growth without having to choose between growth and the environment. Based on historical experience, he said technology is the key to balance environmental and economic interests.

FINANCE AND INTERNATIONAL COOPERATION: Participants then discussed financing and international cooperation. Canada's Minister Prentice said a key question was how to drive, deploy and finance technologies. He said more work is required on flue gas recovery, and emphasized the importance of government regulation in driving technology deployment. He said Copenhagen should consider an international market-based or crediting mechanism to provide additional investment for CCS deployment in developing countries.

Minister Witoelar of Indonesia said developed countries need to assess the "real" needs of developing countries to ensure country-appropriate technologies. US Deputy Assistant Secretary Yoshida urged looking beyond technology transfer, indicating that CCS technology diffusion would be aided by sharing information and ensuring cooperation among scientists to explore and verify CCS projects.

Australia's Minister Ferguson rejected the assertion that the economic crisis had set back environment-related spending. He supported sharing experiences and lessons learned, particularly to achieve the G8's target of 20 CCS projects by 2020. He said technology has "created the problem and will solve it."

China's Su Wei highlighted international cooperation and building the capacity of developing countries to ensure their participation in the development of future technologies. He said that, while technology transfer was key for deployment, the immediate need was to share knowledge and information.

The UK's Lord Hunt said Copenhagen was the right moment to agree on an international regulatory structure to facilitate the roll-out of CCS technologies. He said the G8 was working on removing financial and technical barriers, and stressed the need for scaled-up demonstration projects.

Minister Prestigiacomo of Italy underscored the need for research and development followed by demonstration projects using public funding. However, she added that shifting from demonstration to the transfer, deployment and commercialization of CCS technologies will require international financing, including from the private sector via a reformed carbon market. Minister Belkhadem of Algeria urged developed countries to make CCS projects more accessible, in particular by widening the carbon trading market.

Reflecting on the discussions, Rajendra Pachauri said there was a huge deficit in research and development spending, and called for governments to make strategic investments in mitigation measures.

Nobuo Tanaka said these issues must be considered at Copenhagen. He added that CCS would require a framework under which policy models could be developed.

Prime Minister Stoltenberg thanked delegates for insights, and for highlighting both the potential and challenges of CCS. He emphasized the benefit of establishing a framework for CCS at Copenhagen, which would make it easier to invest in different countries in the future.

EXPERT SESSIONS WITH MINISTERS

The expert sessions with ministers took place on Thursday, 28 May. Terje Riis-Johansen, Norway's Minister of Petroleum and Energy, welcomed participants, noting the diversity of representatives present. He said his role as minister responsible for CCS made him acutely aware of the complexities of such projects, and emphasized the strong need to learn from each other. He said the politicians' role was to establish frameworks and policies, but that experts must drive the deployment of CCS. He drew attention to successful facilities developed in Norway, California, Canada and Algeria, and emphasized that Norway supported CCS as a necessary component among a portfolio of measures. He explained that the storage question needed to be addressed adequately and with care, and should include collaboration between the relevant parties in developed and developing countries. He urged mechanisms to make CCS technology more commercially-viable, without crowding out other mitigation technologies. He underlined that maximum environmental integrity was needed for CCS and its development, and cooperation is needed to develop the guidelines to achieve this.

José Manuel Durão Barroso, President of the European Commission, addressed the meeting via a video presentation. He expressed strong support for CCS and detailed the EU's progress to date in promoting and developing CCS, highlighting the call for 12 large-scale projects by 2015. He noted that commercial opportunities were emerging for CCS under the EU's emissions trading scheme (ETS). He said an EU framework would be valuable not just for Europe but also in sending a signal to partners that CCS is an important part of the solution.

John Ashton, Special Representative for Climate Change, UK Foreign and Commonwealth Office, emphasized the need to take action everywhere and across technologies. He said the ongoing use of coal means CCS should become the standard, but cautioned against "clean coal," a term used for more efficient coal-burning technology, saying this would

not solve the problem of coal-fired generation emissions. He said a major challenge for proving CCS technology was cost discovery, and that combining component CCS technologies at large-scale demonstration was needed for this. On the additional costs of CCS over conventional generation, he recommended these be spread equitably across the rate base.

He noted that, while the CO₂ price was important for CCS, setting a price would not inevitably result in more CCS. On people's risk perceptions of CCS, he cautioned against making the same mistakes as the nuclear industry, and called for transparency and rigor in addressing public concerns.

He also highlighted the UK's policy to only issue licenses for new coal plants with significant CCS plans. He said that CCS activities should not focus just on developed countries, and supported helping developing countries avoid technological lock-in to high carbon technologies. He said environmentalists should accept the role of coal in supporting economic development, and utilities should take early action to support CCS. He added that Copenhagen will be a crucial test for CCS.

In response to a question about whether CCS was just business-as-usual and one on the application of the polluter pays principle, John Ashton said that CCS hadn't won, but was now part of the game. He noted support from the EU, and demonstration projects in Australia, the US and Canada and stressed that it was necessary for demonstration projects to happen before rolling-out at scale. On a question about the role of CCS in the lead-up to Copenhagen, Ashton said CCS has been disadvantaged by being excluded from the CDM, but cautioned that carbon prices will need additional support to deploy CCS, and that supporters of CCS would need to be more effective in building political support. On the scope of CCS, he said that although the current focus was on large fossil fuel power utilities, activities from smaller point sources should also be considered.

SESSION I: DELIVERING CLIMATE SOLUTIONS. THE POTENTIAL OF CCS: This session was moderated by Barbara McKee, Director, Carbon Sequestration Leadership Forum (CSLF). She highlighted the IEA's research that includes CCS as part of the package of technologies to reduce emissions by 50% by 2050, and noted the current momentum behind CCS.

Heleen de Coninck, Manager, Energy Centre of the Netherlands, said that while CCS was a global solution, the geographical distribution of CO₂ storage potential was not universal. On CCS emissions reduction potential, she stressed that fossil fuel power stations will not become carbon neutral with CCS alone, and that emission reductions in the range of 65 to 80% relative to conventional power plants may not be sufficient for ambitious climate targets. She urged participants to think about combining CCS with biomass. She said the CCS community needs to be more open to criticism and stressed that public trust requires an independent expert CCS community that aims to improve, not just promote, the technology. She said Copenhagen provides a golden opportunity for CCS, and identified the option of establishing a global demonstration fund to finance demonstration projects in developing countries. She also highlighted the need to pool funds and ensure global learning.

Su Wenbin, President, GreenGen, China, presented an overview of his company's investments in renewable energy, hydropower and nuclear energy, as well as new developments in Integrated Gasification Combined Cycle and CCS projects. He stressed the need for international cooperation and support.



Carl Bauer, Director, National Energy Technology Laboratory, US, said the recent stimulus package allocated US\$3.4 billion for CCS. Addressing the economic challenge, he noted that wind, solar, and CCS technologies are currently economically immature and not sustainable. He said governments were fostering these technologies to help them become viable in future. He indicated that a major challenge is the cost of capture, and welcomed a focus on CCS with biomass.

Tony Surridge, South African National Energy Research Institute said South Africa's emissions are projected to increase until 2025 and decline in real terms from 2035. He highlighted a government decision that all new coal power stations should be CCS ready. He also reported on the establishment of the South African Centre for CCS in March 2009, which aims to implement a CCS demonstration plant by 2020. He said the Centre was currently focusing on developing a CCS atlas to locate and characterize potential sites and the aim of completing a test injection site by 2016. He noted South Africa's primary concern with poverty eradication and job creation, which means CCS must be balanced with development priorities. He added that CCS is not about extending the life cycle of fossil fuels, but as a transitional step towards renewables and nuclear energy.

In the ensuing discussion, Heleen de Coninck shared lessons learned from public opposition to CCS in the Netherlands. She urged genuine engagement with the public early on in the process. Regarding the Copenhagen talks, she noted their complexity, and observed that while most countries support CCS, some are opposed to its inclusion in the carbon trading mechanisms because of its lack of universality.

Tony Surridge said CCS should not be seen as the only option, but as a part of a mitigation package. He said South Africa is prepared to take voluntary actions in this regard, adding that governments need to address the carbon pricing issue in order to foster CCS in developing countries.

In response to a comment about the lack of plans for commercial-scale CCS in developed countries over the next 10 years, Carl Bauer said there will be at least one plant in the US in the next five to six years. There will also be several small-scale projects that will help create a better understanding of how to separate CO₂ and a better sense of the real potential of CCS.

In conclusion, Moderator Barbara McKee said more technological progress and collaboration is needed for CCS to become viable. She said non-experts and high-level government, industry and non-governmental organization representatives should learn about CCS, as they will be making important decisions on CCS project implementation. She said experts need to hear the views of non-experts, as these are the views that will ultimately determine the future of CCS. She added that, while CCS is among the most promising and important technologies, the ultimate goal is not just to improve technology, but rather people's lives by providing energy access. She called for CCS to be made a reality and a centerpiece of global energy policy and production, and for a renewed determination to deploy CCS.

SESSION II: ENVIRONMENTALLY SOUND TRANSPORT AND STORAGE OF CO₂. EXPERIENCES AND CHALLENGES: This session was moderated by Iain Wright, Project Manager, BP Alternative Energy. Wright explained that CCS so far has a safety record better than natural gas, and that geological storage of gas has occurred for millions of years.

Knut Kroepelien, Environmental Councilor, Mission of Norway to the EU, presented on CCS regulation and the "question of trust." He outlined the history of CCS development, noting that relevant regulatory frameworks exist under the EU and the Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR), which specify the rules for carbon storage. He suggested that risk assessments for storage and the long-term financial security of stakeholders are key components of a regulatory framework. He also said risk assessments must take place on an individual basis to ensure safety of sites. He noted that EU regulations were pending and, with ratification by the Council, would be implemented by 2011.

Ganesh Thakur, Vice President, Global Advisor of Reservoir Management, Chevron, underlined the oil and gas industry's relevant experience. On the role of CO₂ for enhanced oil recovery (EOR), he said that in the US over 350,000 barrels of oil per day are produced using EOR. He noted that miscible CO₂ EOR results in stored CO₂ and greater oil extraction, and highlighted Chevron's experience with CO₂ EOR beginning in 1982 in Texas, where 45 million tons (Mt) of CO₂ is injected per year.

Malcolm Wilson, Acting Director, International Performance Assessment Centre for Geological Storage of CO₂ (IPAC-CO₂), spoke about his organization's role in measuring the behavior of CO₂ in CCS storage. He said studies evaluating the associated risk of the Weyburn facility showed a worst-case leakage scenario of 0.2% of stored CO₂ over 5000 years. He noted the importance of promoting regulator confidence through the provision of objective advice, a transparent process, public information, and clear guidelines. He said IPAC's function was to work towards ensuring a transparent CCS process and to develop CCS risk assessment capabilities around the world.

Linus Spencer Thomas, Chair of the Alliance of Small Island States (AOSIS), said AOSIS supports CCS as critical for the climate change challenge, particularly in relation to the need for ambitious reduction targets by developed countries. He called for more ambitious climate targets, arguing that a 2°C upper limit was too high, and that stronger targets of below 1.5°C and below 350ppm would be needed if AOSIS members were to survive. He noted the limited potential for CCS projects in AOSIS countries, and said their priorities were low emission power options such as renewable energy and energy efficiency.

Margaret Øvrum, Executive Vice President for Technology and New Energy, StatoilHydro, spoke on the company's CCS experience in the Sleipner, Snøhvit, Salah and Weyburn facilities. She highlighted the Sleipner Field as the first large-scale CCS initiative in the world, and said keeping information open to research institutions had been an effective way of promoting its acceptance as a mitigation option. On Snøhvit, she hoped StatoilHydro would set new standards for efficient liquefied natural gas (LNG) production. She stated that research being done at the Mongstad facility is important for developing lower-cost, low-pressure capture technology to improve commercial viability.

In response to a question from Iain Wright on industry's capability to select locations for CCS that would minimize risk of leakage, panelists confirmed that industry and regulators had sufficient experience to assess risks. Knut Kroepelien commented that an EU committee was being developed to evaluate the risk assessments being done by industry.

Responding to a question on Chevron's injection of 45Mt CO₂ per year, Ganesh Thakur said the CO₂ was bought from CO₂ reservoirs where it is produced. He said 30-50% of the injected CO₂ is recovered, while the remainder stays underground. He said the Chevron facility in Texas had sequestered the equivalent CO₂ of 30 Weyburn projects over the last 30 years.

On a question about European regulations for the purity of CO₂, Knut Kroepelien said CO₂ storage regulations prohibited mixing of non-CO₂ gases for disposal purposes, but could include monitoring additives.

On a question about CCS safety records, Iain Wright said they originated from the IEA's network for regulators, and a study comparing natural gas and CCS pipeline safety relative to size.

One delegate urged greater clarity on reporting standards for new CCS projects, as the 2006 IPCC's GHG inventory guidelines only cover industrialized countries. The delegate added that monitorable, reportable and verifiable (MRV) guidelines are needed internationally, and for developing countries. He noted that the IPCC guidelines for reporting did not have any legal status, and were not binding under the UNFCCC.

On a question about the effectiveness of cap-and-trade versus carbon taxes, Margaret Øvrum said Norway's concern for the environment and the carbon tax both played a large part in the Sleipner project, as did the strong sense of cooperation between the government and private sector.

At the end of the session, student representatives from the Norwegian University of Science and Technology gave a presentation on CO₂ transport by ship, in which they presented a proposal for the carbon chain gas carrier (CCGC). With a freight rate of US\$7 per ton of CO₂ and a total capacity of 46,000 tons of CO₂, the CCGC could theoretically transport three million tons of CO₂ annually from mainland Europe to Mongstad in Norway.

SESSION III: GLOBAL NEED FOR MORE ENERGY AND LESS CO₂. CAN WE ACHIEVE BOTH? This session was moderated by Margaret Martin, Senior Director, Natural Resources Canada. She supported contextualizing CCS both in terms of the Bali Action Plan and the overall role of CCS in relation to mitigation and adaptation. Stating that fossil fuels will continue to be utilized well into the middle of the century, she said the challenge was to create a transitional mechanism towards low or zero carbon economies. Suggesting that CCS is a key technology, she said the international community must take advantage of all technologies. She also highlighted local as well as global solutions to climate change.

Edward McBride, Business Editor, *The Economist*, raised several concerns about CCS. He questioned why there were no large-scale CCS investments, particularly when the most common argument in favor of CCS was that climate change cannot be stopped without reducing emissions from coal. He said many companies are struggling to make CCS economically viable and noted that investments in other technologies such as solar, wind and nuclear continue to grow. He said it was doubtful that developing countries can afford to subsidize CCS and other low carbon technologies. He supported establishing a policy framework that keeps the extra cost of low carbon technologies to a minimum.

Katherine Sierra, Vice President of Sustainable Development at the World Bank, underscored that for developing countries the debate is about securing reliable, affordable energy access to people and businesses in order to

support sustainable livelihoods and job creation. Noting that energy access is critical to poverty eradication and economic development, she said most developing countries have low *per capita* electricity use and that many technologies – even those currently “on the table” – remain unaffordable. While there is no “silver bullet” on mitigation, she urged beginning with energy efficiency, renewables, nuclear, and biomass. She noted that, while countries continue to rely on fossil fuels, there is a need to develop CCS. She emphasized technology development and transfer, and stressed the urgency of CCS trials in developing countries. She further stressed the need for incremental financing for initial capital expenses and high operating costs, and asked whether there was a role for the CDM and specialized funds to support technology deployment. Finally, she supported building institutional capacity in relation to the management of liability, regulation and risk assessment.

Frederic Hauge, President, Bellona Foundation, said the international community should strive not only for a low carbon economy, but also for a carbon negative economy. He said energy efficiency is one the most important tools, but the use of renewables must also increase. He said that reaching a global 85% reduction in emissions would require combining biomass and CCS. With more than 6000 stationary CO₂ sources representing more than 65% of global CO₂ emissions, he said CCS needs a policy framework that can lead to carbon negative pathways.

In the ensuing discussion, a participant representing a CCS association said CCS is a very cost effective way of reducing emissions, that the costs are attractive, and that industry is keen to start CCS implementation.

On reducing the costs of low carbon technologies, Katherine Sierra noted the Bali Action Plan's emphasis on nationally appropriate mitigation actions in developing countries. She said the Bank was working with recipient countries to assess what could be done with domestic resources and what can be done with external finance. She noted that the majority of immediate financial requests relate to energy efficiency and renewable energy technologies that are commercially viable. She said others have requested support to move “ahead of the curve” and to participate in the technology innovation cycle. Frederic Hauge said developing countries should benefit from enhanced coal bed methane recovery technologies.

In response to a question on creating incentives for early movers, Hauge said the 20 demonstration projects to be implemented by the EU and US would provide significant knowledge and information to help lower the costs of future CCS projects. Sierra stressed the need for an early and strong signal on carbon pricing, while recognizing that this may take some time. She identified the need to transition from current practices using a mixed global market, eventually moving to a dedicated CCS market. She suggested that global cooperative action, not just on CCS, will need technology diffusion and transfer as well as resources to make the technologies affordable. Edward McBride argued that the international community should not pin their plans on the assumption that CCS works, as it could lead to a misallocation of resources.

SESSION IV: FINANCING CLIMATE TECHNOLOGIES. WHAT INCENTIVES WORK FOR CCS PROJECTS? This session was moderated by Milton Catelin, Chief Executive, World Coal Institute. In his introduction, Catelin noted that although CCS was not inexpensive, it would cost a fraction of the amount used to rescue financial institutions, but with benefits for the entire world.



David Hone, Group Climate Change Adviser, Shell International, presented a plan to generate financial support for CCS, recommending that it needed: an underlying price for CO₂; a robust approach to CO₂ storage certification; and clear guidelines on MRV based on the 2006 IPCC Greenhouse Gas Inventory Guidelines. He said clear objectives were needed with funding packages commensurate to goals, and that regulatory frameworks need to be replicated internationally along with mechanisms for technology transfer to developing countries. He said the CDM must evolve and underlined the importance of Copenhagen in opening up developed country carbon markets.

Nick Otter, Chief Executive Officer, Global Carbon Capture and Storage Institute (GCCSI), supported speedy CCS deployment, which he said required effective risk appraisal. He noted GCCSI's research on industry readiness and on identifying bottlenecks for deployment. Noting that the value of CO₂ would play a role in closing the finance gaps, he said a mixture of financing mechanisms would be required to promote CCS in different countries.

Bronwen Northmore, Policy Director, Cleaner Fossil Fuel Unit, UK Department of Energy and Climate Change, said the UK's commitment to reduce CO₂ emissions by 80% by 2050 would include a strong CCS focus, particularly as more coal generation was needed. She said new generation in the UK greater than 300MW would require CCS capabilities. On the administration of funds for CCS projects, she said the UK hoped to get funds from the EU to co-finance CCS projects, and noted the aim of making CCS commercially viable in the future.

Lynn Sheppard, Policy Officer, International Climate Negotiations and Relations with East Asia, EC, outlined the EU's cooperation with China on CCS, noting that developing countries need to use coal. She said an EC communication on the EU's plans should be released soon, as well as a study on CCS investment returns. She said EU-China cooperation could be seen as an example of bilateral cooperation for future CCS-related projects.

Rashad Kaldany, Vice President for Infrastructure at the International Finance Corporation (IFC), explained that the IFC co-finances projects with the private sector, but that none of the CCS projects assessed are bankable at this stage. He suggested that making CCS a success would require appropriate regulations or carbon prices, support from public policy, and technology with a decreasing cost curve. On the promotion of CCS in developing countries, he recommended focusing on several key projects in India, China and some smaller countries, and engaging with a wide range of multilateral institutions and governments.

In the subsequent discussion, one participant commented that oil and coal prices of over US\$100 would significantly increase the costs of CCS. David Hone agreed that the price of carbon and the increased operational expenditure for such a case had not yet been reflected. On paying for higher running costs for CCS plants, Hone said that as the CO₂ market matures, the price of carbon should move towards the costs incurred by other mitigation technologies. He noted that difficulties may arise if other mechanisms are introduced that undermine the emissions trading scheme's carbon prices, and urged that the policy mix be carefully considered.

On the question of decreased operating efficiencies in CCS plants in developing countries, Bronwen Northmore appreciated that this was a "tough ask" for those without basic

electricity, and said that in time research and development would bring about improved efficiencies and reduced costs. On the effect of the changing political landscape in the UK on CCS, Northmore said the current leadership had shown its commitment to climate change throughout the financial crisis, and she hoped CCS would not require government support in the future.

Alfred Norgård, Norwegian Oil Industry Association, highlighted the effectiveness of a nitrogen oxides (NO_x) fund in Norway that effectively reduced NO_x emissions below target levels.

On the conditions for IFC investment in CCS, Rashad Kaldany said the key issue was making projects bankable. On education and exposure to CCS for commercial bankers, Kaldany referred to the work being carried out by Carbon Sequestration Leadership Forum (CLSF). Nick Otter said the aim of big demonstration projects is to share knowledge and educate all sectors, including commercial and other institutions on the potential of CCS.

CLOSING SESSION

Jonas Gahr Støre, Norway's Minister of Foreign Affairs, said this event had taken place at a critical juncture in the process leading towards Copenhagen and expressed hope that Bergen would feed into the Copenhagen process. He stressed the enormous potential of CCS for global emission reductions, observing that there is currently no other technology with the potential to reduce CO₂ from coal power stations. He urged global action on CCS and said no new fossil fuel generation plants should be built unless they include CCS.

He then presented the Chair's summary of the meeting, which includes eight key messages raised during the conference. These eight key messages are outlined in the section entitled "Chair's Summary" (see below).

In closing, Minister Støre said the challenges are real and the obstacles many, but that a combination of good will and the right policies will overcome barriers to wide-scale implementation. He said this meeting demonstrated that the international community should speed up work for development and deployment of CCS as a key part of the global climate response. He declared the meeting closed at 5:00 pm.

CHAIR'S SUMMARY

A comprehensive approach to reduce CO₂ must include CCS: The Chair's summary indicates that the international community must move forward with a suite of options, including CCS as a key climate technology. It stresses that the deployment of new technologies, including CCS, depends on public confidence and strong political leadership to build public confidence on safety and environmental impacts.

Sustainable economic growth is possible, and CCS is a key step in the transition to a low emission society: The summary notes that the conference considered key challenges, including decoupling economic growth from emissions growth, combining the need for global growth with fewer emissions. The summary also recognizes that a transition to a low emissions society is both necessary and feasible, but needs the introduction of system-wide incentives to promote a change in investment, production and consumption patterns.

More large-scale demonstration plants, more research and development and a major scaling-up of present CCS efforts are needed: The summary stresses that public financing is particularly important for research and development and

pilot plants, and that plans for large-scale plants need to be intensified. It supports including major CO₂ emission points from the industrial sector, including cement, steel and chemicals.

Stimulating framework conditions are necessary to encourage wide-scale CCS: The summary underscores the need to further develop and implement legal and regulatory frameworks to encourage CCS, and to ensure implementation and the wider advancement of public health, safety, liability and financing issues.

Transport and storage projects must minimize the risk of negative impacts to the environment, health and safety: The summary notes participants' comments that the broader deployment of CCS must correspond to global storage capacity, and that international cooperation should be strengthened to facilitate access and lift current barriers. The summary stresses that proper site selection, environmental impact assessment, monitoring and remediation plans are important to ensure storage is environmentally safe.

Private sector companies have a particular role to make CCS commercially viable: The summary indicates that stronger financial incentives are needed for CCS development, as well as the removal of barriers to scaling-up CCS. One of the most important commercial incentives is setting a carbon price.

CCS must be made accessible to developing countries: The summary states that developed countries must show the way to reduce CO₂ emissions, and that technology cooperation, capacity building and financial support must be part of the global solution. The international climate regime should strengthen technology cooperation and partnerships to make CCS accessible to developing countries.

From Bergen to Copenhagen: The summary notes that Bergen is an essential step on the road to Copenhagen and that the Bergen Summary should feed into a number of international processes and bodies, such as the IEA, World Bank and other multilateral financial institutions, and the CSLF ministerial meeting in October 2009.

UPCOMING MEETINGS

30TH SESSIONS OF THE UNFCCC SUBSIDIARY BODIES, AWG-LCA 6, AND AWG-KP 8: The 30th sessions of the Subsidiary Bodies of the UNFCCC – the Subsidiary Body for Implementation and Subsidiary Body for Scientific and Technological Advice – are scheduled to take place from 1-12 June 2009 in Bonn, Germany. At the same time, AWG-LCA 6 and AWG-KP 8 will also take place. For more information, contact: UNFCCC Secretariat; tel: +49-228-815-1000; fax: +49-228-815-1999; e-mail: secretariat@unfccc.int; internet: <http://unfccc.int/meetings/items/2654.php>

GLOBAL FORUM ON SUSTAINABLE ENERGY: TOWARDS AN INTEGRATED ENERGY AGENDA BEYOND 2020: SECURING SUSTAINABLE POLICIES AND INVESTMENTS: The Global Forum on Sustainable Energy will take place from 22-24 June 2009 in Vienna, Austria. For more information contact: Martin Lugmayr, Austrian Development Agency (ADA); tel: +43(0)1 90 399 2557; fax: +43 (01) 90 3 99 290; e-mail: martin.lugmayr@ada.gv.at; Internet: <http://www.gfse.at/>

OSPAR 2009: The Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR) Commission will meet from 22-26 June 2009, in a venue to be

determine. For more information contact: OSPAR Secretariat; tel: +44 20 7430 5200; fax: +44 20 7430 5225; e-mail: secretariat@ospar.org; internet: <http://www.ospar.org/>

G8 SUMMIT 2009: The Summit of the eight leading industrialized nations (G8) will convene in L'Aquila, Italy from 8-10 July 2009. For more information contact: Italian Prime Ministers office; tel: +39 06 6820 40 90; internet: http://www.g8italia2009.it/G8/G8-G8_Layout_locale-1199882116809_Home.htm

INFORMAL MEETINGS OF THE AWG-LCA AND AWG-KP: Informal meetings of the AWG-LCA and the AWG-KP are scheduled to take place from 10-14 August 2009 in Bonn, Germany. For more information, contact: UNFCCC Secretariat; tel: +49-228-815-1000; fax: +49-228-815-1999; e-mail: secretariat@unfccc.int; internet: <http://unfccc.int/>

WORLD CLIMATE CONFERENCE 3: The third World Climate Conference will take place from 31 August to 4 September 2009 in Geneva, Switzerland. The conference will take as its theme "Better climate information for a better future." For more information contact: WCC-3 Secretariat, WMO; tel: +41-22-730-8273; fax: +41-22-730-8042; e-mail: wcc-3@wmo.int; internet: http://www.wmo.int/pages/world_climate_conference

AWG-LCA 7 AND AWG-KP 9: The seventh meeting of the AWG-LCA and ninth session of the AWG-KP are scheduled to take place from 28 September - 9 October 2009 in Bangkok, Thailand. For more information, contact: UNFCCC Secretariat; tel: +49-228-815-1000; fax: +49-228-815-1999; e-mail: secretariat@unfccc.int; internet: <http://unfccc.int/meetings/items/2654.php>

LONDON MINISTERIAL MEETING OF THE CSLF: The third Ministerial Meeting of the Carbon Sequestration Leadership Forum (CSLF) will take place from 12-14 October 2009 in London, UK. For more information contact: CSLF Secretariat; tel: + 1-301-903-3820; fax: 1-301-903-1591; e-mail: CSLFSecretariat@hq.doe.gov; internet: <http://www.cslforum.org/meetings/london2009/premeeting.html>

IPCC-31: The thirty-first session of the IPCC will be held from 26-28 October in Bali, Indonesia. For more information, contact: IPCC Secretariat; tel: +41-22-730-8208; fax: +41-22-730-8025/13; e-mail: IPCC-Sec@wmo.int; internet: <http://www.ipcc.ch/>

RESUMED AWG-LCA 7 AND AWG-KP 9: A resumed seventh session of the AWG-LCA and the ninth session of the AWG-KP is scheduled to take place from 2-6 November 2009 at a location to be announced. For more information contact: UNFCCC Secretariat; tel: +49-228-815-1000; fax: +49-228-815-1999; e-mail: secretariat@unfccc.int; internet: <http://unfccc.int/>

UNFCCC COP 15 AND KYOTO PROTOCOL COP/MOP 5: The fifteenth Conference of the Parties to the UNFCCC and fifth meeting of the Parties to the Kyoto Protocol are scheduled to take place from 7-18 December 2009 in Copenhagen, Denmark. These meetings will coincide with the 31st meetings of the UNFCCC's subsidiary bodies. Under the "roadmap" agreed at the UN Climate Change Conference in Bali in December 2007, COP 15 and COP/MOP 5 are expected to finalize an agreement on a framework for combating climate change post-2012 (when the Kyoto Protocol's first commitment period ends). For more information, contact: UNFCCC Secretariat; tel: +49-228-815-1000; fax: +49-228-815-1999; e-mail: secretariat@unfccc.int; internet: <http://unfccc.int/>