INTERNATIONAL ENERGY AGENCY

INSIGHTS SERIES 2016

Carbon Capture and Storage: Legal and Regulatory Review

Edition 5

INTERNATIONAL ENERGY AGENCY

The International Energy Agency (IEA), an autonomous agency, was established in November 1974. Its primary mandate was – and is – two-fold: to promote energy security amongst its member countries through collective response to physical disruptions in oil supply, and provide authoritative research and analysis on ways to ensure reliable, affordable and clean energy for its 29 member countries and beyond. The IEA carries out a comprehensive programme of energy co-operation among its member countries, each of which is obliged to hold oil stocks equivalent to 90 days of its net imports. The Agency's aims include the following objectives:

- Secure member countries' access to reliable and ample supplies of all forms of energy; in particular, through maintaining effective emergency response capabilities in case of oil supply disruptions.
- Promote sustainable energy policies that spur economic growth and environmental protection in a global context – particularly in terms of reducing greenhouse-gas emissions that contribute to climate change.
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Acknowledgements

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The *Carbon Capture and Storage Legal and Regulatory Review*

The International Energy Agency (IEA) considers carbon capture and storage (CCS) a crucial part of worldwide efforts to limit global warming by reducing greenhouse-gas (GHG) emissions. The IEA estimates that carbon dioxide (CO_2) emissions can be reduced to a level that would limit long-term global temperature increases to 2°C through the broad deployment of low-carbon energy technologies, including CCS. In the IEA's Energy Technology Perspectives 2012 2°C Scenario (2DS), CCS would contribute about one-seventh of cumulative emissions reductions from a business-as-usual scenario (6DS) through 2050 (IEA, 2013a). Reaching this goal, however, requires that hundreds of $MtCO_2$ be captured and stored across power generation and industrial sectors in 2020, increasing exponentially to 7.8 $GtCO_2$ in 2050 (IEA, 2012a).

Achieving such rapid expansion requires appropriate policy frameworks to both promote demonstration and deployment of CCS and ensure it is undertaken in a safe and environmentally responsible manner. To this end, in 2008 the IEA established the IEA International CCS Regulatory Network (Network) as a forum for sharing knowledge amongst regulators and policy makers.[1] This publication, the IEA *Carbon Capture and Storage Legal and Regulatory Review (CCS Review)*, was launched in October 2010 in response to a suggestion made at the Network's second meeting (Paris, January 2010) that the IEA produce a regular review of CCS regulatory progress worldwide.

The *CCS Review* aims to help countries develop their own regulatory frameworks by documenting and analysing recent CCS legal and regulatory developments from around the world. It is produced approximately every 12 months, to provide an up-to-date snapshot of global CCS regulatory developments.

Analysing trends

The *CCS Review* gathers contributions by national, regional, state and provincial governments, at all stages of CCS regulatory development. The first half of each contribution provides an overview of CCS advances since the last edition and those expected to occur in the following 6 to 12 months, with links provided to publicly available documents. The second half of each contribution addresses a particular theme, such as long-term liability for stored CO_2. Where a contributor is new to the *CCS Review*, an overview of CCS legal and regulatory developments to date is also provided, to give context for future editions. Each contribution is limited to about two pages, to ensure the information is concise and easy to consult.

To introduce each edition, the IEA provides a brief analysis of key advances and trends. This analysis is informed by the contributions, but themes discussed may be relevant beyond the jurisdictions mentioned. In addition to contributions from governments, the *CCS Review* includes contributions from leading international and academic organisations engaged in CCS regulatory activities. Each contributor is given the opportunity to comment on the IEA analysis before the *CCS Review* is released on the IEA CCS website (www.iea.org/topics/ccs/ccslegalandregulatoryissues/).

[1] The Network provides a forum for stakeholders to discuss global developments via topical web-based seminars and annual meetings in Paris.

The fifth edition of the CCS Review

The theme for this fifth edition of the *CCS Review*, discussed in the second part of contributions is the process for permitting CO_2 storage projects in various jurisdictions. Contributions were received from 16 governments and 2 international CCS organisations, as set out below.

Countries

Australia
Belgium
Canada
Germany
Japan
Netherlands
New Zealand
Norway
Poland
Switzerland
United Arab Emirates
United Kingdom
United States

Regional jurisdictions

Alberta
British Columbia
European Union
Saskatchewan

Organisations

Global CCS Institute
IEA Greenhouse Gas R&D Programme

Further information

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Introduction

Since the first edition of the IEA CCS Legal and Regulatory Review in 2010, activity in the regulation of CO_2 storage and CCS more broadly has shifted from creating and implementing frameworks to the permitting of projects within these frameworks. The pace of activity has slowed as early moving jurisdictions have implemented their legislative and regulatory frameworks, while fewer jurisdictions are in the development and drafting phases.

Six jurisdictions have now permitted, or are in the process of permitting, CO_2 storage projects under CCS or CO_2 storage legislation. Jurisdictions will learn from the experience of permitting these first projects which will help to streamline future legislation or inform reviews of existing frameworks. However, to date there is not enough experience to accurately assess the suitability and effectiveness of legal frameworks. Indeed, a recent review of the EU CCS Directive, under which only one project has been permitted, found that there was insufficient experience to meaningfully assess the Directive.

Nonetheless, early mover projects are providing valuable insights for legislators and regulators. Over the past five years, seven CO_2 storage projects have been permitted under specific CO_2 storage legislation; while a further three planned projects have been awarded rights or access to the subsurface pore space for exploration or the storage CO_2.

This front section of the *Review* describes the permitting processes in four jurisdictions, highlighting common and divergent aspects of the approaches taken. The four featured jurisdictions have been home to some of the first projects to be permitted or apply for permitting under CO_2 storage specific legislation.

Key aspects of permitting

Generally, there are two main categories of permits relating specifically to CO_2 storage, those relating to the operation of storing CO_2 and those relating to rights to access and use the pore space or subsurface.

Most jurisdictions issue permits which regulate the **operation** and management of CO_2 storage projects. These permits are typically concerned with ensuring the storage of CO_2 is safe and effective. They generally cover a range of operational matters including risk management, MMV requirements, closure and post closure requirements, and the financial stability of the proponent or operator.

The second type of permit often required for CO_2 storage provides the right to **access** the pore space or subsurface in which the CO_2 is to be stored. Where pore space or the mineral rights are owned by the state, access can be granted through various instruments such as leases or tenure agreements. Where the rights to the subsurface are held privately, access is usually negotiated through private contracts.

The processes for obtaining access and rights to the subsurface vary in different jurisdictions according to the treatment of the ownership of the subsurface, mineral rights and pore space. These differing approaches to the ownership of the pore space are borne out in the various permitting processes. In the US, the arrangements for mineral rights and subsurface property rights vary across the country and can be held privately, or by the state or Federal Government. Accordingly the arrangements for access vary but are often negotiated through private contracts.

Contrastingly, in the UK and the Province of Alberta the crown retains ownership of the pore space and grants access and rights to its usage. Accordingly CO_2 storage projects require a lease, demise or tenure agreement covering the pore space. The main considerations in granting access to the subsurface are:

- ensuring that the storage project does not jeopardise, interfere with or harm other legitimate uses of the subsurface
- ensuring the economical exploitation of subsurface resources.

Leases can also impose requirements on the project for site closure or insurance that must be held.

In certain jurisdictions projects will require a permit, or lease, to **explore** the suitability of a site for storing CO_2. The exploration and characterisation of potential storage resources often require activities such as drilling and undertaking seismic testing which require permits. Projects would often be unable to obtain a full CO_2 storage permit to cover the exploration as such permits usually will require a detailed understanding of the subsurface.

To overcome this issue, many jurisdictions have introduced an interim permit or interim lease which allows for exploration activities but not full CO_2 storage. Examples include the Agreement for Lease issued by The Crown Estate in the United Kingdom, the CO_2 storage exploration permit in the Netherlands, and the evaluation permit in the Province of Alberta, Canada.

These interim permits also give project proponents a level of confidence that a permit will eventually be issued. The full characterisation of a storage site can take a large investment of time and capital; therefore projects look for a degree of certainty that a full permit will be available if the site is appropriate.

Permitting processes – four examples

Netherlands

The ROAD project is currently undergoing the last stage of the permitting process in the Netherlands, and is also the only project having been permitted under the framework set out in the EU CO_2 Storage Directive.[2] The Netherlands has fully transposed the EU directive largely through amendments to its Mining legislation. In transposing the EU directive, the Netherlands has closely followed the text of the directive and therefore makes a useful case study for projects elsewhere in the European Union.

In the Netherlands, three permits are needed to undertake CO_2 storage: 1) an all-in-one permit, 2) an emissions permit, and 3) the CO_2 storage permit, which is the only permit unique to CO_2 storage projects.

The **all-in-one permit** from the Ministry of Economic Affairs covers the physical aspects of the full CCS process. The all-in-one permit is common to most commercial construction projects and ensures that, amongst other things, the physical infrastructure doesn't cause environmental harm.

CO_2 storage sites are also required to secure an **emissions permit** under the EU ETS. Again, this is not unique to CO_2 storage. Most potential emissions sources are required to secure an emissions permit and report emissions under the EU ETS, including facilities equipped with CO_2 capture and the CO_2-transport infrastructure also needs an emissions permit.

The **CO_2 storage permit** issued under the Mining Act is the primary permit for CO_2 storage projects. The storage permit in the Netherlands deals with operational aspects of a project and is completely derived from the EU Directive.

The primary requirements for the permit are that proponents are technically competent to undertake CO_2 storage and are able to offer financial security for damage. Applicants for the permit are required to submit plans for risk management, monitoring, corrective measures, site closure and the transfer of responsibilities of the site to the Competent Authority after closure. Furthermore, essential requirements for the storage permit are related to financial security for potential liabilities related to leakage of CO_2 and for the transfer of responsibilities to the Competent Authority.

Under amendments to the Mining Act, parties can apply for a CO_2-storage exploration permit which allows them to undertake drilling and other activities to gather information on the suitability of a subsurface reservoir. The exploration permit must define the exact timeframe and area of the exploration, and can only be refused to an applicant on certain grounds, such as technical or financial competence. The holder of an exploration permit, once they have demonstrated the suitability of the resource, has priority in being granted a CO_2 storage permit (Hambergand van der Weijden, 2011).

Not all projects will seek an exploration permit, as the potential storage site may already be sufficiently characterised to apply for a CO_2 storage permit. The ROAD project, for example, did not need an exploration permit as it intends to store the CO_2 in a depleted gas field which was extensively characterized during its operations (Jonker, 2013). Therefore a permanent CO_2 storage-permit might be obtained without a prior exploration permit.

[2] Directive 2009/31/EC of the European Parliament and of the Council of 23 April 2009 on the geological storage of carbon dioxide and amending Council Directive 85/337/EEC, European Parliament and Council Directives 2000/60/EC, 2001/80/EC, 2004/35/EC, 2006/12/EC, 2008/1/EC and Regulation (EC) No 1013/2006

United Kingdom

CO_2 storage projects[3] in the UK need to secure both permission to undertake a CO_2 storage project, and access to the pore space in which the CO_2 will be stored.

Permission to undertake the project is given through a Carbon Dioxide Storage License (License) and Carbon Dioxide Storage Permit (Permit), both issued by the Secretary of State for the Department Energy and Climate Change (DECC). Initially, the project is granted a License which allows it to appraise potential storage sites and select a suitable site for the project. Once a site is selected, the project then applies for a Permit which allows it to undertake the CO_2 injection and storage.

While the project is being issued its License, it will also seek an Agreement for Lease (AfL) from The Crown Estate. The AfL and the subsequent Lease convey the project the right to undertake different activities in the pore space in which the CO_2 will be stored. The Lease also provides the project the right to undertake activity related to CO_2 on a specified area of the seabed. The area of the seabed covered by the Lease does not necessarily sit directly above the pore space. This can lead to Leases for storage which overlap Leases for other purposes. The interface between overlapping leases is managed by commercial arrangements between the relevant parties.

The AfL is an exclusive, time limited option over a Lease for a specified area of the pore space in the seabed. The AfL allows the project to appraise a potential storage site prior to applying for a Permit from DECC; and provides the time necessary for the project to be issued a Permit from DECC. Once the project has been issued a Permit, it will exercise the option provided by the AfL and be granted a Lease to inject and store CO_2 in the specified area of the seabed.

The Lease will be for the specific pore space under the seabed in which the CO_2 will be stored, and is limited in time to the period of construction, operation, closure and post closure monitoring. The conditions for the Lease are negotiated when the AfL is granted to allow the project to quickly secure the Lease once it has a Permit.

United States

CO_2 storage projects in the United States require a Class VI well permit issued by the Environmental Protection Agency under the Underground Injection Control (UIC) program or by the competent state authority if the state has been given primacy in regulating Class VI wells.

The UIC program regulates the construction, operation and closure of wells used for the injection of substances for storage or disposal underground. The UIC program is primarily intended to protect underground sources of drinking water from pollution from substances being injected in to the subsurface.

There are six different well types, or classes, under the program. Class VI regulates the storage of CO_2 underground, while Class II regulates the injection of CO_2 for enhanced oil recovery (EOR).

To date, six Class VI permits have been issued, all in the State of Illinois. Four permits were issued to the now cancelled FutureGen project, one to the Illinois Basin Decatur Project (IBDP), and one to the Illinois Industrial CCS project (IL-ICCS).

[3] Two projects, Peterhead and White Rose, were recently moving through the permitting processes in the United Kingdom; however, neither project has yet completed the permitting process and it is not yet clear whether either project will continue following the November 2015 decision to withdraw the £1 billion available through the CCS Commercialisation programme. Nevertheless, these two projects illustrate the permitting process in the United Kingdom.

In order to satisfy the requirement of protecting underground sources of drinking water under the UIC, Class VI wells require:

- extensive site characterization
- wells to be constructed using materials that are compatible with and can withstand contact with CO_2 over the life of the CO_2 storage project
- comprehensive monitoring of all aspects of well integrity, CO_2 injection and storage, and groundwater quality during the injection operation and the post-injection site care period
- demonstration of the availability of funds for the life (including post-injection site care and emergency response) of the CO_2 storage project.

To be awarded a Class VI permit, projects must submit an application to the EPA that includes plans for the well construction, details of the subsurface characterisation, plans for monitoring and verification, and evidence of financial security to cover the project. Once the EPA has approved the project and the project plans, there is a public hearing and a public comment period before the final permit is issued.

CO_2 capture projects can also provide CO_2 for injection for enhanced oil recovery (EOR) rather than undertaking a dedicated geological storage project. The injection of CO_2 for EOR is regulated under Class II, a separate but parallel well class under the EPA UIC. Class II wells are only used to inject fluids associated with the recovery of oil and gas. There are currently approximately 180,000 Class II wells in the United States, whereas only 6 permits have been issued under Class VI. Class VI wells are subject to a number of different requirements to Class II wells which aim to ensure the long term effectiveness of the storage.

The rights to use of the pore space in the United States are generally held by the pore space owners which can be states, the Federal Government or private individuals. Access to and the rights to exploit the subsurface are generally governed by contract rather than through permits allowing access and rights to storage as in jurisdictions where rights to the subsurface are leased.

The EPA also requires projects injecting CO_2 for storage are also required to report under subpart RR of the Greenhouse Gas Reporting Program. Projects are required to submit a monitoring and verification plan and then during operation report the volumes of CO_2 received, injected, sequestered and emitted from the subsurface. Any Class VI well is automatically required to report under subpart RR; however exemptions can be given to projects undertaken for research and development.

Province of Alberta, Canada

In Canada, CCS projects located onshore are under the jurisdiction and subject to the regulations of the provincial governments. In the Province of Alberta, Shell Canada Ltd. is the first operator to be granted carbon sequestration leases for the Quest CCS project.

Projects in Alberta are required to obtain a **lease, or tenure agreement, for the use of the pore space** from the Government of Alberta Department of Energy and operational approvals from the Alberta Energy Regulator (AER) for the injection of the CO_2.

In Alberta, the pore space under Provincial and freehold land is the property of the Crown in right of Alberta and is leased by the Government of Alberta through tenure agreements. The *Carbon*

Capture and Storage Statutes Amendment Act, 2010[4] clarified that the pore space is retained by the Provincial Crown irrespective of mineral rights ownership.

The Alberta Department of Energy may grant a prospective project an **evaluation permit**, which is a form of tenure agreement or lease, granting the right to conduct evaluations and testing, including injection, to determine the suitability of the subsurface reservoirs. The evaluation permit lasts for five years and is non-renewable.

The actual storage of CO_2 in the subsurface requires a **carbon sequestration lease** which is also a tenure agreement between the proponent and the Government of Alberta. The carbon sequestration lease allows for the storage of CO_2 in the given pore space. The carbon sequestration lease is valid for 15 years and can be renewed for further periods of 15 years. In their application for a lease, projects submit MMV and closure plans which must be renewed at least every three years.

The operational approvals for a CO_2 storage project in Alberta are issued by the Alberta Energy Regulator. The AER approvals cover the physical and operational aspects of the project including injection schemes and pipelines. Projects apply for operational approval from the AER once they have been granted a carbon sequestration lease.

[4] The Carbon Capture and Storage Statutes Amendment Act, 2010 (RSA 2000 cE-10)

Country contributions

Australia

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Part 1: Developments in 2014

The Australian Government's Offshore Petroleum and Greenhouse Gas Storage Act 2006 (OPGGSA) provides a legal framework that establishes a title system for pipeline transportation, injection and storage of Greenhouse gas (GHG) substances in geological formations in the Commonwealth waters of Australia's offshore areas three nautical miles from the coastline to the boundary of Australia's Exclusive Economic Zone.

Major features of the legislation include:

- the provision of access and property rights through a title system similar to that used for petroleum for exploring for and using GHG storage formations and sites
- ensuring safe and secure storage
- mechanisms for managing interactions with the petroleum industry
- site closure and the treatment of long-term liability.

In relation to access and property rights, the OPGGSA provides for the issue of invitations to apply for assessment permits through an acreage release on either a work program bid or cash bid basis, followed by assessment of bids against publicly available criteria and then issue of permits to successful applicants. Conditions of the title would also be determined at this time.

All current legislation, regulations and guidelines governing the offshore GHG Storage industry can be found at: www.nopta.gov.au/legislation/index.html

In practice most of this regulatory regime is yet to be tested. To date, one offshore GHG assessment permit has been granted to the State Government of Victoria for a permit area offshore from Victoria. This followed the release of a number of areas around offshore Australia for bidding for GHG assessment permits between 2009 and 2012.

Developments expected in next six-twelve months

To enable exploration of additional prospective sites offshore from Victoria the Australian Government released for bidding GHG storage assessment acreage in August 2014. This will allow GHG storage explorers to bid for the necessary exploration permits to assess potential storage formations, as supported by the OPGGSA.

More information on the acreage release including guidance material for requirements and assessment of bids for GHG Assessment Permits can be found at the Australian Government's website at: www.industry.gov.au/resource/LowEmissionsFossilFuelTech/Greenhouse-Gas-Storage-Acreage-Release/Pages/default.aspx

Part 2: How do you issue a CO_2 storage (or CCS) permit?

The regime for awarding titles for offshore GHG Storage in Commonwealth waters is administered by the Australian Government through the Responsible Commonwealth Minister (RCM) who is currently the Minister for Industry.

The National Offshore Petroleum Titles Administrator (NOPTA) and the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) perform regulatory functions related to offshore GHG Storage activities.

The RCM makes the major decisions under the OPGGSA concerning the granting of GHG titles, the imposition of title conditions and the cancellation of titles. Other key functions and powers of the RCM include the release of offshore GHG storage acreage areas and assessment of bids for these areas.

NOPTA is responsible for the day-to-day administration of GHG titles in offshore areas and is the point of contact for matters pertaining to offshore titles administration in Commonwealth waters.

NOPTA's key functions include:

- providing information, assessments, analysis, reports and advice to the RCM
- managing the collection, administration and release of data
- facilitating life of title administration, including RCM consideration of changes to permit conditions, and approval and registration of transfers and dealings associated with offshore GHG titles maintaining the registers of petroleum and GHG storage titles.

More information on NOPTA can be found at: www.nopta.gov.au

NOPSEMA is the regulator of safety management of GHG Storage operations in Commonwealth offshore areas. More information on NOPSEMA can be found at: www.nopsema.gov.au

Belgium

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Part 1: Developments in 2014 and developments expected in next six to twelve months

In Belgium, the EU CO_2 Storage Directive has to be transposed by the three Regions (the Flemish Region, the Walloon Region and the Brussels Capital Region) for onshore storage and by the Federal Government for offshore storage.

In 2014 there have only been regulatory developments in the Flemish Region.

The Flemish Government has adopted an Implementing Act on 6 June 2014[5], providing more detailed rules for the provisions on the geological storage of CO_2 in the Flemish Parliament Decree of 8 May 2009.[6] The Flemish Government Implementing Act provides more detailed rules on the permitting procedure for exploration and storage permits, on CO_2 stream acceptance criteria, on inspections, on financial securities, on the transfer of responsibility and the financial contribution from the operator, on monitoring requirements after the transfer of responsibility and on third-party access to CO_2 transport networks and storage sites.

In the next six to twelve months, some developments are expected with regard to the ratification of the 2007 OSPAR Convention CCS amendments and the 2009 London Protocol CCS amendment. In Belgium, both the 2007 OSPAR Convention CCS amendments and the 2009 London Protocol CCS amendment have to be ratified by the Federal Government and the three Regions (the Flemish Region, the Walloon Region and the Brussels Capital Region).

The Flemish Region has started the ratification process of both the 2007 OSPAR Convention CCS amendments and the 2009 London Protocol CCS amendment. Ratification of these amendments by the Flemish Region is expected in 2015.

Part 2: How do you issue a CO_2 storage (or CCS) permit?

The Federal Government (for offshore storage) and the Brussels Capital Region have both conducted a geological study that proves the total absence of geological storage capacity on their territory. As a result, they did not have to transpose the provisions of the EU CO_2 Storage Directive that are directly related to the geological storage itself. No CO_2 storage permits will be issued by the Federal Government (for offshore storage) or by the Brussels Capital Region.

In the Flemish Region, a CO_2 storage project operator will need two different permits: a storage permit pursuant to the Flemish Parliament Decree of 8 May 2009 on the deep subsoil[7] (and its Implementing Act), and a combined environmental and building permit pursuant to the Flemish Parliament Decree of 25 April 2014 on the combined environmental and building permit[8] (and its

[5] Belgian State Gazette of 9 October 2014, page 79244.
[6] Belgian State Gazette of 6 July 2009, page 45942, and Belgian State Gazette of 16 July 2009, page 49616.
[7] Belgian State Gazette of 6 July 2009, page 45942, and Belgian State Gazette of 16 July 2009, page 49616.
[8] Belgian State Gazette of 23 October 2014, page 82085.

Implementing Act). Both permits are issued by the Flemish Government. No other approvals or permits from other levels of government are required for a CO_2 storage project.

Within 240 days after the application for a storage permit, the Flemish Government has to either decline the application, or issue a draft storage permit which it needs to send to the European Commission for review. Within four months after receipt of the draft storage permit, the Commission may issue a non-binding opinion on it. The Flemish Government then has 120 days to make a final decision on the storage permit application. As regards the combined environmental and building permit, the Flemish Government needs to decide within 105 to 120 days after the permit application.

The provisions of the EU CO_2 Storage Directive on permanence and safety of a proposed storage site, on site characterisation and on monitoring are integrated in the Flemish Parliament Decree of 8 May 2009 on the deep subsoil.

Due to the uncertainty about realistic storage capacity in the Flemish Region and the existence of nearby offshore storage capacity in the Dutch, British and Norwegian parts of the North Sea, no permit applications are expected for CO_2 storage in the Flemish Region in the near or foreseeable future.

In the Walloon Region, a CO_2 storage project operator will also need two different permits: a storage permit issued by the Walloon Government pursuant to the Walloon Parliament Decree of 10 July 2013 on the geological storage of CO_2[9] (and its Implementing Act), and an environmental permit pursuant to the Walloon Parliament Decree of 11 March 1999 on the environmental permit, as amended.[10]

The provisions of the EU CO_2 Storage Directive on permanence and safety of a proposed storage site, on site characterisation and on monitoring are integrated in the Walloon Parliament Decree of 10 July 2013 on the geological storage of CO_2.

[9] Belgian State Gazette of 3 September 2013, page 60561.

[10] Belgian State Gazette of 3 September 2013, page 60570.

Canada

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Part 1: Developments in 2014

2014 was a banner year for CCS in Canada with the official launch of SaskPower's Boundary Dam CCS project[11], the world's first large-scale power station equipped with CCS technology. This project, funded in part by a CAD 240 million (Canadian dollars) contribution from the Government of Canada and expected to capture and store up to 90% of its CO_2 emissions (or one million tonnes of CO_2 per year), is now the cleanest coal-fired power station in the world. During the official launch ceremony, held on 2 October 2014 and attended by representatives from around the world, the Boundary Dam project was hailed by former IEA Executive Director Maria van der Hoeven as "a momentous point" in the history of the development of CCS.

In addition to progress in large-scale demonstration projects, important research and development on next-generation CCS technologies continued in 2014 at Canada's national CanmetENERGY Laboratories, including work on more efficient and less costly CO_2 capture methods, CO_2 injection, and CO_2 monitoring, measurement and verification in collaboration with national and international partners.[12]

In conjunction with the work of the federal government, Canada is also home to a growing contingent of cutting-edge private-sector CCS technology developers such as Inventys, Shell Cansolv, CO_2 Solutions, and HTC Purenergy Solutions who are developing world-leading products to improve the economic viability of large-scale CCS deployment.

Canada also remains active internationally on CCS, participating in a variety of bilateral and multilateral fora such as the Canada-U.S. Clean Energy Dialogue, the Carbon Sequestration Leadership Form, and the Clean Energy Ministerial. This involvement is further strengthened by the signing of bilateral agreements in 2014 such as the U.S. Department of Energy-Natural Resources Canada MoU on energy cooperation, and a renewal of the Canada-UK Joint Statement on CCS. Canada also maintains bilateral CCS-related arrangements with government entities in Japan, China, South Korea, and Mexico among others.

Work also continues with the International Standards Organization to prepare international standards for CO_2 capture, transportation and geological storage. Canada's Province of Alberta chairs the Technical Committee (TC265) responsible for this work, with Canada's Canadian Standards Association (CSA) sharing twinned secretariat duties with the Standardization

[11] More information on SaskPower's Boundary Dam project can be found at http://www.saskpowerccs.com/.

[12] More information on CanmetENERGY's CCS-related research and development can be found online at http://www.nrcan.gc.ca/energy/coal/carbon-capture-storage/4295.

Administration of China. Several working draft standards have been developed in 2014, with work continuing in 2015.[13]

In addition, several first-mover provinces in Canada such as Alberta, Saskatchewan, and British Columbia have submitted individual responses to this publication on recent and expected developments in their jurisdictions below. Outside of these three provinces, work also continues in the Province of Nova Scotia with *CCS Nova Scotia*, a non-profit public-private research consortium, exploring the technical and economic feasibility of CCS within its borders. With financial support from the Government of Canada through the ecoENERGY Innovation Initiative, *CCS Nova Scotia* is currently analysing seismic data, as well as cores and wireline well logs from an exploratory well that was drilled in 2014 to develop a report on CO_2 storage opportunities in the Province, with an expected completion date of early 2015.

Developments expected in next six-twelve months

In addition to continued research, development and demonstration on CCS technologies at federal, provincial and private sector laboratories, two large-scale demonstration projects in Canada are projected to begin operations in 2015:

- The Quest project, a joint venture between Shell Canada Energy, Chevron Canada Limited, and Marathon Oil Canada Corporation, expects to capture up to one million tonnes of CO_2 per year from an oil sands bitumen upgrader in the Province of Alberta for geological storage in a saline aquifer
- The Alberta Carbon Trunk Line project will include a pipeline network constructed by Enhance Energy Inc., with captured CO_2 expected from both an Agrium Inc. fertilizer plant (beginning in 2015) and a North West Redwater Partnership oil sands upgrader/refinery (beginning in 2017). With these two sources of CO_2, this project is expected to capture and store up to 1.8 million tonnes of CO_2 per year, with a total pipeline capacity of up to 15 million tonnes per year possible.

In terms of regulatory development, Environment Canada's regulations for coal-fired power generation, which include provisions for CCS and which were posted in 2012, will officially take effect on July 1st, 2015. Titled "Reduction of Carbon Dioxide Emissions from Coal-Fired Generation of Electricity Regulations", the regulation sets an emissions performance standard of 420 t/GWH for coal-fired power generation and will affect any new units, or older units that have reached the end of their useful life (generally 50 years from the commissioning date). Environment Canada continues its work to inform and support the implementation of this regulation.

Part 2: How do you issue a CO_2 storage (or CCS) permit?

Generally speaking, the permitting of CO_2 storage projects in Canada is within the jurisdiction of individual provinces and territories. In the Province of Nova Scotia for example, CCS activities are regulated under the Activities Designation Regulations made under section 66 of Nova Scotia's

[13] More information on ISO/TC 265 can be found online at http://www.iso.org/iso/home/standards_development/list_of_iso_technical_committees/iso_technical_committee.htm?commid=648607.

Environment Act.[14] Several first-mover jurisdictions in Canada who have developed, or are developing, CCS specific regulations have provided individual entries to this publication below.

In some cases, such as when a project crosses international or interprovincial borders, or when a project involves lands owned by the Government of Canada, or when a project involves certain, defined lands in Canada's far north, the Government of Canada assumes regulatory jurisdiction through the National Energy Board (NEB). Further details on the NEB's role and mandate can be found on the NEB's website[15] with additional details on the NEB's permitting process found within the Filing Manual.[16]

[14] More information on Nova Scotia's CCS regulations and permitting can be found within Nova Scotia's Environment Act at http://www.novascotia.ca/just/regulations/rxaa-l.htm#env.
[15] National Energy Board website: https://www.neb-one.gc.ca/bts/whwr/index-eng.html.
[16] The National Energy Board's *Filing Manual* can be found online at https://www.neb-one.gc.ca/bts/ctrg/gnnb/flngmnl/flngmnl-eng.pdf.

Germany

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Part 1: Developments in 2014

The German CCS Law contains – apart from a restriction of the annual storage capacity - a time limit for applications for storage permits. Applications have to be submitted until 31 December 2016. Germany is planning to extend this time limit. However, new demonstration projects have not been initiated after the abandonment of Vattenfall's demonstration project Jänschwalde in Brandenburg in 2011.

On federal states' level several states have already enacted or have initiated legislative proceedings to enact laws that fully or partly prohibit CO_2 storage on their territory (following so called states' clause in federal CCS Law).

Projects:

Germany is continuing efforts to support the ROAD Demonstration Project in Rotterdam/ Netherlands.

CO_2 storage in the pilot storage site in Ketzin/Brandenburg operated by the German Research Centre for Geosciences (GFZ) ended in August 2013 and operational installations have meanwhile been deconstructed. A final project ("Complete") deals with monitoring the first closed CO_2 storage site (at pilot scale) and will deliver knowledge on post-injection monitoring, long term site behaviour and site abandonment.

The pilot project for CO_2 capture with oxyfuel technology of Vattenfall at Schwarze Pumpe, Brandenburg, was officially decommissioned on 1 September 2014. Vattenfall signed a knowledge sharing agreement with SaskPower to use for the CCS plant in Boundary Dam, Saskatchewan, Canada.

Developments expected in next six-twelve months

Initiate proceedings to amend CCS Law in order to extend time limit for application of storage permits.

Continue efforts towards ROAD Demonstration in Netherland, dependant on future decisions of project partners

Part 2: How do you issue a CO_2 storage (or CCS) permit?

Based on the Directive 31/2009/EC the German CCS Law contains detailed provisions for applications for a storage permit including a proof of financial competence and technical knowledge, information on the expected effects in the underground and plans for corrective measures, monitoring and post-closure. The permit is issued in a planning approval procedure based on highest environmental standards. Permits are issued by the competent authorities of the federal states as those are generally administering federal laws.

Japan

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Part 1: Developments in 2014

Accumulate knowledge about the marine ecosystems in waters around Japan, which is essential for the environmental impact assessment review.

Accumulate knowledge about leaked CO_2 detection technology for review of the monitoring plan for permits.

Discuss criteria for shifting monitoring to an advanced level in case of potential leakage.

Developments expected in next six-twelve months

Continue work on accumulating knowledge about the marine ecosystems in waters around Japan and leaked CO_2 detection technology, as well as discussing criteria for shifting monitoring level.

The Netherlands

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Part 1: Developments in 2014

The Netherlands ratified the amendment to Article 6 of the London Protocol in November 2014.

Further on, there have not been significant developments legally or regulatory in 2014.

The announced long term CCS-strategy to re-inforce CCS In the *Energy Agreement for Sustainable Growth* (September 2013) has been developed by the Central government in 2014 and will be input for the *Dutch Energy report 2015*.

Developments expected in next six-twelve months

Legislation to amend the Civil Code with regard to long-term liability for CO_2 storage is still ongoing and expected to be in consultation.

Preparation of final permits and decisions regarding the ROAD-project is ongoing. Special attention is given to the spatial decision and the views of interested parties on the draft spatial decision that was published late 2011. The final spatial decision will be published before the end of 2015.

Part 2: How do you issue a CO_2 storage (or CCS) permit?

The first draft CO_2-storage permit in accordance with the EU CCS Directive was published in December 2011. The permit regards the storage of CO_2 from the ROAD project (Rotterdam Opslag en Afvang Demonstratie). The final CO_2-storage permit was published at July 29th 2013.

New Zealand

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Part 1: Developments in 2014

The New Zealand Government supports the global uptake of CCS internationally, especially by large carbon dioxide (CO_2) emitters, because we view it as a potentially significant climate change mitigation technology.

This year, the Ministry of Business, Innovation and Employment reviewed research on possible regulatory frameworks for CCS in New Zealand. The research identified possible areas for improvement for CCS regulation, and officials are considering what changes, if any, may be required for the regulatory regime for CCS.

However, it is worth noting that the likelihood of a CCS project being undertaken in New Zealand in the next 10 years is low. New Zealand has relatively few point sources of CO_2 emissions and a far higher renewable energy contribution to electricity generation than many countries. In 2013, a total of 75% of electricity generation came from renewable sources, the fourth highest in the OECD. This means that the potential contribution of CCS for climate change mitigation in New Zealand is limited.

Developments expected in next six-twelve months

The New Zealand government will continue to keep a watching brief on CCS development and on how this could be best utilised in New Zealand.

New Zealand will also continue to support the global development of CCS.

Part 2: How do you issue a CO_2 storage (or CCS) permit?

No CCS permits have been issued. There are currently no plans to engage in CCS in New Zealand.

Poland

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Part 1: Developments in 2014

The act amending the act Geological and Mining Law came into force on 27 September 2013 (Journal of Laws 2013 item 1238).[17] The act is transposing the CCS Directive into Polish law. The regulation applies only to the demonstration projects.

To the present, executive acts have been prepared:

- the regulation about the detailed requirements concerning the plan for geological storage of carbon dioxide (the regulation of 9 May 2014, Journal of Laws 2014 item 591)[18]
- the regulation about hydrogeological and geological-engineering documentation prepared for the needs of geological carbon dioxide storage (the regulation of 9 May 2014, Journal of Laws 2014 item 596)[19]
- the regulation about the areas where the location of the storage complex of carbon dioxide is allowable (the regulation of 23 September 2014, Journal of Laws 2014 item 1272)[20]
- the regulation about the register of mining areas and closed geological storages of carbon dioxide (the regulation of 16 October 2014, Journal of Laws 2014 item 1469).[21]

So far no applications for the permits (in Poland it is kind of 'license') for geological storage of carbon dioxide were submitted to Ministry of the Environment.

All of the regulations which are described above are available on the website of the Online System of Legal Acts of the Polish Sejm.

Developments expected in next six-twelve months

Works continue on the other executive regulations, which will enable the effective application of the provisions of the CCS, they concern: detailed requirements about exploitation of geological storage of carbon dioxide, stream of carbon dioxide and the monitoring of the storage complex of carbon dioxide; and financial security and financial mechanism.

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[17] Journal of Laws 2013 position 1238 [link]
[18] Journal of Laws 2014 position 591 [link]
[19] Journal of Laws 2014 position 596 [link]
[20] Journal of Laws 2014 position 1272 [link]
[21] Journal of Laws 2014 position 1469 [link]

Both of these drafts of regulations were prepared and the legislative process is continued.

We might predict that all the legislative works on the executive acts will be completed in 2015.

Part 2: How do you issue a CO_2 storage (or CCS) permit?

In compliance with the provisions of the Geological and Mining Law, the prospecting and exploration of storage complex of carbon dioxide is conducted based on permits (licenses) granted by the Polish Minister of the Environment. Any legal entity may apply for a permit (license) provided that they comply with the legal requirements. The regulations proposed in Poland will only be applied to the implementation of CCS demonstration projects.

The activity of the geological storage of carbon dioxide is based on the storage permit - an administrative decision. This document describes, establishes and defines the type and the method of activity, the area where this activity will be conducted, the time limit, the scope and other requirements regarding environment protection. The main information for the license will be described in the applications. These applications should be reviewed during two months from their submission. The applications for the storage permits need to be sent to the European Commission which has to give their opinion. Other consulting bodies are: the Minister of the Economy and the local administration.

One should also mention that the company which is interested in the geological storage of carbon dioxide must have: a proof of the financial security and a proof of the financial mechanism and the plan for geological storage of carbon dioxide which must be approved by the State Mining Authority.

Switzerland

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Part 1: Developments in 2014

There are no ongoing legal and regulatory developments regarding CCS.

Developments expected in next six-twelve months

There are no legal and regulatory developments expected in the upcoming six to twelve months.

Part 2: How do you issue a CO_2 storage (or CCS) permit?

Swiss Federal Law does not provide specific regulation concerning the permit procedure of CO_2-storage projects in particular, but provides a legal framework for the development of construction projects in general.

Swiss Federal Law only provides the legal framework for spatial planning (article 75 of the Swiss Federal Constitution).[22] The competence for implementing regulations concerning spatial planning resides with the member states of the Swiss Confederation, the cantons (article 10 paragraph 1 Spatial and Planning Act).[23] Granting permits for subsurface planning or construction fall within the cantons' remit as well. The mandatory procedures may vary from one canton to another. Whereas construction permits are usually being granted by the appropriate municipal authorities.

The conduct of an environmental impact assessment (EIA) is required for installations that could cause substantial pollution to environmental areas to the extent that it is probable that compliance with regulations on environmental protection can only be ensured through measures specific to the project or site (article 10*a* and 10*b* Environmental Protection Act).[24] EIA is not a procedure of its own but part of the general permit procedure. The decision to order an EIA is taken by the competent authorities on basis of the annex of the Ordinance of the Environmental

[22] http://www.admin.ch/ch/e/rs/c101.html
[23] http://www.admin.ch/ch/f/rs/c700.html; in French
[24] http://www.admin.ch/ch/e/rs/c814_01.html

Impact Assessment[25] that lists the types of installations requiring EIA. To date, CO_2-storage projects are not listed in the annex. Notwithstanding, the competent authority may as well order to conduct an EIA if the applicant or the cantonal authority in environmental matters requires so.

Irrespective of whether to conduct an EIA or not, the project has to comply with the Swiss environmental regulations and the spatial planning regulations as well as the applicable cantonal regulations.

[25] http://www.admin.ch/ch/f/rs/c814_011.html; in French

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Part 1: Developments in 2014

The regulation of carbon capture, utilization and sequestration (CCUS) in Abu Dhabi is closely related to the regulation of the oil and gas sector as the development of CCUS is primarily driven by the interest on CO_2-EOR at this moment. By replacing traditional gas-EOR with CO_2-EOR, Abu Dhabi is aiming to reduce its natural gas imports for domestic power and water production while meeting its climate change mitigation commitments.

Under Article 23 of the United Arab Emirates (UAE) Federal Constitution, the natural resources of each Emirate in UAE are considered the public property of that Emirate. Consequently, each Emirate is entitled to pursue its own policies and regulations regarding the development of oil and gas within its borders, with the ruler in each Emirate retaining ultimate control over the development of its reserves. For Abu Dhabi, the Supreme Petroleum Council (SPC) directs oil and gas policy and regulates operations of this sector. Meanwhile, the Abu Dhabi National Oil Company (ADNOC) leads the day-to-day operations of oil and gas exploration and production through its 15 subsidiaries following SPC directives. While there is no comprehensive petroleum legislation in Abu Dhabi, there are a number of laws and decrees relevant to the industry, which include: Law No. 7 of 1971 on establishing ADNOC; Law No. 4 of 1976 on gas ownership; Law No. 2 of 1973 on petroleum ports; Law No. 8 of 1978 on the conservation of petroleum resources; and Law No. 1 of 1988 on establishing the SPC. Under the legislative framework, ADNOC is entitled to develop all underground assets, including hydrocarbon resources as well as pores, in the oil and gas fields. ADNOC oversees the ownership, organization and operation of oil and gas transmission and distribution infrastructure. Third parties may gain access to the oil and gas infrastructures by negotiating the terms and fees of access rights with ADNOC on contract basis. Project level activities are regulated by ADNOC through its mandate to manage all oil and gas projects in Abu Dhabi.

No standalone CCUS legislation has been established in Abu Dhabi at this moment as CO_2-EOR activities are regulated following the existing practice in the oil and gas sector. CO_2 was not classified in the environmental law and is now treated as one of the inputs for oil and gas production and is thus subject to ADNOC's regulation. Under this regulatory scheme, Abu Dhabi has initiated the Abu Dhabi CCUS project through a joint venture between ADNOC and Masdar, a wholly-owned subsidiary of the Abu Dhabi Government-owned Mubadala Development Company. The Abu Dhabi CCUS Project involves the capture of 800,000 tonnes of CO_2 per year from an Emirates Steel factory in Mussafah, an industrial zone near the Abu Dhabi city, and transportation of the CO_2 via a 45 km pipeline to the ADNOC reservoirs in Rumaitha and Bab for EOR. In November 2013, the ADNOC and Masdar Joint Venture awarded the Dodsal Engineering and Construction Group with a USD 122.5 million EPC contract to build the CO_2 compression and dehydration facilities in Mussafah and the pipeline to the ADNOC reservoirs. The project is targeted to start operating from 2016. In November 2014, the ADNOC-Masdar joint venture was launched into a company called Al Reyadah ("Leadership" in Arabic) to develop commercial-scale CCUS network in Abu Dhabi. The transformation of the joint venture will allow Abu Dhabi to

explore feasible strategies to align CO_2-stroage regulation with CO_2-EOR regulation once the post-Kyoto value proposition of CO_2-storage becomes clear after COP 21.

Other CCUS relevant activities in Abu Dhabi in 2014 include:

- In 19 October, the Abu Dhabi Education Council (ADEC) and Masdar Institute of Science and Technology won the bid to host the 14th International Conference on Greenhouse Gas Technology (GHGT-14), the primary meeting on CCUS research and development.
- In 5 and 6 November, the Global CCS Institute hosted its annual conference to coincide with the launch of its flagship Global Status of CCS report in Abu Dhabi.

Developments expected in next six-twelve months

Major progress of CCUS policy and regulation development in Abu Dhabi will be closely related to the preparation of national plans to be submitted for COP 21 in Paris as well as the expected value proposition of CO_2-storage in the post-Kyoto agreement. Major issues that may affect the directions of CCUS regulation in Abu Dhabi include:

- The amount and timeline of carbon reductions from CCUS as to be identified in the Intended Nationally Determined Contributions (INDC).
- The accounting measure of carbon reductions from CCUS to be concluded in or after COP21.
- The possibility of the introduction of a market-based carbon price for carbon reductions from CCUS in the post-Kyoto agreement.

Part 2: How do you regulate CCS projects?

The development and operation of CCUS projects in Abu Dhabi are currently governed following existing practice in the oil and gas sector. The project developers have to comply with both the relevant laws that regulate industrial activities (e.g. labor law, environmental law) as well as ADNOC's requirements for oil and gas development. For the Abu Dhabi CCUS project, the Masdar/ADNOC joint venture is responsible for delivering the CO_2 capture and transport parts of the project within the Guidelines of the Federal laws. The major regulatory requirements include:

Prior to Construction:

- An Environmental Impact Assessment (EIA) to be submitted and approved by the Environmental Agency of Abu Dhabi (EAD), which represents the Government. The EIA includes consultation with representative bodies and cultural heritage. Upon approval and prior to construction an Environmental Management Plan is submitted and approved.
- A Health, Safety and Environmental Impact Assessment (HSEIA) to be submitted and approved by ADNOC to meet its HSEIA Code of Practice (CoP) requirements. The HSEIA Phase 1 & 2 identifies the safety critical design elements and the mechanisms for their implementation and monitoring during the construction phase.
- As part of the Municipality and the Urban Planning Council construction permit, receipt of No Objections to the proposed construction from all concerned stakeholders.

Prior to Operation:

- An Operation EIA and HSEIA to be submitted and approved by EAD and ADNOC respectively in order to receive the necessary operating permits

The Abu Dhabi Company of Onshore Oil Operations (ADCO) is responsible for receiving the CO_2 and the downhole injection of CO_2 for EOR. This operation is performed in an operating ADNOC field which ADNOC self regulates.

United Kingdom

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Editorial note: The United Kingdom contribution was provided prior to the November 2015 decision that the £1 billion set aside for the CCS Commercialisation Programme would no longer be available.

Part 1: Developments in 2014

As reported in the 2014 edition, the UK continues to make considerable progress with the CCS Commercialisation Programme. The £1 billion capital funding, together with additional operational funding through the UK Electricity Market Reforms, to support the design, construction and operation of the UK's first commercial-scale CCS projects. Following projects being shortlisted in October 2012, the two preferred bidders, the White Rose Project and the Peterhead Project were awarded multi-million pound contracts to undertake Front End Engineering and Design (FEED) studies in December 2013 and February 2014 respectively. FEED is a programme of detailed engineering, planning and financial work to finalise and de-risk aspects of the proposal ahead of taking final investment decisions, and proceeding to construction.

The two projects are as follows:

White Rose (coal project)

The White Rose Project involves capturing around 90% of the carbon dioxide from a new super-efficient coal-fired power station at the Drax site in North Yorkshire, before transporting offshore and storing it in a saline rock formation beneath the North Sea.

The project developers are Capture Power Ltd. (a consortium of Alstom, Drax Power and BOC) and National Grid.

If built, the planned c.£2 billion state-of-the-art coal power plant with full CCS could provide clean electricity to more than 630,000 homes, capturing approximately 2 million tonnes of carbon dioxide per year. The proposal also includes the development of a large capacity pipeline - the Yorkshire Humber CCS Trunkline - which will have capacity for additional carbon capture projects in the area.

On 8 July 2014 the European Commission announced a €300 million (around £240 million) grant for the White Rose CCS project. The funding comes from the New Entrants Reserve (NER 300) programme managed by the European Commission, European Investment Bank and member states.

Peterhead (gas project)

The Peterhead CCS Project is in Aberdeenshire, Scotland. This project involves capturing around 85% of the carbon dioxide from an existing combined cycle gas turbine (CCGT) power station at Peterhead, before transporting it offshore and storing it safely in the Goldeneye depleted gas field 2.5km beneath the North Sea.

The project developer is Shell, with SSE. The Peterhead CCS project is the world's first planned CCS project on a gas power station.

If built, the project would capture 1 million tonnes of CO_2 each year and provide clean electricity to over half a million homes.

Following the FEED studies, in late 2015 the projects will take final investment decisions with the government taking funding decisions shortly after.

In August 2014 the UK Government published "Next steps in CCS: A Policy Scoping Document". This document develops an approach for the next phase of Carbon Capture & Storage projects in the UK. https://www.gov.uk/government/publications/ccs-policy-scoping-document. It solicited views across all facets of CCS, covering areas such as;

Financial Incentives & Electricity Market Reform: The Government's long-term vision for the electricity market, through its Electricity Market Reform programme, is to transition to a point where low carbon technologies can compete fairly on price. The Government has already noted its intention that any future Contract for Difference (CfD) allocation for CCS projects would take place through competitive project selection processes, wherever practical and effective, and noted that bilateral negotiation remains an alternative where such processes are not practical; it has also committed26 to further discussions with CCS developers on these issues.

In order to continue to make progress in the course of the remainder of 2014 and 2015, DECC will engage with developers on the design of a generic CCS CfD and options for the criteria which might be applied in any future allocation frameworks. Without prejudice to future decisions on the Levy Control Framework or any future allocation processes under the EMR enduring regime, this work should enable an appropriate suite of enabling architecture to be in place for CCS by 2016.

Financing CCS: The Government has recognised that raising finance for low carbon energy and other major infrastructure projects, including CCS, from traditional sources may be challenging, and therefore has a range of mechanisms available to support investors.

Transport and Storage infrastructure: Analysis shows that effective investment in and use of transport and storage infrastructure could deliver significant cost reductions.

Part chain projects: Looks at the possibility that early Phase 2 projects could be "part-chain" CCS projects; clarifies what "part-chain" refers to; and briefly outlines some of the issues affecting such projects.

Enhanced Oil Recovery: The Government is exploring with industry the extent to which CO_2-EOR could play a significant role in the UK's CCS deployment and maximise future recovery from the North Sea.

Industrial CCS: To meet the UK's longer term ambitions on climate change, carbon dioxide emissions from energy intensive industries will need to be substantially reduced. For some of these industries, CCS is likely to be a key part of the technology mix required to make such reductions.

Bio-CCS/Bioenergy with CCS: In the long term, combining bioenergy with CCS (BECCS) to produce negative emissions is predicted to offer a key route by which the UK could meet its 2050 targets.

Carbon Capture and Utilisation technologies: These could offer a route by which to make CO_2 a commodity rather than a waste product.

CCS Supply Chain: This is likely to be similar to those for other major energy infrastructure projects.

Knowledge Transfer: Knowledge transfer is a key philosophy which underpins the CCS Commercialisation Programme. CCS projects in receipt of Government funding will be expected to share their experience and learning with the wider industry to support development and cost reduction.

Underpinning Research, Development and Innovation: Continued research, development and innovation is a key way in which to further reduce the costs of CCS by creating better, cheaper components and processes.

Developments expected in next six-twelve months

Work is ongoing to address issues and policies associated with the CCS Policy Scoping document; this is a significant piece of work being undertaken over the next 12 months.

During this time it is proposed that final investment decisions (FID) should be made on the two commercialisation projects described above.

Part 2: How do you issue a CO_2 storage (or CCS) permit?

An Agreement for Lease (AfL) issued by The Crown Estate provides the time and rights for developers to obtain a license from DECC, appraise the prospective storage site and develop the detailed storage plan to underpin a permit application. The lease itself provides the rights to install, commission, operate and maintain storage infrastructure, and store CO_2 permanently in the permitted storage site. It also provides the time for the tenant to carry out closure, decommissioning and post closure monitoring obligations.

The Crown Estate will publicly advertise proposals to grant AfLs for a two month period on its website and in the newsletter of the Carbon Capture and Storage Association (CCSA). This process will give people notice that The Crown Estate intends to allocate an AfL to the site and therefore that the site will no longer be available to subsequent applicants. The notice will invite comments from interested parties.

Any such rights granted by The Crown Estate will be conditional upon an applicant obtaining a suitable carbon storage permit as the Lease is dependent on the permit from DECC or the Scottish Government (in relation to Scottish territorial waters around Scotland).

The Crown Estate awards rights for CO_2 storage through three documents: an Agreement for Lease (AfL), a lease and a pipeline lease (if necessary). The AfL grants to the holder a time limited exclusive option to proceed through to a pre-agreed lease once a number of conditions have been met, including obtaining a storage permit from DECC.

Anyone who wants to explore for, drill for or use a geological feature for the long term storage of CO_2 in the UK offshore area must hold a Licence issued under Section 18 of the Energy Act 2008. Licences are issued by the Secretary of State for DECC, except in respect of activities in the UK territorial sea (12 miles from the baseline) adjacent to Scotland, for which Scottish Ministers are the Licensing Authority. The Storage of CO_2 (Licensing etc..) Regulations 2010 (SI 2010/2221) http://www.legislation.gov.uk/uksi/2010/2221/pdfs/uksi_20102221_en.pdf provide more detail of the licensing regime for which the Secretary of State is the licensing authority.

References

http://www.legislation.gov.uk/uksi/2010/2221/pdfs/uksi_20102221_en.pdf

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/341995/Final_Version_Policy_Scoping_Document_PSD.pdf

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Part 1: Developments since mid-2013

USEPA Greenhouse Gas Reporting Program

On September 30 2014, EPA's Greenhouse Gas Reporting Program[27] released GHG data that was collected by facilities in 41 source categories during the 2013 calendar year. The Greenhouse Gas Reporting Program collects facility-level greenhouse gas data from major industrial sources across the United States. CCS-related source categories include CO_2 suppliers (subpart PP), underground injection of CO_2 (subpart UU), and geologic sequestration of CO_2 (subpart RR).

USEPA Underground Injection Control Program

The EPA's Underground Injection Control (UIC) Program[28] continues to implement the 10 December 2010 Geologic Sequestration (Class VI) Rule. Guidance documents finalized in 2012 and 2013 address Class VI site characterization, area of review evaluation and corrective action, testing and monitoring, project plan development, and well construction. An additional guidance, the Class VI Primacy manual was finalized and posted on EPA's website in 2014. These documents complement the Class VI Financial Responsibility guidance finalized in 2011. Also, in 2013 and 2014, EPA posted and sought public comment on draft guidance documents for: reporting, recordkeeping and data management (documents for both Class VI well owners or operators and Class VI permitting authorities), well plugging post-injection site care and site closure, and the Class II to Class VI transition guidance. All of these technical guidance documents support Class VI well permit applicants in complying with the final Class VI Rule requirements, and support permit writers in reviewing Class VI permit application submittals and developing protective Class VI permits.

As of January 2015, EPA has issued six final Class VI well permits in the State of Illinois in the United States. EPA is currently reviewing another Class VI permit application for a proposed project in the State of Kansas, and anticipates receipt of additional Class VI permit applications in 2015.

The EPA is currently the only U.S. regulatory authority that can issue Class VI permits. However, EPA has completed the review of the first Class VI state primary enforcement responsibility (primacy) application from the State of North Dakota and is preparing to make a decision

[27] http://www.epa.gov/ghgreporting/

[28] http://water.epa.gov/type/groundwater/uic/wells_sequestration.cfm

regarding that application. EPA anticipates that other states will be seeking Class VI primacy in the future.

Developments expected in next six-twelve months

EPA will continue its efforts related to assuring the safety and effectiveness of geologic sequestration including: developing technical guidance documents and informational materials for the Class VI Rule, working with states interested in implementing the Class VI Program, continuing to evaluate risks to drinking water sources and human health and the environment, evaluating Class VI permit applications and developing Class VI permits, and working to address other key policy issues.

An additional UIC Program technical guidance document is expected to be released for public comment during the next six to twelve month period addressing the Class VI requirements allowing injection depth waivers under specific conditions. In addition to finalizing the well plugging, post-injection site care and site closure guidance, and the Class II to VI transition guidance, a GS implementation manual to assist UIC Program Directors is also expected to be completed within this time period.

Part 2: How do you issue a CO_2 storage (or CCS) permit?

Class VI UIC Geologic Sequestration Permits

As of early 2015, EPA is the only regulatory authority in the United States that can issue Class VI Geologic Sequestration injection well permits. For Class VI permit projects, owners or operators of the proposed injection wells submit their permit applications to one of ten EPA Regional Offices depending on where the GS project is located. The EPA Regional Office conducts a completeness review, and then a technical evaluation is initiated. The permit application review is an iterative process, with continuous communication between an applicant and the permit writer in order to determine if additional material is needed in order to make a determination whether to approve or deny a permit application. When an affirmative decision is made, a draft Class VI permit is issued, public comment is taken, a public hearing may be held, and comments are evaluated before a final Class VI permit is issued allowing the construction of the well. The timeframe for each Class VI permit determination is site-specific and depends on the complexity of the project related to site-specific considerations such as geology, hydrogeology, area of review considerations, and other conditions at the injection site. The number and type of public comments received and needing to be addressed is also a determining factor in the timeframe for making a decision to issue a Class VI permit.

Regional jurisdiction contributions

Alberta

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Part 1: Developments since mid-2013

Since mid-2013, the Government of Alberta has put significant effort around better understanding the long term risks, and subsequent costs, associated with permanent storage of CO_2. Considering the long term perspective of CO_2 storage, the Government of Alberta introduced legislation (2011) to allow it to become the owner of captured CO_2 and assume the long-term liability for a CCS storage site where an operator has been issued a closure certificate. The Post Closure Stewardship Fund (PCSF) was introduced at the same time to offer the Government a mechanism to fund potential costs associated with long term liability for CO_2 storage sites thereby avoiding the Alberta public from bearing post-closure costs. Some of the potential uses of PCSF include ongoing monitoring of the CCS Storage site to ensure containment of the CO_2 and, remediation and/or reclamation activities in case of a leak event during the post-closure period.

In Alberta, CCS Operators are required to pay into the PSCF a fee per tonne of captured CO_2 injected at the rate established by the Minister of Energy. Establishing this fee per tonne is the current focus of Alberta's CCS program.

Alberta's CCS Regulatory Framework Assessment (RFA), developed over 18 months through an extensive multi-stakeholder initiative[29], provided some elements to consider when establishing this rate. Notably, the RFA recommends that the PCSF rate be set on a risk-based and probability weighted basis. In other words, each CCS project should be assessed individually, and PCSF rates would be set accordingly.

To further facilitate the complex task of determining what rate a CCS project operator would pay into the PCSF, a working group was established in June of 2013 and comprised of key domestic and international stakeholders from industry, government, academia and the environmental community. The primary purpose of the working group was to advise the Government of Alberta and a consultant on developing a methodology which would assist in determining a CCS operator's PCSF rate. The discussions focused on the post-closure period of a CCS project and the potential liabilities that the Government of Alberta would assume from a CCS operator. These liabilities have been defined via the applicable sections of the *Mines and Minerals Act* (MMA) and further informed through the final report of the RFA.

The working group met several times over the course of one year. A final report and methodology for determining the PCSF rate was brought forward in June 2014. The final methodology incorporates a Monte Carlo simulation model to reflect the uncertainty associated

[29] See the fourth edition of the *CCS Review* for an overview of the RFA.

with risk events and future costs. From this, future costs are translated into a corresponding PCSF rate.

The two key inputs into the methodology are:

The monitoring, measurement and verification (MMV) costs, which are calculated based on planned MMV activities at post closure;

Costs associated with potential risk events. Risk events are scenarios related to the possibility of loss of containment from the CO_2 storage site.

Going forward, the methodology will be used to inform PCSF rate negotiations for key CCS projects in the province.

Developments expected in next six-twelve months

In the coming months, the Government of Alberta will be looking to put the PCSF rate methodology to work as it determines the rate for the Quest CCS project which is planned to commence injection in 2015.

The intent will be to review the PCSF rate periodically during the course of a project. The RFA recommends the PCSF rate be reviewed every three years, which corresponds to the three year renewal of a CCS project's MMV and closure plans.

Related to this, the Government of Alberta is also working to prescribe a minimum closure period. The closure period is essentially a timeframe during which the site will no longer be active but will be managed or administered by the CCS operator. This timeframe will allow the Government to be confident a site is in compliance before accepting future liability. The RFA recommends a 10 year closure period. The Government of Alberta will work to establish the closure period as part of ongoing legislative and regulatory review efforts.

Part 2: How do you issue a CO_2 storage (or CCS) permit?

Alberta's current regulatory regime for CCS projects is governed by key legislation and processes to ensure the effective and safe implementation of CCS in the province. The approval process generally involves two regulatory bodies, the Department of Energy at the Government of Alberta in the issuing of CCS tenure or rights, and the Alberta Energy Regulator (AER) in the approvals of CCS injection schemes, and pipelines.

Under the *Mines and Mineral Act,* CCS project proponents are required to have a tenure agreement with the Government of Alberta in order to inject CO_2 into Crown-owned pore space. Alberta legislation requires that sequestration must take place at a depth of more than 1000 metres below the surface and the *Carbon Sequestration Tenure Regulation* describes in greater detail the two types of CCS tenure agreements in Alberta. The first, with a term of five years, is an evaluation permit. An evaluation permit grants the right to conduct evaluations, injections, and testing for the purposes of determining the suitability of a site for sequestration of CO_2. An application for an evaluation permit requires a monitoring, measurement and verification (MMV) plan that includes an analysis of the likelihood that the operations will interfere with mineral recovery. In Alberta CCS projects may not negatively impact hydrocarbon activities.

The other agreement, a carbon sequestration lease, grants the right to inject CO_2 into deep subsurface reservoirs within the location of the lease. A carbon sequestration lease secures the pore space for a period of 15 years with the ability to renew the lease for further terms of 15 years. To obtain a carbon sequestration lease, an application is made to the Department of Energy for review and assessment. This application must include an MMV plan and a closure plan

that sets out a description of the activities to close down sequestration operations and facilities. MMV and closure plans are required to be renewed a minimum of every three years.

Overall, the process for acquiring an evaluation permit or a carbon sequestration lease could take, at minimum, three months to complete and is dependent on the strength of the application.

When a carbon sequestration lease has been issued, project proponents are then required to seek operational approvals from the Alberta Energy Regulator (AER). The AER acts at arm's length from the Government of Alberta and is authorized to make decisions on applications for energy development, monitoring for compliance assurance, decommissioning of developments, and all other aspects of energy resource activities. Formerly the Energy Resources Conservation Board (ERCB), the Alberta Energy Regulator was established in 2013 as the single regulator of energy development, taking on many of the functions previously held by Alberta's ministry of Environment and Sustainable Resource Development.

Currently, applicants for a CO_2 sequestration project would use the AER acid gas disposal scheme requirements, and CCS applications would be examined on a case by case basis. The AER also has public involvement requirements that must be met. Should concerns with an application be brought forward, and the appropriate dispute resolution process fails to resolve them, the matter may then go to an AER hearing for a decision. In addition, a CCS proponent may be required to provide an environmental impact assessment to Alberta Environment and Sustainable Resource Development that will examine the effects a project may have on the environment. As such, the timeframe from which to gain approval from the AER could take months to a few years.

British Columbia

Part 1: Developments in 2014 and developments expected in next six to twelve months

British Columbia is in the process of developing a regulatory policy framework for carbon capture and storage (CCS). During the spring of 2014 a public consultation document, *Carbon Capture and Storage Regulatory Policy Discussion and Comment Paper*[30], was posted seeking feedback on the proposed policy. A CCS Working Group, with representatives from the Ministry of Natural Gas Development and the BC Oil and Gas Commission, reviewed and considered all consultation comments in finalizing the proposed framework. In the next six months a Consultation Summary Report and Q&A Document clarifying the proposed CCS regulatory policy framework will be completed. Legislative and regulatory amendments will be proposed once final policy approval is complete.

Part 2: How do you issue a CO_2 storage (or CCS) permit?

In British Columbia, the Ministry of Natural Gas Development is responsible for issuing storage reservoir exploration licences and leases, administering the tenure application process and managing tenures. The expected timeline for evaluating a CCS storage reservoir tenure application is four to twelve months. Currently, British Columbia has issued one *Petroleum and Natural Gas Act* section 126 licence to explore for a CCS storage reservoir.

The British Columbia Oil and Gas Commission (Commission) is responsible for regulating all oil and gas operational activities in the province, including CCS. The Commission has the regulatory authority to approve and issue permits for the exploration and use of storage reservoirs, facilities, wells, and pipelines. The expected timeline for evaluating CCS storage reservoir permit applications is six to eight months.

An environmental assessment may be required from one or more other levels of government. Please see the *IEA CCS Legal and Regulatory Review - Edition 3* page 66 for further information.

Proposed CCS Regulatory Policy Framework

In order to be assured of the permanence and safety of a proposed storage site, the following information, among other items, are expected to be required when applying for a CCS storage reservoir lease:

- A site characterisation of the proposed storage site including: geology of the sedimentary succession from the storage unit to ground surface, fault and fracture characteristics, properties of reservoir and caprock, hydrogeology, in-situ conditions of pressure, temperature and stress, fluid compositions and PVT (pressure, volume, temperature) phase behaviour and geochemistry of rock-fluid interactions, reservoir history, well history, and land features.
- A site model including an assessment of the anticipated security of the storage site.
- A corrective measures/contingency plan in the event of any significant leakage or unintended migration of CO_2.

[30] *See* www.gov.bc.ca/carboncapture

Evaluation of the application would include verification that the site is suitable as a storage reservoir for the proposed project in terms of storage capacity, injectivity, risk of leaks and unintended migration, and risk to health and the environment. Third party experts, who are professionally certified and/or recognized in their field of practice, may be consulted to review site characterization data to validate site risk assessments, monitoring and verification programs and mitigation plans.

In addition to the storage reservoir lease application, an application to operate a CCS project would be submitted for approval to the BC Oil and Gas Commission and will, among other items, include:

- A description of the mechanisms of geologic confinement that would ensure containment of CO_2.
- A public health, safety and emergency response plan.
- A worker safety plan.
- A corrosion monitoring and prevention plan.
- A facility and storage reservoir leak detection and monitoring program.

As per current legislation, permit holders will follow the industry standard: Canadian Standards Association (CSA) Z662 - Oil and Gas Pipeline Systems for the construction, testing, operating, deactivation, reactivation and abandonment of pipelines. The new CSA Standard Z741 - Geologic Storage of Carbon Dioxide, may be adopted in the future.

The operator would also notify the Commission of any significant leakage and/or unintended migration of CO_2, or if any other irregularity occurs during operations, at cessation of injection and in the post injection assurance period.

The monitoring requirements for a CCS project are expected to be based on the following general principles:

- Monitoring requirements will be flexible and results based, as appropriate, rather than prescriptive.
- Monitoring requirements will be informed by site-specific risk assessments.
- Monitoring programs will need to adapt over time as knowledge and data from the reservoir and the CO_2 behaviour increases and/or the monitoring technologies and practices evolve.
- Monitoring programs may need to meet the requirements of current or future regional, national or international greenhouse gas quantification programs.

The CCS Regulatory Policy Framework proposes the following requirements for monitoring, measurement and verification:

- upon application for a storage reservoir lease, submission of a proposed monitoring plan, closure plan and post-closure plan
- applying existing acid gas disposal monitoring, inspection and enforcement requirements to CCS projects, including at a minimum: monitoring of fugitive emissions of CO_2 at injection point, the volumetric CO_2 stream at the well head, pressure and temperature of CO_2 at the well head, the chemical analysis of the CO_2 stream, and pressure and temperature conditions in the reservoir

- plans for monitoring programs will be reviewed and approved prior to the start of an operation, and then reviewed and updated regularly (i.e. every 3 – 5 years) during the injection period, at closure and during post-closure operations as deemed necessary
- the regulatory authority may require and must approve any modification to a monitoring program, and will inspect and audit monitoring programs
- at the end of the post-closure assurance phase, an application should demonstrate that:
    - Continuous monitoring occurred throughout the period which included mechanical integrity, pressure, temperature, plume position and seismic conditions as well as any other monitoring as ordered by the regulatory authority.
    - The reservoir has been stable and no leakages or significant changes have been detected.
    - The proponent's reservoir modelling:
        - Predicts site stability in the long-term.
        - Has been demonstrated to be consistent with real-life monitoring data for a minimum period.

In the future, monitoring requirements in the new CSA Z741 – Geological Storage of Carbon Dioxide, may be adopted.

Saskatchewan

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Part 1: Developments in 2014

Completion of the Boundary Dam Unit 3 (BD3) CCS project

http://www.saskpower.com/our-power-future/innovating-today-to-power-tomorrow/capturing-carbon-and-the-worlds-attention/?linkid=MM_capturing_carbon_worlds_attention

Developments expected in next six-twelve months

Carbon dioxide captured from the BD3 project will be injected in the Aquistore project

http://ptrc.ca/projects/aquistore

Part 2: How do you issue a CO_2 storage (or CCS) permit?

Carbon dioxide storage wells are approved as disposal wells according to the provisions of *The Oil and Gas Conservation Act* and *The Oil and Gas Conservation Regulations*.

European Union

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http://ec.europa.eu/clima/policies/lowcarbon/ccs/index_en.htm

http://ec.europa.eu/clima/policies/lowcarbon/ner300/index_en.htm

Part 1: Developments in 2014

Directive 2009/31/EC on the geological storage of carbon dioxide (CCS Directive) establishes a legal framework for the environmentally safe geological storage of carbon dioxide. Between July 2011 and April 2013 the European Commission (EC) received reports on implementation of the CCS Directive from the Member States (MS). These reports fed into the first Commission's report to the European Parliament and to the Council on the implementation of the CCS Directive, adopted in February 2014.[31]

The report covers implementation of all key provisions of the CCS Directive, i.e. competent authorities and transboundary coordination; exploration permits and storage permits issued versus restrictions placed by Member States on CO_2 storage; geological assessments of the storage capacity; CO_2 stream acceptance criteria and procedures; monitoring, reporting and inspections provisions; procedures in case of leakages or significant irregularities; closure and post-closure obligations; provisions for the transfer of responsibility; financial security and financial mechanism requirements; state of transposition of the CCS Directive, as well as Commission actions to improve implementation.

The transposition measures have been deemed complete by the European Commission for all Member States, with the exception of one Member State. The Commission is in the process of checking if the notified measures, while complete, also conform in substance to the CCS Directive.

In support of the review report on the CCS Directive required in Article 38 by 31 March 2015, the Commission contracted a study, which did an evaluation of the performance of the Directive and provided recommendations on the CCS Directive and the wider CCS enabling policy. The main conclusions of the study[32] are that the Directive is fit-for-purpose and necessary – unanimously supported by all stakeholders and Member States. The Directive gives the necessary flexibility for Member States and it would be premature to undertake revision due to the current limited experience with CCS in Europe. CCS is an important cost-competitive low-carbon technology with long lead times. Hence it is important to continue support to CCS demonstration projects both at EU and Member States level so the safety of the technology is fully demonstrated and it becomes cost-competitive by 2030.

In its 2014 Communication "A policy framework for climate and energy in the period from 2020 to 2030"[33], the Commission recognises that in the power sector, CCS could be a key technology for fossil fuel-based generation that can provide both base-load and balancing capacity in an

[31] http://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:52014DC0099
[32] http://www.ccs-directive-evaluation.eu/
[33] http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52014DC0015

electricity system with increasing shares of variable renewable energy. CCS may be the only option available to reduce direct emission from industrial processes at the large scale needed in the longer term. Increased R&D efforts and commercial demonstration of CCS are, therefore, essential over the next decade so that it can be deployed in the 2030 timeframe. A supportive EU framework will be necessary through continued and strengthened use of auctioning revenues. European Council agreed on 23 October 2014 the domestic 2030 greenhouse gas reduction target of at least 40% compared to 1990 together with the other main building blocks of the 2030 policy framework for climate and energy. To achieve the overall 40% target, the sectors covered by the EU emissions trading system would have to reduce their emissions by 43% compared to 2005. The Council also called for renewal of the existing NER300 facility[34], including for carbon capture and storage and renewables, with the scope extended to low carbon innovation in industrial sectors and the initial endowment increased to 400 million allowances (NER400).

In February 2015, the Commission adopted the Energy Union Package "A Framework Strategy for a Resilient Energy Union with a Forward-Looking Climate Change Policy".[35] The Commission advocates a forward-looking approach to carbon capture and storage and carbon capture and use for the power and industrial sectors, which will be critical to reaching the 2050 climate objectives in a cost-effective way. This will require an enabling policy framework, including a reform of the Emissions Trading System and the new Innovation Fund (NER 400), to increase business and investor clarity, which is needed to further develop this technology.

One CCS project, the oxyfuel White Rose project in the UK, was selected for funding in the second NER 300 call, awarded in July 2014 with 300 million euro. The project concerns the building and operation of a full CCS chain, which includes a coal power plant capturing CO_2, onshore and offshore pipelines transporting CO_2 and an offshore storage safely encasing CO_2. The new oxyfuel coal power plant and CO_2 processing and compression units will be built at the Drax power plant site near Selby, in the United Kingdom. The technology will capture 90% of the CO_2 emissions from the coal power plant – on average 1.8 million tonnes of CO_2 per year. The captured CO_2 will be transported by a short pipeline to a larger pipeline system and injected into storage offshore in the southern North Sea.

Developments expected in next six-twelve months

European Commission is working on a review report to the European Parliament and to the Council, required by Article 38 by 31 March 2015. EC has included the CCS Directive in its REFIT programme.[36] The report will answer the questions put forward in Article 38 and draw conclusions regarding the REFIT evaluation. Conclusions and follow up actions will be drawn on all the above.

Part 2: How do you issue a CO_2 storage (or CCS) permit?

The storage permit is the key tool in ensuring that CCS takes place in an environmentally safe way. Sites may not operate without one according to Article 6 of the CCS Directive. Potential operators need to supply information to the MS Competent Authority that proves their technical competence to operate a storage site safely. They have to provide detailed data on the storage site and complex to ensure that a geological formation will be selected only if there is no

[34] The NER 300 is one of the world's largest funding programmes for innovative low-carbon demonstration projects, which awarded in total € 2.1 billion to one CCS and 38 renewable energy projects. http://ec.europa.eu/clima/policies/lowcarbon/ner300/index_en.htm

[35] http://ec.europa.eu/priorities/energy-union/docs/energyunion_en.pdf

[36] REFIT is the European Commission's Regulatory Fitness and Performance programme. http://ec.europa.eu/smart-regulation/refit/index_en.htm

significant risk of CO_2 leakage or other environmental or health damage. The applicant also needs to outline what measures will be taken to prevent significant irregularities; propose plans for monitoring, corrective measures if necessary, and post-closure arrangements; and provide proof of financial security to be valid and effective prior to injection of CO_2, to ensure that all legal obligations can be fulfilled at all times (Article 7 and 9). A storage permit can be granted only if all the requirements of the CCS Directive and of other relevant EU legislation are met (Article 8).

Member States have responsibility for issuing permits, but must forward the permit applications they receive, as well as the draft permits they intend to issue, to the European Commission for review (Article 10). The Commission may issue an opinion and national authorities must give reasons for not following this. This procedure is designed to ensure coherent implementation of the Directive, and to boost public confidence in safety of the technology. The first such Opinion[37] was adopted in February 2012 on the draft permit for the permanent storage of CO_2 offshore on the Dutch continental shelf.

National authorities must be informed about any changes to storage sites, and if necessary the permit should be updated (Article 11). In the event of CO_2 leakages, or failure to meet other conditions, the authorities can withdraw the permit and take over management of the site, recovering costs from the former operator. All storage permits shall be reviewed five years after they are issued, and then every 10 years.

[37] http://ec.europa.eu/clima/policies/lowcarbon/ccs/implementation/docs/c_2012_1236_en.pdf

International organisation contributions

Global CCS Institute

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Part 1: Developments in 2014

The past twelve months have seen the Global CCS Institute progress its policy, legal and regulatory work programme, across its regional operations. In addition to its wider engagement and advocacy activities, the Institute has undertaken a number of core legal and regulatory-specific activities in 2014. These activities are discussed in greater detail in the following sections.

Global Status of CCS 2014

The Institute published two editions of its *Global Status of CCS* Report in 2014.

A February edition of the report provided an update on the global status of large-scale integrated capture and storage projects, as well as analysis of significant policy, legal and regulatory developments which had occurred since November 2013.[38]

The *Global Status of CCS 2014* report was released in early November 2014. This report contains a detailed overview of the current status of CCS projects worldwide, as well as discrete chapters on capture, transport, storage, developing country activities and policy, legal and regulatory developments.[39]

In addition to detailed analysis of global legal and regulatory developments, the Institute again undertook a perceptions survey on the status of policy, law and regulation with many of the Large Scale Integrated Projects (LSIPs) globally. From a legal and regulatory perspective, the survey revealed that projects' largely view their legal and regulatory environment as unchanged in the past twelve months and evenly split, as to whether their regulatory environment was supportive for the purpose of proceeding to a final investment decision.

In addition to these observations, the surveyed projects also highlighted several issues that they considered to be largely 'unaddressed' by domestic legal and regulatory regimes. Standards to account for the cross-border movement of stored CO_2, rules to accommodate CCS projects within market mechanisms, and a range of issues associated with financial security and longer-term liabilities for storage operations; were again highlighted as issues yet to be fully addressed by regulators and policymakers.

CCS Directive Evaluation

The Institute's policy, legal and regulatory team have been actively involved in the European Commission's assessment of the CCS Directive, which commenced in May 2014. In addition to

[38] *The Global Status of CCS: February 2014*, available at: http://www.globalccsinstitute.com/publications/global-status-ccs-february-2014

[39] *The Global Status of CCS: 2014*, available at: http://www.globalccsinstitute.com/publications/global-status-ccs-2014

attendance at the key stakeholder meetings held throughout the year, the Institute provided feedback through the online questionnaire and submitted a formal written response to the consultation in July 2014.[40]

The Institute's submission recognised the significance of the CCS Directive and legal and regulatory frameworks more widely; nevertheless insufficient project-level experience of the entirety of the Directive's provisions meant that the Institute was ultimately of the view that a detailed assessment of the CCS Directive was premature. The submission did, however, raise the importance of some early experience of the regulatory model which had been gained by the European demonstration projects.

Legal liability study

In early October 2014, the Institute published Legal Liability and Carbon Capture and Storage: A Comparative Study.[41] The study, which was co-authored by the Institute and University College London, compares and contrasts the approaches to liability for CCS operations, adopted by regulators in the United Kingdom; the State of Victoria, Australia; and the Province of Alberta, Canada.

The study focuses in particular upon administrative and civil liabilities, as well as those potentially borne by an operator under an emissions trading scheme. The report also examines the scope of the three jurisdictions' provisions in relation to the transfer of responsibility for a storage site and financial security against liability.

Analysis of these select jurisdictions' revealed that all three offer well-characterised legal regimes, which address a wide range of potential liabilities. Perhaps importantly, aspects of these regimes may offer important models and analogues for those jurisdictions currently seeking to develop CCS programmes, which include the design of legal and regulatory frameworks. Notwithstanding these observations, the study also highlights several areas where further work may be necessary, or where the legislation's application is currently speculative in the absence of project-level experience.

Analysis of US regulatory landscape for CCS

The Institute's policy, legal and regulatory team have provided analysis of the U.S. Environmental Protection Agency's (EPA) proposed New Source Performance Standards (NSPS) to regulate CO_2 emissions from new, modified and reconstructed fossil fuel-fired electric generating units and EPA's Draft Underground Injection Control (UIC) Program Guidance on Transitioning Class II Wells to Class VI Wells for their potential impacts on CCS/CCUS deployment. The Institute has also considered how CCS could be included as a compliance pathway in State Implementation Plans required by the EPA under NSPS.

Developments expected in next six-twelve months

The Institute will continue to engage its membership and the wider CCS community in its policy, legal and regulatory activities over the forthcoming six to twelve months. These activities will

[40] *Global CCS Institute Submission to the European Commission's evaluation process of the Directive on the geological storage of carbon dioxide*, available at: http://www.globalccsinstitute.com/publications/global-ccs-institute-submission-european-commission%E2%80%99s-evaluation-process-directive-geological-storage-carbon-dioxide-directive-200931ec

[41] Available at: http://www.globalccsinstitute.com/publications/legal-liability-and-carbon-capture-and-storage-comparative-perspective

include a series of country or regionally-specific work packages, which include thematic workshops, targeted reports and knowledge networks.

The issues surrounding liability for CCS operations are one area, which the Institute will continue to focus upon in the forthcoming year. As a part of this activity, the Institute and the IEA's CCS Unit are currently planning an expert workshop on the topic in early 2015.

Part 2: How do you issue a CO_2 storage (or CCS) permit?

As a part of its ongoing engagement activities, including through its provision of services to the EU's CCS Demonstration Project Network, the Institute has published several studies and reports which highlight tangible, project-level experiences of the permitting process.[42]

[42] See for example, *ROAD CCS permitting process: special report on getting a CCS project permitted*, available at: http://www.globalccsinstitute.com/publications/permitting-process-special-report-getting-ccs-project-permitted

IEA Greenhouse Gas R&D Programme (IEAGHG)

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Part 1: Developments in 2014

IEAGHG is an international R&D programme established as an Implementing Agreement of the International Energy Agency in 1991, funded by 19 member countries and 21 sponsor organisations. It aims to provide impartial and independent information on the role and issues around technologies to reduce greenhouse gas emissions from fossil fuel use, focussing primarily on carbon dioxide capture and storage. One of IEAGHG's objectives is to assist legal and regulatory developments by providing technical information relevant to the needs of legal and regulatory developments, so that they can be based on a sound evidence-base, and so it is involved in many activities to undertake this. It is an actively contributing observer to the London Convention and UNFCCC meetings, and is a member of ISO TC265 on CCS.

A major activity of IEAGHG is organising the GHGT conference series, and GHGT-12 was held in Austin Texas 5-9 October 2014. Of the 900 papers presented, many were relevant to regulatory issues, and there was a dedicated session to legal and regulatory issues and to emissions trading, and a Discussion Panel on US EPA experiences and another on ISO TC265. Papers are now published and can be found at http://www.sciencedirect.com/science/journal/18766102 .

Another flagship activity of IEAGHG is the IEAGHG Storage Research Networks. Each of their meetings includes regulatory considerations.

The Social Research Network was held in Calgary on 14-15 January 2015, hosted by the University of Calgary. The presentation and report are available at http://www.ieaghg.org/networks/social-researc-network.

A combined meeting of the Monitoring Network and Modelling Network was hosted by the National Coal Research Center for Coal and Energy (NCRCCE), West Virginia University, Morgantown on 5-7 August 2014. The three day meeting focussed on the theme of 'reducing uncertainty with the application and effectiveness of monitoring and modelling' and has significant regulatory relevance. The report is due to be published soon, and the presentations are available at http://www.ieaghg.org/networks/monitoring-network .

The IEA International CCS Regulatory Network held a meeting on 27-28 May at IEA Paris. IEAGHG was invited to put together a session to report on relevant technical developments from IEAGHG Research Networks (see blog http://www.ieaghg.org/publications/blog/122-policy-and-legal/457-iea-regulatory-network-first-class-vi-permits-issued-and-10-years-of-ieaghg-storage-networks-marked).

Table 1 • Reports of relevance published in 2014 include:

	Contractor	Report number	Publication date
CO_2 Pipeline Infrastructure (a review of experiences)	Ecofys (GCCSI)	2013-18	14/01/2014
Deployment of CCS in the Cement Industry (barriers)	ECRA (GCCSI)	2013-19	13/02/2014
Comparing Different Approaches to Managing CO_2 Storage Resources in Mature CCS Futures	BGS (GCCSI)	2014-01	19/03/2014
Evaluation of Reclaimer Sludge Disposal from CO_2 PCC Process	Trimeric Corporation	2014-02	24/03/2014
CO_2 Capture at Coal-Based Power and Hydrogen Plants (baseline costs)	Foster Wheeler	2014-03	03/07/2014
Evaluation and analysis of the performance of dehydration units for CO_2 capture	AMEC	2014-04	14/04/2014
Biomass and CCS - Guidance for accounting for negative emissions	Carbon Counts	2014-05	03/07/2014
Iron and Steel Workshop Tokyo	**N/A**	**2014-07**	**19/08/2014**

Developments expected in next six-twelve months

Further reports are being produced and will be published. The next meeting of the Social Research Network will be on 6 July 2015 hosted by Cambridge University. The next meeting of the Monitoring Network will be hosted by Lawrence Berkeley National Laboratory California in June 2015. The Risk Management Network and the Environmental Research Network will hold a combined meeting in September, hosted by the National Oceanography Centre at Southampton, UK. These meetings will include content of direct regulatory relevance. Please see the IEAGHG website for further information.

Part 2: How do you issue a CO_2 storage (or CCS) permit?

IEAGHG participates in international regulatory activities, including those for developing and issuing permits. The following summarise related IEAGHG activities from 2014.

Report on London Convention meeting LC-36 and LP-9.

It was the 36th meeting of the London Convention and the 9th meeting of the London Protocol 3-7 November 2015. All of the detailed work on CCS was completed last year (see IP26), but outstanding is the ratification of the CO_2 export amendment (which is a barrier to transboundary projects offshore) and there is a routine request for information and experiences with offshore CCS.

In terms of ratification of the CO_2 export amendment, UK and Norway have previously ratified. Netherlands have their ratification approved domestically and will submit to the London Protocol in early 2015. Korea, Canada and Australia are still working on theirs (as they were last year). Sweden announced they have started work on theirs. The London Convention Chair emphasised that this ratification "is crucial to combat climate change". So only modest progress given two thirds of the 45 Parties to the London Protocol need to ratify it for it to come into force.

On marine geoengineering, work is ongoing to develop the procedure for including new marine geoengineering activities (it includes just ocean fertilisation at the moment) and to develop a roster of experts for an 'independent expert advice group'. The geoengineering amendment from 2013 (see IP27) is also slow in being ratified so far (none so far), but may provide addition motivation to ratify the CO_2 export amendment at the same time.

IEAGHG attended and spoke in plenary. It was important to highlight that there is considerable progress being made with CCS. Japan provided an update on the Tomakomai project, Saudi followed IEAGHG to reinforce IPCC AR5 and UNFCCC messages (see IEAGHG blogs of 4th Nov and 23rd October) and Greenpeace asked for examples of application of the London Protocol's CO_2 Specific Guidelines, particularly regarding site selection and CO_2 stream purity.

See IEAGHG Information Paper 2014/19 for more information at http://www.ieaghg.org/publications/information-papers .

EU CCS Directive Review

IEAGHG provided technical input to and attended the meetings held to review the CCS Directive.

UNFCCC

IEAGHG attended the ADP TEM workshop on CCS in Bonn in October, presenting on the concluding panel. See http://www.ieaghg.org/publications/blog?start=11 for more information and links to the presentations.

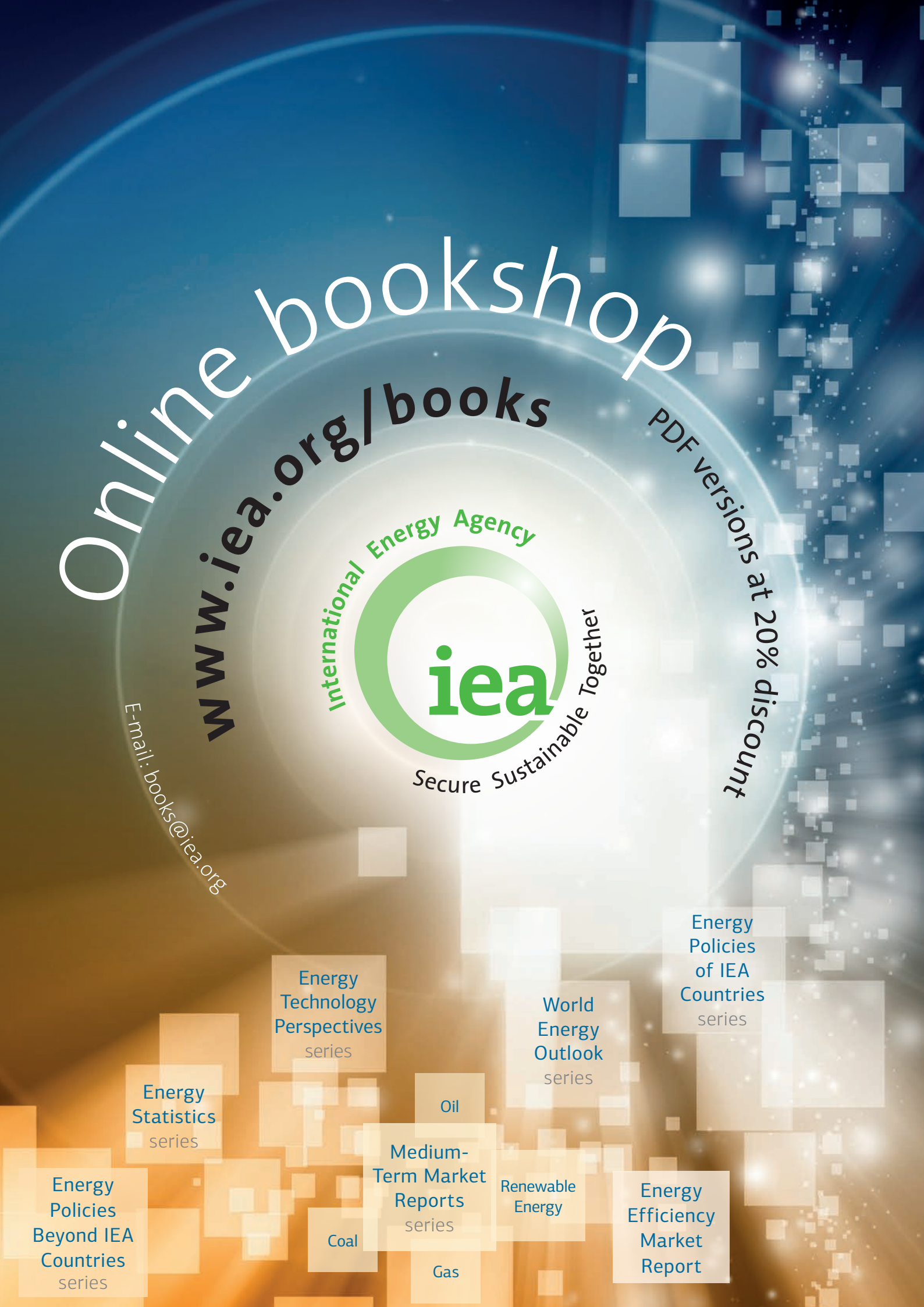
IEAGHG attended COP-20 in Lima. The main UNFCCC Side Event on CCS was held on Tuesday 9 December. Entitled "New Large-scale Carbon Capture and Storage (CCS) Projects Operating in the Americas", it was organised by the IEAGHG with The University of Texas and CCSA. In terms of understanding the role of CCS in future climate ambitions this was a valuable event, as it included the world's first full-scale CCS project on a coal power plant, at Boundary Dam in Canada, and Brazil's offshore CO_2 management. The presentations are available on http://www.ieaghg.org/publications/blog and will be made available by UNFCCC also. See IEAGHG Information Paper 2014-26; COP-20 Lima for more information at http://www.ieaghg.org/publications/information-papers .

IEAGHG also attended COP-19 in Warsaw in November 2013. See Information Paper 2014-IP3 for CCS-relevant information http://www.ieaghg.org/publications/information-papers .

References

Jonker, T. (2013), *The permitting process: Special report on getting a CCS project permitted,* Maasvlakte CCS Project C.V., the Netherlands. http://hub.globalccsinstitute.com/sites/default/files/publications/94946/permitting-process-special-report-getting-ccs-project-permitted.pdf

Hamberg, M. and van der Weijden, C., November 17 2011. "Implementation of the CCS Directive into the Dutch mining legislation (CO_2-storage)" Lexology, www.lexology.com/library/detail.aspx?g=293c6316-444d-4b1b-8737-881335e440af.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