Proposed CCS Projects- International

IGCC Coal Power

Centrica- Teesside, United Kingdom

- Status: July 2008- Coastal Energy, a joint venture of Centrica and Progressive Energy, is finalizing transportation and storage decisions for the Teesside IGCC CCS project. Deliberation is focused on pipeline versus rail transportation.
- Capture Method: Pre-combustion; (pending decision)
- CO_2 Destination: EOR offshore; North Sea oilfields
- Key Figures: 800 MWe, 5 $MtCO_2$/yr. injected, $2.7 billion
- Project Timeline: Construction- 2009, Completion- 2012

E.ON- Killingholme, United Kingdom

- Status: July 2008- Despite completing a promising 2007 feasibility study for the site, E.ON has allowed its E.ON Killingholme Project to become 'dormant' after the UK government announced the terms of its CCS competition, funding only post-combustion CCS projects.
- Capture Method: Pre-combustion; (cancelled)
- CO_2 Destination: EOR offshore; North Sea gas fields
- Key Figures: 450 MWe, CO_2 capture quantity undetermined, $2.0 billion
- Project Timeline: Projected was projected for 2011

EPCOR- Alberta, Canada

- Status: August 2008- EPCOR announced a design partnership with Siemens for the Genesee IGCC plant, currently running as a SCPC plant. A FEED study is being conducted, and if subsequent investments go as planned, the plant could be operational by 2015.
- Capture Method: Pre-combustion; Siemens SFG-500 (Selexol)
- CO_2 Destination: EOR
- Key Figures: 500 MWe, CO_2 capture quantity undetermined, $2.0 billion
- Project Timeline: Completion- 2015

GreenGen- Tianjin, China

- Status: May 2007- IGCC R&D being conducted for a 450 MW facility hoped to be completed by 2015. A small-scale demonstration project will begin in 2009, results collected, and then construction of a full-scale site will begin mid-2012. The project, akin to America's FutureGen project, is supported by several public and private organizations.
- Capture Method: Pre-combustion; (pending decision)
- CO_2 Destination: Undetermined
- Key Figures: 350 MWe, CO_2 capture quantity undetermined, $3.3 billion
- Project Timeline: Stage 1 Construction- 2009, Stage 2 Construction- 2012, Completion- 2015

Hydrogen Energy- Kwinana, Australia

- Status: May 2008- Hydrogen Energy, a joint-venture between BP and Rio Tinto announced the termination of all plans to build an IGCC plant in Kwinana, Australia. BP announced the decision after the discovery that geological formations near Perth, the only viable storage site, contain gas "chimneys" which would make it next to impossible to establish a strata seal.
- Capture Method: Pre-combustion; (cancelled)
- CO_2 Destination: Offshore storage; saline formation (Perth Basin)
- Key Figures: 500 MWe, 4 $MtCO_2$/yr. stored, $1.5 billion
- Project Timeline: Completion was projected for 2014

Powerfuel- Yorkshire, United Kingdom

- Status: July 2008- Powerfuel has announced a phased development plan for its proposed Hatfield Colliery IGCC plant. Powerfuel selected GE Energy CCGT turbines to power the plant through mid-2011, at which time it start to phase-in Shell's proprietary IGCC technology. The goal of this approach is to give the plant greater fuel flexibility while CCS technology matures.
- Capture Method: Pre-combustion; Shell SCGP WQ (Selexol)
- CO_2 Destination: EOR offshore; North Sea oilfields
- Key Figures: 900 MWe, 4.7 $MtCO_2$/yr. stored, $1.6 billion
- Project Timeline: Construction- 2009, Completion- 2013

RWE- Huerth, Germany

- Status: August 2008- RWE made a final decision to move forward with plans to build a state of the art IGCC plant in Huerth, Germany. The plant will be fueled with local lignite and will be equipped with CCS technology. RWE said broad public acceptance was integral to their decision.
- Capture Method: Pre-combustion; (pending decision)
- CO_2 Destination: Undetermined
- Key Figures: 450 MWe, 2.6 $MtCO_2$/yr. stored, $3.0 billion
- Project Timeline: Construction- 2010, Completion- 2016

ZeroGen- Brisbane, Australia

- Status: May 2008- ZeroGen Pty Ltd, a subsidiary of the Queensland state-owned Stanwell Corporation, has announced the reconfiguration of the ZeroGen project into two stages. The ZeroGen project will now involve the development of a world-class demonstration plant by 2012, followed by an equally advanced full-scale plant labeled 'ZeroGen Mark II' by 2017.
- Capture Method: Pre-combustion; Shell SCGP SQ (Selexol)
- CO_2 Destination: Offshore storage; Northern Denison Trough
- Key Figures: 400 MWe, 420 $KtCO_2$/yr. stored, $350 million
- Project Timeline: Construction- 2009, Demonstration- 2012, Completion- 2017

IGCC CTL Power

Monash Energy- Latrobe Valley, Australia

- Status: May 2008- Monash Energy, a collaboration between Shell and Anglo American Coal, has invested $20 million on preliminary work related to the commercial and technical feasibility of an IGCC CTL CCS-equipped plant in Australia's Latrobe Valley. The Project is expected to move forward soon with plans to construct a scaled demonstration plant.
- Capture Method: Pre-combustion; (pending decision)
- CO_2 Destination: Offshore storage; Gippsland Basin
- Key Figures: 30 kBPD/yr. (synthetic hydrocarbons), 10 $MtCO_2$/yr. stored, $4.3 billion
- Project Timeline: Construction- 2009, Completion- 2016

NG Processing

Chevron- Barrow Island, Australia

- Status: October 2007- Gorgon Project partners, Chevron, ExxonMobil and Shell, welcomed a big step forward for the Gorgon Project. The Australian Federal Minister for the Environment has issued final governmental approval for the Gorgon Project on Barrow Island, which will elicit gas from the Gorgon Joint Venture resources located off Australia's northwest coast.
- Capture Method: Post-combustion; (amine scrubbers)
- CO_2 Destination: Storage; deep saline
- Key Figures: 7.5 MtLNG/yr., 3.3 $MtCO_2$/yr. stored, $650 million
- Project Timeline: Completion- 2010

StatoilHydro- Barents Sea

- Status: April 2008- StatoilHydro has begun carbon injection and storage at the Snohvit field. Natural gas is pumped from Snohvit to StatoilHydro's Melkoya Plant, containing 5-8% CO_2. The CO_2 is separated from the natural gas using a chemical amine before it is sent to a special LNG tanker. The CO_2 is transported back to and injected beneath the Tubasen sandstone inside the Snohvit reservoir.
- Capture Method: Post-combustion; (amine scrubbers)
- CO_2 Destination: Offshore storage; Tubasen sandstone
- Key Figures: 4.1 MtLNG/yr., 700 KtCO_2/yr. stored, $5.2 billion
- Project Timeline: Operational

NG Processing (Retrofit)

Gassnova (Norwegian Ministry of Petroleum and Energy)- Rogaland, Norway

- Status: July 2008- Gassnova, the Norwegian state-owned entity responsible for the Karsto Project, signed a contract with Aker Clean Carbon to conduct technical pre-studies for the planned full-scale CO_2 capture facility at Karsto in Norway. The plant, already in operation, hopes to start construction of retrofit CCS equipment early next year.
- Capture Method: Post-combustion; (amine scrubbers)
- CO_2 Destination: Offshore storage
- Key Figures: 420 MWe, 1.2 MtCO_2/yr. stored, $1.0 billion
- Project Timeline: Construction- 2009, Completion- 2012

NGCC CHP

Gassnova (Norwegian Ministry of Petroleum and Energy)- Bergen, Norway

- Status: July 2008- Gassnova, the Norwegian state-owned entity responsible for the Mongstad CHP Project, announced that the site would be used to test Alstom's new chilled ammonia post-combustion CO_2 separation technology. Gassnova and Alstom believe chilled ammonia has the potential to significantly reduce energy lost in the CO_2 capture process.
- Capture Method: Post-combustion; (Alstom Chilled Ammonia Process)
- CO_2 Destination: Offshore storage
- Key Figures: 280 MWe, 2.5 MtCO_2/yr. stored, $700 million
- Project Timeline: Pilot- 2010, Completion- 2014

Coal/NG Offshore CCS

Dynamis- Europe (EU Various)

- Status: July 2008- Dynamis has selected four sites on which to focus HYPOGEN research and development efforts; two in the UK, one in Germany, and one in Norway. HYPOGEN is a European Commission initiative to test various energy and carbon management technologies across the EU. The project hopes to advance high-yield cleaner energy technologies for Europe.
- Capture Method: Post-combustion; (pending decision)
- CO_2 Destination: Undetermined
- Key Figures: Power output unavailable, CO_2 capture quantity unavailable, $1.8 billion
- Project Timeline: Construction- 2008, Completion- 2015

SCPC Power

E.ON- Kingsnorth, United Kingdom

- Status: September 2008- E.ON is planning to replace existing coal-fired units at the Kingsnorth Power Station with two new supercritical cleaner coal units. E.ON's plans for Kingsnorth, the UK's first new coal-fired power station in two decades, became the focus of media attention last month when environmental activists set up a 'climate camp' near the intended site at Kingsnorth.
- Capture Method: Post-combustion; pending decision (likely Fluor Econamine FG+ (MEA))
- CO_2 Destination: EOR; North Sea
- Key Figures: 1600 MWe, 2.0 $MtCO_2$/yr. injected, $1.8 billion
- Project Timeline: Construction- 2009, Completion- 2012

RWE- Tilbury, United Kingdom

- Status: March 2007- In an environmental 'scoping document' submitted to the Department of Trade and Industry, RWE npower submitted plans for a state-of-the-art cleaner coal power station to replace its existing coal-fired station in Tilbury. RWE approved plans to incorporate CCS technology but conceded many financial, regulatory, and technical barriers still exist.
- Capture Method: Post-combustion; Cansolv DC101 (Amine)
- CO_2 Destination: Offshore storage
- Key Figures: 1600 MWe, 2.0 $MtCO_2$/yr. stored, $1.8 billion
- Project Timeline: Construction- 2010, Completion- 2016

RWE- Blyth, United Kingdom

- Status: May 2007- In an environmental 'scoping document' submitted to the Department of Trade and Industry, RWE npower submitted plans for a state-of-the-art cleaner coal power station to replace its existing coal-fired station in Blyth. RWE approved plans to incorporate CCS technology but conceded many financial, regulatory, and technical barriers still exist.
- Capture Method: Post-combustion; Cansolv DC101 (Amine)
- CO_2 Destination: Offshore; North Sea
- Key Figures: 2400 MWe, 3.0 $MtCO_2$/yr. stored, $3.6 billion
- Project Timeline: Construction- 2009, Completion- 2014

Oxyfuel Coal Power

CS Energy- Biloela, Australia

- Status: September 2007- The Callide A Oxyfuel Project is entering the final stages of its Front End Engineering and Design (FEED) study, and the project team is preparing to issue contracts for plant supplies. The Project hopes to demonstrate the viability of integrating the carbon capture and geosequestration to achieve near-zero GHG emissions from coal-fired electricity generation.
- Capture Method: Oxyfuel process
- CO_2 Destination: Storage; deep saline
- Key Figures: 30 MWe, 30 $KtCO_2$/yr. stored (up to 3 years), $206 million
- Project Timeline: Construction- 2009, Completion- 2011

CIUDEN- El Bierzo, Spain

- Status: July 2008- The Spanish government sponsored Energy City Foundation (Fundación Estatal Cuidad de la Energía or CIUDEN for its initials in Spanish) is finalizing an agreement with Energy Commissioner Andris Piebalgs' to build an experimental plant in El Bierzo, in the Spanish province of León. The project would advance ultra-efficient CO_2 capture techniques.
- Capture Method: Oxyfuel process
- CO_2 Destination: Undetermined
- Key Figures: 30 MWe, CO_2 capture quantity unavailable, $84 million
- Project Timeline: Construction-2008, Completion- 2010

Vattenfall- Janschwalde, Germany

- Status: September 2008- Vattenfall has inaugurated one of the world's first coal-fired power plant implementing CCS. The pilot unit, which has a thermal capacity of 30 MWe, was constructed over the last 15 months at the “Schwarze Pumpe” plant. Following several years of test operations, the company intends to construct two 500 MWe demonstration power plants by 2015.
- Capture Method: Oxyfuel process
- CO_2 Destination: Offshore storage
- Key Figures: 30 MWe, 30 $KtCO_2$/yr. stored (up to 3 years), $100 million
- Project Timeline: Operational

SaskPower- Saskatchewan, Canada

- Status: February 2008- New funding for Saskatchewan announced in the 2008 federal budget has enabled SaskPower to proceed with plans to develop one of the first and largest cleaner coal and carbon capture demonstration projects in the world. The budget includes $240 million in new funding for a major carbon capture project in Saskatchewan. The proposed SaskPower Boundary Dam demonstration project is a seven-year, $1.4 billion initiative.
- Capture Method: Oxyfuel process
- CO_2 Destination: EOR
- Key Figures: 100 MWe, 1.0 $MtCO_2$ stored, $1.5 billion
- Project Timeline: Completion- 2013

Proposed CCS Projects- International

IGCC Coal Power

Centrica- Teesside, United Kingdom
- http://www.h2net.org.uk/PDFs/AnnualMeeting_2007/004_DR_H2NET_12_July_2007.pdf

E.ON- Killingholme, United Kingdom
- http://www.dynamis-hypogen.com/publications/Meeting_20060905/15_E.ON_IGCCPlans_(Irons).pdf

EPCOR- Alberta, Canada
- http://www.epcor.ca/NR/rdonlyres/CC9648D1-3426-417F-844F-D5C58565A856/0/Aug15 backgrounder2.pdf
- http://www.epcor.ca/About/Media+Room/News+Releases/Recent+News+Releases/081508Siemens.htm

GreenGen- Tianjin, China
- http://belfercenter.ksg.harvard.edu/files/07-shisen%20xu.pdf

Hydrogen Energy- Kwinana, Australia
- http://www.theenergycollective.com/TheEnergyCollective/22864

Powerfuel- Yorkshire, United Kingdom
- http://www.powerfuel.plc.uk/id2.html
- http://www.gasification.org/Docs/Conferences/2007/04HERN.pdf

RWE- Huerth, Germany
- http://www.rwe.com/generator.aspx/templateId=renderPage/id=76864?pmid=4002414
- http://www.platts.com/Electric%20Power/News/8990764.xml?src=Electric+Powerrssheadlines1

ZeroGen- Brisbane, Australia
- http://www.zerogen.com.au/project/overview.aspx
- http://www.zerogen.com.au/_CMSImages/zerogen/projectoverviewfactsheet.pdf

IGCC Coal Liq/Power

Monash Energy- Latrobe Valley, Australia
- http://www.monashenergy.com.au/project/project.html
- http://www.coalportal.com/news_details.cfm?type=CoalArticles&article_date=2008-05-20%2009:40:41.0&article_headline=CTL%20positions%20Queensland%20as%20energy%20province&current_row=3

NG Processing

Gorgon- Australia
- http://www.gorgon.com.au/06-news/factsheets/Project%20Overview%20Factsheet%20 CHEVRON.pdf
- http://www.gorgon.com.au/06ln_news.html

StatoilHydro- Barents Sea
- http://www.energycurrent.com/index.php?id=2&storyid=10150
- http://www.statoil.com/STATOILCOM/snohvit/svg02699.nsf?OpenDatabase&lang=en
-

NG Processing (Retrofit)

Gassnova (Norwegian Ministry of Petroleum and Energy)- Rogaland, Norway
- http://www.regjeringen.no/en/dep/oed/Subject/Carbon-capture-and-storage/karsto-carbon-capture-and-storage-projec.html?id=502211
- http://www.ogj.com/articles/print_screen.cfm?ARTICLE_ID=301672

NGCC CHP

Gassnova (Norwegian Ministry of Petroleum and Energy)- Bergen, Norway

- http://www.regjeringen.no/en/dep/oed/Subject/Carbon-capture-and-storage/mongstad-ccs-project.html?id=502210
- http://findarticles.com/p/articles/mi_qa5392/is_200802/ai_n25137628/pg_3

Coal/NG Offshore CCS

Dynamis- Europe (EU Various)

- http://www.dynamis-hypogen.com

SCPC Power

E.ON- Kingsnorth, United Kingdom

- http://www.eon-uk.com/generation/supercritical.aspx
- http://www.theengineer.co.uk/Articles/307952/EON+Energie%27s+PCC+world.htm

RWE- Tilbury, United Kingdom

- http://www.rwe.com/generator.aspx/rwe-npower/group-structure/language=en/id=242814/rwe-npower-generation-and-renewables-tilbury.html
- http://www.npowermediacentre.co.uk/Content/Detail.asp?ReleaseID=1142&NewsAreaID=2

RWE- Blyth, United Kingdom

- http://www.rwe.com/generator.aspx/presse/language=en/id=76864?pmid=4001632
- http://uk.reuters.com/article/domesticNews/idUKL1924306120080320

Oxyfuel Coal Power

CS Energy- Queensland, Australia

- http://www.csenergy.com.au/research_and_development/oxy_fuel.aspx

CIUDEN- El Bierzo, Spain

- http://www.youtube.com/watch?v=Cr3c66_RdEc&feature=related
- http://waste.environmental-expert.com/resultEachPressRelease.aspx?cid=30601&codi=35261 &level=561&idproducttype=8

Vattenfall- Janschwalde, Germany

- http://www.vattenfall.com/www/co2_en/co2_en/399862newsx/404068press/index.jsp?pmid=75588
- http://www.vattenfall.com/www/co2_en/co2_en/879177tbd/879336comme/index.jsp

SaskPower- Saskatchewan, Canada

- http://www.saskpower.com/cleancoal/oxyfuel.html

Databases and Additional Information

- http://sequestration.mit.edu/tools/projects/index.html
- http://www.innovasjonnorge.no/upload/Surveillance%20of%20CCS%20projects%20and%20initatives%20-%20ver3.0%20dist.pdf
- http://www.greencarcongress.com/2007/06/alstom-signs-tw.html
- http://www.energy.ca.gov/2007_energypolicy/documents/2007-05-29_workshop/presentations/Dalton_Capture_and_Sequestration.pdf
- http://www.geos.ed.ac.uk/sccs/storage/sitelist2.html
- http://www.climit.no/gassnova/frontend/files/CONTENT/CCSWorld/IN-report-june08-projects.pdf
- http://www.gasification.org/Docs/Conferences/2003/26BRES_paper.pdf
- http://www.rite.or.jp/Japanese/labo/choryu/workshop/futuregenws2008/2008FGWS_MrHIGMAN.pdf
- http://www.co2captureandstorage.info/project_specific.php?project_id=171

- http://www.perf.org/pdf/Rojey.pdf