

Potential Job Benefits of Advanced U.S. Coal Generation with CCS Technologies

Copenhagen Update

NARUC Clean Coal and Carbon
Sequestration Subcommittee

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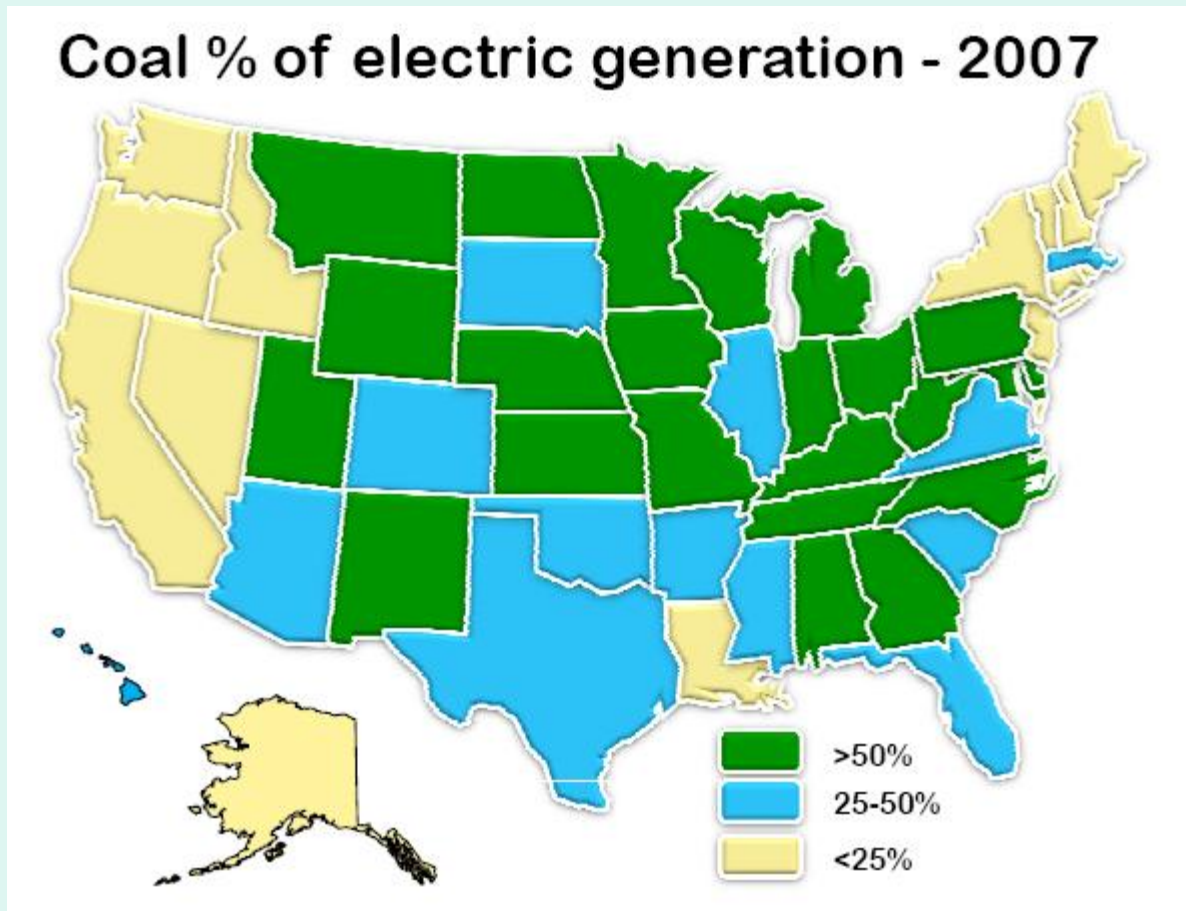
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United Mine Workers of America

Today's topics

- Review U.S. job benefits of commercial deployment of advanced coal-based generation with CCS technologies.
- Compare job benefits associated with alternative power generation technologies.
- Brief update of climate developments based on the Copenhagen meetings.

Why CCS? The majority of U.S. states rely on coal for 25% or more of their electricity (green = >50%)



Source: US DOE, Electric Power Annual 2008.

CCS is job-intensive

- Coal mining, transportation and generation are both labor- and capital intensive processes.
- The addition of CCS technologies increases overall labor inputs per kWh of electricity, by adding CO₂ pipelines, compression, injection and monitoring.
- ACCCE, UMWA, IBEW, Boilermakers and AFL-CIO Industrial Union Council supported a study by BBC Research & Consulting to estimate U.S. job impacts of alternative levels of CCS deployment.

Employment and other economic benefits from advanced coal electric generation with carbon capture and storage

Prepared for:

- Industrial Union Council, ...
- International Brotherhood of Oilfield Workers,
Iron Pipe Fitters, Fitters, Welders, and
Electricians
- International Brotherhood of Electrical Workers
- United Mine Workers of America
- American Coalition for Clean Coal Electricity

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Advanced Coal Plant Technology

- **The BBC study focused on two technologies: Advanced Supercritical Pulverized Coal (PC) with CCS and Integrated Gasification Combined Cycle (IGCC) with CCS.**
 - **PC – Pulverized coal in a boiler designed to deliver "supercritical" steam generating power with high plant generating efficiency and a chilled ammonia scrubber to remove approximately 90% of the CO₂.**
 - **IGCC – Coal is partially oxidized generating a synthetic gas (syngas). The IGCC design assumed for this study removes approximately 90% of the CO₂.**

Benefits from Rep. Boucher's Bill (Section 114 of Waxman-Markey bill passed by U.S. House)

- **Section 114 of WM is based on the "Carbon Capture and Storage Early Commercial Demonstration Act of 2008" (negotiated among NARUC, AEP and others) to advance the commercial deployment of Advanced Coal CCS facilities.**
- **Proposes \$10 billion in CCS funding through a "wires charge" for early commercial deployment of CCS technology, estimated to support development of six (6) 540 MW plants:**
 - **Including multiplier effects, BBC estimates that construction would stimulate between \$33 billion and \$36 billion in total economic output, about 225,000 total job-years of employment, and about \$12 billion in labor income.**
 - **Ongoing operations and maintenance would support about 7,500 permanent jobs throughout the economy and about \$500 million in annual labor income.**



enefits from future
deployment of a fleet of
advanced coal facilities

Potential Extent of Advanced Coal CCS Development

- This study illustrates the potential magnitude of CCS-only benefits under three alternative levels of deployment: 20 gigawatts (GW), 65 GW and 100 GW. The study assumes an equal mix of PC plants with CCS and IGCC plants with CCS.
- The study is not intended to imply any policy endorsement of these levels of deployment; rather, the study simply assumes these levels for purposes of analysis. Moreover, these results do not consider any potential economic impacts of emission reduction requirements.
- 20 GW of advanced capacity would require deployment of about 38 plants, based on the generating capacities for typical plants (540 MW for PC and 520 MW for IGCC). 65 GW of advanced capacity would require development of approximately 122 plants, and 100 GW of advanced capacity would require approximately 188 plants.

Economic Benefits from Construction and O&M for 65 GW of Advanced Coal Facilities with CCS

Economic Benefits from Construction (one-time)		
Economic Measure	Direct Benefit	Total Benefit
Output	\$254.8 Billion	\$711.9 Billion
Value-added	\$108.6 Billion	\$343.9 Billion
Employment	1.7 Million Job-years	4.5 Million Job-years
Labor Income	\$94.5 Billion	\$240.1 Billion

Economic Benefits from Operations & Maintenance (annual)		
Economic Measure	Direct Benefit	Total Benefit
Output	\$16.0 Billion	\$35.9 Billion
Value-added	\$9.5 Billion	\$19.9 Billion
Employment	31.6 Thousand Jobs	152.5 Thousand Jobs
Labor Income	\$4.0 Billion	\$10.4 Billion

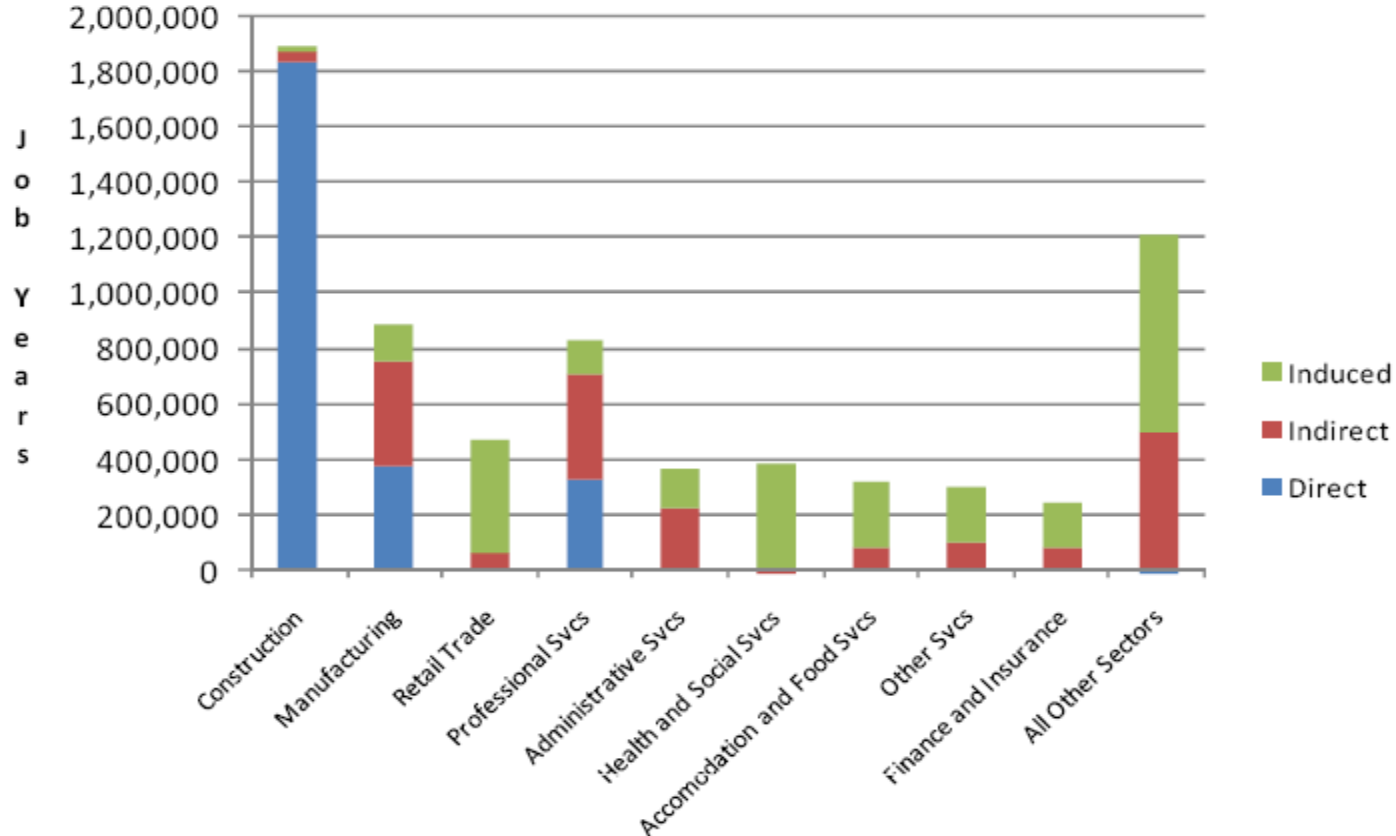
Economic Benefits from Construction and O&M for 100 GW of Advanced Coal Facilities with CCS

Economic Benefits from Construction (one-time)		
Economic Measure	Direct Benefit	Total Benefit
Output	\$392.6 Billion	\$1.1 Trillion
Value-added	\$167.3 Billion	\$529.9 Billion
Employment	2.6 Million Job-years	6.9 Million Job-years
Labor Income	\$145.6 Billion	\$370.0 Billion

Economic Benefits from Operations & Maintenance (annual)		
Economic Measure	Direct Benefit	Total Benefit
Output	\$24.7 Billion	\$55.4 Billion
Value-added	\$14.6 Billion	\$30.7 Billion
Employment	48.8 Thousand Jobs	235.0 Thousand Jobs
Labor Income	\$6.1 Billion	\$16.0 Billion

Most direct jobs are in high-wage construction and manufacturing

Distribution of Jobs by Sector Due to Construction of 100 GW of Advanced Coal Facilities with CCS



Comparison of BBC findings with National Commission on Energy Policy's Energy Jobs Task Force Report (2009)

- NCEP Task Force Report on U.S. energy jobs used data on direct construction jobs from Bechtel, an international engineering design/build contractor.
- UMWA, IBEW, Boilermakers and AFL-CIO IUC participated in the Task Force.

Man-years per 1 Gigawatt of new capacity: coal and nuclear create ~5-10x more direct jobs than wind or natural gas

Man-Years per Gigawatt of New Generation Capacity, Development plus Construction Phases

Technology	Salaried Workforce	Hourly Workforce	Total Man-Years
Nuclear	4,785	9,575	14,360
Supercritical PC coal with CCS	2,140	8,435	10,575
IGCC gasified coal with CCS	2,795	8,145	10,940
Natural gas combined cycle (NGCC)	495	1,270	1,765
Onshore wind	305	1,180	1,485

Source: NCEP, Task Force Report on America's Future Energy Jobs (2009).

Basic messages on CCS

- U.S. climate legislation (or U.S. EPA regulation) should support substantial CCS commercial deployment at new and retrofit units.
- CCS technologies have wide applicability in cement, chemicals, refining, steel and all other energy-intensive sectors, both in the U.S. and worldwide.
- CCS deployment will be essential for meeting any global climate targets under consideration.

Copenhagen: A Step Forward or Back?



Source: itsgettinghotinhere.org

The 2007 Bali Action Plan provided the recipe for Copenhagen: Emission caps for industrial nations, sustainable development and financial assistance for developing countries

- (b) Enhanced national/international action on mitigation of climate change, including, inter alia, consideration of:
 - (i) Measurable, reportable and verifiable nationally appropriate mitigation commitments or actions, including **quantified emission limitation and reduction objectives, by all developed country Parties**, while ensuring the comparability of efforts among them, taking into account differences in their national circumstances;
 - (ii) **Nationally appropriate mitigation actions by developing country Parties in the context of sustainable development, supported and enabled by technology, financing and capacity-building**, in a measurable, reportable and verifiable manner;

G-77 & China Core Position

- “Measurable, reportable and verifiable” actions by developing countries are *only those actions made possible by the transfer of technology and financial resources from industrial nations.*
- *Obama sought to cut through this one-sided recipe for deadlock by developing support from India & China for voluntary commitments, albeit not legally-binding, with a \$100 Bil. aid package.*

Copenhagen Accord

- EU left in the hallway. Concerns about “transparency.”
- Recognizes 2 degree C temperature target (~450 ppm).
- Pledges industrial nations to 80% carbon reductions by 2050 – but near-term targets are left to “fill in the blank” responses by industrial & developing nations.
- China and India “commitments” appear to be based on BAU projections of CO₂ efficiency improvements.
- Promises collective \$100 Bil/yr aid to small developing and vulnerable nations by 2020 from unspecified sources.
- Review of progress in five years (?)

Copenhagen, cont.

- UN Conference “noted” the Accord in its decisions, declined to adopt it as a UN FCCC document.
- Copenhagen Accord has no legal status within the UN climate process – it is a “political agreement” – and is not a treaty subject to ratification by the Senate.
- UN agreed to extend the mandates of both the Kyoto Protocol and Long-Term Cooperative Action ad hoc groups with a view toward reaching conclusions in Cancun in late 2010.
- 3-5 negotiating sessions of the ad hoc groups in 2010, prior to Cancun.

\$64 Billion Questions

- Will the Accord form the basis for a new global climate treaty through the UN negotiation process? Will the Accord fold into G-20 negotiations? How would G-20 “commitments” be translated to legally binding commitments?
- How will Congress respond to U.S. pledges for a major share of \$100 billion in financial and technical assistance to least-developed and vulnerable nations? (USAID FY2009 total budget = \$14 Bil.)
- Would U.S. EPA seek to rely on the Accord for developing CO₂ reduction targets in the absence of Congressional legislation?

Thanks to ...

- NARUC for the invitation here today, and its support of the Boucher CCS bill.
- ACCCE for supporting this presentation and the BBC study.
- UMWA for the initial concept of the BBC study, and leadership with other unions in promoting participation in the UN climate change process.