



Briefing on Northern Plains-Midwest Coal Technology and Climate Policy Delegation to Europe

Lessons Learned and Opportunities for South Dakota and the Region

**Hosted by Gary Hanson,
South Dakota Public Utilities Commissioner
Pierre, South Dakota
July 26th, 2007**





Delegation Briefing



Opening Remarks

Gary Hanson
Commissioner and Vice Chairman,
South Dakota Public Utilities
Commission





Delegation Briefing



- **Mike Gregerson:** Program Consultant, Great Plains Institute
- **Beth Soholt:** Executive Director, Wind on the Wires
- **David Hadley:** V.P. for State Regulatory Relations, MISO, former Indiana Utility Regulatory Commissioner, former chair of NARUC's clean coal committee
- **Betsy Engelking:** Manager, Resource Planning and Bidding, Xcel Energy





Mike Gregerson
Program Consultant
Great Plains Institute

Moderator





Delegation Background



- Outgrowth of Great Plains Institute's (GPI) Coal Gasification Work Group
- Planning, organization, and staffing by GPI
- Sponsored by the Edgerton Foundation





Beth Soholt
Executive Director
Wind on the Wires

Delegation Objectives
& Overview





Delegation Objectives



Assess European experience in commercializing advanced coal technologies with potential to capture carbon dioxide (CO₂) for geologic sequestration

- Dry-feed gasification technologies for power, gas and liquid fuel production
- Oxyfuel combustion for power production
- Focus on low rank coals and biomass as dominant resources in our region





Objectives



- Share European climate policies and experience with CO₂ emissions trading with U.S. delegation participants
- Support U.S. state & regional initiatives
 - Northern Plains/Upper Midwest Coal Gasification Work Group's efforts to develop policy and support key low-rank coal demonstration projects
 - Report and follow-up to Wisconsin Gov. Doyle's IGCC Study Group
 - Lower Midwest/Ohio River Valley initiative under development





Delegation Participants



Twenty-seven individuals from 11 states and 21 public, private and nonprofit institutions

- Executives from American Electric Power, Great River Energy, Headwaters, North American Coal, PacifiCorp, & Xcel Energy
- Bi-partisan regulatory commissioners/state officials from IN, MN, MT, ND, SD, & WI
- Advocates from Clean Air Task Force, Clean Wisconsin, Izaak Walton League, Ohio Environmental Council, Western Resource Advocates, & Wind on the Wires
- Trustees and staff of the Edgerton and Joyce Foundations





Delegation Activities



- Technology briefings from major gasification vendors and leading energy companies
- Site visits to commercial gasification plants
- Policy briefings from government officials and industry executives





Delegation Program: Monday, July 10, The Hague



- Briefings from Royal Dutch Shell
 - Sustainable development and energy scenarios
 - Clean coal energy and Shell's dry feed gasifier technology and business strategy
 - Roundtable discussion





Royal Dutch Shell Briefing: Major Observations



- Shell expects coal to dominate future global energy supply with 6% annual growth
- Steady improvement in Shell's gasifier performance, including with biomass
- Company focused on China and coal to gas and liquids
 - Recent emphasis on other markets
- Shell's U.S. business model and strategy:
 - Minimal interest in smaller projects: technology licensing only; little offered for performance guarantees
 - Greater interest in equity participation in large projects with greater performance guarantees
 - (e.g. 75,000 bpd coal-to-liquids or larger)





Briefing from NL Emissions Trading Authority: Key Observations



- **CO₂ and NO_x emissions trading**
 - Building on U.S. experience with SO_x trading
 - Uncertainty due to CO₂ price fluctuations caused by over-allocation of allowances
 - Compliance varies, with richer northern European countries generally doing better
- **Carbon capture & sequestration (CCS)**
 - Early stage planning with focus on storage in the Netherlands' North Sea gas fields





David Hadley
V.P. for State Regulatory Relations
Midwest Independent System
Operator

Site Visit Observations





Tuesday, July 11th: Buggenum, The Netherlands



Nuon 250 MW IGCC plant

- One of three commercial IGCC plants in Europe today
- Shell dry-feed technology
- Previously served as feedstock testing facility
 - Experience with many feedstocks, including low rank coals and biomass (municipal sludge, ag processing wastes, etc.)





Nuon IGCC Plant: Key Observations



High availability achieved

- High integration of gasification island & other units yielded high efficiency but low reliability
- Integration issues overcome with plant modifications

Biomass co-gasification at 30%

- Business model built on NL and EU renewable energy incentives and revenues for managing municipal and ag wastes

50% target by weight in 2008

- 300,000 tons biomass/yr = 50 MW





Nuon's Magnum Project



- EUR 1 billion investment
- 1,200 MW plant (750 IGCC-450 NGCC) by 2011
- Carbon capture-ready with actual CCS post start-up
- Substantial biomass component planned
- Poly-generation approach:
 - Syngas for power generation
 - Syngas and heat for local industry
 - Liquid fuels (including biodiesel synthesized from captured CO₂ equivalent to biomass component)
 - Hydrogen for chemicals, fuel cell applications and power generation
 - Largest oxygen plant in the Netherlands to supply industrial customers with nitrogen





Wednesday, July 12th: Freiberg, Germany



- **Future Energy briefings**
 - Future Energy engineers
 - Characteristics/performance of dry-feed gasifier
 - Experience with lignite coal and biomass
 - Siemens German and U.S. executives
 - Update on Future Energy acquisition and plans to integrate GSP gasifier technology into Siemens portfolio
- **Tour of Future Energy's gasification testing facility**





Future Energy: Key Observations



- GSP gasifier has extensive lignite track record & simple, reliable and less costly design
- Biomass experience less extensive than Shell's
 - Siemens optimistic about modifications for biomass
- Focus on China as well
- No North American footprint
 - Prospects for Siemens to bring GSP technology to U.S. market with guarantees





Thursday, July 13th: Tour of SVZ Schwarze Pumpe



- Formerly part of East German state industrial complex
 - Syngas supplied 85% of GDR's gas from lignite coal
 - Once world's 2nd largest gasification facility after Sasol in South Africa
- Currently gasifying problem waste streams with Future Energy and BGL gasifiers
 - 250,000 tpy into syngas, methanol, formaldehyde & power
 - Non-recyclable plastics, sewage sludge, contaminated wood, tars, shredder residue, etc.

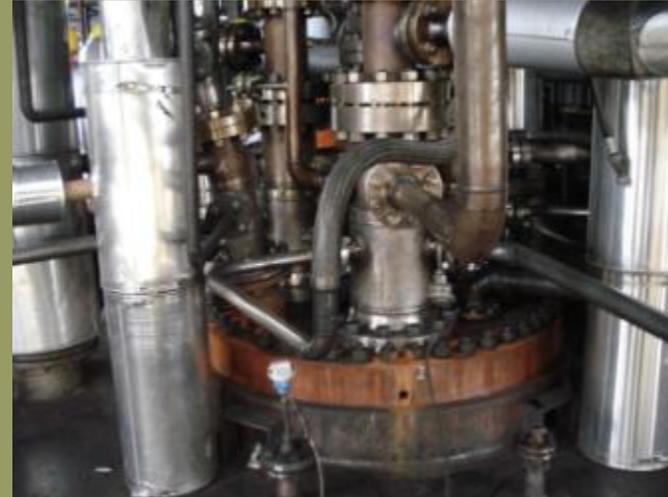




SVZ Schwarze Pumpe: Key Observation



Schwarze Pumpe's Future Energy GSP gasifier performs at high availability despite heterogeneous feedstocks





Tour of Kraftwerk Schwarze Pumpe



Vattenfall's 1,400 MW supercritical power plant

- Most efficient lignite combustion plant in the world today
- Representative of new combustion plants being built in Europe





Kraftwerk Schwarze Pumpe: Key Observations



- Uses lignite at 56% moisture before drying
- Waste heat utilized for lignite drying & district heating systems of two nearby towns
- Scrubber units generate 5,000 tpd of gypsum
 - Plant stockpiles what wallboard market cannot absorb
- Not carbon capture-ready





Betsy Engelking
Manager of Resource Planning and Bidding
Xcel Energy

Key Observations from Policy Briefings





Friday, July 14th in Berlin: Policy & Technology Briefings



Presentations from government & industry

- Germany's federal climate & energy policy
- British Petroleum's climate strategy and projects
- RWE's climate strategies and proposed 400 MW lignite IGCC demo project with CCS
- Vattenfall's climate strategies & 30 MW oxyfuel project





German Climate Policy: Key Observations



- One of few European countries that may meet Kyoto targets
- Lignite CO₂ emissions down from 34.9 % to 21.9 % of total German emissions (1990-2002)
 - Replacement of antiquated GDR fleet and efficiency improvements
 - Planned combustion units may erode lignite gains
- Economy-wide energy efficiency, renewables development and CO₂ credit trading are source of other major reductions
- Germany supports a firm cap and trade policy
- Debate over retaining nuclear power and challenge to continued CO₂ reductions





BP Presentation: Key Observations



- Oil and gas will last until 2100
 - Problem: 80% of it in unstable regions
- Global energy use to increase 30% by 2030
- BP has announced major gasification projects
 - Power generation with CCS and enhanced oil recovery (EOR)
 - UK example: 350 MW natural gas to hydrogen with CO₂ for EOR by 2009
 - Similar plant planned in CA (petcoke)





RWE Presentation: Key Observations



- Commitment to IGCC with CCS despite post-Kyoto uncertainty
 - Sees carbon management as necessary component of any future business model
- 400 MW lignite IGCC in 2014 will include CCS from the start
 - Builds on RWE's operational experience with gasification
- Lignite is company's preferred coal





Vattenfall Presentation: Key Observations



- Vattenfall also views carbon management as fundamental to future business strategy
- Comprehensive commitment to improving combustion power plant efficiency
- Strategic choice for oxyfuel combustion over IGCC
 - 30 MW oxyfuel demonstration at Schwarze Pumpe has broken ground; operational by 2008
 - Experience and comfort with boiler technology
 - Stated that commercial-scale oxyfuel plant only possible by 2020 at earliest





Major Conclusions: Gasification is Commercially Demonstrated



IGCC is Commercially Demonstrated

- European experience confirms the reliability of gasification technologies for electric power, syngas, and other energy/chemical products
- Use of low-rank coal with IGCC has been demonstrated in Europe, including lignite





Major Conclusions: Gasification Ensures Options for Future CO₂ Management



Gasification is the best technical and commercial option for managing CO₂ emissions from coal in the short to medium term

United States and Northern Plains a leadership advantage in carbon management and the use of CO₂ for EOR, due to world class experience and proximity to geologic reservoirs.





Major Conclusions: Gasification Can Support Renewable Energy



Gasification Can Reduce Long-Term Risk and Increase Options

- Multiple feedstock, products and revenue streams as hedge against future regulatory and market uncertainty





Major Conclusions: Gasification Can Support Renewable Energy



Gasification may facilitate large-scale use of renewable biomass through co-gasification with coal

- Opportunity to fulfill Northern Plains & Midwest's significant biomass resource potential
- Prospect of net carbon-negative energy production through co-gasification with CCS





Major Conclusions: Gasification Reduces Risk and Increases Options Long-Term



European utility business strategies confirm gasification's poly-generation business model of multiple products and revenue streams to hedge against future regulatory and market uncertainty.





Major Conclusions: Gasification Needs Incentives & Regulatory Help Short-Term



European and American industry face similar challenges of institutional culture, financial risk and regulatory uncertainty in commercializing coal gasification with CCS.





Gary Hanson
Commissioner and Vice Chairman
South Dakota Public Utilities
Commission

Closing Remarks





Examples for Achieving Regulatory Certainty



- Projects approved as “in the public interest”, “reasonable and necessary” and “for economic development” and not least cost test.
- Pre-approval of pre-construction and construction investments for generation and transmission.
- Enhanced rate of return on investment.





State Investment Recovery Policy Examples



Investment Recovery

- Indiana (Code Section 8-1-8.8)
- Kentucky (Code Section 278)
- Arkansas (Act 755)
- Virginia (SB 1416)
- Colorado (House Bill 06-1281)

FEED Studies/Cost Reductions/tax credits:

- Illinois, North Dakota, Wyoming





Thank You



- Major Support for Coal Gasification Work Group from the Joyce Foundation
- For more information on the delegation and the Coal Gasification Work Group, please see www.gpisd.net
- For an online press kit including this presentation, please see www.gpisd.net/media

