

WHY IGCC? WHY NOW?

THE MESABA ENERGY PROJECT

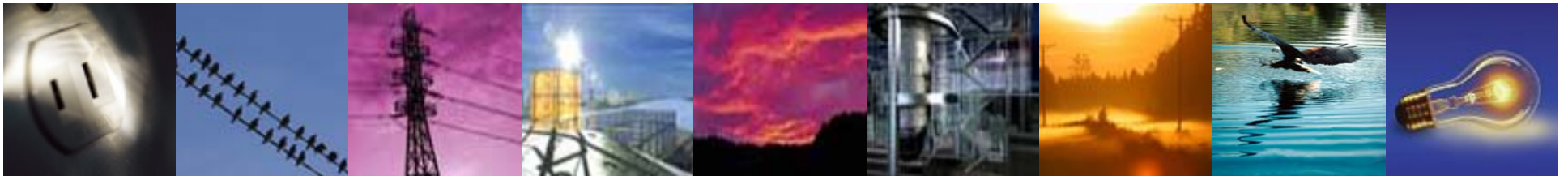


ENERGY, INNOVATION, AND ECONOMIC DEVELOPMENT

**Presentation to Public
Service Commission of
Wisconsin
Clean Coal Study Group
February 10, 2006**

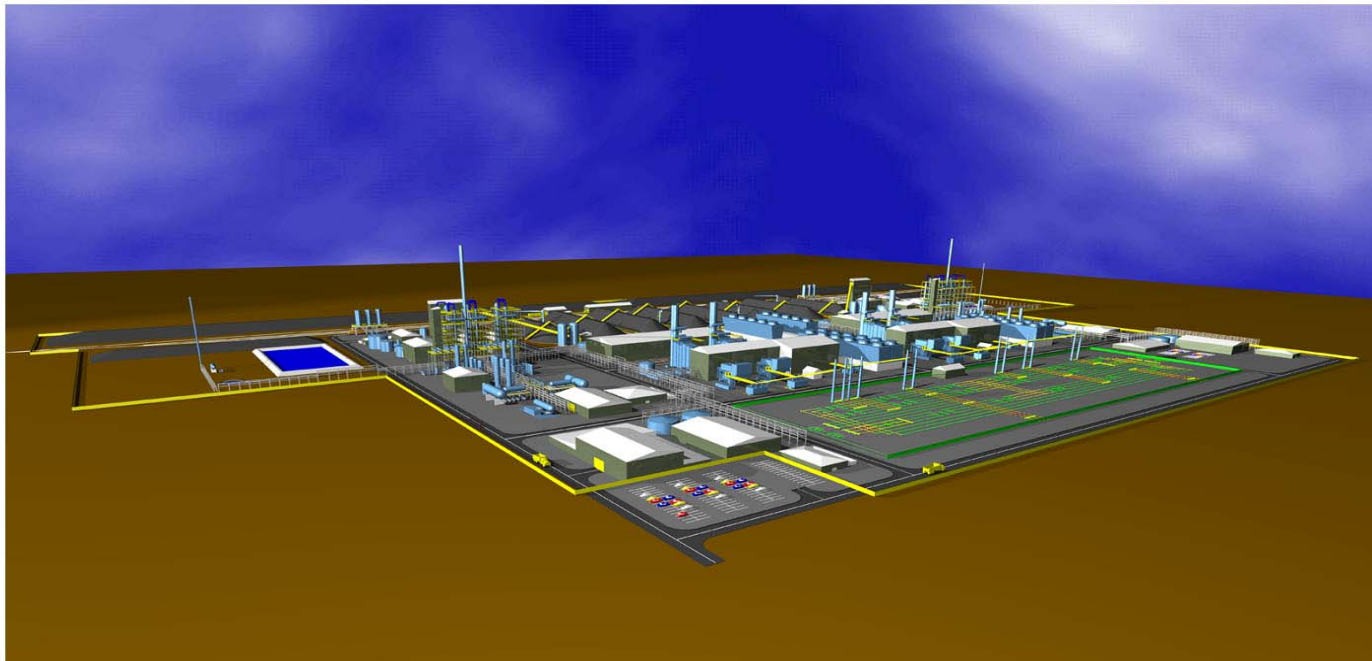
Why IGCC? Why Now? From Three Perspectives

- ▶ Minnesota Policy Makers
- ▶ National Perspective
- ▶ Owners and Economic Regulators



Mesaba Energy Project Overview

EXCELSIOR ENERGY INC. MESABA ENERGY PROJECT



FLUOR

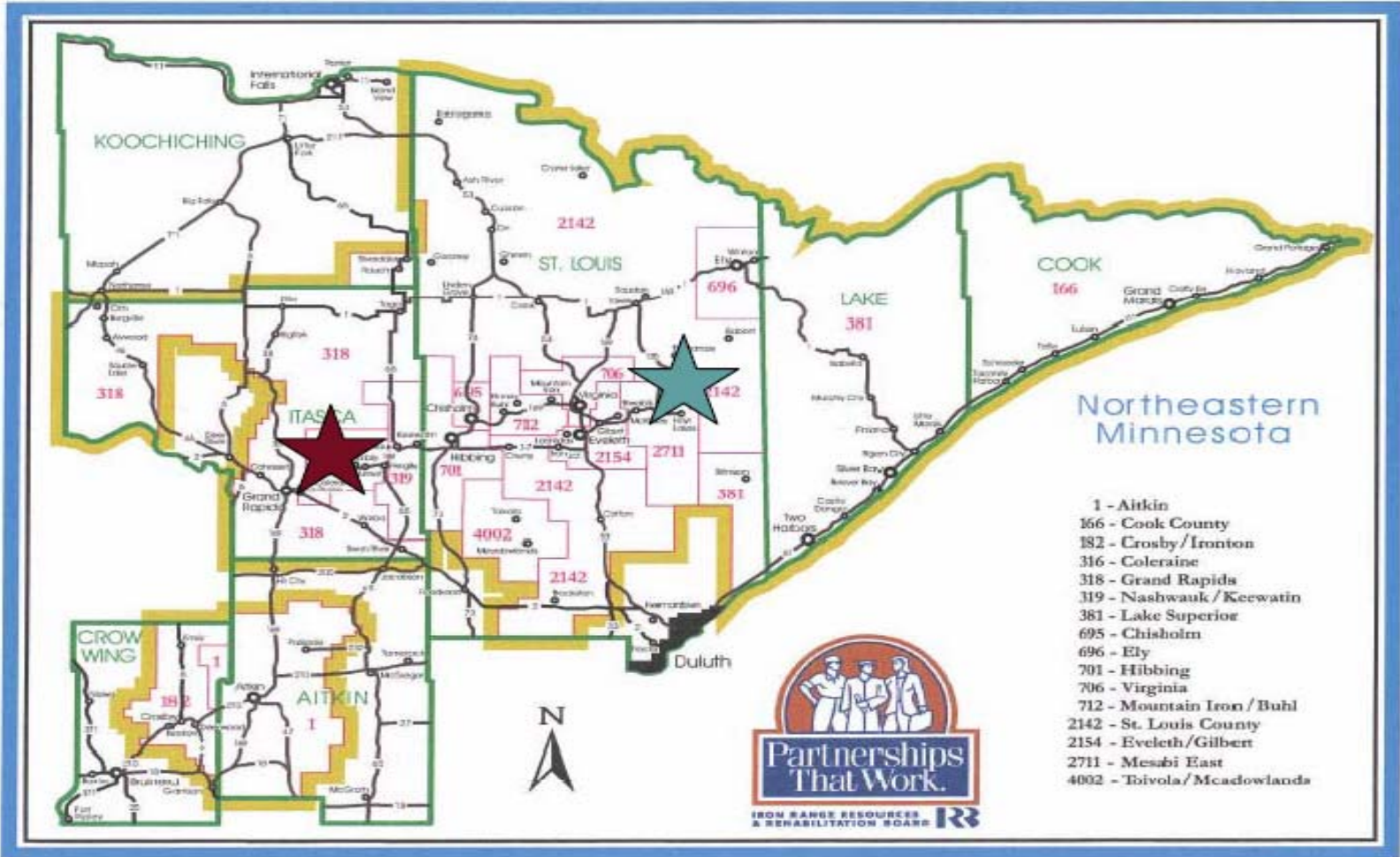
ConocoPhillips


EXCELSIOR  **ENERGY**

Mesaba Energy Project - Overview

- ▶ Integrated gasification combined cycle (IGCC) plant with initial capacity of 606 MW (net) to be in service in 2011
- ▶ Project located on Northeastern Minnesota's Iron Range, on site offering multiple fuel transportation options
- ▶ License of ConocoPhillips E-Gas technology
- ▶ Groundbreaking benefits under Minnesota enabling legislation for Project installations on up to three sites
- ▶ Significant expansion opportunities and regional demand for new baseload generation capacity
- ▶ Selected by U.S. Department of Energy to receive funding under Round II of Clean Coal Power Initiative

Mesaba Energy Project Location



 Preferred Site



 Alternative Site

Mesaba Project Overview

Project Status

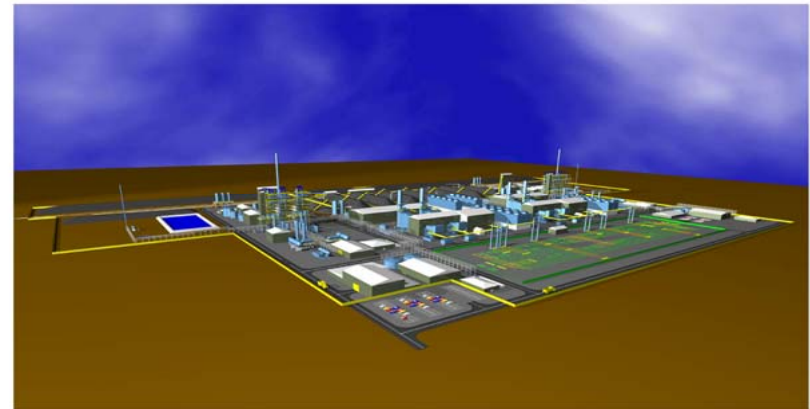
Completed To Date:

- ▶ Plant Optimization Studies
 - ▶ Nominal 600 MW Net plant size
 - ▶ Fuel Flexible Gasifier
 - Sub Bituminous
 - Bituminous
 - Petcoke Blends
- ▶ Sufficient Engineering to support permit applications
- ▶ Submitted Generator Interconnect requests to MISO
 - ▶ East Range Site – 10/2004
 - ▶ West Range Site – 05/2005
- ▶ Selection of Fluor as Project engineering, procurement and construction contractor (EPC)
- ▶ License Agreement with Conoco Phillips for E-Gas technology
- ▶ Selection of Preferred and Alternate sites for the siting and routing process
- ▶ Selection of Combustion Turbine Supplier

Next Steps:

- ▶ Submit Permits
 - ▶ Siting & Routing - March 2006
 - ▶ Air – February 2006
 - ▶ Water Appropriation – February 2006
 - ▶ NPDES – February 2006
- ▶ Begin Front End Engineering & Design – 1st Qtr 2006
- ▶ PPA Approval August - 2006
- ▶ Completion of MISO Facilities Study – 4th QTR 2006

EXCELSIOR ENERGY INC.
MESABA ENERGY PROJECT



FLUOR.

ConocoPhillips

Mesaba Project Overview

Annual Emissions Comparison: New Plants

Coal-Fired Power Plants Emissions

(tons per year)

	SCPC ^{(1),(4)}	PC WITH ESP & FGD ^{(2),(4)}	CFB ^{(3),(4)}	MESABA IGCC
SO ₂	3,000	3,600	3,100	400
NO _x	1,300	1,600	1,600	1,100
VOC	100	N/A	100	40
CO	2,200	2,000	2,200	540
PM/PM10	300	400	300	180
Hg	0.4	0.1	0.1	0.01
Total⁽⁵⁾	6,900	7,600	7,300	2,260

- (1) Wisconsin Electric Power SCPC information from April 2003 Draft Environmental Impact Statement, Elm Road Generating Station, Volume 1, Public Service Commission of Wisconsin & Department of Natural Resources, Table 7-11, p. 155 (Pittsburgh No. 8 coal).
- (2) Evaluation of IGCC to Supplement BACT Analysis of Planned Prairie State Generating Station, May 11, 2003. Prepared by Donald J. Wilhelm SFA Pacific, Inc. for Prairie State Generating Company, LLC.
- (3) Supplemental Information for PSD Permit Application, March 25, 2003, Prepared by Earth Tech, Inc. for Indeck - Elwood, LLC.
- (4) Electric Utility Steam Generating Unit Hg Test Program, EPA, October 1999.
- (5) Tons per year. 531 MW (net) Basis, 90% Capacity Factor.

Only ~1/3 the annual air emissions of a conventional coal unit



Mesaba Project Overview

Annual Emissions Comparison: New Plants

Comparison of Estimated Emissions from IGCC versus Super Critical Pulverized Coal Plants*

Annual Mass Emissions	NRG Cajun (08/22/05 Permit Limit)	Mid American (06/17/03 Permit Limits)	Elm Road (01/14/04 Permit Limits)	Mesaba Energy Project (Worst Case)
SO2 (TPY)	2,293	2,293	3,440	573
NOx (TPY)	1,605	1,605	1,605	1,376
VOC (TPY)	344	83	80	73
CO (TPY)	3,096	3,532	2,752	803
PM/PM10 (TPY)	344	573	413	229
Mercury (lbs/Yr)	198	78	51	28

* Emissions normalized to 606 MWs Net and 92% Availability

Flue Gas Constituent Concentration

- ▶ SO2, based on 50 ppmvd, as H2S in the undiluted syngas, rolling 30-day average and assuming 100% conversion of H2S to SO2
- ▶ NOx, 15 ppmvd (@ 15% O2)
- ▶ CO, 15 ppmvd (@ 15% O2)
- ▶ PM10, 25 lb/hr/CTG
- ▶ VOC, 2.4 ppmvd (@15% O2)

Mesaba Project Overview

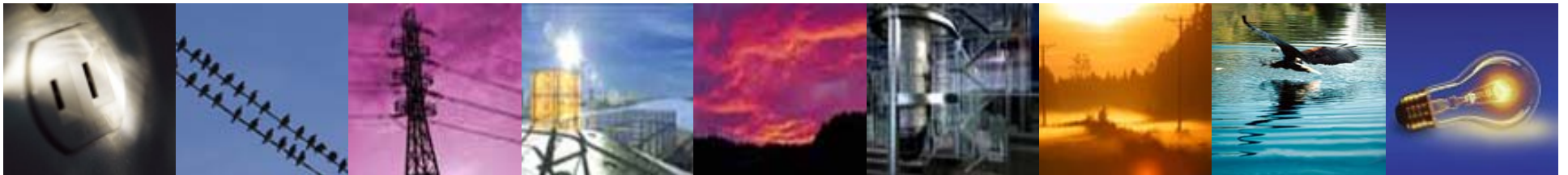
Development Funding

Sources of development funding include:

- ▶ \$9.5 million Iron Range Resources
- ▶ \$10 million Renewable Development Fund
- ▶ \$36 million DOE CCPI
- ▶ Additional Funding Equity, in-kind equity, at-risk deferrals

Why IGCC? Why Now? Minnesota's Perspective

Meet need for power and provide energy security in Minnesota while furthering State and National policy goals



Key Terms of State Enabling Legislation

- ▶ Entitled to power purchase agreement with Xcel Energy, subject to public interest finding by MPUC that by statute will take a broad range of Project benefits into account
- ▶ Entitled to provide an additional percentage of Xcel's energy needs if likely to be a least cost resource
- ▶ MPUC must ensure that Project is considered as a supply option for all future utility needs in the State
- ▶ Exempted from certificate of need for all initial and future generation and transmission
- ▶ Awarded \$10 million in funding from renewable development account
- ▶ Job Opportunity Building Zone designation, which provides a holiday in early years on State taxes

Minnesota Enabling Legislation – State Policy Goals

Goal: Energy Security for Minnesota

- ▶ Need for power
 - ▶ No new base-load generation or transmission resources built in past decades
 - ▶ Significant load growth in the region (3000 – 5000 MW in coming decade) – reserve margins dwindling and transmission tapped out
 - ▶ Expansion-ready site provides ready baseload supply option
- ▶ Secure, hedged supply
 - ▶ Coal provides stable pricing
 - ▶ Diversify consumers' energy portfolio between natural gas used for home heating and coal used for electricity
 - ▶ Hedge against cost of compliance with tightening emission limits
 - ▶ Reduce pressure on natural gas price and supply



Minnesota Enabling Legislation – State Policy Goals

Wisconsin weighs in:

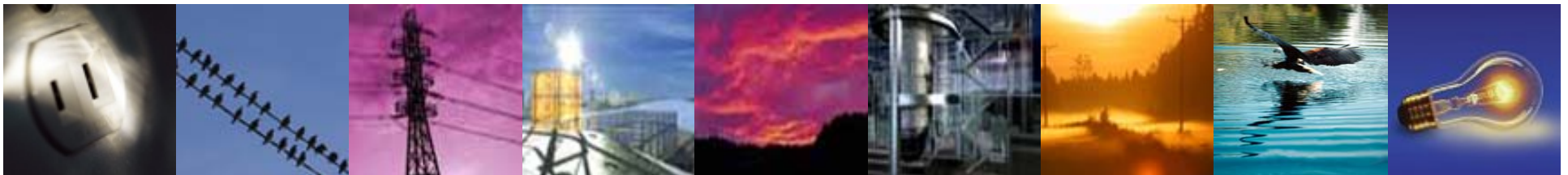
“The Wisconsin Public Service Commission argued gas is not a cost-effective fuel source because of current high prices and because Wisconsin is at the end of the pipeline system, subjecting the State to the possibility of having gas cut off if it was needed earlier on the system.”

Platts, March 31, 2005

Minnesota Enabling Legislation – State Policy Goals

Goal: Economic Development

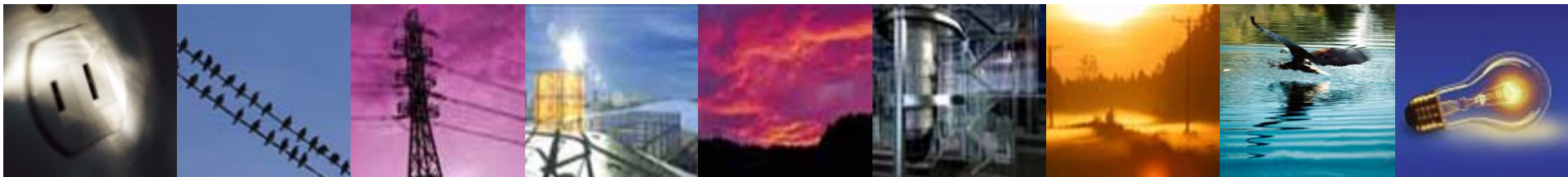
- ▶ Supply Minnesota’s baseload needs with in-state plants that protect Minnesota’s natural environment
- ▶ Provide investment needed to reverse economic decline in Northeastern Minnesota
- ▶ Create jobs for available, skilled industrial workforce
- ▶ Use sites and infrastructure in industrial region
- ▶ Create IGCC anchor facilities on large industrial sites to attract new industries that can tap IGCC’s polygeneration capabilities



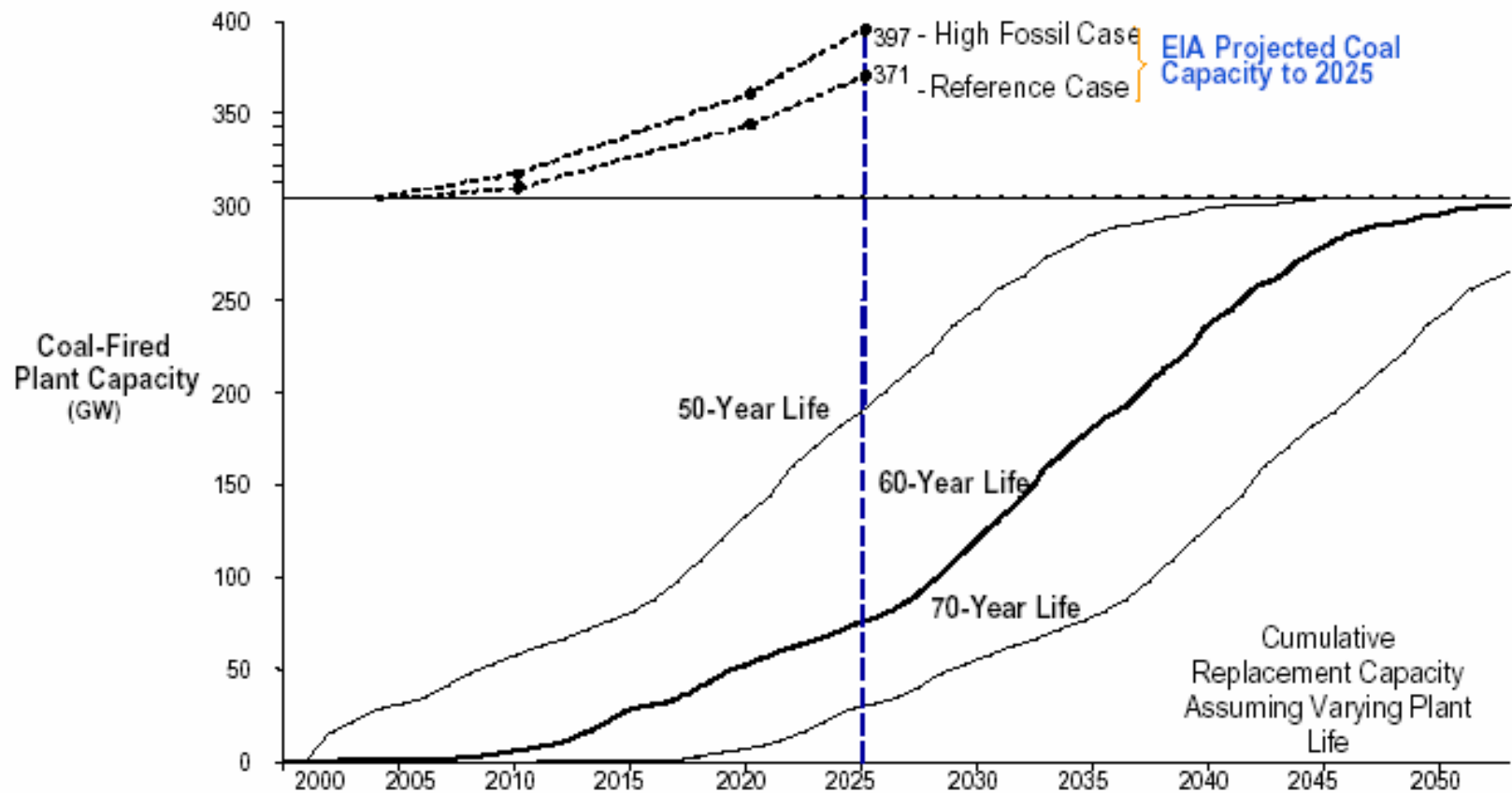
Minnesota Enabling Legislation – State Policy Goals

Goal: Innovation and Environmental Stewardship

- ▶ Continue Minnesota’s environmental leadership tradition and provide immediate local environmental benefits
- ▶ Ensure rapid market penetration of IGCC nationally to dramatically reduce criteria pollutant levels in Minnesota
- ▶ Play a lead role in critical U.S. effort to develop cost-effective means to limit global carbon emissions



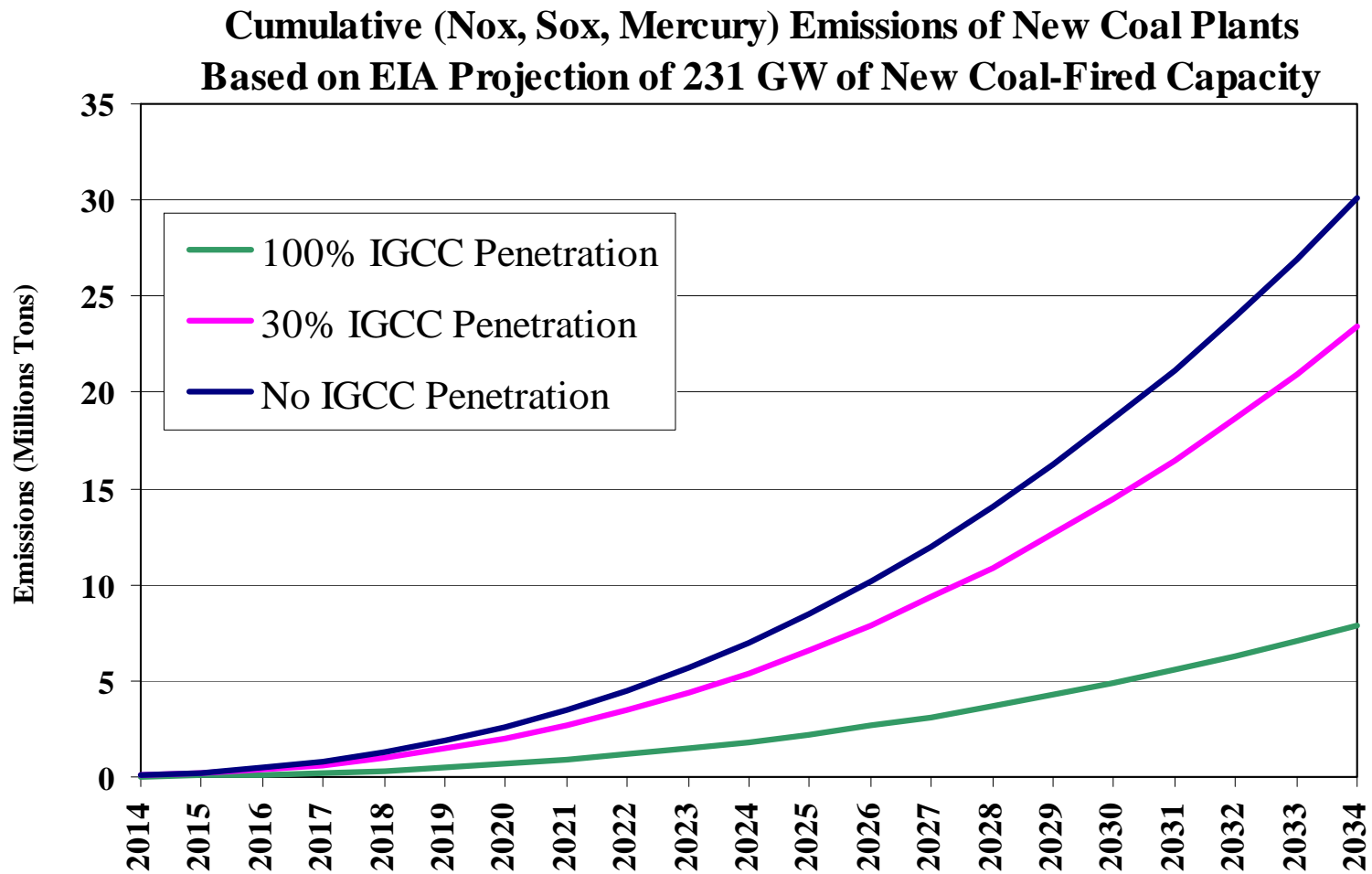
The Race is On for IGCC: Market For New Coal Power Plant Technology



Department of Energy, the Electric Power Research Institute,
and the Coal Utilization Research Council

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Avoided Emissions With IGCC: The Importance of IGCC Plants in 2010 To Ensure IGCC Market Penetration

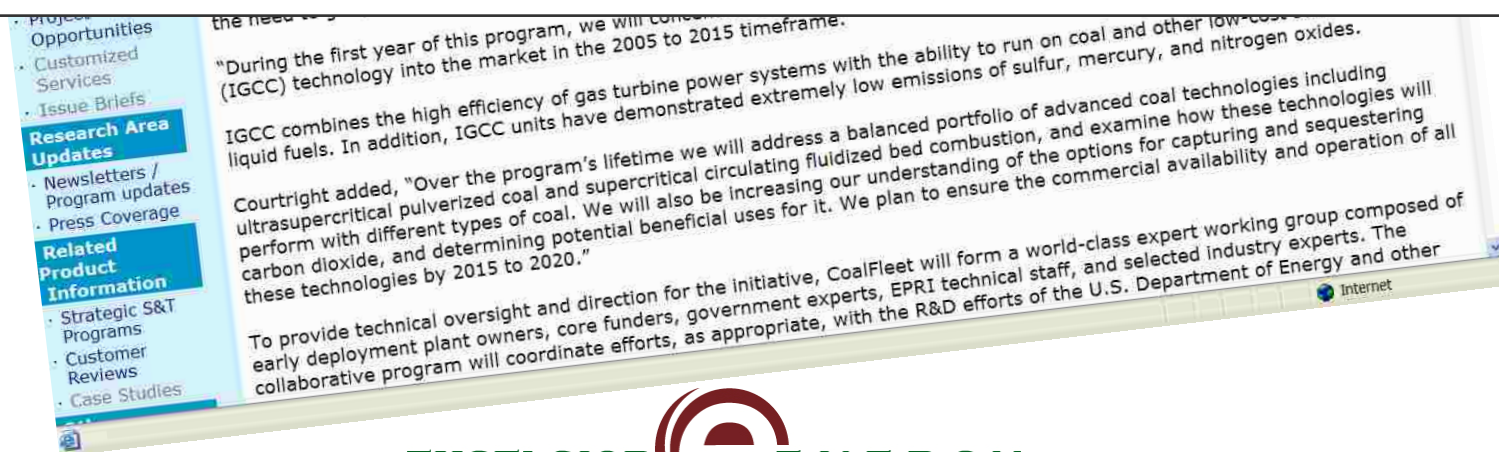


In The News



“During the first year of the program, we will concentrate much of our effort on accelerating integrated gasification combined cycle (IGCC) technology into the market in the 2005 to 2015 timeframe.”

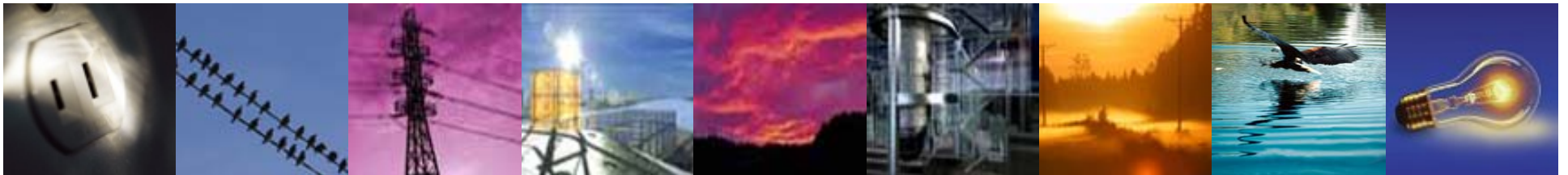
Hank Courtright, EPRI VP of Generation
November 11, 2004



Why IGCC? Why Now? National Perspective

“The Mesaba Project, and the many IGCC plants that will follow its lead, will put Americans to work, protect our natural environment, reduce pressure on natural gas resources and further our Nation’s energy independence and national security goals.”

U.S. Senator Norm Coleman

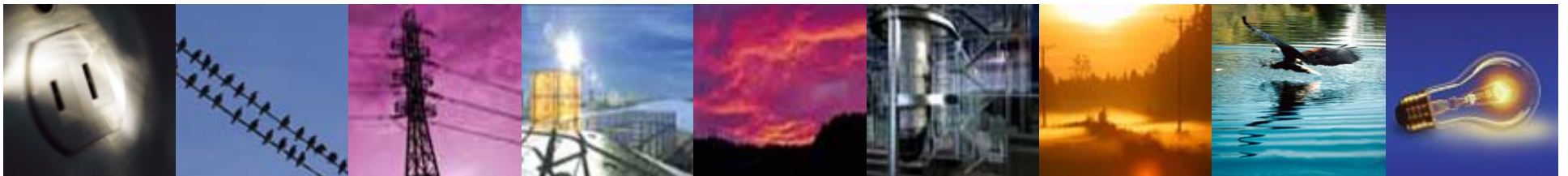


Why IGCC? Why Now? National Perspective

“The Excelsior plant builds on the significant progress we have already made toward meeting America’s growing energy needs in an environmentally sound manner.”

“The technologies we seek to foster through Round II [of the Clean Coal Power Initiative] will help make it possible for coal to remain a cornerstone of our domestic energy portfolio...”

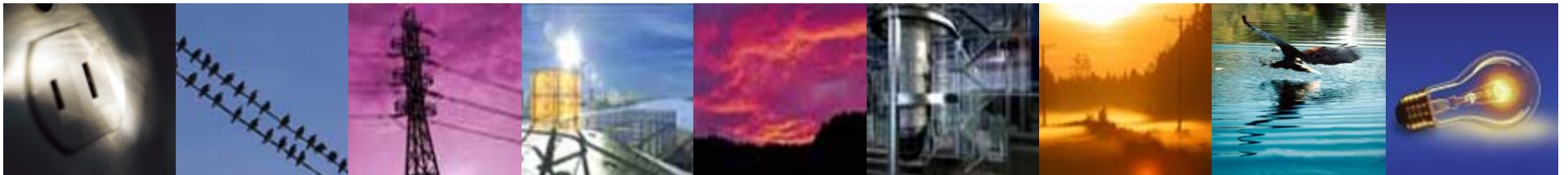
Secretary of Energy Spencer Abraham



Why IGCC? Why Now? National Policy Goals

Goal: Energy and National Security

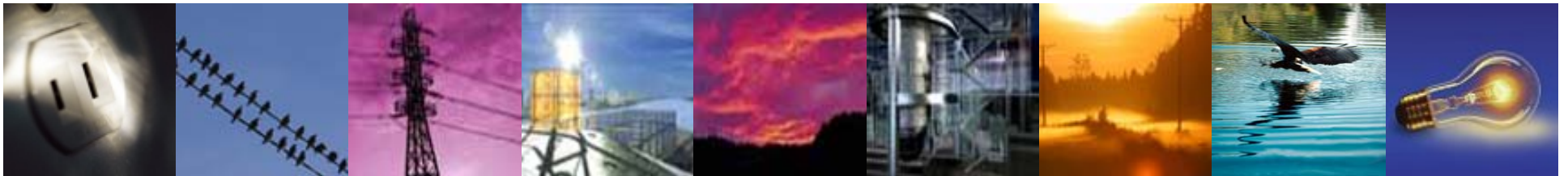
- ▶ Allow continued prominent role for abundant domestic coal in meeting Nation's energy needs
- ▶ Reduce reliance on oil imports
- ▶ Minimize new dependencies on offshore natural gas suppliers
- ▶ Improve balance of trade
- ▶ Ensure critical knowledge base of technology that can produce liquid fuels and hydrogen for transportation to meet essential national supply needs



Why IGCC? Why Now? National Policy Goals

Goal: Economic Growth

- ▶ Reduce pressure on natural gas prices and supply
- ▶ Avoid further demand destruction and permanent loss of jobs in chemical and other energy-intensive industries
- ▶ Strengthen farm sector by stabilizing fertilizer and energy costs



Why IGCC? Why Now? National Policy Goals

Goal: Innovation and the Environment

- ▶ Stepping-stone to FutureGen and Hydrogen Vision
- ▶ Foster technological innovation required that enables U.S. and all coal-rich nations to commit to meaningful carbon constraints with manageable impact on economic growth

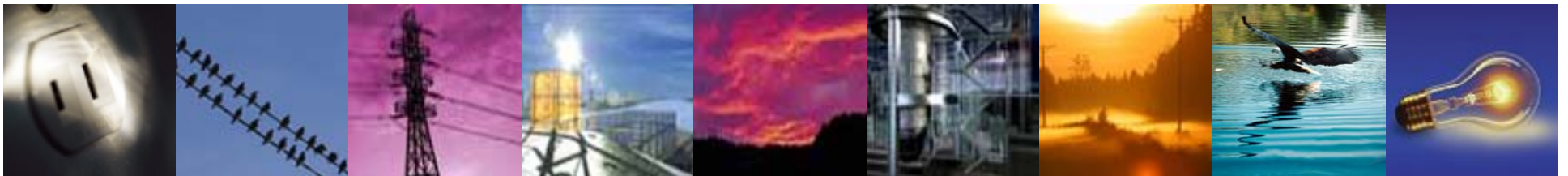
"The power plant of the future will be a 'coal refinery' that turns coal into hydrogen fuel and electricity with zero emissions."

Kurt E. Yeager, president and chief executive of EPRI

Wall Street Journal, Oct. 15, 2003

Why IGCC? Why Now? Perspective of Owners and Ratepayers

IGCC is the least cost option for baseload generation, when the alternatives are compared on a life of plant, risk-adjusted basis

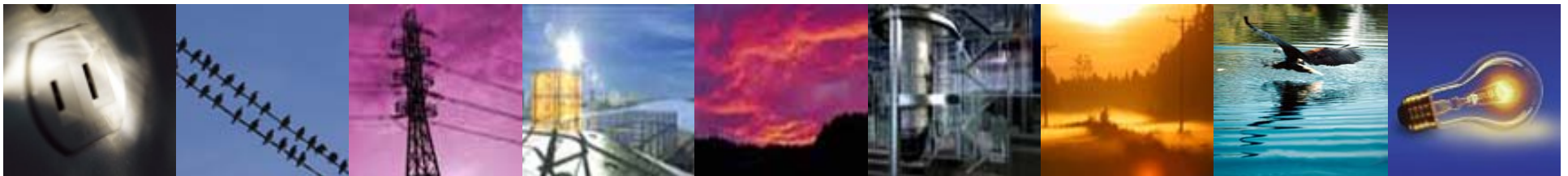


IGCC Advantages Over Conventional Technologies

	<u>Mesaba</u>	<u>Conventional PC</u>
Initial capital cost		<input checked="" type="checkbox"/>
Technology familiarity		<input checked="" type="checkbox"/>
Operating Efficiency (heat rate)	<input checked="" type="checkbox"/>	
Fuel-Flexible Plant	<input checked="" type="checkbox"/>	
Environmental Externalities	<input checked="" type="checkbox"/>	
In-Service Timing	<input checked="" type="checkbox"/>	
Industrial Ecology		
-No landfill	<input checked="" type="checkbox"/>	
-On-site synergies	<input checked="" type="checkbox"/>	
Path to carbon capture	<input checked="" type="checkbox"/>	
Future environmental regulations risk	<input checked="" type="checkbox"/>	
DOE support	<input checked="" type="checkbox"/>	
Supports H ₂ economy	<input checked="" type="checkbox"/>	

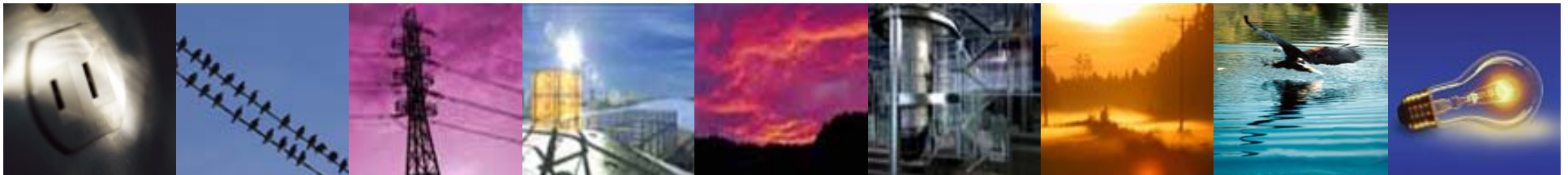
Factors In Calculating Cost of Power

- ▶ Installed capital cost
- ▶ Financing costs
- ▶ Availability
- ▶ Fuel cost and flexibility
- ▶ Thermal efficiency
- ▶ Operating costs
- ▶ Costs of meeting environmental requirements for life of plant
- ▶ Delays and unforeseen costs
- ▶ Relationships with stakeholders



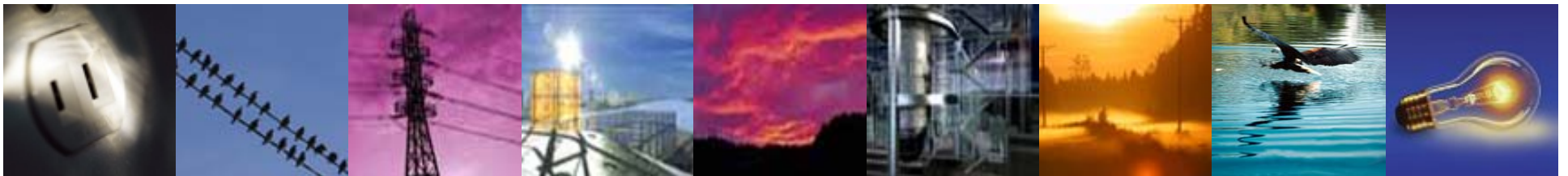
Cost Factors: Installed Capital Cost

- ▶ Capital cost of IGCC is converging with conventional, super critical pulverized coal (SCPC) technologies
 - ▶ SCPC cost is a moving target – costs of recent, actual SCPC plants under construction are higher than generic industry numbers due to increasing capital costs associated with back-end clean-up requirements
 - ▶ IGCC cost has decreased due to maturation of combined-cycle market and cost optimization achieved by multiple-train units



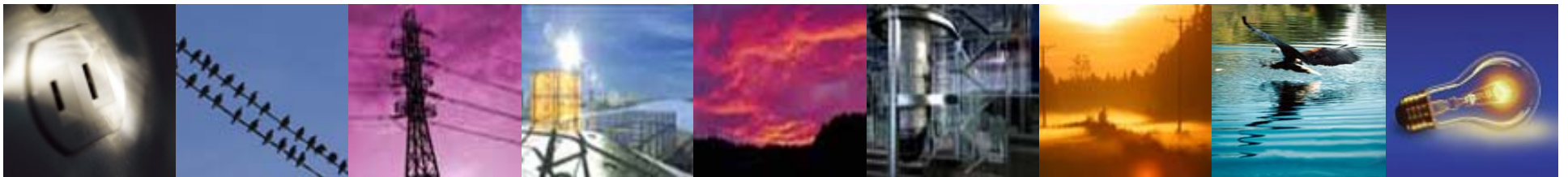
Cost Factors: Financing Costs

- ▶ Financing costs managed through effective risk allocation and mitigation
 - ▶ Pact between ratepayers, plant owners and EPC turnkey contractor can be structured to place appropriate burdens on EPC contractor and owner to meet financing requirements
 - ▶ Ratepayers bear manageable risks associated with start-up, schedule and performance to manage cost of EPC financial guarantees to the “sweet spot”



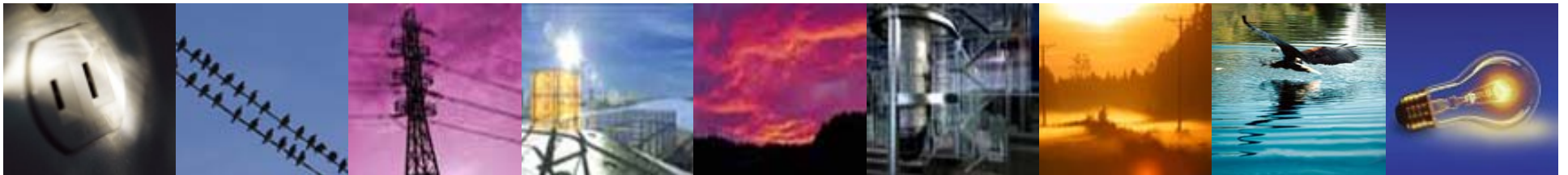
Cost Factors: Availability

- ▶ IGCC availability on solid fuel with spare gasification train is comparable to SCPC
- ▶ Built-in spinning reserve, natural gas back-up from combined cycle power island provides ratepayers with an availability hedge that is a value-added product not offered by SCPC



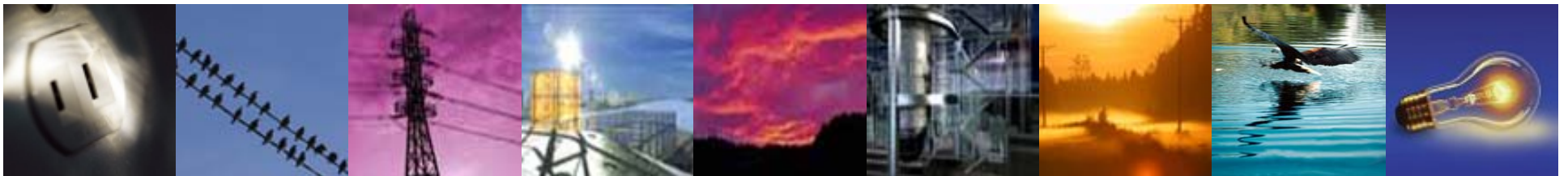
Cost Factors: Fuel Cost and Flexibility

- ▶ IGCC can be cost-effectively configured to use a broad range of fuels (including sub-bituminous, all Eastern fuels and petcoke)
- ▶ Provides fuel optionality not possible with conventional technologies
- ▶ Fuel flexibility is increasingly important in tighter, shorter term solid fuel supply and transportation markets, particularly in the context of a 40 year plant life

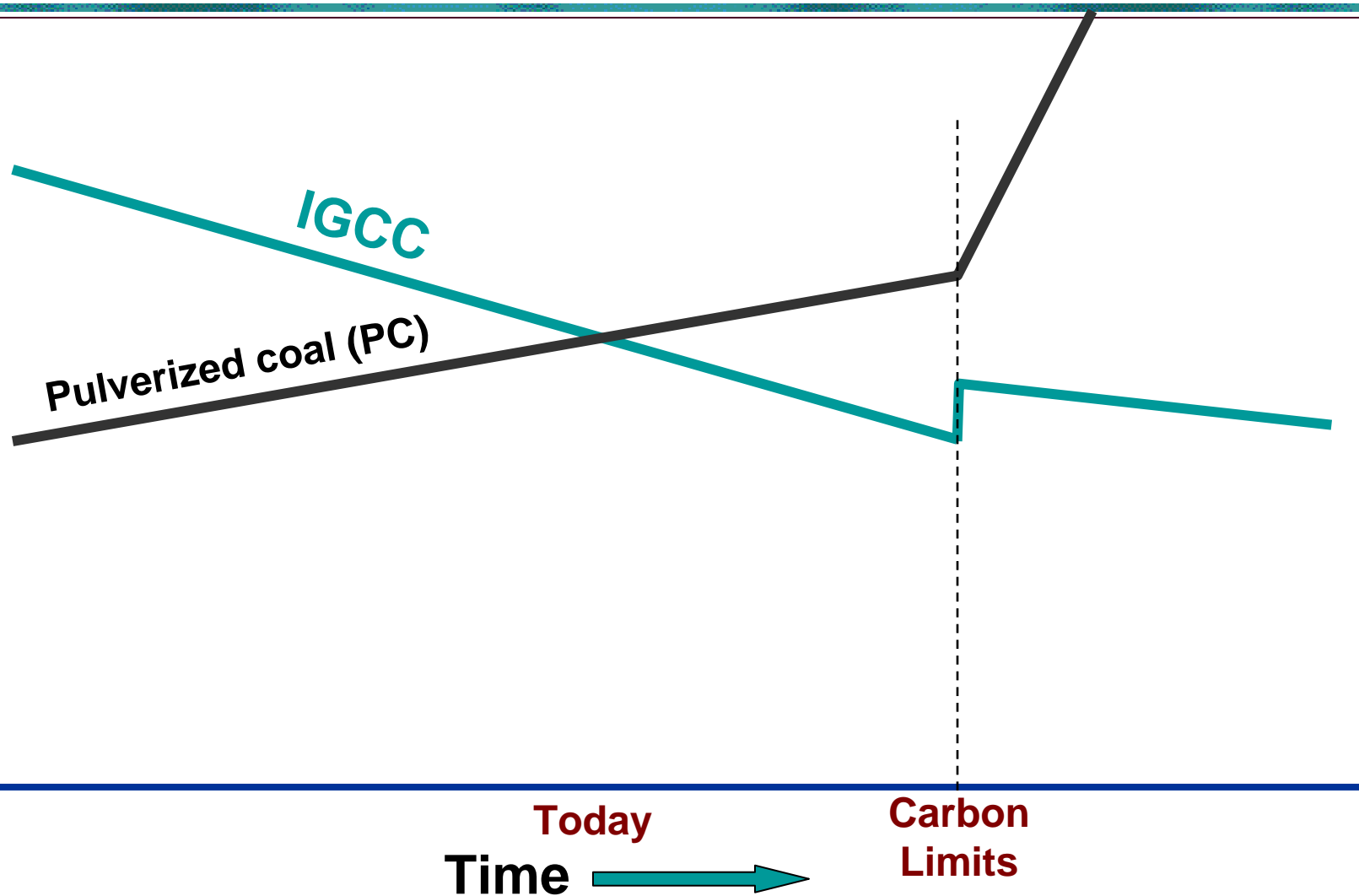


Cost Factors: Efficiency

- ▶ IGCC efficiency improvement over SCPC increases with each new back-end clean up requirement
 - ▶ Results in lower fuel costs at the outset compared to SCPC and advantage increases over the life of the plant
 - ▶ Higher efficiency also reduces criteria pollutants and carbon emissions

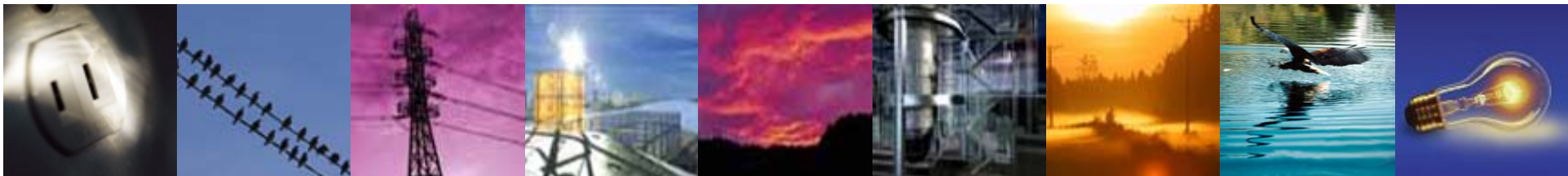


Cost and Heat Rate Trends



Cost Factors: Operating Costs

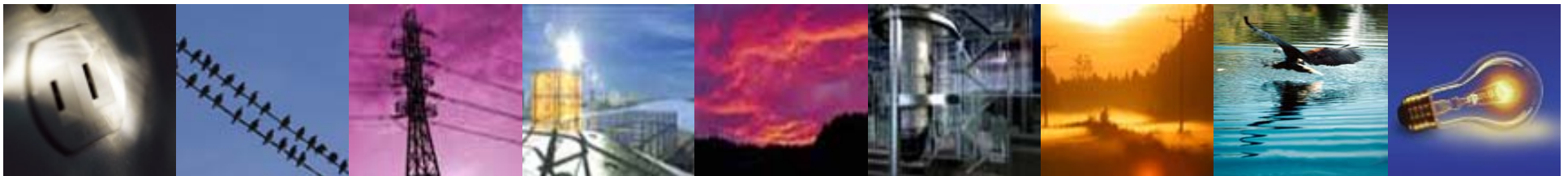
- ▶ IGCC direct operation and maintenance costs comparable to SCPC
- ▶ Landfill costs for SCPC can be significant and are virtually eliminated by industrial ecology of IGCC (byproducts of slag and marketable sulfur rather than waste products)
- ▶ IGCC emission allowance expense much lower than SCPC under all allowance program scenarios



Cost Factors: Meeting Current Environmental Requirements

- ▶ SCPC emission limits are a moving target and coal plants have eight to ten year development and construction timelines
- ▶ Creates substantial risk that final construction costs of SCPC unit will exceed estimate that was the basis for the initial approval
- ▶ Portfolio limits (such as interstate transport rules) must be considered in addition to individual plant emission limits

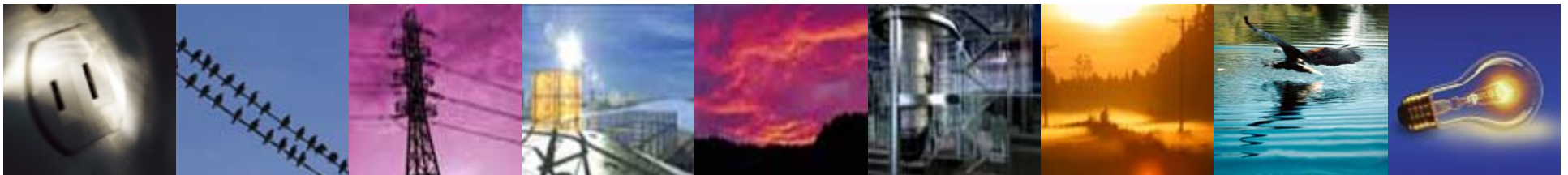
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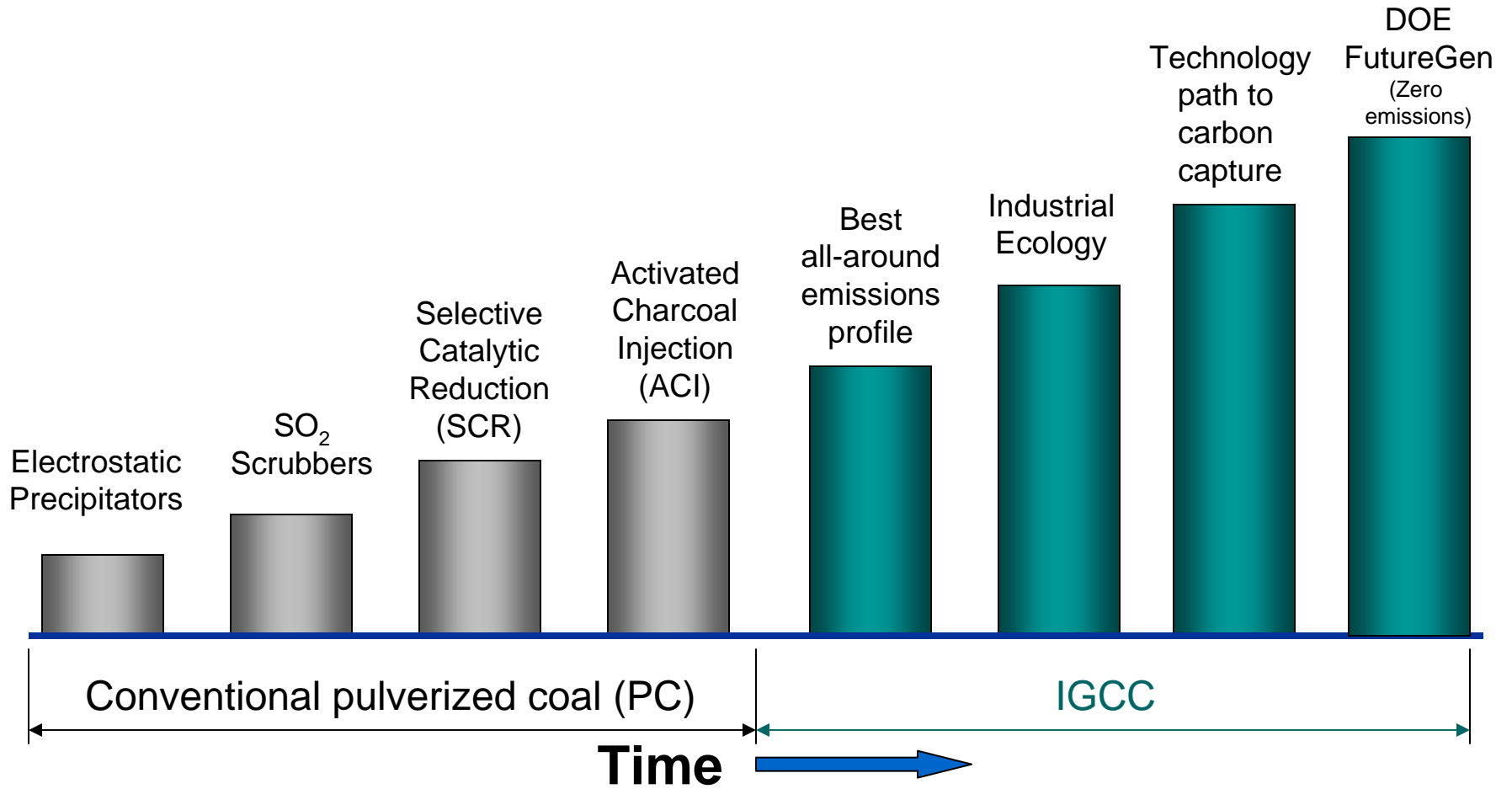
Cost Factors: Meeting Current Environmental Requirements

- ▶ IGCC base design pricing includes:
 - ▶ Ability to control 90%+ of mercury, even with lower rank Western coals (critical in Midwestern market)
 - ▶ Extremely low SO_x, NO_x and particulate emissions
 - ▶ Readiness to incorporate carbon capture equipment to control 20-30% of carbon dioxide by weight with minimal changes to core plant

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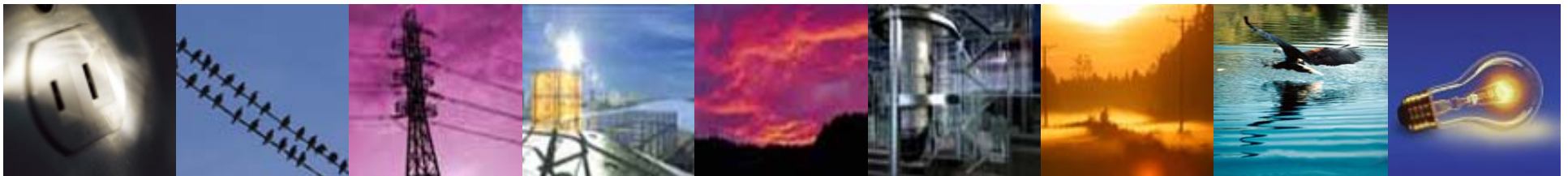
Evolution of Coal Plant Emissions Controls



Cost Factors: Meeting Life of Plant Environmental Requirements

- ▶ Trend of regulation is, in the long-term, to internalize all externalities associated with power generation, as the scientific community increases the understanding of, and quantifies, the societal costs of emissions
- ▶ Uncertainty over the form that future limits will take requires scenario planning and leadership at state level to protect ratepayers from significant and likely retrofit costs associated with taking a short-term view

(continued...)



Cost Factors: Meeting Life of Plant Environmental Requirements

- ▶ Technology selected must minimize retrofit risk no matter what form future environmental requirements take:
 - ▶ Plant-specific limits (BACT, LAER, NSPS, MACT) including solid waste disposal constraints
 - ▶ Utility portfolio limits (carbon, cap-and-trade)
 - ▶ State portfolio limits (Interstate transport rules)
 - ▶ Taxes
 - ▶ Litigation orders or settlement

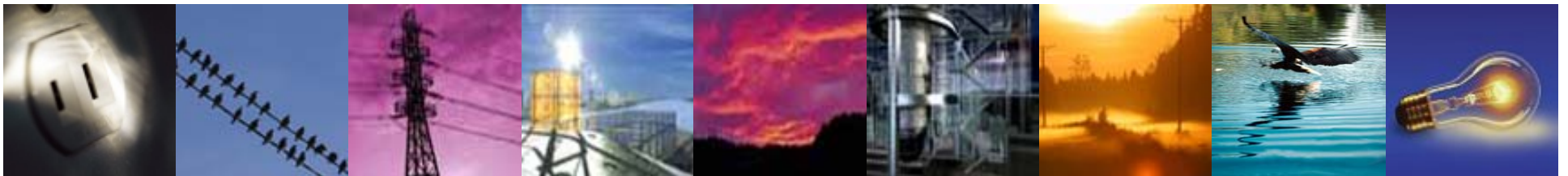
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Cost Factors: Meeting Life of Plant Environmental Requirements

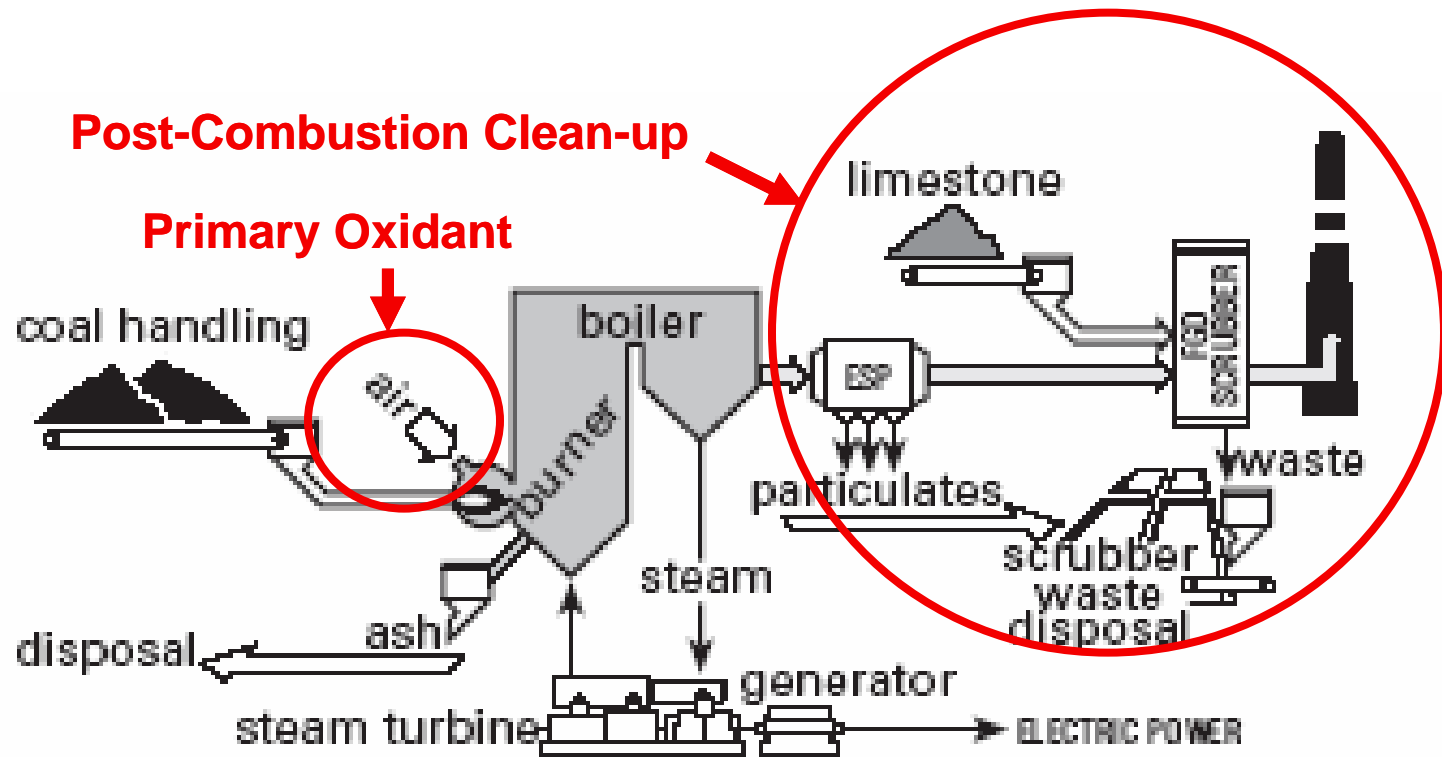
- ▶ IGCC is at the beginning of a long road of continuous improvement
 - ▶ Offers significant flexibility benefits to meet tighter limits over conventional technologies,
 - ▶ SCPC technology is stretching design capabilities to meet existing limits on criteria pollutants and mercury
 - ▶ Lack of technology development roadmap to meet carbon constraints increases risk of stranded investment in SCPC units

Cost Factors: Meeting Life of Plant Environmental Requirements

IGCC has superior flexibility to meet tightening environmental requirements over conventional coal-fueled technologies

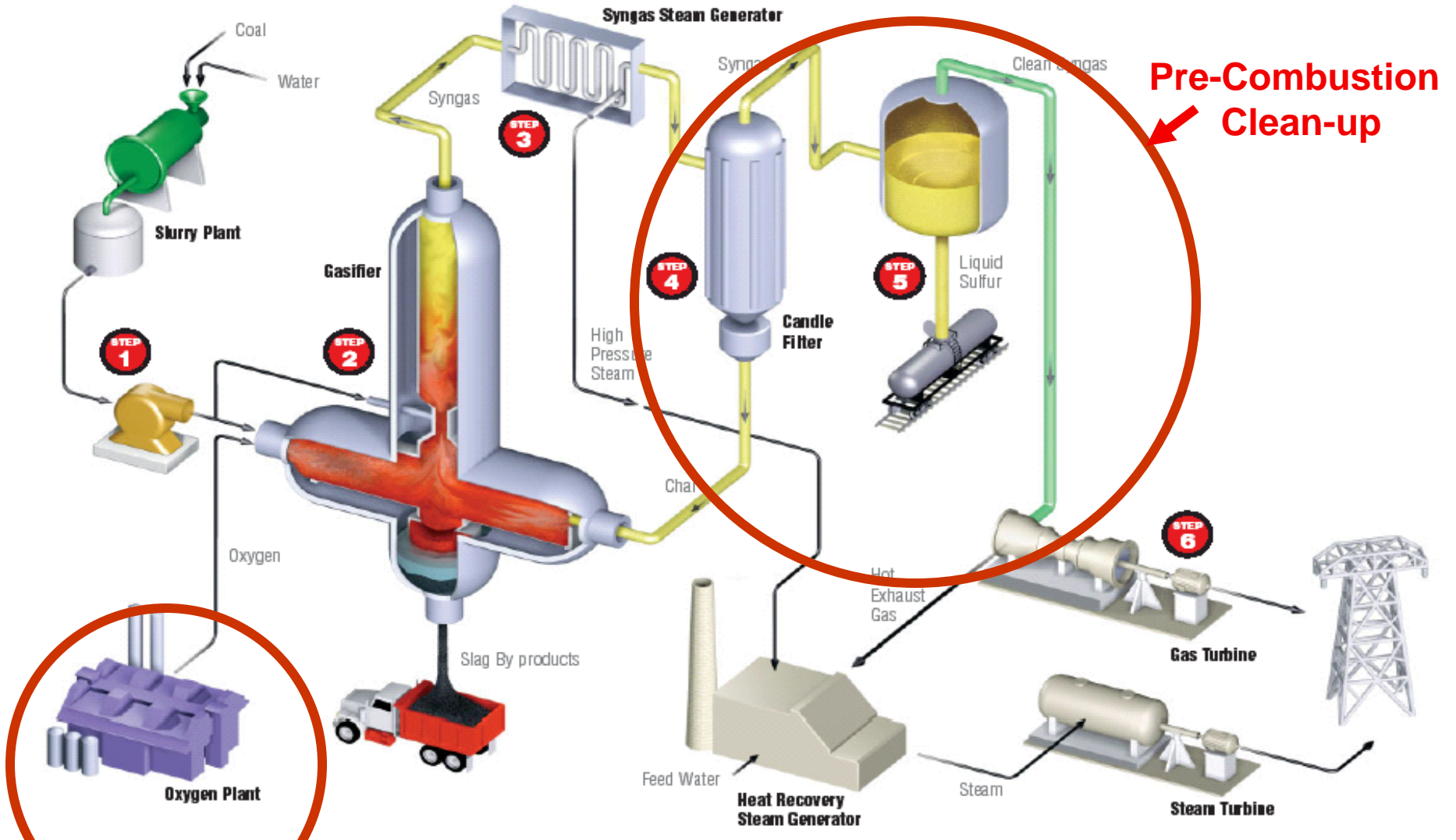


Conventional Coal-Fired Power Plant



Flow diagram of flue-gas desulfurization technology (from Ohio Electric Utility Institute, p. 7).
ESP = electrostatic precipitator; FGD = flue-gas desulfurization.

A LOOK INTO THE PROCESS



Pre-Combustion Clean-up

Primary Oxidant

ConocoPhillips

EXCELSIOR ENERGY

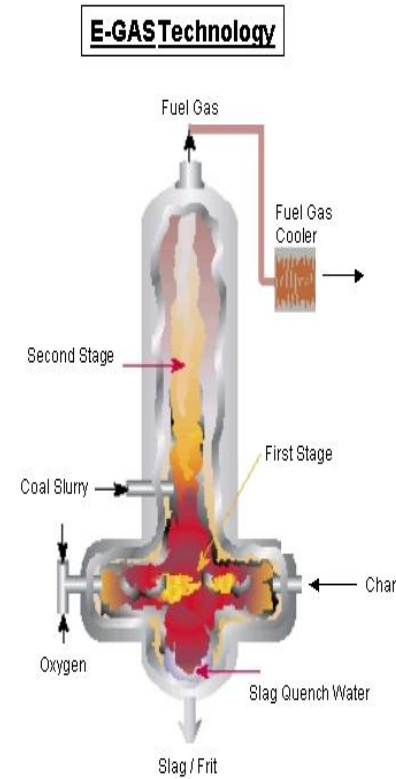
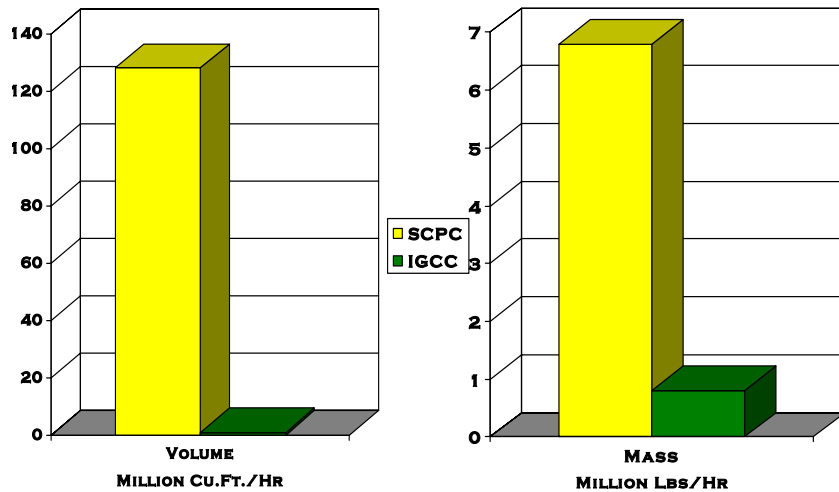
Mesaba Project Overview

Environmental Performance – Gas Clean Up

Gasification involves the incomplete combustion of a low value hydrocarbon stream in an oxygen deficient (reducing) environment.

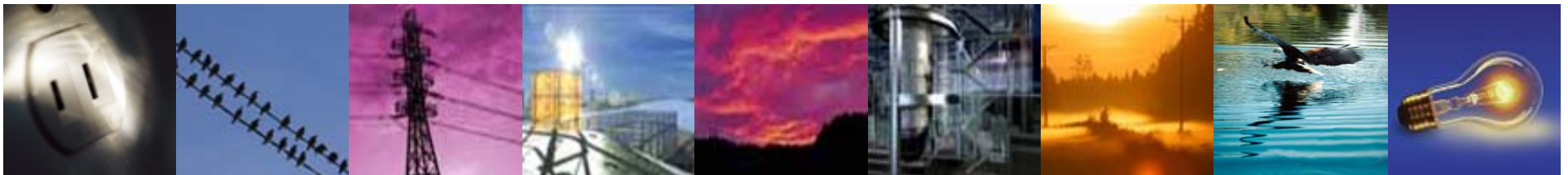
Gasification only uses 20 to 30% of the oxygen required for complete combustion.

Therefore, oxygen blown gasifiers have greatly reduced gas volumes and mass as compared to air blown gasifiers and traditional coal fueled technologies.



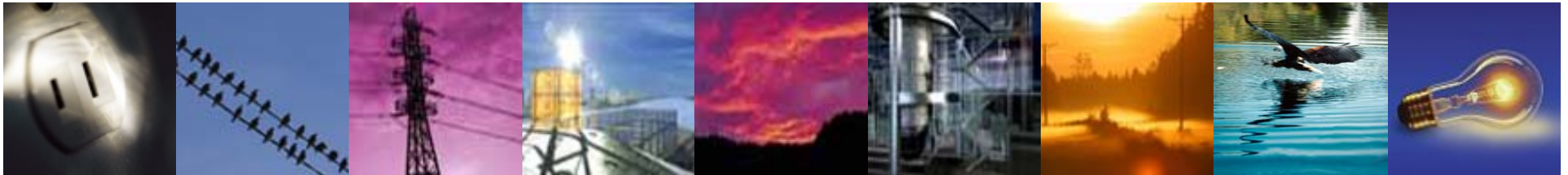
Cost Factors: Delays, Unforeseen Costs

- ▶ Costs and delays outside project sponsor and regulator's control
 - ▶ SCPC faces greater permitting and litigation delay risk, which may result in shortages in baseload capacity, over-reliance on gas-fired units and capacity shortfalls
 - ▶ SCPC faces potential development cost write-off risk for units that fail in permitting stage
 - ▶ SCPC total cost must include cost of settlement with intervenors in conventional coal project approval processes



Cost Factors: Stakeholder Relations

- ▶ Shareholders: Value of corporate stewardship is not reflected on the balance sheet, but improves the bottom line
- ▶ Wall Street: Clean portfolio improves cost of capital as rating agencies begin to penalize companies with large conventional coal portfolios – and equity markets may have prudence concerns
- ▶ Consumers: Increasing awareness of environmental impact (including climate change implications) of power generation choices creates opportunity to think longer-term
- ▶ Community: Public relations efforts to improve coal's image (and keep coal in the mix) will only work if the power industry is actually doing what it can to make coal a clean choice



In The News



“Strategically, you have to acknowledge the possibility of future regulations.”
“IGCC is a hedge against change-of-law risk.”
Public Utilities Fortnightly - January 2005



“Mesaba will accelerate the deployment of advanced clean coal projects and help the industry meet DOE’s aggressive roadmap goals for coal fired power generation with minimized environmental emissions.”
Power Engineering International - January 2005

42 Public Utilities Fortnightly January 2005



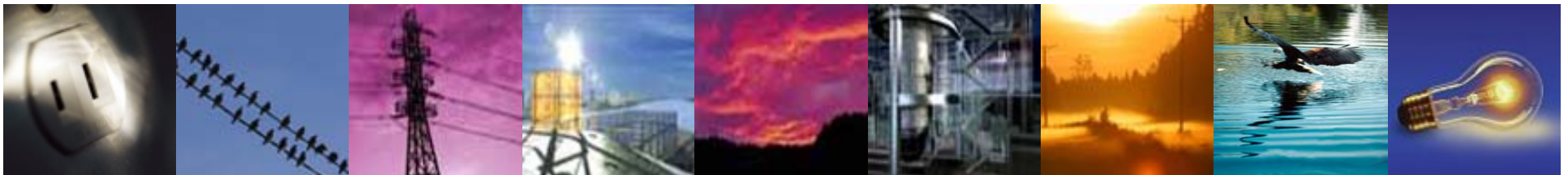
About Excelsior Energy

Excelsior Energy is a competitive power development company dedicated to bringing the benefits of IGCC power generation to Minnesota and the Midwest. Excelsior believes that IGCC is a critical component to a comprehensive national energy independence and environmental protection strategy. IGCC is a clean bridge to the large gap in power generation resources that remains when even the most comprehensive and renewables and conservation efforts are implemented and large amounts of natural gas-fired generation are included in the mix.

Excelsior's leadership team consists of twelve seasoned power industry executives who have developed, permitted, financed, constructed and operated innovative and technology-intensive power plants around the world. Excelsior brings the know-how, creativity and tenacity required to overcome the barriers to providing market-based solutions to our national energy policy challenges.

For more information, please visit Excelsior's website at:

www.excelsiorenergy.com



New York Times Op Ed: Coal in a Nice Shade of Green

The New York Times

March 25, 2005

OP-ED CONTRIBUTORS

Coal in a Nice Shade of Green

By THOMAS HOMER-DIXON and S. JULIO FRIEDMANN

WHEN it comes to energy, we are trapped between a rock and several hard places. The world's soaring demand for oil is pushing against the limits of production, lifting the price of crude nearly 90 percent in the last 18 months. Congress's vote in favor of drilling in the Arctic National Wildlife Refuge won't make much difference because the amount of oil there, at best, is tiny relative to global or even American needs. And relief isn't likely to come anytime soon from drilling elsewhere: oil companies spent \$8 billion on exploration in 2003, but discovered only \$4 billion of commercially useful oil.

Sadly, most alternatives to conventional oil can't give us the immense amount of energy we need without damaging our environment, jeopardizing our national security or bankrupting us. The obvious alternatives are other fossil fuels: natural gas and oil products derived from tar sands, oil shale and even coal. But natural gas supplies are tightening, at least in North America.

And, of course, all fossil fuels have a major disadvantage: burning them releases carbon dioxide, a greenhouse gas that may contribute to climate change. This drawback is especially acute for tar sands, oil shale and coal, which, joule for joule, release far more carbon dioxide than either conventional oil or natural gas.

New York Times: Coal in a Nice Shade of Green (continued)

As for energy sources not based on carbon, it would be enormously hard to meet a major percentage of America's energy needs at a reasonable cost, at least in the near term. Take nuclear power - a source that produces no greenhouse emissions. Even assuming we can find a place to dispose of nuclear waste and deal with the security risks, to meet the expected growth in total American energy demand over the next 50 years would require building 1,200 new nuclear power plants in addition to the current 104 - or one plant every two weeks until 2050.

Solar power? To satisfy its current electricity demand using today's technology, the United States would need 10 billion square meters of photovoltaic panels; this would cost \$5 trillion, or nearly half the country's annual gross domestic product.

How about hydrogen? To replace just America's surface transportation with cars and trucks running on fuel cells powered by hydrogen, America would have to produce 230,000 tons of the gas - or enough to fill 13,000 Hindenburg dirigibles - every day. This could be generated by electrolyzing water, but to do so America would have to nearly double its electricity output, and generating this extra power with carbon-free renewable energy would mean covering an area the size of Massachusetts with solar panels or of New York State with windmills.

Of course technology is always improving, and down the road some or all of these technologies may become more feasible. But for the near term, there is no silver bullet. The scale and complexity of American energy consumption are such that the country needs to look at many different solutions simultaneously. On the demand side, this means huge investments in conservation and energy efficiency - two areas that policy makers and consumers have sadly neglected.

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New York Times: Coal in a Nice Shade of Green (continued)

On the supply side, the important thing is to come up with so-called bridge technologies that can power our cities, factories and cars with fewer emissions than traditional fossil fuels while we move to clean energy like solar, wind and safe nuclear power. A prime example of a bridge technology - one that exists right now - is gasification.

Here's how it works: in a type of power plant called an integrated gasification combined-cycle facility, we change any fossil fuel, including coal, into a superhot gas that is rich in hydrogen - and in the process strip out pollutants like sulfur and mercury. As in a traditional combustion power plant, the heat generates large amounts of electricity; but in this case, the gas byproducts can be pure streams of hydrogen and carbon dioxide.

This matters for several reasons. The hydrogen produced could be used as a transportation fuel. Equally important, the harmful carbon dioxide waste is in a form that can be pumped deep underground and stored, theoretically for millions of years, in old oil and gas fields or saline aquifers. This process is called geologic storage, or carbon sequestration, and recent field demonstrations in Canada and Norway have shown it can work and work safely.

The marriage of gasified coal plants and geologic storage could allow us to build power plants that produce vast amounts of energy with virtually no carbon dioxide emissions in the air. The Department of Energy is pursuing plans to build such a zero-emission power plant and is encouraging energy companies to come up with proposals of their own. The United States, Britain and Germany are also collaborating to build such plants in China and India as part of an effort by the Group of 8. Moreover, these plants are very flexible: although coal is the most obvious fuel source, they could burn almost any organic material, including waste cornhusks and woodchips.

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Coal in a Nice Shade of Green (continued)

This is an emerging technology, so inevitably there are hurdles. For example, we need a crash program of research to find out which geological formations best lock up the carbon dioxide for the longest time, followed by global geological surveys to locate these formations and determine their capacity. Also, coal mining is dangerous and strip-mining, of course, devastates the environment; if we are to mine a lot more coal in the future we will want more environmentally friendly methods. On balance, though, this combination of technologies is probably among the best ways to provide the energy needed by modern societies - including populous, energy-hungry and coal-rich societies like China and India - without wrecking the global climate.

Fossil fuels, especially petroleum, powered the industrialization of today's rich countries and they still drive the world economy. But within the lifetimes of our grandchildren, the age of petroleum will wane. The combination of gasified coal plants and geologic storage can be our bridge to the clean energy - derived from renewable resources like solar and wind power and perhaps nuclear fusion - of the 22nd century and beyond.

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