

Cost of IGCC: Pipedreams of Green & Clean



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What's the current state of IGCC?

We're on the verge of reliving the 70's

- ❑ 70's were not a good time for power plants
 - Construction outpaced demand – grossly overbuilt
 - High investments in untried technology
 - ❑ Plants built incorporating design changes and fixes
 - ❑ Couldn't estimate cost because of design problems
 - ❑ Demonstration technology needed many false starts
 - ❑ Costs escalated manyfold
 - ❑ Some plants abandoned and ratepayers took hit
- ❑ Revitalization of coal industry is taking precedence over prudent expenditures, environment, public health and public interest – it's nuclear all over again, about to go critical

What's the current state of IGCC?

- ❑ Denial – promotional efforts are based on false promises of IGCC's superior environmental performance and capture "ready" technology that is all talk and no action
- ❑ Chaos – many plants are proposed but there's little basis in fact or experience to guide proponents or opponents
- ❑ Flux – if the truth of IGCC comes out, it knocks the flux out of a well-orchestrated promotional scheme
- ❑ Vulnerable – all the above makes successful deployment doubtful – the house of cards will come down

If you don't need it...

It's not least cost if you don't need it!

State need - Minnesota's proposed IGCC is based on a legislative initiative that was part of a deal to allow extension of life of nuclear plants, but there's criteria that Excelsior must meet – and it can't!

- ❑ PUC Order in Xcel IRP found first Xcel "need" is 375MW in 2015 – Xcel will use wind and hydro
- ❑ Excelsior is trying to force PPA on Xcel for 600MW in 2011 at 2-3 times price of other generation – the amount and timing is off

They say we “need” it, but

Region – Industry
says we “need”
6,300MW to cover
The region,
8,000MW to cover
6,300MW need
because of line
losses, etc.

Source: CapX2020 Technical report

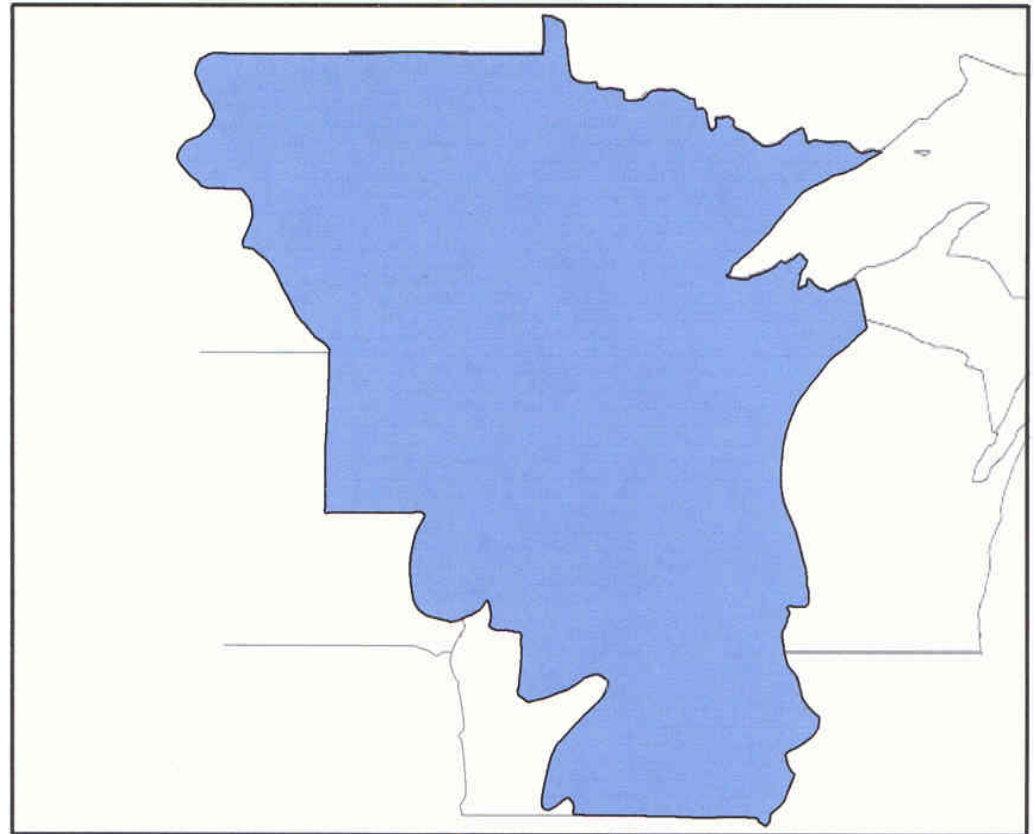
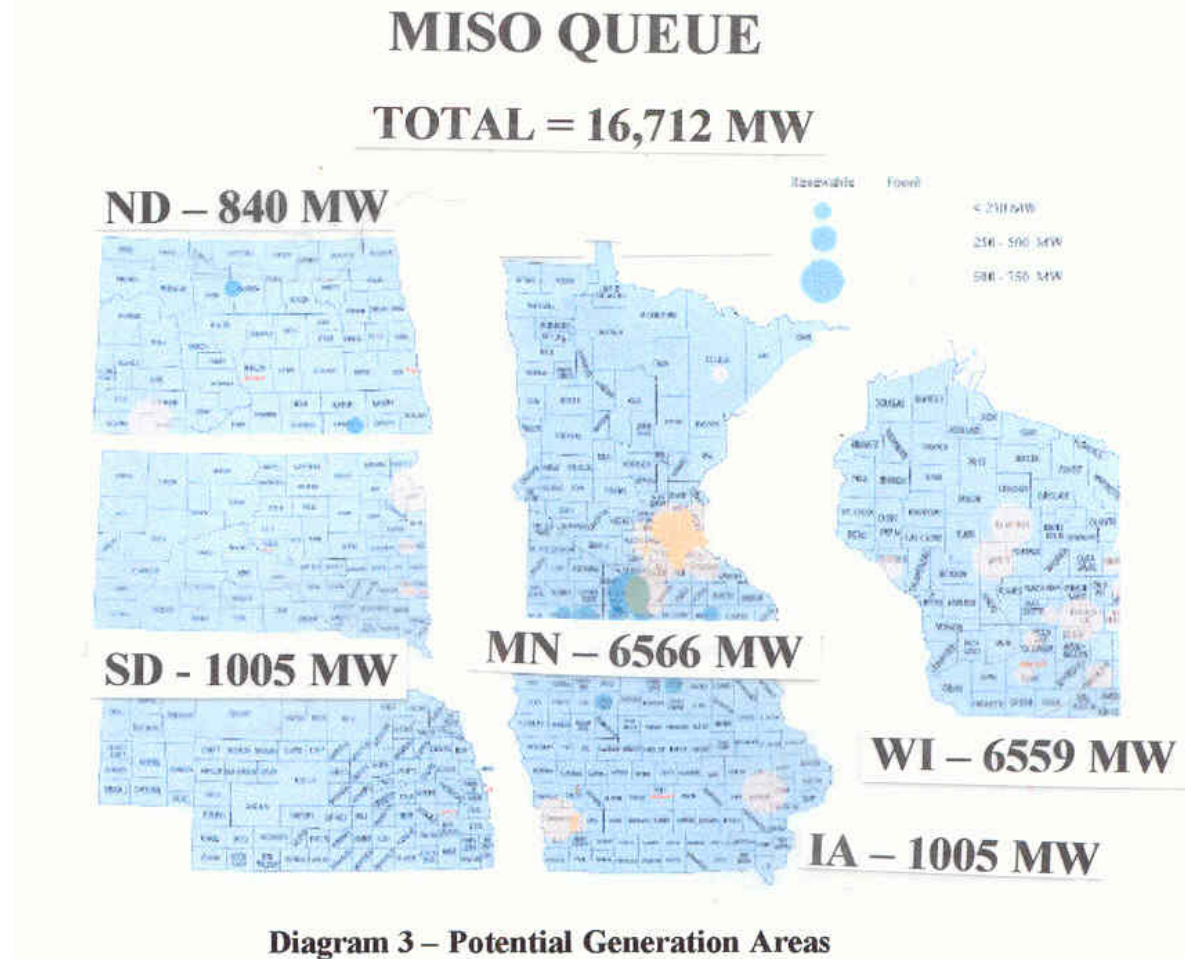


Diagram 1 – CapX 2020 Region

...there's planned generation

But p. 7 of that same report shows 16,712MW in queue then, and it's a LOT more now, over 16,000MW of coal alone!

What is planned in your region?



We don't need more...

In MAPP/MRO region, utilities overestimated:

- ❑ Demand increasing slowly, NOT fast
- ❑ Utility estimates of 2-2.9% are WRONG
- ❑ Entire MAPP/MRO region increased 0.6%
(Xcel's nuclear is through legislature, now they don't need to say they NEED power)
- ❑ Reserve margins at all time high
- ❑ 16,000MW of coal in queue! AAAAAAGH!

Cost of IGCC?

Cost of Mesaba (shhhh, it's a secret):

- \$2,155,680,783 for 600MW
- \$3,593/kW

That's about twice the \$1.2 billion cited in the press in AP articles across state just before public hearings on cost!!!

(took 3 weeks to get a correction)

How is IGCC financed?

- ❑ Demonstration-stage technology
- ❑ Not ready for commercial deployment
- ❑ Deemed by DOE to be “too risky” for private investment
- ❑ Assumed at least 20% more expensive than conventional coal (reality is a LOT higher)

A financing scheme...

“IGCC is not perceived in the U.S. to have sufficient operating experience to be ready to use in commercial applications.”

Harvard set out to find a way around these financial barriers:

- 3 Party Covenant
 - Federal Government
 - State Government
 - Equity investor or IPP with PPA for equity

A financing scheme...

Purpose of financing scheme is
To transfer risk & burdens and
lower IGCC's cost of capital:

- Reduce cost of debt
- Raise debt/equity ratio
- Minimize construction financing costs
- Allocate financial risk

A financing scheme...

- ❑ Federal provides grants, tax credits and guaranteed loans
- ❑ State provides assured revenue stream (PPA) where state finds need for baseload; regulatory free passes (see, e.g., MN, IN)
- ❑ Utility or IPP provides... well...not much...
IPP provides only a Power Purchase agreement, and equity ratio is shifted from typical 45% to 20%; in PPA risks are unreasonably shifted off of developer onto ratepayers, utility, taxpayers

A financing scheme...

IGCC's best chance of success under the Harvard scheme:

- ❑ Take existing federal and state perks and always grab for more!
- ❑ Distressed gas generation assets
- ❑ Tout emissions "benefits" of IGCC
- ❑ Sites with existing infrastructure
- ❑ Conversion of coal or natural gas plants
- ❑ Cogeneration opportunities, i.e., chemical, hydrogen

A financing scheme...

The industry latched onto 3 Party Covenant.

Booz Allen report – same scenario with more detail of cost and carbon aspects and similar recommendations

- We now know cost estimates are WAY low
- Based on IGCC as alternative to high-priced natural gas, but coal price spikes (tripled in Dec. 2005) and transport woes are problem
- Recognized that point is get plants built and then to demonstrate commercial viability

Mesaba takes, but that's all

Excelsior's Mesaba Project doesn't utilize the key factors to success – it's vulnerable:

- ❑ Takes federal and state perks, does good job of lining them up – takes & takes, but...
- ❑ Not conversion of old-style coal
- ❑ Not cogeneration or combo w/chemicals
- ❑ Not on brownfield utilizing infrastructure
- ❑ Not cannibalizing natural gas plant
- ❑ No CO2 capture & sequester

Financing scheme crashed

Primary objection to Excelsior's PPA:

It's overpriced power that we don't need

Some other financial issues:

- Transfer of risk to Xcel unacceptable
 - Shareholders would take hit because Xcel would have to carry on balance sheet as debt
 - Ratepayers would take massive hit – too many variables, i.e., no coal contract (~1/3 PPA cost), EPC cost wouldn't be nailed down until after PPA
- Transmission interconnection and network upgrades unidentified, could be very high, and Xcel and Minnesota Power would take hit

What perks are there?

Federal benefits are lined up

- Grants
- Guaranteed loans
- Tax credits

What does your state offer?

- Check your state's perks
- Track utility attempts to use 3 Party Covenant
- A little attention can stop their efforts – bills pass because legislators don't understand

A small MN success story

Mesaba was ramping up, prior to Petition

- We knew a prior utility tax exemption expired
- Sent thorough packet to county explaining Minnesota's utility personal property tax (goes to host county, city/township, and school district) – if exempted, they'd lose millions/yr
- Provided info on options for Host Fee Agmts, where they could negotiate fee in lieu of tax
- Four months later – legislators introduced bill WITHOUT any notification to local gov'ts!!
- IMMEDIATELY county passed resolution for HFA
- IMMEDIATELY the bill was amended accordingly

What does IGCC cost?

- \$2,155,680,783, not \$1.2 billion
- \$3,593/kW (600MW), not \$1,800/kW (Wolk)
- Doesn't incorporate:
 - Infrastructure - \$55 million+ paid by public
 - Transmission - \$28-280 million - varies wildly
 - DOE guaranteed loans; \$36 million DOE; \$21 million DOE to PCOR to "study sequestration;" \$9.5 million MN IRR; \$10 million Renewable Development Fund.
 - Fed 48A tax credit; state utility tax exemption

What does IGCC cost?

From MN Dept. of Commerce analysis:

All levelized costs:

	/c emissions /s xmsn	Xmsn \$/MWh	Cost /c Xmsn	Sequestration \$/MWH	TOTAL \$/MWh
West 603MW	96.04	9.21	105.25	50.02	155.27
East 598MW	104.91	9.21	114.12	50.02	164.14
West 450MW	120.87	9.21	130.08	50.02	180.10
East 450MW	130.76	9.21	139.97	50.02	189.99

What does IGCC cost?

From MN Dept. of Commerce analysis (Dr. Amit):

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East 598MW	104.91	9.21	114.12	50.02	164.14
West 450MW	120.87	9.21	130.08	50.02	180.10
East 450MW	130.76	9.21	139.97	50.02	189.99
BS II	73.02	2.74	75.76	----	75.76
Sherco4	72.54	2.79	75.33	----	75.33

CO2 CSS cost?

Three elements to CO2 CSS:

- Capture, Transport & Sequestration
- Capture
 - 30% fairly easy, to 85-90% difficult & costly
 - Sequestration not considered – cost estimates are to plant gate only – Booz Allen
 - Efficiency loss 25+%, 600MW becomes 450MW
 - Capital cost increase of 45+% (low wag)
 - O&M increase \$2-2.5 million annually
 - Capture alone is so costly that utility modeling picks trade over CSS every time! (Booz Allen)

CO2 CSS cost?

Transport of CO2 requires high volume (Mesaba is 5.4 million tons annually) high psi pipeline and repressurization stations

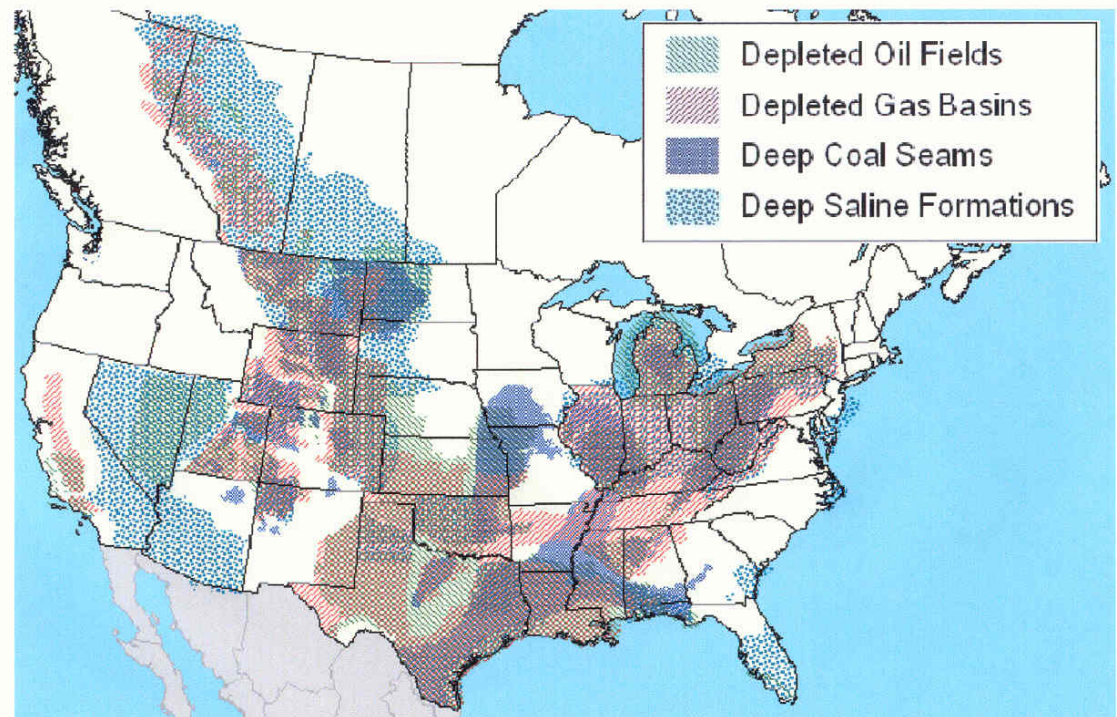
- ❑ Experiments have begun – Weyburn, Texas, all on very small scale
- ❑ \$60,000 per inch per mile (Steadman)
- ❑ \$1.4 million for pipeline from Taconite to western North Dakota
- ❑ Capital cost of repressurization stations?
- ❑ Parasitic load = 4-10MW each

CO₂ CSS Cost?

Where to sequester?

- Deep saline best
- Inverse correlation between enviros "Midwest" IGCC target and CSS potential!
- 600 miles from Taconite to West North Dakota

Potential CO₂ reservoirs: not a constraint most places.



Source: J. Dooley et al, "A CO₂ Storage Supply Curve For North America and its Implications for the Deployment of Carbon Dioxide Capture and Storage Systems," GHGT-7, September 8, 2004

CO2 CSS Cost?

Sequestration – identify, characterize and obtain site; pump in, monitor forever

- ❑ DOE Addendum to Gilberton, PA coal-to-liquids plant shows it's not feasible and CO2 volume far exceeds potential available storage
- ❑ Cost estimates range from \$3-10/ton to \$260 Dr. Sally M. Benson, Testimony 11/6/03, House Science Committee: To answer your fourth question, estimated costs for geologic sequestration of CO2 range from about \$3 to \$10 per ton, depending on site specific considerations such as how many injection wells are needed, surface facilities, economy of scale and monitoring requirements. As the technology matures, uncertainties in costs will be reduced. These costs are small fraction of the cost of CO2 capture and consequently have not been the focus of much attention.
- ❑ Hydrological issues – like plunger in toilet
- ❑ Seismic issues – impact of millions of tons of CO2
- ❑ Migration issues – see “Gas Migration,” the tome of underground storage

Geologist Alison Burchell is presenting this afternoon

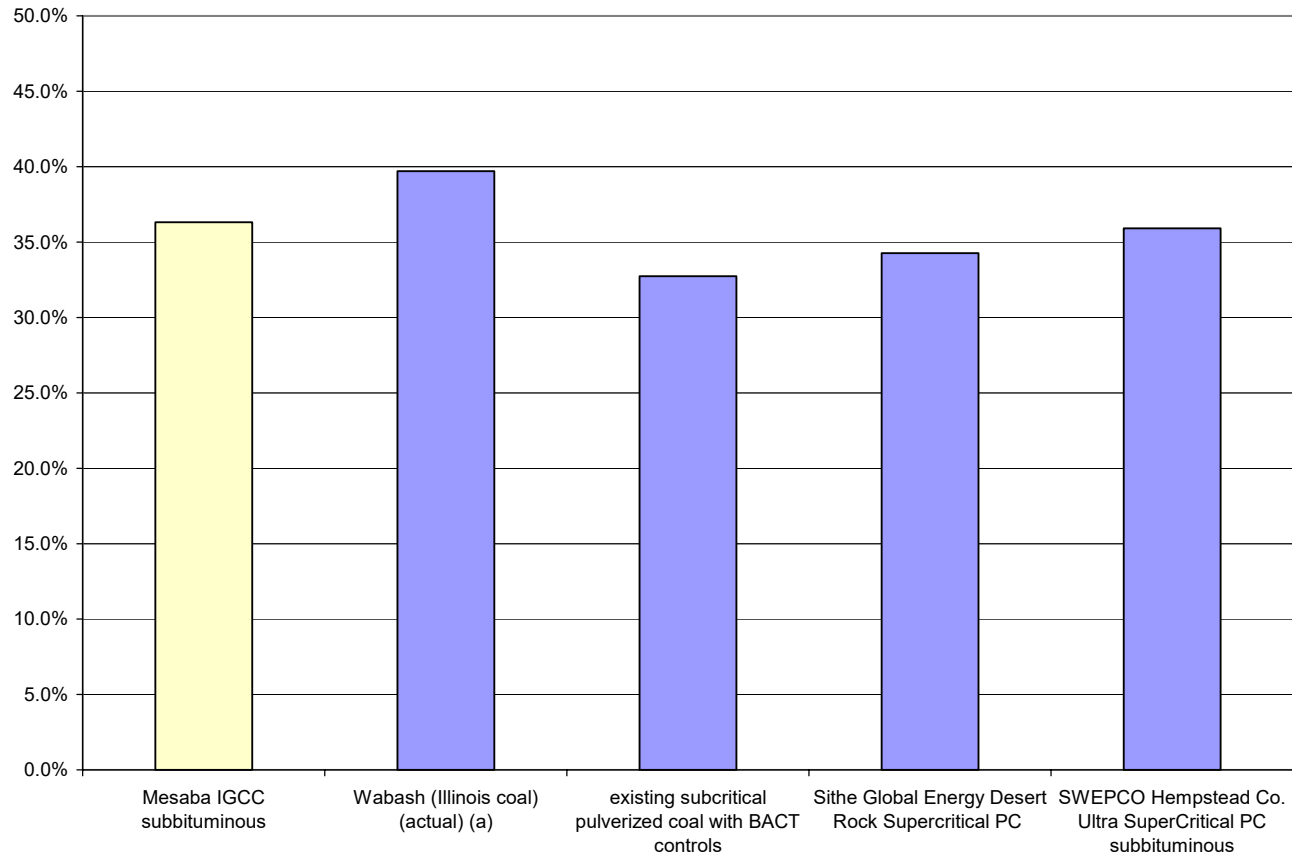
Environmental costs

Excelsior's comparative emissions, Table RSE-1:

Emission	ICF Modeled Rate for Mesaba (lb/hr)	Mesaba Project PSD Permit Application (lb/hr)	ICF SCPC Plant (lb/hr)	CFB South Heart (lb/hr)
Sulfur Dioxide, SO ₂	123	158	431	259
Nitrogen Oxide, NO _x	339	321	377	598
Carbon Monoxide, CO	274	257	809	996
Particulate matter, MP10	48	51	108	153
Volatile organics, VOC	16	17	22	17
CO ₂ (not modeled, but provided for information)	N/A	616 tons/hour	618 tons/hour	720 tons/hour

Environmental costs

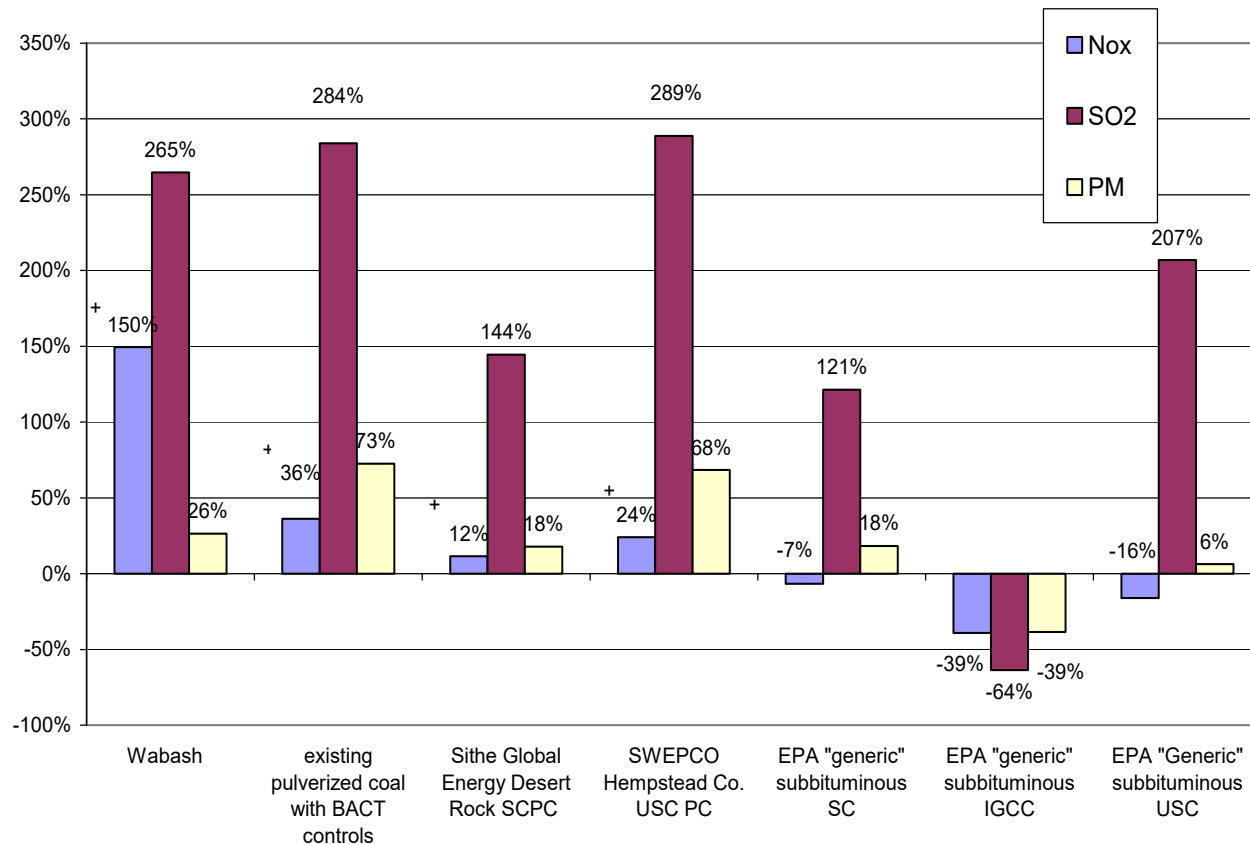
Figure 1. Net Thermal Efficiency for operating and proposed subbituminous-fired facilities.



Source: MPCA Comparisons, PUC Mesaba Docket, Nov. 3, 2006.

Environmental costs

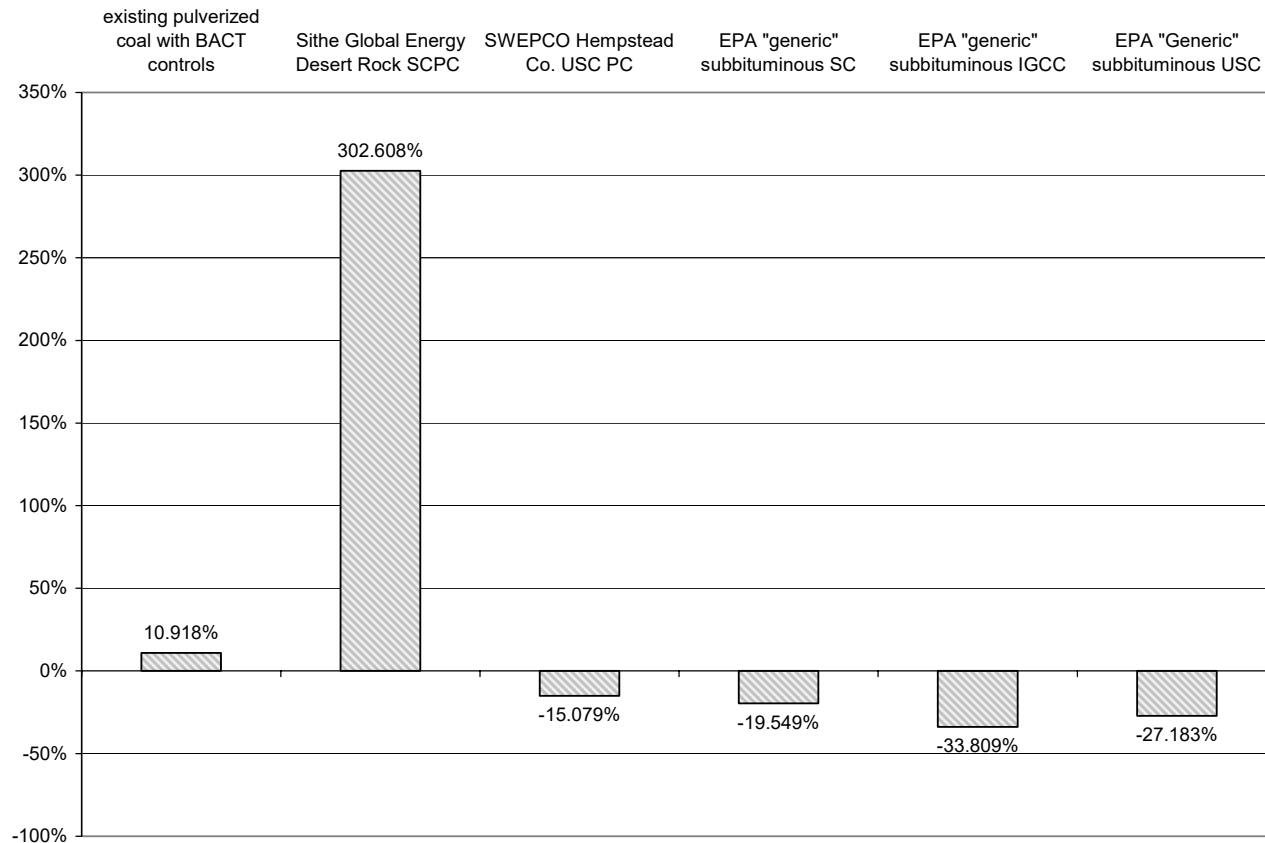
Figure 3. Nitrogen Oxides, Sulfur Dioxide and Particulate Matter emission rates per MWh as a percentage of Mesaba Energy I



Source: MPCA Comparisons, PUC Mesaba Docket, Nov. 3, 2006.

Environmental Costs

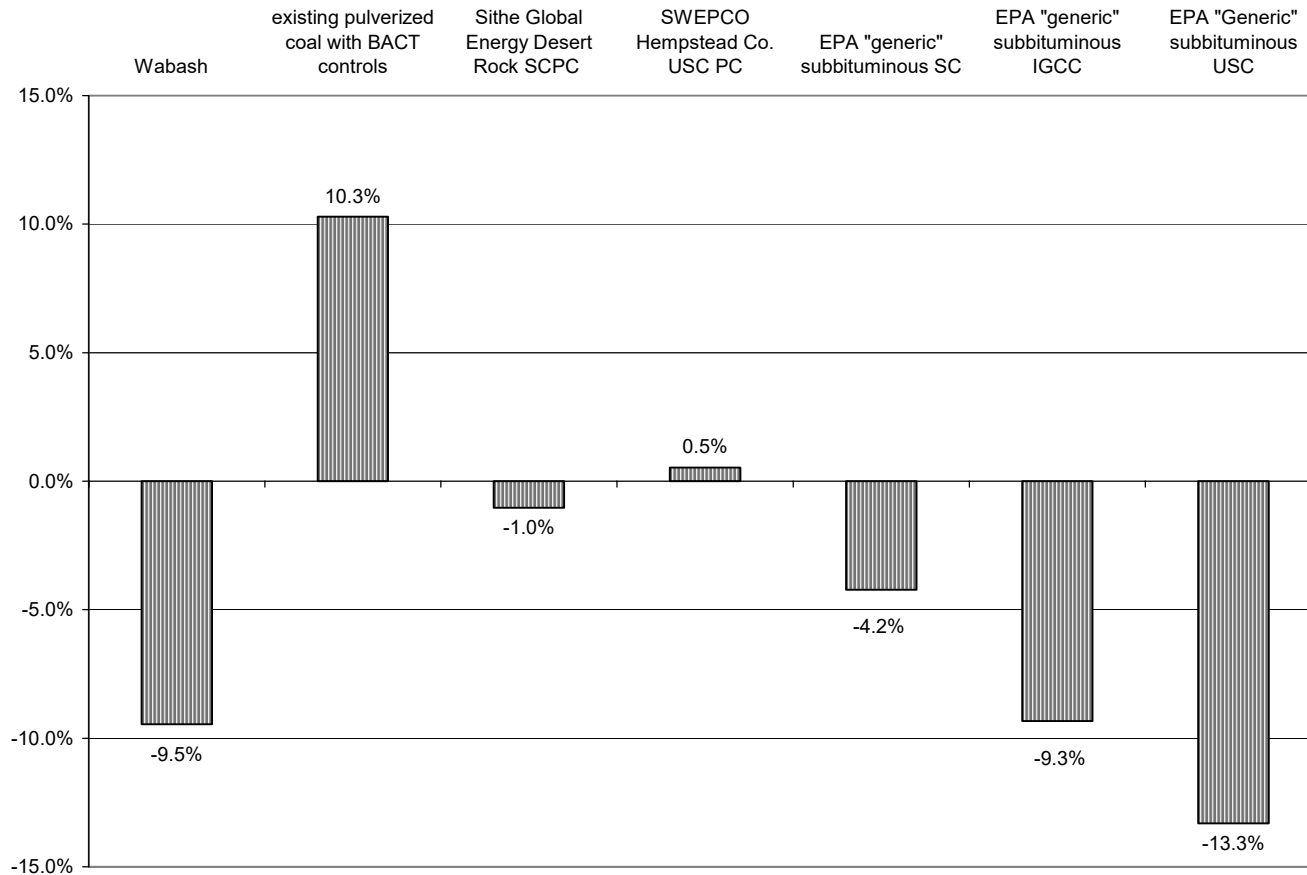
Figure 4. Mercury emissions as a percentage of mercury emissions per MWh from Mesaba Energy I



Source: MPCA Comparisons, PUC Mesaba Docket, Nov. 3, 2006.

Environmental costs

Figure 5. Carbon Dioxide Emissions per MWh as a percent of Mesaba Energy I



Source: MPCA Comparisons, PUC Mesaba Docket, Nov. 3, 2006.

Environmental costs

	NOx		SO2		PM		Hg		CO2	
	lb/MWh	lb/MMBtu	lb/MWh	lb/MMBtu	lb/MWh	lb/MMBtu	lb/MWh	lb/mmBtu	lb/MWh	lb/mmBtu
Mesaba IGCC subbituminous (a)	0.536	0.057	0.24	0.03	0.085	0.009	4.70E-06	5.00E-07	2005	213.34
EPA "generic" subbituminous IGCC (f)	0.326	0.044	0.09	0.01	0.052	0.007	3.58E-06	4.20E-07	1818	213.34
Wabash (Illinois coal) (actual) (b)	1.337	0.150	0.89	0.10	0.107	0.012			203.74	203.74
EPA "Generic" subbituminous ultra-supercritical (f)	0.450	0.060	0.75	0.10	0.090	0.012	3.42E-06	4.20E-07	1738	213.34
existing subcritical pulverized coal with BACT controls (c)	0.730	0.070	0.94	0.09	0.146	0.014	5.21E-06	5.00E-07	2211	212.14
Sithe Global Energy Desert Rock Supercritical PC (d)	0.597	0.060	0.60	0.06	0.100	0.01	1.89E-05	1.90E-06	1984	199.29
SWEPCO Hempstead Co. Ultra SuperCritical PC subbituminous (e)	0.665	0.070	0.95	0.10	0.143	0.015	3.99E-06	4.20E-07	2015	212.14
EPA "generic" subbituminous supercritical (f)	0.500	0.060	0.54	0.07	0.100	0.012	3.78E-06	4.20E-07	1920	213.34

	Net Thermal Efficiency % HHV	Net Heat Rate Btu/kWH	Gross Power MW	Internal power MW	Heat input mmbtu/hr	fuel required lb/hr	Net Power MW
Mesaba IGCC subbituminous (a)	36.3%	9,397	740	143	5616		598
EPA "generic" subbituminous IGCC (f)	40.0%	8,520	575	75		484,089	500
Wabash (Illinois coal) (actual) (b)	39.7%	8,910					192
EPA "Generic" subbituminous ultra-supercritical (f)	41.9%	8,146	543	43		460,227	500
existing subcritical pulverized coal with BACT controls (c)	32.7%	10,423			3355		350
Sithe Global Energy Desert Rock Supercritical PC (d)	34.3%	9,956	1500		6800	800,000	2 @ 683 net
SWEPCO Hempstead Co. Ultra SuperCritical PC subbituminous(e)	35.9%	9,500			6000 (b)	750,000	600
EPA "generic" subbituminous supercritical (f)	37.9%	9,000	541	41		517,045	500

(a) Mesaba Energy I air emissions permit application, June 2006, p. 48. Excelsior Energy December 2005 Filing, Section IV, p. 51 Also, Robert Evans Rebuttal Testimony, October 10, 2006 p. 18.

(b) Wabash performance from www.clean-energy.us/projects/wabash_indiana.htm accessed on October 10, 2006

(c) Minnesota Power Boswell 3 retrofit, August 2006 permit application

(d) Desert Rock efficiency, heat rate calculated from PSD permit application accessed 10/9/06 at www.epa.gov/region9/air/permit/desertrock/index.html

(e) SWEPCO permit application indicates the boiler to be a supercritical boiler with a heat input rate of 6000 mmbtu/hr; AEP contact indicates the plant is being designed as an ultra supercritical plant, and design heat input rate is 5700 to 5800 mmbtu/hr, net electrical output 600 MW. This difference affects the net heat rate calculation and total boiler efficiency.

(f) EPA generic expected plant performance characteristics EPA-430/R-06-006 July 2006

Given the costs, WHY?

- These are the costs of Mesaba.
- This is the reality of IGCC.
- This is what we have learned through our participation in this docket at the PUC.
- Resources and citations are provided so you can take time to review the record and see for yourself.

www.mncoalgasplant.com

Pipedreams of Green & Clean

We're in a position where we can choose the means of electrical generation.

We have the facts to expose the pipedream and hold promoters accountable.

We're at a binary point, where we need to take responsible action.

We can choose generation we can live with.