HEALY UNIT 2 &
OBSTACLES TO CLEAN COAL TECHNOLOGY USAGE

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Golden Valley Electric Assn.

What is Clean Coal Technology?

- Definition of Clean Coal Technology = moving target
  - 1993 – focused on reduction of Criteria Pollutants (NOx, SOx, PM, CO, Ozone, Lead)
  - Current focus – reduction of Green House Gases (GHGs) or CO2
    - EPA also currently addressing Criteria Pollutants and Hazardous Air Pollutants (HAPS) reduction but CO2 in forefront

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Healy Unit 2 History

- Was an official Department of Energy Clean Coal Technology Project that received DOE funding
- Underwent full NEPA and New Source Review (NSR) review prior to construction

  Outfitted or met with the most stringent pollution controls/limits at the time
  - NOx control – TRW advanced combustion technology (slagging combustor/boiler air staging)
  - SO2 control – Spray Dryer Absorber (lime)
  - PM control – combustion technology - removes mineral content before ash can enter the boiler followed up with bag house technology

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Benefits of Healy 2

- Fuel Diversity
- Mine mouth coal plant
- Long term stable rates
- Significant coal reserves

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GVEA Generation Assets

CHARACTERISTICS	NORTH POLE 1	NORTH POLE 2	ZEHNDER 1	ZEHNDER 2	DELTA POWER PLANT	HEALY 1	BRADLEY LAKE[2]	BESS[3]	NORTH POLE 3 & 4	AURORA
Location	North Pole	North Pole	Headquarters	Headquarters	Delta[1]	Healy	Homer	Fairbanks	North Pole	Fairbanks
Type	CT Frame 7	CT Frame 7	CT Frame 5	CT Frame 5	CT Frame 5	ST-Coal	Hydro	Energy Storage	CC-LM6000	ST
Year Installed	1976	1977	1971	1972	1976	1967	1991	2003	April, 2006	-
Fuel	HAGO	HAGO	HAGO	HAGO	No. 2	Coal	Hydro	Battery	Naphtha	Coal
Peak Winter Ratings	62.6 MW	60.6 MW	19.2 MW	19.6 MW	25.8 MW	25.5 MW	15.2 MW	46 MW (for 5 min)	63.3 MW	24.8 MW
Full Load NPHR (Btu/kWh)[4]	10,010	9,720	14.030	14,190	13,210	13,441	0.0	NA	6,620	10,000
Forced Outage Rate	0.78%	0.88%	0.23%	1.9%	0.2%	3.69%	0.0%	0.0%	0.83%	-

Heat Rate – Thermal Efficiency

Healy 2 NPHR – 12,500 Btu/kWh (1999 test results)

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Environmental Groups Opposed Restart

- Environmental group opposition resulted in Consent Decree with EPA. Pertinent results:
  - Unit 2 must install Selective Catalytic Reduction (SCR) for additional NOx reduction by introduction of ammonia to flue gas coupled with catalyst
  - Unit 1 must install Selective Non-Catalytic Reduction (SNCR) for additional reduction in NOx and either shutdown in 2024 or install SCR
  - Retrofitting plants with pollution control devices is much more challenging and costly than installation at initial construction

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Projected Pollution Reduction due to Consent Decree

Combined Unit 1 & Unit 2 Permit Limits

Pre-CD controls NOx = 1366 tons/yr

Post-CD controls NOx = 533 tons/yr

Pre-CD emission limits SO2 = 720 tons/yr

Post-CD emission limits SO2 = 701tons/yr

Primary target was NOx and application of current Best Available Control Technology (BACT). Current SO2 and PM Controls is BACT.

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Current Healy 2 Activities

- In November 2012the joint Consent Decree between GVEA, AIDEA and the Environmental Protection Agency (EPA) was approved.
- Jan thru Dec 2013 – GVEA began engineering effort on the SCR and SNCR and began planning restart activities
  - Black and Veatch selected as EPC for SCR and SNCR and also selected as project manager for restart and commissioning activities
- December 2013 – GVEA closed on the purchase of Healy 2

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Current Healy 2 Activities (continued)

- Long lead restart items have been ordered
- Update to the Digital Control System underway
- Developing training plans
  - Operation of Healy 2 results in a staffing increase
    - Training on Healy 1 for new employees
    - Training on Healy 2 for all employees
- Contracting for a Work Camp in progress
- Civil work and foundations planned for this summer
- Begin system testing after DCS work is completed

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Obstacles - Future Regulatory Challenges

Coal is the primary target

- Utility Mercury and Air Toxics Standards (UMATS)
- Green House Gasses
- Additional coal regulation
- Ultimately leads to increased cost of power

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Utility Mercury and Air Toxics Standards (UMATS)

- Must comply by April 2015.
- Target non-mercury hazardous air pollutants, mercury and select acid gases.
- Anticipate compliance without additional controls
- Additional cost for monitoring, frequent stack tests, reporting.

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Green House Gases Reporting & Proposed NSPS

- GHG Reporting Rule – EPA began annual reporting requirement beginning for calendar year 2010. Select industries must report GHG emissions (CO2, CH4, N2O).
- EPA's most recently proposed GHG's New Source Performance Standards in January 2014. Still out for public comment. When final will apply to new fossil fuel-fired electric steam generating units (mostly coal boilers), IGCC and NG-fired stationary combustion turbines.
- For comparison, no current GVEA coal or oil plant can meet standards without Carbon Capture and Sequestration (CCS).

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Proposed GHG NSPS

- Proposed Utility boilers and IGCC Units limit
  - 1,100 lb CO2/MWh
  - limit based on partial implementation of CCS
- Proposed Natural Gas Combined Cycle Units
  - 1000 lb CO2/MWh large units
  - 1100 lb CO2/MWh small units
  - no control required to meet limit

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GVEA GHG Emissions

- Approximate CO2 Emissions from GVEA Units
  - Healy U1- 2900-3000 lb/MWh (PC)
  - North Pole GT1 & 2 – 1800-2000 lb/MWh (oil)
  - North Pole GT 3 – 1100-1200 lb/MWh (naphtha)
  - Zehnder GT 1 & 2 – 3000-3800 lb/MWh (oil)

(depends on efficiency of unit/fuel type)

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CCS Major Challenges

- Cost of Equipment
- Modification to Units
- Energy Penalty
- Sequestration Location: transportation to where?

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Coal Regulation on the Horizon

- GHG Guidelines for Existing Plants – EPA developing strategy now. Plan to propose guidelines (regulation) this summer. Impacts unknown.
- Proposed CCR rule – coal combustion residual rule
  - Impacts disposal/recycling of coal ash/ash impoundments
  - Initial proposal - coal will be regulated either as hazardous waste or solid waste. EPA appears to be leaning towards solid waste regulation or regulation by citizen suit.
- CWA 316b rule – impacts water intake structures for protection of fishery resources
  - May require cooling towers, larger intake structures or alternate mechanism

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Coal Regulation on the Horizon

(continued)

- Effluent limitation guidelines – may ban or apply limits to certain wastewater discharges. Target air pollution and ash related wastewater discharges

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Key Take-Aways

- Coal provides fuel diversity
- Coal generation provides long term stable rates
- Significant coal reserves exist in Alaska
- Future regulatory challenges are the major obstacle to Clean Coal Technology Usage
  - Increased cost of power production to meet regulatory requirements makes coal fired generation less economic

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