MONTANA-DAKOTA UTILITIES CO.

Advance Determination of Prudence
Lewis & Clark Station
Filterable Particulate Matter Pollution Controls Project
ND PSC Case No. PU-13-332

September 25, 2013

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12 PU-13-332 Filed 09/25/2013 Pages: 28
Presentation provided at the informal hearing
Montana-Dakota Utilities Co., a Division of MDU Resources Group, Inc.
Tamie Aberle

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Alan Welte, Director of Generation

Lewis & Clark Baghouse Project

- **Station Overview**
- **MATS Rule**
- **Control Technology Evaluation**
- **Cost & Schedule**
- **Update**

September 25, 2013

Lewis & Clark Baghouse Project

- Lewis & Clark Station Overview
  - Commercial operation since October 1, 1958
  - Single-unit, 50-MW lignite-fired
  - Located near Sidney, Montana
  - 29 employees
  - Lignite received by truck from Savage Mine
  - Existing emissions controls
    - NOx - Low-NOx burners with close-coupled overfire air
    - Particulate Matter – Multiclone collectors and flooded disk scrubber
    - SO2 – Flooded disk scrubber
    - Hg – Calcium bromide and Activated Carbon Injection

Lewis & Clark Baghouse Project

Lewis & Clark Baghouse Project

- Lewis & Clark Station Overview
  - Low cost baseload resource in Montana-Dakota's fleet
    - Provides 12 percent integrated system energy
    - Provides nine percent of required capacity credits
    - Ranks 2 or 3 in lowest average fuel costs
    - Ranks 3 or 4 in lowest average total station costs
  - Provides reliability to region
    - Serves load and provides voltage support
    - Provides support during transmission system outages

Lewis & Clark Baghouse Project

- Project is required to meet EPA Mercury and Air Toxics Standard (MATS) Rule
- MATS Rule
  - Regulates hazardous air pollutant emissions
  - Includes standards for mercury, non-mercury metals, and acid gas emissions
  - Includes alternative limits for non-mercury metals
  - Finalized on February 16, 2012
  - Compliance must be demonstrated on April 16, 2015
  - Opportunity for MT DEQ to approve an additional year to install control technologies

Lewis & Clark Baghouse Project

- Control Technology Evaluation
  - Diagnostic stack testing performed in 2011 and 2012 to determine baseline emissions
  - Test results determined Lewis & Clark is exceeding limits for non-mercury metals
  - Sargent & Lundy hired to evaluate strategies to reduce the non-mercury metal emissions

Lewis & Clark Baghouse Project

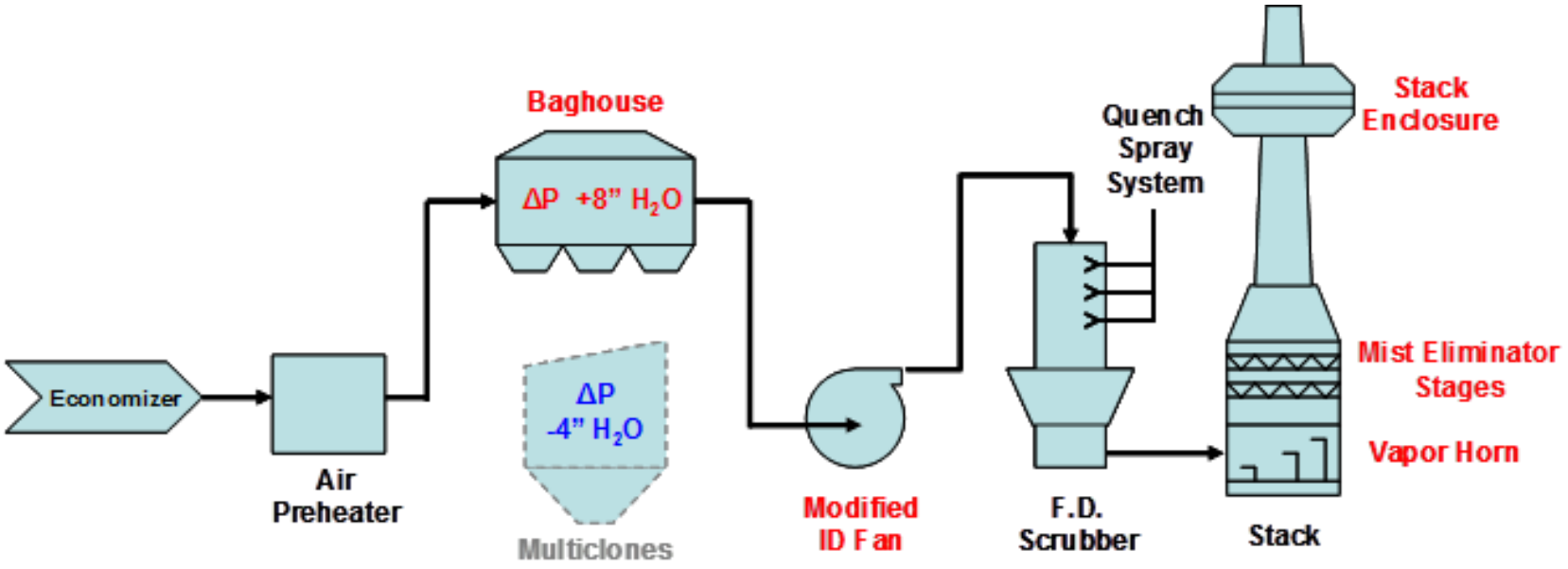
- Control Technology Evaluation
  - Several compliance strategies were considered
    - Fuel switching
    - Flooded wet disk scrubber modifications
    - Dry and Wet electrostatic precipitators
    - Baghouse with modifications to existing mist eliminators
    - Baghouse with dry sorbent injection
    - Baghouse with dry flue gas desulferization

Lewis & Clark Baghouse Project

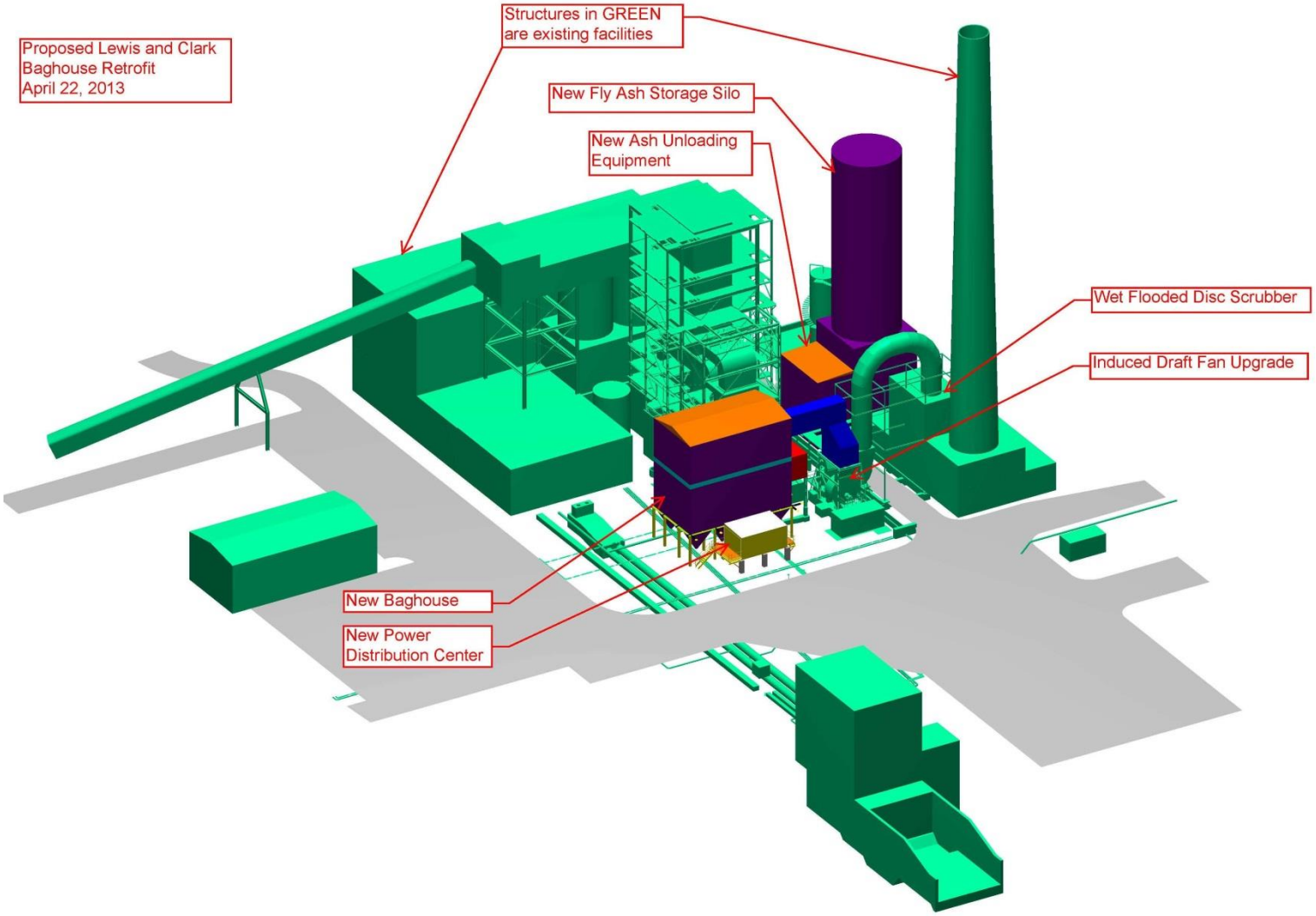
- Control Technology Evaluation
  - Optimal MATS compliance option was identified as
    - Install Baghouse
    - Modify existing scrubber mist eliminators
    - Modify / Replace induced draft fan
    - Demolish abandoned chimney for optimal tie-in
    - Install dry fly ash handling system and silo

Lewis & Clark Baghouse Project

- Control Technology Evaluation
  - Optimal MATS compliance option



Lewis & Clark Baghouse Project



Lewis & Clark Baghouse Project

- Conceptual Project Cost Estimate - $27.7 million ± 20% (includes ES&GA and AFUDC)
- Completion milestones
  - Preliminary Engineering & Equipment Procurement Packages - February 2014
  - Detailed Engineering – October 2014 (substantial); March 2015
  - Equipment & Construction Contract Awards – December 2014
  - Civil Construction – December 2014
  - General Construction with tie-in outage – December 2015
  - Commercial Operation – January 2016 (pursuing MT DEQ approval of one year compliance date extension)

Lewis & Clark Baghouse Project

- Project Update
  - S&L reviewing design, specifications, and drawings
  - S&L site visit September 17 – 19th. Gather Station information and advance preliminary design
  - Reviewing items of potential impact to project
    - Changes to operation of existing flooded disk scrubber (water chemistry & balance, lime consumption, scaling of vessel components)
    - Waste disposal
    - Emissions monitoring and testing

Advance Determination of Prudence Resource Expansion Modeling ND PSC Case No. PU-13-332

Brian Giggee
Electrical Systems Engineer III

September 25, 2013

Resource Expansion Modeling

- Utilized Electric Generation Expansion Analysis System (EGEAS) model developed by Electric Power Research Institute (EPRI)
- Same model as North Dakota 2013 Integrated Resource Plan filed with ND PSC on July 1, 2013
- Utilized Montana-Dakota's 2013 – 2032 Load Forecast

Resource Expansion Modeling

- Supply Side Resources
  - Existing Montana-Dakota Generating Resources
    - Coal, natural gas, diesel engines, waste heat, wind, and capacity purchase contracts
  - Committed Montana-Dakota Generating Resources
    - Big Stone AQCS – 2015
    - Heskett Unit #3 combustion turbine – 2015
  - MISO Energy Market Purchases
  - Demand Response Programs
    - Commercial and industrial demand response
    - Interruptible tariff service

Resource Expansion Modeling

Year	Generator Planning Resource Credits	WE Energies Peaking Purchase	Total Zonal Resource Credits	50/50 Coincident Summer Peak Demand w/MISO Losses	Planning Reserve Margin Requirement	Surplus/ Deficit (+)/(-)
2013	469.3	115.0	584.3	533.7	566.7	17.6
2014	475.5	120.0	595.5	556.3	590.8	4.7
2015	556.1		556.1	572.9	608.4	-52.3
2016	556.1		556.1	584.5	620.8	-64.7
2017	556.1		556.1	591.8	628.5	-72.4
2018	556.1		556.1	601.3	638.6	-82.5
2019	556.1		556.1	610.8	648.7	-92.6
2020	556.1		556.1	620.0	658.4	-102.3
2021	556.1		556.1	629.2	668.3	-112.2
2022	556.1		556.1	638.2	677.8	-121.7
2023	556.1		556.1	647.0	687.1	-131.0
2024	556.1		556.1	655.6	696.3	-140.2
2025	556.1		556.1	664.3	705.5	-149.4
2026	556.1		556.1	672.9	714.6	-158.5

- Total ZRC's represent MISO capacity accreditation for generation, demand response and contract purchases
- A 90 percent Coincident Factor used to calculate coincident summer peak demand
- Montana-Dakota set an all-time summer peak load on July 19, 2012 of 573 MW. The previous all-time summer peak load was 535 MW set on July 19, 2011.

Resource Expansion Modeling

- Supply Side Resources (continued)
  - Potential new resources included
    - Natural gas, coal, wind, solar, biomass, geothermal, and 4-Lewis & Clark Station options
- Modeled potential unit retirements
  - Heskett Unit 1 – End of 2019
  - Existing wind at their 20 year life

Resource Expansion Modeling

- Modeled Lewis & Clark Options
  - Plant retired the end of 2014 in its existing configuration
  - 3 Natural Gas Options
  - Lewis & Clark Baghouse Option
    - Cost
      - Capital - $27.42 million
      - Additional Fixed O&M - $3.46/kW-yr
      - Additional Variable O&M - $0.59/MWh
    - Five year life – retired end of 2019

Resource Expansion Modeling

- Optimal (Least Cost) Resource Plan – 2013 ND IRP
  - Install Lewis and Clark Baghouse Project- 2015
  - 50-100 MW wind purchased power agreement - 2015
  - 110 MW of internal combustion engines – 2015 to 2017
  - Partnering for 200 MW of a large combined cycle unit - 2020
  - 20 MW of self-built wind – 2032

Resource Expansion Modeling

Year	Base Case: L&C Retired end of 2014	Optimal Resource Case: L&C Retrofit	L&C Gas Option 1
2014			
2015	4-ICE (146 MW) Wind PPA (50 MW)	L&C Baghouse Wind PPA (50 MW) 2-ICE (73 MW)	L&C Natural Gas Wind PPA (50 MW) 2-ICE (73 MW)
2016			
2017		1-ICE (37 MW)	1-SCCT (72 MW)
2018			
2019	1-SCCT (72 MW)		
2020		1-CCCT (200 MW)	
2021+	1-CCCT (129 MW) 1-ICE (36 MW) 1-Wind (20 MW)	1-Wind (20 MW)	1-CCCT (129 MW) 2-ICE (73 MW)
NPV ($Mil)	3,640	3,525	3,643

Resource Expansion Modeling

Year	Optimal Resource Case: L&C Retrofit	Low Natural Gas (-$1/Dkt)	High Natural Gas (+$3/Dkt)
2014			1-Wind (50 MW)
2015	L&C Baghouse Wind PPA (50 MW) 2-ICE (73 MW)	L&C Baghouse Wind PPA (50 MW) 2-ICE (73 MW)	L&C Baghouse Wind PPA (50 MW) 2-ICE (73 MW)
2016			1-ICE (37 MW)
2017	1-ICE (37 MW)	1-ICE (37 MW)	
2018			1-Wind (20 MW)
2019			1-Wind (50 MW)
2020	1-CCCT (200 MW)	1-CCCT (200 MW)	1-CCCT (200 MW)
2021+	1-Wind (20 MW)	1-Wind (20 MW)	1-Wind (20 MW) 1-Wind (50 MW)
NPV ($Mil)	3,525	3,264	4,145

Resource Expansion Modeling

Year	Optimal Resource Case: L&C Retrofit	Low Growth	High Growth
2014			
2015	L&C Baghouse Wind PPA (50 MW) 2-ICE (73 MW)	Wind PPA (50 MW)	L&C Baghouse Wind PPA (50 MW) 2-ICE (73 MW)
2016			1-ICE (37 MW)
2017	1-ICE (37 MW)	1-ICE (37 MW)	1-SCCT (72 MW)
2018			
2019			
2020	1-CCCT (200 MW)		1-CCCT (200 MW)
2021+	1-Wind (20 MW)	1-ICE (37 MW)	Others (640 MW)
NPV ($Mil)	3,525	2,417	5,229

Resource Expansion Modeling

Year	Base Case: L&C Retired end of 2014	Optimal Resource Case: L&C Retrofit	Current MISO Resource Adequacy (80.6% CF)
2014			
2015	4-ICE (146 MW) Wind PPA (50 MW)	L&C Baghouse Wind PPA (50 MW) 2-ICE (73 MW)	L&C Baghouse Wind PPA (50 MW)
2016			
2017		1-ICE (37 MW)	1-ICE (37 MW)
2018			
2019	1-SCCT (72 MW)		
2020		1-CCCT (200 MW)	1-CCCT (200 MW)
2021+	1-CCCT (129 MW) 1-ICE (36 MW) 1-Wind (20 MW)	1-Wind (20 MW)	
NPV ($Mil)	3,640	3,525	3,412

Resource Expansion Modeling

- 2013 ND IRP - 5 Year Action Plan
  - Proceed with installation of Lewis & Clark Station Baghouse project
  - Continue construction of Heskett #3
  - Continue installation of Big Stone AQCS
  - Continue to grow demand response programs
  - Pursue 50 to 100 MW of wind under a power purchase agreement (PPA)

Resource Expansion Modeling

- 2013 ND IRP 5 Year Action Plan (continued)
  - Purchase short term capacity needs from MISO capacity market or through a capacity PPA
  - Pursue potential partnership in a large combined cycle natural gas-fired facility

Resource Expansion Modeling

- Summary of Supply-side Resource Expansion Analysis Results
  - Modeling supports installation of the Lewis & Clark Baghouse Project in all sensitivity scenarios except for the low growth scenario
  - Lewis & Clark Station with the Baghouse Project was determined to be the least-cost alternative
  - Lewis & Clark Station continues to be a vital resource in Montana-Dakota's least cost resource plan and in meeting the load serving needs in the Bakken area

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