

NeuCo Power Project

Benefits Presentation



Clean Coal Power Initiative - Round 1 -

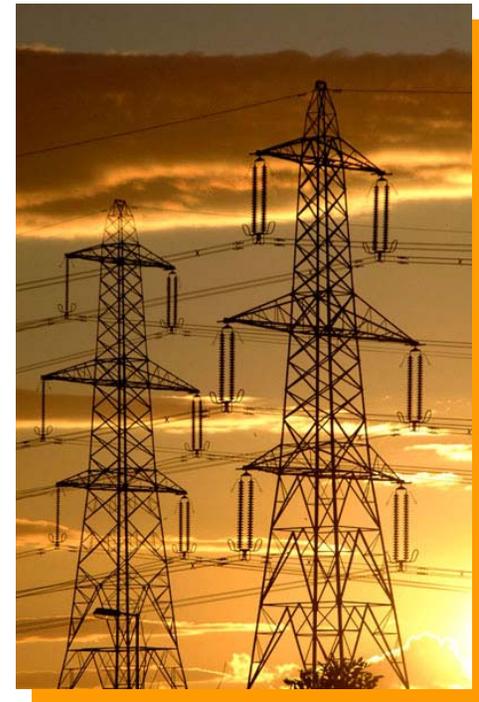
Demonstration of Integrated
Optimization Software at
Baldwin Energy Complex

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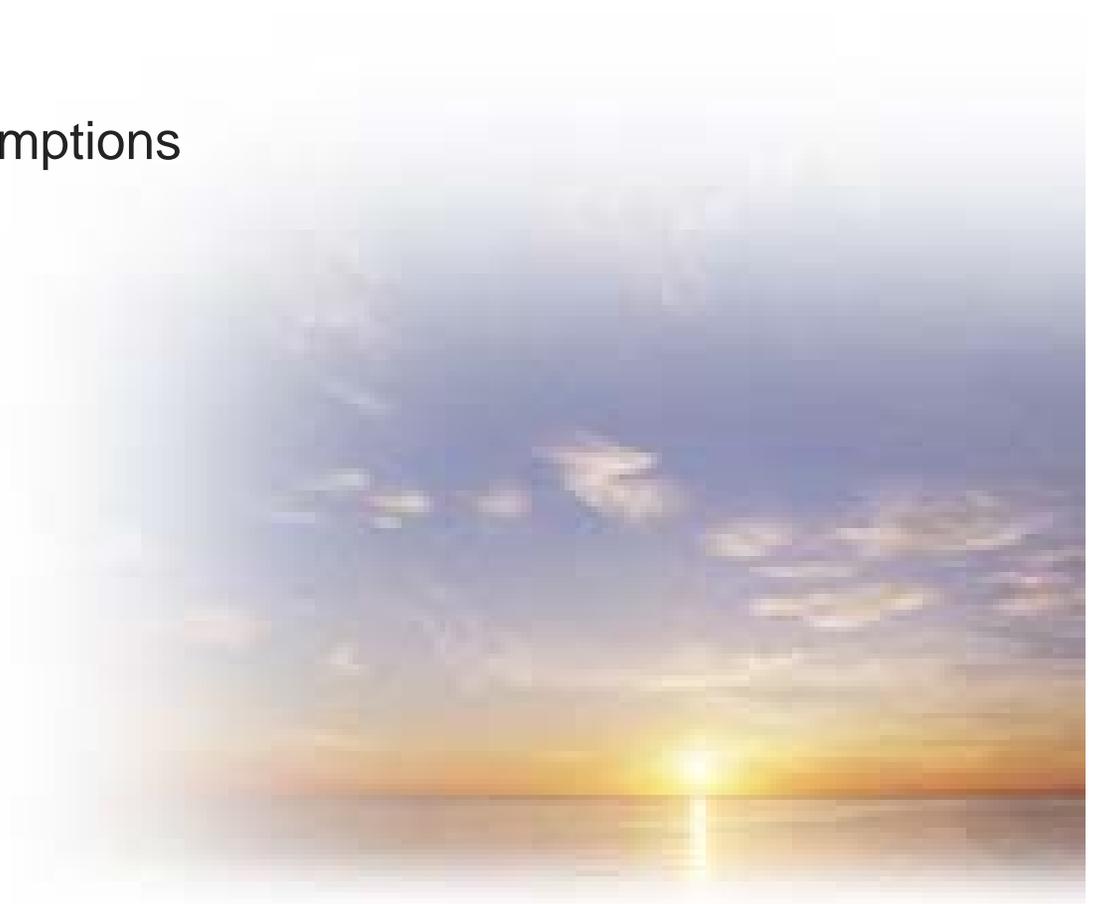
Outline

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Outline (continued)

- **Estimated Benefits**
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Executive Summary

- **NeuCo proposes to design, develop, and demonstrate integrated on-line optimization systems at Dynegy Midwest Generation's Baldwin Energy Complex**
- **The modules to be developed as part of this project will address**
 - Combustion optimization
 - Sootblowing
 - Selective Catalytic Reduction (SCR) operations
 - Overall unit thermal performance
 - Plant-wide maintenance optimization
- **Benefits will include reduced NO_x, increased fuel efficiency and reliability**



Project Information

Plant, Fuel, Location, Cost, and Schedule

- **Demonstration of Integrated Optimization Software System on three coal-fired units totaling 1765 MWe**
- **Units 1 and 2 consist of cyclone-fired (2x585 MWe) boilers with SCR systems, and Unit 3 consists of a tangentially-fired (595 MWe) boiler with low-NO_x burners, burning Powder River Basin coal**
- **Project Location:
Dynergy Midwest Generation's
Baldwin Energy Complex, Baldwin, IL**
- **Project cost: \$19.1 million;
DOE share: \$8.6 million**
- **Schedule:**
 - 2004 Project Start
 - 2004 to 2007 Operation
 - 2007 Completion



Project Information (continued)

Team Members

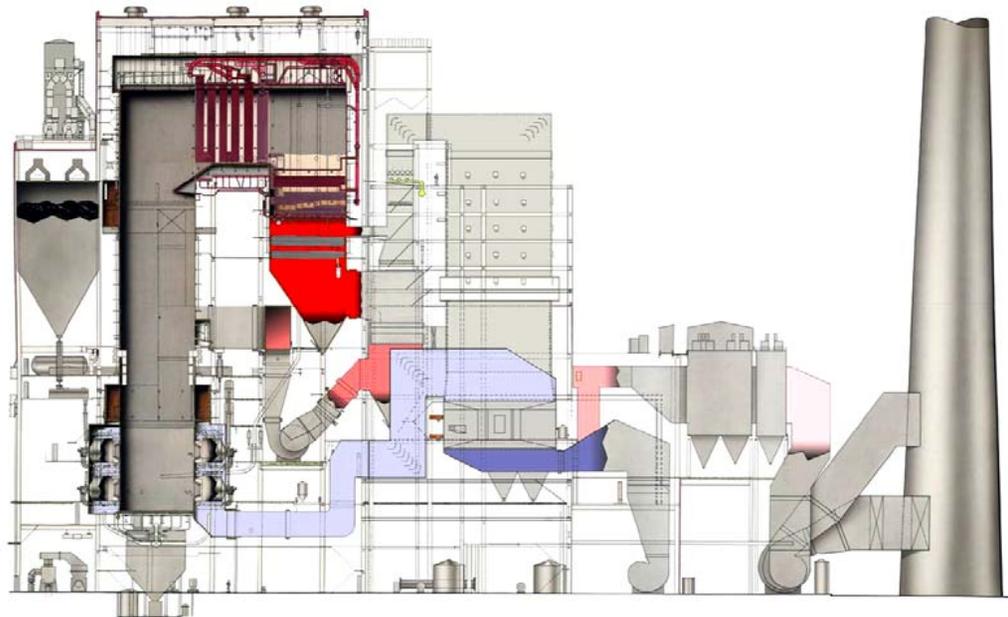
- **NeuCo, Inc. (Boston, MA)**
 - Technology and optimization system design
- **Dynegy Midwest Generation (Baldwin, IL)**
 - Host plant



Project Information (continued)

Optimization Process

- Integrate existing controls, control systems, sensors, and computer hardware with advanced optimization techniques
- Reduce emissions, increase efficiency, and increase reliability



Dynegy Midwest Generation's Baldwin Energy Complex



Project Information (continued)

Optimization Process

- Includes five optimization modules: Cyclone Combustion, Sootblowing, SCR Operations, Performance, and Maintenance
- Integrated technology performance objectives: Reduce NO_x emissions by 15%, improve heat rate and annual MWh output by 1.5%, extend SCR catalyst life by one year, and reduce NH₃ consumption by 15%.
- Expect five products (modules) to be installed on 214 GWe of fossil fuel-fired capacity



Baldwin Energy Complex Control Room



Project Information (continued)

Advantages

- Heat rate improvement
- Increase in annual MWh
- NO_x emissions reductions
- SCR catalyst life extension and reduction in NH₃ consumption
- Reductions in greenhouse gases, mercury, and particulates
- Increased efficiency and improved reliability would result in lower costs to the consumer



Project Information (continued)

Performance

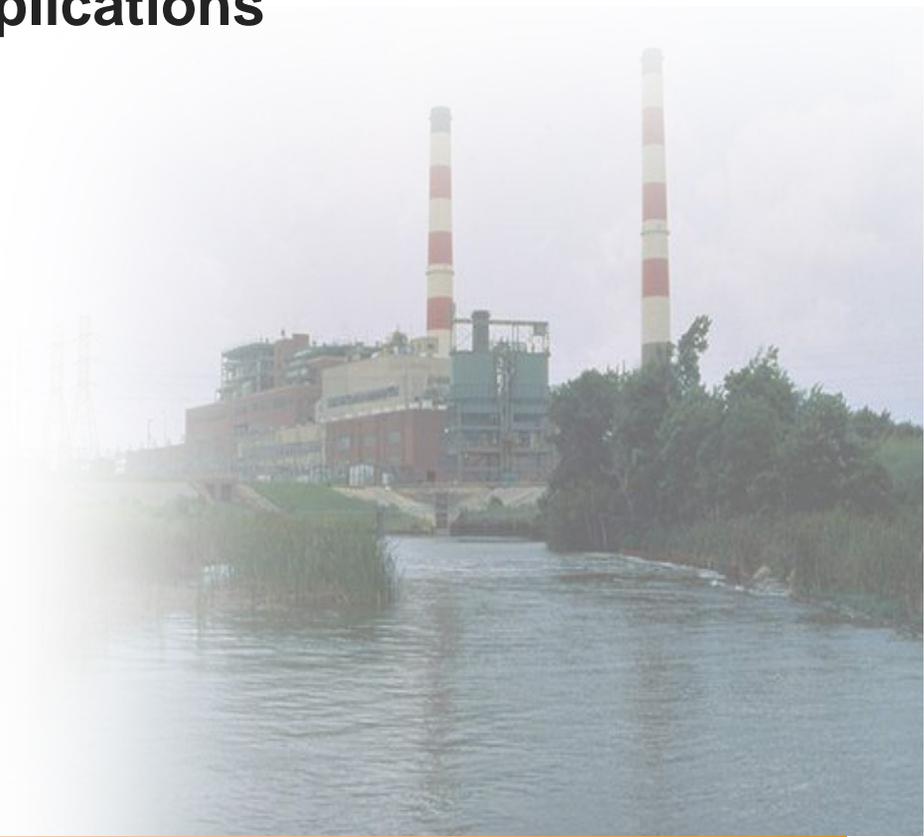
- **Corporate commitment to environmental responsibility**
- **A pro-active power producer that realizes value of advanced technologies such as economically feasible Integrated Optimization Software System that remains competitively viable**
- **An anticipation of more stringent emissions regulations for utility boilers in future**
- **Current SCR systems on cyclone-fired Units 1 and 2, and low-NO_x burners with overfire air on tangentially-fired Unit 3 increase complexity of operation and provide Integrated Optimization Software System operating challenges**



Project Information (continued)

Unique Contributions

- **Boiler tuning**
- **Computational fluid dynamics modeling**
- **Utility industry software applications**



Estimated Benefits

Approach

- **Forecast market penetration**
- **Quantify anticipated performance of Integrated Optimization Software System being demonstrated**
 - Pollutant emissions, tons per year
 - Cost savings associated with improvement in increased annual MWh output
 - Cost savings associated with improvement in SCR operations
 - Capital cost, constant dollars



SCR Installed on Unit 2 at Baldwin Energy Complex



Estimated Benefits (continued)

Market Penetration Assumptions

- **Individual boilers most likely to install Integrated Optimization Software System were selected from NETL Coal Power Data Base, McIlvaine Company Utility Environmental Upgrade Tracking System, and UDI North American Energy Business Directory**
- **These target boilers were selected based on specific attributes that made them most likely to benefit from this technology**
 - Greater than or equal to 50 MW capacity for all five product optimization modules
 - For Cyclone Combustion Optimization Product, cyclone boilers
 - For Sootblowing Optimization Product, coal-fired plants
 - For SCR Optimization Product, coal-fired plants equipped with SCR
 - For Performance and Maintenance Optimization Products, coal, gas, and oil-fired plants in operation or construction pending mode, and unit type as steam turbine, also with heat recovery and steam sendout



Estimated Benefits (continued)

Market Penetration Assumptions

- **Total Market Potential**

- Cyclone Combustion Optimization Product, 28 GWe (100 boilers)
- Sootblowing Optimization Product, 315 GWe (1,066 boilers)
- SCR Optimization Product, 121 GWe (234 boilers)
- Performance Optimization Product, 485 GWe (1,688 boilers)
- Maintenance Optimization Product, 485 GWe (1,688 boilers)

- **Assumed market penetration of 15%**

- Cyclone Combustion Optimization Product, 4.1 GWe (15 boilers)
- Sootblowing Optimization Product, 47 GWe (160 boilers)
- SCR Optimization Product, 18 GWe (35 boilers)
- Performance Optimization Product, 72 GWe (250 boilers)
- Maintenance Optimization Product, 72 GWe (250 boilers)



Estimated Benefits (continued)

Pollutant Reductions

- **The technology provides additional electric power while reducing NO_x emissions without increasing emissions of other pollutants**
 - 175 GWh increase in electricity produced over a year's time at the Baldwin Energy Complex
 - 5,625 GWh increase in electricity produced over a year's time from commercialization throughout the Nation



Estimated Benefits (continued)

National Pollutant Reductions from Commercialization

	Emissions Reductions, tons/year	Current NO_x Emissions From all Coal-fired Boilers in United States, tons/year
Cyclone Optimization	13,420 Basis: Technology market penetration of 4.1 GWe	4,766,000
Sootblowing Optimization	64,990 Basis: Technology market penetration of 47.2 GWe	4,766,000 Basis: McIlvaine Company 2000 NO _x tons



Estimated Benefits (continued)

Total Emissions for Baldwin Energy Complex

- **Total NO_x emissions currently emitted by individual boilers most likely to install this technology were calculated using Mcllvaine Company Utility Environmental Upgrade Tracking System database**
- **Total NO_x emissions reductions after installation of two technology products on these boilers were estimated by taking 15% of current emissions for Cyclone Optimization Product technology, and 10% of current emissions for Sootblowing Optimization Product technology**



Estimated Benefits (continued)

Total Emissions for Baldwin Energy Complex

	Total NO _x Emissions, tons/year
Before Retrofit	26,020
After Retrofit	24,720
Emissions Avoided	1,300

Total NO_x Emissions at Baldwin Energy Complex are estimated to decrease by about 5% due to installation of Integrated Optimization Software System



Estimated Benefits (continued)

Capital Cost

- **Integrated Optimization Software System technology is estimated to annually save about**
 - \$1,780,000 for combustion optimization
 - \$2,047,000 for sootblowing optimization
 - \$426,000 for SCR operations optimization
 - \$1,478,000 for performance optimization
 - \$721,000 for maintenance optimization
 - total cost savings of \$6,452,000 at Baldwin Energy Complex



Estimated Benefits

National

- **Integrated Optimization Software System could result in cost savings**
 - \$7.5 million/yr for reduced NH₃ consumption and extended catalyst life for SCR operation
 - \$28.6 million/yr for 0.5% increased annual MWh output / heat rate improvement for sootblowing optimization
 - \$51.5 million/yr for 0.5% increased annual MWh output / heat rate improvement for plant performance optimization
 - \$51.5 million/yr for 0.5% increased annual MWh output for maintenance optimization



Conclusions

- **Successful commercial application of Integrated Optimization Software System in United States would significantly reduce emissions**
 - 13,420 tons per year of NO_x with Cyclone Optimization Product
 - 64,990 tons per year of NO_x with Sootblowing Optimization Product
- **By installing optimization technologies, power companies could save annually**
 - \$7.5 million for SCR units,
 - \$28.6 million for sootblowing operation,
 - \$51.5 million for performance improvement
 - \$51.5 million for maintenance optimization



**Visit the NETL web site for information on all
Power Plant Improvement Initiatives and
Clean Coal Power Initiative projects**

www.netl.doe.gov/technologies/coalpower/cctc

