

Co-firing Coal and Forest Biomass in Colorado: Bridging the Cost Gap Through Renewable Energy Certificates (RECs)



National Bioenergy Conference

Denver, Colorado

March 14-16, 2006

Scott Haase

Presentation Outline

- Background, goals
- Power plant description
- REC certification
- Emissions reductions
- Costs
- USFS Procurement
- Lessons learned
- Future efforts

Overview

- Funding from DOE and Aquila
- Implemented by OEMC
 - McNeil Technologies
 - Colorado Energy Science Center
 - College student research
- Built off demonstration project conducted by CSU in 2001
 - Dr. Kurt Mackes

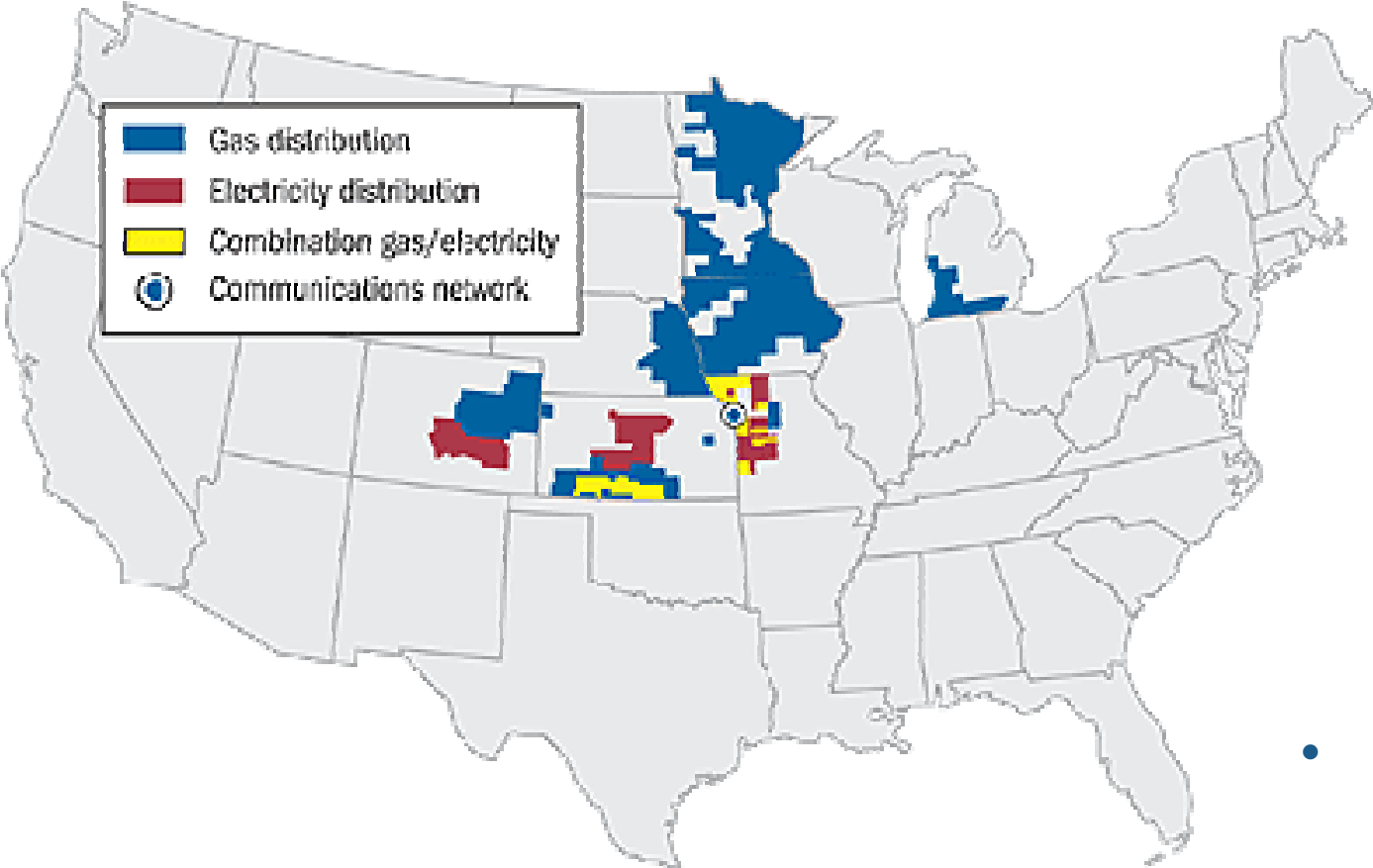
Rationale

- Forest biomass is expensive
- Economics of biomass power in the west are challenging
- Coal-fired power plants are prevalent in the region
- Co-fired biomass is least-cost conversion option
 - Low to no capital costs
 - Biomass fuel costs are still greater than coal on \$/MMBtu basis
- Growing demand for green power, often at a premium

Goals

- Assist Aquila with co-firing forest biomass and coal at the W.N Clark plant
- Certify co-fired forest biomass electricity as Renewable Energy Certificates (RECs)
 - First forest biomass RECs in the U.S.
- Develop new market to help recover incremental costs of forest biomass

Aquila Service Territory



- 2,000 MW power generation
- 446,000 customers in CO, KS and MO

Co-firing in Colorado



- Cañon City plant
 - 2 tons/day test
 - No technical problems



- Utility benefits
 - Near-term, low-risk, low-cost dispatchable renewable energy option
 - Reduces SO_x and CO_2
 - Fuel supply diversity
 - Good corporate citizen
- Barriers
 - Permit modifications may be needed
 - Upfront costs
 - Power purchase contract requirements

W.N. Clark Plant

- 38.5 MW capacity
- 2 units (16 MW, 22.5 MW)
- Built 1955, 1959
- Coal-fired B&W stokers
- Permitted to burn wood
 - Up to 5% by weight
- Wood mixed with coal prior to entering chutes
- 97% capacity factor



- Biomass unloading from live-bottom truck. Coal rail cars in background.
- Chips by loader bucket into full coal cars; mixes on the way to the bunkers and coal feeders.
- Problems with sizing of wood delivered for REC project – caused back-up at boiler infeed
- Wood had to be screened and re-chipped (added to cost)

Fuel Consumption

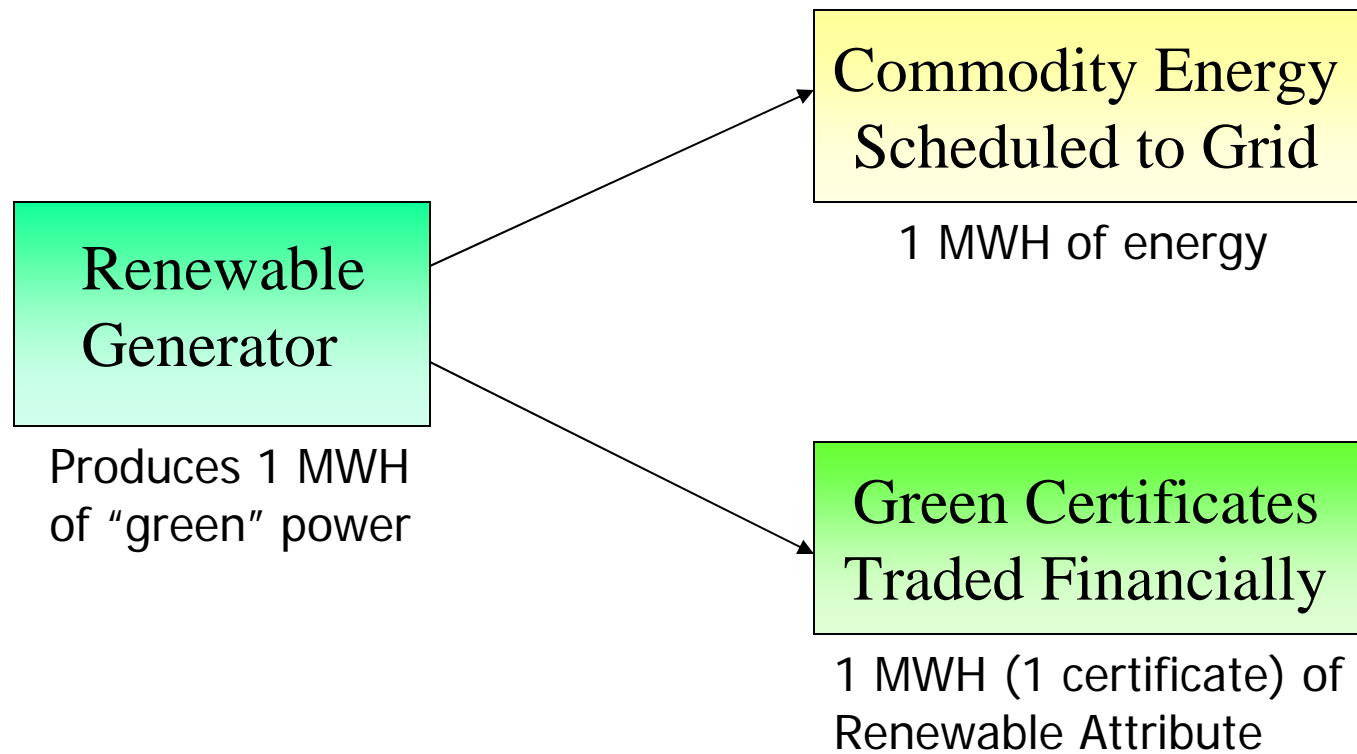
- Coal
 - 540 tons/day peak
 - 360,000 MWh/yr
- Biomass
 - Consumed an average of 6-7 tons/day during period
 - 1.5% by weight
 - From Air Force Academy
 - Consumed about 730 tons during project period
 - 730 MWh

RECs

- Each certificate represents 1 MWH of renewable generation input into the grid
- The green attribute is traded separately from the commodity energy and sold as a “green certificate”
- Green certificates do not need to be scheduled
- Trades are financial transactions, where the buyer purchases the environmental attributes of the power

RECs: Unbundling of Green Attributes and Power

(Source: Sterling Planet)



CRS vs. ERT

- CRS
 - Green-e, Green Tags
 - Widely accepted in market place, first ones
 - Consensus based approach using local interest groups for approval
 - Would have to reconvene the Colorado group
 - Generally not supportive of co-firing or forest biomass
- ERT
 - ECOPowerSM Certificates
 - Equally accepted in the marketplace, emerging certifier
 - Science based approach
 - Based on net environmental benefits
 - Willing to work with us, lower cost

ERT's
Certification
Process

- Project description
- Documentation of emissions reductions
 - CO₂
- Plant audit
- Establish timeframe for generation
- \$3,500 cost
- Authorization issued for RECs

Emissions

- CO₂, SO₂, NO_x, Mercury all reduced when biomass is added
- Methane and nitrous oxide increase slightly
 - When compared to slash burning or slow decay in forest, these go down as well
- CO₂ Emissions, measured numbers:
 - 1.298 lb/KWh coal only
 - 1.201 lbs/kWh with biomass

CO2 Reductions over 12 day period

	Coal	Wood	Total
Generation (kWh)	8,438,475	128,322	8,566,797
	CO2 lb/Kwh co-fired		1.201
	Total lbs CO2, co-fired		10,288,723
	CO2 lb/kWh coal only		1.298
	Total lbs CO2, coal only		11,119,703
	Tons CO2 avoided over 12 days		415
	Total Reduction		7.47%
	Tons CO2 avoided, per year		12,638

Wood/Coal Co-fire Program – Sample Costs

Biomass and Coal Fuel Costs	Wood	Coal
Tons fuel/year	1,095	609
Fuel Delivered (\$/GT)	\$ 30.00	\$ 34.30
On-site handling (\$/GT)	\$ 4.50	\$ 1.75
Total Fuel Cost (\$/GT)	\$ 34.50	\$ 36.05
Total Fuel (\$/Year)	\$ 37,777.50	\$ 21,957.83
Biomass fuel, energy costs (\$/kWh)	0.035	0.020

Program Administration Costs

ERT Certification	\$ 3,500.00
Biomass (\$)	\$ 37,777.50
Utility internal costs of program	\$ 6,000.00
Total Program Costs	\$ 47,277.50
\$/kWh	\$ 0.043
Costs of coal generation	\$ 0.020
Incremental \$/kWh	\$ 0.023

“Forest Tags” Strategy

- New REC product, emphasizing different but important environmental attributes
- Outreach, education
 - Product not well understood
 - Competing with other renewables
 - Have to justify the premium
- Contacted federal agencies, brokers, corporations
 - Federal renewable energy goal
 - Green corporations
 - RPS compliance
 - REC Wholesalers
- USFS stepped up to the plate

USFS Procurement

- Discussions with regional USFS staff in Denver
- Contacted Washington DC staff
 - Technical and procurement
- Explained the concept, documentation, outreach
- Funding availability is issue
- Procurement process
 - Sole source justification
- Publicity once deal completed

Colorado Amendment 37

- Forest biomass is an eligible resource in Colorado, but...
 - A37 rules provide a set aside for solar, but nothing for biomass
 - \$4.50/watt rebate to customers includes RECs
 - Bills will rise 68 cents/month to cover costs
- RECs can be used to meet obligation, and come from anywhere
 - 1.25 in-state multiplier likely to be of limited value
- Aquila may use to meet its obligations in 2007

Accomplishments

- Project completed in September 2005:
 - RECs from forest biomass co-firing certified by Environmental Resources Trust (ERT)
 - Marketing plan developed
 - Benefits and costs documented
 - RECs sold to USFS

Lessons Learned

- RECs can be used to increase recover higher costs and payment for low-value forest biomass
 - Closes the loop between costs of removal and market outlets
- Need to justify the forest biomass price premium
 - wind ~ \$3/MWh
 - solar ~ up to \$150/MWh
 - Solar is expensive but people willing to pay, also set asides require it
- Significant education is needed to teach brokers, utilities and consumers about forest biomass power benefits

Lessons Learned

- Fuel supply is critical
 - Can't guarantee MWh without the biomass
 - Must be up to spec
- Permits in place to burn wood makes process easier

Next Steps

- Implement regional education and outreach campaigns
- Facilitate long-term contracts
- Study better fuel handling options
 - Pellets?
 - Separate handling systems?
- Enact federal legislation to allow co-firing without requiring utilities to open air permits to EPA review
- Create forest biomass set-asides:
 - Federal green power RFPs
 - State Renewable Portfolio Standards (RPS)

Resources

- Final Report is online:
 - www.coloradobiomass.org
- BioCycle Article
 - April 2005, Vol 46, No 4, Pg. 48
- Contacts:
 - Scott Haase, 303-906-0513
 - Angela Crooks, OEMC
 - 303-866-2309