

INDECK[®]
ENERGY SERVICES, INC.

Wood Pellets: Production,
Applications, and Co-firing Potential

Presented By Gerry DeNotto, President

Power-Gen International Conference

December 15, 2010

Energy for Generations®

Presentation Overview

- Introduction to Indeck Energy
- Introduction to Wood Pellets
 - Pellets for Co-firing with Coal
 - Co-firing Pellets in Wisconsin
 - Pellets for Institutional and Industrial-Sized Boilers
 - Technical Overview of Wood Pellet Production

Indeck Energy Services, Inc.

- Formed in 1985
- Part of the Indeck Group of Companies
 - Indeck Energy Services, Inc.
 - Indeck Operations, Inc.
 - Indeck Power Equipment Company
 - Indeck Boiler Company
 - Indeck Keystone Energy, LLC

Indeck Energy Services, Inc.

- Developer, owner and operator of power and biofuels projects
 - Power generation projects consisting of 3,000 MW internationally
 - Ethanol and biodiesel facilities representing 755 million gallons per year production
 - Wood pellet production facilities
 - 90,000 TPY in production
 - 90,000 TPY in development

Indeck Energy Services, Inc.

Indeck's Alternative Energy Projects

Facility	Location	Technology	Capacity	Commercial Operation	Status
West Enfield	West Enfield, ME	Biomass C.F.B.	25 MW	1987	Sold
Jonesboro	Jonesboro, ME	Biomass C.F.B.	25 MW	1987	Sold
Alexandria	Alexandria, NH	Biomass Stoker	16 MW	1988	Operating
Senneterre	Quebec, Canada	Biomass Stoker	25 MW	Development	Sold
Hydro West Enfield	West Enfield, ME	Run of River	13 MW	1988	Sold

Indeck's Wood Pellet Project

Facility	Location	Capacity (Tons/Year)	Commercial Operation	Status
Indeck Ladysmith BioFuel Center	Ladysmith, WI	90 Thousand	2009	Operating
Indeck Magnolia BioFuel Center	Magnolia, MS	90 Thousand	2011	In Development

Indeck Energy Services, Inc.

Indeck's Biofuel Projects

Facility	Location	Capacity (Gallons/Year)	Commercial Operation	Status
Little Sioux Corn Processors	Marcus, IA	50 Million	2003	Operating
KAAPA Ethanol	Kearney, NE	60 Million	2003	Operating
Lincolnland Agri-Energy, LLC	Robinson, IL	45 Million	2004	Operating
Big River Ethanol	West Burlington, IA	100 Million	2004	Operating
Platte Valley Ethanol	Central City, NE	40 Million	2004	Sold
United Wisconsin Grain Producers	Friesland, WI	45 Million	2005	Operating
Granite Falls Ethanol	Granite Falls, MN	40 Million	2006	Operating
Iroquois Bioenergy	Rensselaer, IN	40 Million	2006	Sold
Western Wisconsin Energy	Boyceville, WI	40 Million	2006	Operating
Cardinal Ethanol	Winchester, IN	100 Million	2008	Operating
Blackhawk Biofuels, LLC	Danville, IL	45 Million	2009	Operating
Big River Development	Various, IA	100 Million	Various	Operating
Highwater Ethanol	Lamberton, MN	50 Million	2009	Operating
Total Annual Production	755 Million			

Coal Use in the U.S.

- U.S. is 2nd largest user of coal in the world, after China
- U.S. consumed approx. 1 billion tons of coal in 2009
- Coal accounts for 46% of U.S. electricity generation
- U.S. has nearly half of a billion tons of biomass available for energy production

Co-firing Wood Pellets

- Most U.S. experience of co-firing pellets with coal in utility boilers is in the testing stage
- Europe has been co-firing pellets successfully with coal since the 1990s
 - Sweden, Denmark, Germany, and Austria are biggest users
 - Europe used about 6.6 million tons of pellets in 2009 and imported about 30% of that. Imports are increasing from large U.S. pellet plants, mainly in southeastern U.S.
 - Co-firing is successful financially in Europe because of carbon legislation and utility cooperation

Co-firing

- Wood pellets are well-suited for co-firing with coal
 - Densified, low-moisture, uniform biomass
 - Avoid many challenges of co-firing raw biomass
 - Many characteristics similar to coal
 - Cause fewer harmful emissions than coal, such as mercury and nitrous oxides
 - Lower in ash and result in less boiler corrosion and slagging
 - Carbon neutral

Wood Pellet Characteristics

Property	Wood Pellets (Industrial)	Bituminous Coal
Heat Content (MMBTU/ton)	15.8 – 17.0	16.7 – 26.9
Ash Content (% wt.)	2.0	3.3 – 11.7
Moisture Content (% wt.)	<8.0 (TYP 4.0-6.0)	2.2 – 15.9
Sulfur (% wt.)	0.010 – 0.015	0.7 – 4.0
Nitrogen (% wt.)	0.03	1.5
Mercury (% wt.)	0.16 E-8	2.21 E-8 – 6.91 E-7
Bulk Density (lb/ft ³)	45	43 – 50



- ▣ Average Test Results from various samples of Indeck Ladysmith Wood Pellet Fuel from 11/2009 – 02/2010. Tests performed by 3rd Party Testing Company, Twin Ports Testing, Inc.
- ▣ <http://www.engineeringtoolbox.com>
- ▣ 2008 EIA Monthly Time Series File, EIA-923. Range of coal heat content in WI power plants only was used.
- ▣ Walker, Anne. "Transport, Storage, and Handling of Coal." IEA Clean Coal Centre. 2003.
- ▣ Davidson, Robert. "Nitrogen in Coal." University of Kentucky, Center for Applied Energy Research. 1994.
- ▣ EIA Coal Transportation Sensitivity Analysis, April 2005

Why Use Wood Pellets for Co-firing? Environmental Benefits

- Reduction of greenhouse gas emissions, CO₂
- Reduction of SO_x
- Reduction of NO_x
- Reduction of harmful heavy metals such as mercury and cadmium



Technical Benefits

- Co-firing Fuel – Wood Pellets vs. Wood Chips or Ag-Residue
 - Consistent fuel specification – provides for high reliability
 - Low moisture content – provides for minimal degradation of boiler performance
 - High heat content – closely matches heat content of coal
 - Low ash content – less ash than coal
 - No agricultural biomass fertilizer residuals – avoid impact on boiler tubes
 - Ease of transport and handling
 - Extensive test runs already performed
 - UWEC, Alliant, FirstEnergy, AEP, EKPC

Focus on Wisconsin: An Energy Importer

- Over \$16 billion/year spent on energy imports
- Almost \$900 million/year spent on coal imports alone
- 5% co-firing keeps more than \$45 million spent on coal imports in the state

Co-firing

- Wood pellets in utility coal boilers
- Sustainability - Wisconsin has the biomass resource to co-fire every coal boiler in the state with wood pellets at a 15% co-firing rate utilizing less than one-third of the available resource annually
- Co-firing is a least cost solution compared to wood chip biomass power plants and is on par with wind energy, typically the most economic of the renewable technologies

Co-firing

- WI has 30+ utility, industrial, and institutional coal boilers totaling 7,800 MW
- Consumes 26 million tons of coal annually
 - All sourced from out of state

Co-firing

- Wisconsin utilities could set an example for other states and become a leader in this field
- Likely that Wisconsin will be required to implement renewable legislation in near future
- Use clean, renewable, dependable in-state resources

The True Cost of Coal

All Coal-Fired Boilers in Wisconsin (7800 MW)			
	Tons	Unit Cost	TOTAL ANNUAL COST
Average Delivered Cost	26,224,036	\$35.68/ton	\$935,673,604.48
Carbon (CO ₂) Cost	61,460,733	\$18.90/ton	\$1,161,607,853
NO _x Cost	480	\$450/ton	\$215,827
SO ₂ Cost	166,614	\$10/ton	\$1,666,144
Mercury Cost	9.35	\$1450/oz	\$433,848,354
TOTAL COST			\$2,553,011,782

Assumptions and Sources

Coal Cost: EIA 2009 WI average electric utility coal cost, delivered.

Carbon (CO₂) Cost: Spot settled CO₂ price from European Climate Exchange as of 8/24/2010.

NO_x and SO₂ Costs: TFS Energy Daily Coal & Emissions Report, 2010 Offer Price.

Mercury Cost: US EPA Mercury Cap-and-Trade Program Allowance, 2010.

Total WI Coal Usage: 26,224,036 tons/year, per EIA-923 and EIA-860 data series.

Emissions Factors: EIA, EPA.

Coal CO₂: 2.34 ton CO₂/ton coal.

Coal NO_x: 1.15E-05 ton NO_x/MWh.

Coal SO₂: 4.00E-03 ton SO₂/MWh.

Coal Mercury: 3.57E-07 % wt.

The True Cost of Co-firing

All Coal-Fired Boilers in Wisconsin: 5% Co-firing Case (7800 MW)

	Tons	Unit Cost	TOTAL ANNUAL COST
Average Delivered Cost: Coal	24,912,834	\$35.68/ton	\$888,889,924
Average Delivered Cost: Pellets	1,402,870	\$150/ton	\$210,430,536
Carbon (CO ₂) Cost	58,387,696	\$18.90/ton	\$1,103,527,460
NO _x Cost	462	\$450/ton	\$208,045
SO ₂ Cost	158,373	\$10/ton	\$1,583,726
Mercury Cost	8.91	\$1450/oz	\$413,197,427
Pellet Mill Job Creation (Annual Salaries)			\$14,700,000
Related Job Creation (Annual Salaries)			\$58,800,000
TOTAL COST			\$2,544,337,119

Assumptions and Sources

Pellet Cost: \$135/ton, bulk, industrial grade pellets. FOB production facility. \$15/ton delivery via rail from Ladysmith, WI to Madison, WI.

Pellets Required: 1,402,870 tons based on 5% by energy co-firing.

Job Creation (Pellet Mills): Based on 21 pellet mills (Production: 70,000 tons annually each) required to produce 1.4 million tons of pellets annually. Each mill has 20 employees.

Job Creation (Related): Encompasses logging, aggregation, transportation, construction and other indirect jobs. Approximately 80 indirect jobs created per pellet mill.

CO₂ Cost: Assumes carbon neutrality of pellets.

Emissions Factors: EIA, EPA.
 Pellets NO_x: 3.21E-06 ton NO_x/MWh.
 Pellets SO₂: 4.27E-05 ton SO₂/MWh.
 Pellets Mercury: 1.60E-08 % wt.

See previous slide for remaining assumptions.

Clean Renewable Energy Jobs

5% Co-firing Case: 21 Wood Pellet Plants

Construction Jobs: 1,300

Permanent Jobs: 1,300

350 Wood pellet plant operators

800 Loggers

150 Truckers

Clean Renewable Energy Benefits

5% Co-firing Case: 21 Wood Pellet Plants

Annual Benefits

- \$45 million would not be spent on out of state coal
- \$15 million wood pellet plant salaries
- \$59 million logger and trucker wages

Additional Annual Benefits

- Real estate taxes
- Plants buy or lease products
- Things break or need to be serviced: repair bills
- Water, sewage, electricity & telephone bills

Capital Investment for Wood Pellet Plants

- \$400 million
- Additional costs for road and infrastructure upgrades

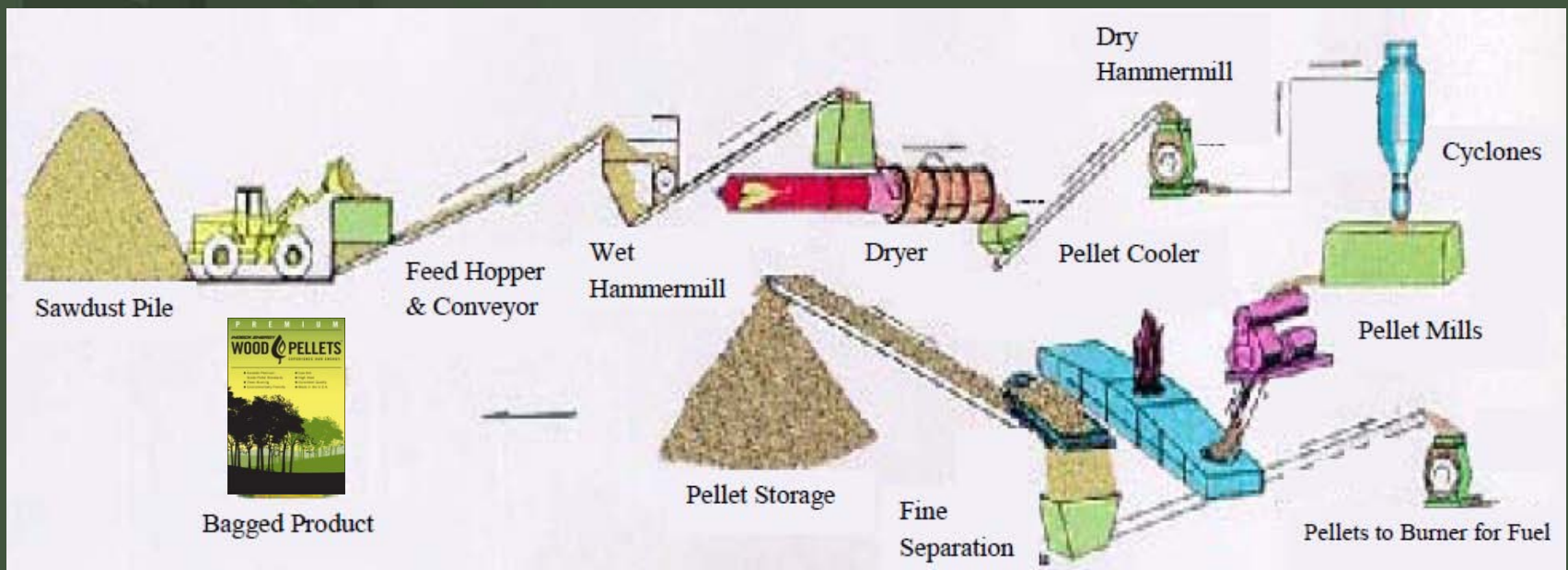
Wisconsin Wood Resource

- About 16.2 million acres of timberland
- Over 70% of timberland in WI is privately owned
- Annual growth is about 1.7 x annual harvest (16 million tons grown vs. 9.5 million tons harvested)
- On average, growth rate is increasing, while mortality and removals have remained static for past decade
- Aspen and basswood make up approximately 50% of Wisconsin forests

Wisconsin Wood Pellet Market

- Utility co-firing / coal replacement
 - Co-firing is ideal for meeting state RPS
 - No energy imports required
 - No major technological advances required
 - Creates in-state jobs
 - Feedstock available for pellets can supply 100% of renewable generation required
 - Institutional and industrial pellet boilers

Wood Pelletization Process



Wood Pelletization: Technical Overview

- Feedstock can be de-barked
- Feedstock chipped



Wood Pelletization: Technical Overview

- Chips conveyed, ground, dried, and re-ground



Wood Pelletization: Technical Overview

- Sawdust pelletized
- Pellets cooled
- Pellets filtered via shaker and screener
- Transported to Bulk Bins

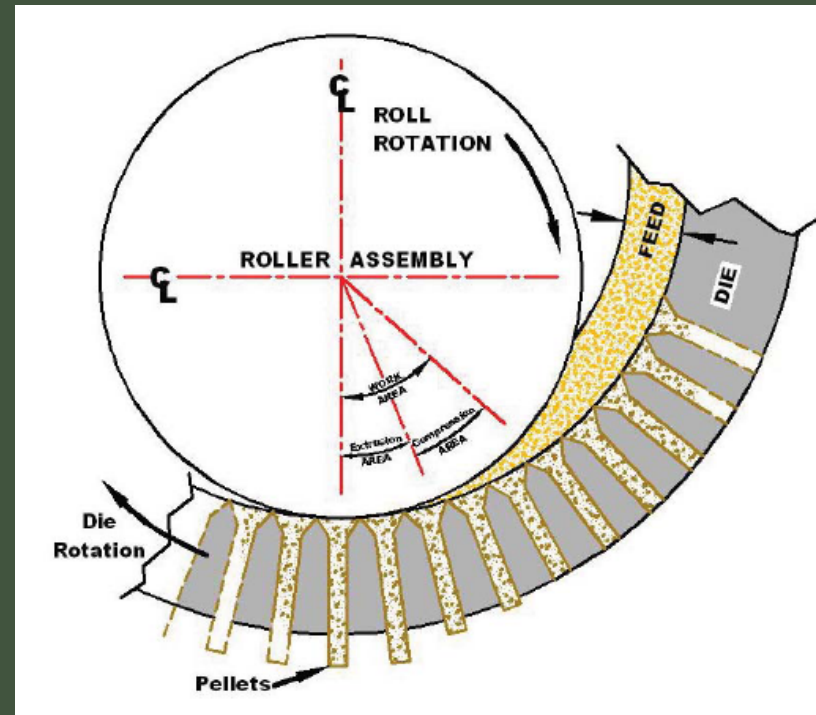


Image Source: Leaver, Richard H. "The Pelletizing Process." Plate 2. Andritz, Inc. Andritz Sprout Division.

Wood Pelletization: Technical Overview

- Bulk Storage



Institutional/Industrial Pellet Boilers

- Current coal boilers:
 - State/government facilities
 - Manufacturing companies, especially paper and pulp mills
 - More than 20 total in state
- Incentives should exist for converting industrial coal users to biomass
- Utilities must meet RPS but institutional and industrial facilities are not required to meet RPS
 - Industrial coal users in WI consume over 1.3 million tons and emit over 5% of total CO₂ emissions in state
 - Could be using in-state resources and emitting far less

Indeck in Wisconsin: Indeck Ladysmith BioFuel Center

- Wood pellet plant with 90,000 TPY capacity, enough to heat up to 30,000 homes
- Located in Ladysmith, Rusk County
- Began operation in August 2009
- First BCAP-approved facility in Wisconsin
- Feedstock mainly hardwood from sustainable forestry practices, forest residue, and local mill residue



Indeck Ladysmith BioFuel Center

- Located in northwest Wisconsin 50 miles from Eau Claire, WI
- Supported off CN railroad main line
- Feedstock requires over 200,000 TPY forest and mill residue
- Industrial, commercial, and residential pellets available
- Bulk rail and truck loading available
- Employs 25+ Wisconsin residents when fully operational and supports 45-75 logging and transportation jobs

Wisconsin Partner: Midwest Forest Products Co.

- Feedstock aggregator and partial owner of Indeck Ladysmith BioFuel Center
- Formed in 1977 for the production of high quality debarked pulpwood to paper mills
- Pioneered portable ring debarking and chipping services
- Actively involved with
 - Wood processing and procurement
 - Chipping
 - Trucking
 - Harvest
 - Timberland management

Summary

- Wisconsin has an abundant biomass supply and wood pellets are ideal way to utilize this biomass for energy
 - Technical Benefits
 - Economic Benefits
 - Environmental Benefits
- Wood pellets create clean renewable energy jobs
- Wisconsin energy independence: offset out of state/country fossil fuels – keeps money flowing within the state
- Going forward

Indeck Energy Services, Inc.

Energy for Generations[®]

For more information please visit us at:

www.indeckenergy.com

- and -

www.indeckpellets.com