FRÖLING ENERGY

BIOMASS BOILERS • SERVICE • FUEL

Jim Van Valkenburgh

VP Sales & Marketing

Office & PDC Production Facility:

590 Hancock Road, Peterborough, NH

FRÖLING ENERGY

BIOMASS BOILERS • SERVICE • FUEL

A Self-Performing Contractor

What We Do:

- **Biomass Boiler System Installations**

  with Integration into Existing Boiler Systems

- **Complete Project Management**
- **Biomass Boiler Servicing & Maintenance**
- **Manufacture & Delivery of PDCs**

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3 Biomass Fuels:

- ***Wood Pellets***
- ***PDCs***
- ***Green Wood Chips***

Wood Pellets

7% moisture content

Precisely controlled small size

Flows like water—easy to store & move

Compact BTU storage (by weight & volume)

PDCs

"Precision Dry Wood Chips"

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That's a K-Cup →

25% moisture content

Screened: Nothing bigger than a matchbook

Stacks—does not flow. Hardwood & Softwood

Green Wood Chips

45% moisture content (varies by season)

Many Variables: Size, hard/soft wood, % bark

Price is determined by Quality

3 BIOMASS FUELS TO CONSIDER

HOW MUCH OIL DOES YOUR BUILDING BURN?

PELLETS — **3000 to 30,000 gallons of oil/year**

PDCs — **20,000 to 70,000 gallons of oil/year**
(Precision Dry Wood Chips)

GREEN CHIPS — **40,000 gallons of oil and UP/year**

3 BIOMASS FUELS TO CONSIDER

Net (burned) Heat Content of Fuel

PELLETS

120.45 Gal Oil per Ton

13.370 Million BTU per Ton

PDCs

93.62 Gal Oil per Ton

10.392 Million BTU per Ton

GREEN CHIPS

66.08 Gal Oil per Ton

7.335 Million BTU per Ton

Calculations use HHV energy content of hardwood burned at 84% Efficiency

EXAMPLE: Project Parameters

To Offset 30,000 Gallons of Oil …

PELLETS

Burn 249 Tons
Total Biomass Boiler Output: 1.3 Million BTU
Storage: 28 ton steel silo (12' dia) 1400 cu ft
9 fillings using a 25 ton blower truck

PDCs

Burn 321 Tons
Total Biomass Boiler Output: 1.3 Million BTU
Storage: 20 ton bin (Min 15' x 15' x12'h) 2800 cu ft
14 fillings using 15 ton blower truck

GREEN CHIPS

Burn 486 Tons
Total Biomass Boiler Output: 1.75 Million BTU
Storage: 40 ton bin (Min 16' x 20') 4000 cu ft
20 fillings using 25 ton liver floor truck

Calculations use HHV energy content of hardwood burned at 84% Efficiency

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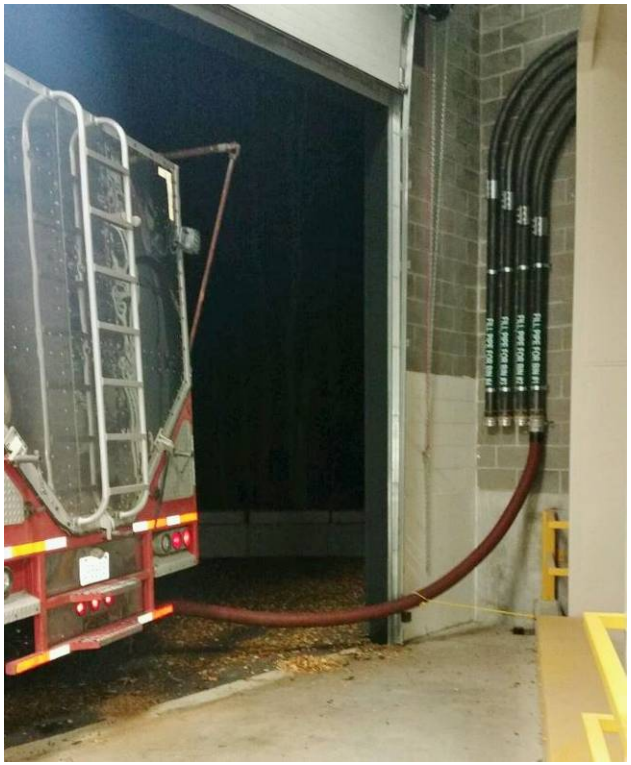
Our New Biomass Fuel: PDCs

Made at our facility in Peterborough



Delivered in our Box Truck and *BLOWN* into customer storage bins

3 BIOMASS FUELS TO CONSIDER

***Net Cost* of Delivered Heat……$ per Million BTU**

Propane at $2.75/gal = $35.95

Oil at $3.00/gal = $27.02

Propane at $2.00/gal = 26.14

Oil at $2.50/gal = $22.52

Propane at $1.50/gal = $19.61

Oil at $2.00/gal = $18.02

PELLETS

…at $240/ton = $17.95

Oil at $1.50/gal = $13.59

Propane at $1.00/gal = $13.07

PDCs

…at $120/ton = $11.55

…at $75/ton = $10.22

GREEN CHIPS

Oil at $1.00/gal = $9.06

…at $60/ton = $8.18

3 BIOMASS FUELS TO CONSIDER

Net Cost of Delivered Heat……in Oil Equivalents

Propane at $2.75/gal = $3.97 Oil Equiv

Oil at $3.00/gal

Propane at $2.00/gal =$2.88 Oil Equiv

Oil at $2.50/gal

Propane at $1.50/gal =$2.16 Oil Equiv

Oil at $2.00/gal

PELLETS

…at $240/ton = $1.98/gal Oil Equiv

Oil at $1.50/gal

Propane at $1.00/gal = $1.44 Oil Equiv

PDCs

…at $120/ton = $1.28/gal Oil Equiv

…at $75/ton = $1.13/gal Oil Equiv

GREEN CHIPS

Oil at $1.00/gal

…at $60/ton = $ .91/gal Oil Equiv

3 BIOMASS FUELS TO CONSIDER

Net Cost* of Delivered Heat……*in Oil Equivalents

With RECs!!
at $16 net
(MA & NH Only)

Propane at $2.75/gal = $3.97 Oil Equiv

Oil at $3.00/gal

Propane at $2.00/gal =$2.88 Oil Equiv

Oil at $2.50/gal

Propane at $1.50/gal =$2.16 Oil Equiv

Oil at $2.00/gal

PELLETS

…at $240/ton = $1.51/gal Oil Equiv

Oil at $1.50/gal

Propane at $1.00/gal = $1.44 Oil Equiv

Oil at $1.00/gal

PDCs

…at $120/ton = $ .80/gal Oil Equiv

GREEN CHIPS

…at $75/ton = $ .68/gal Oil Equiv

…at $60/ton = $ .45/gal Oil Equiv

3 BIOMASS FUELS TO CONSIDER

Approximate T-REC Values

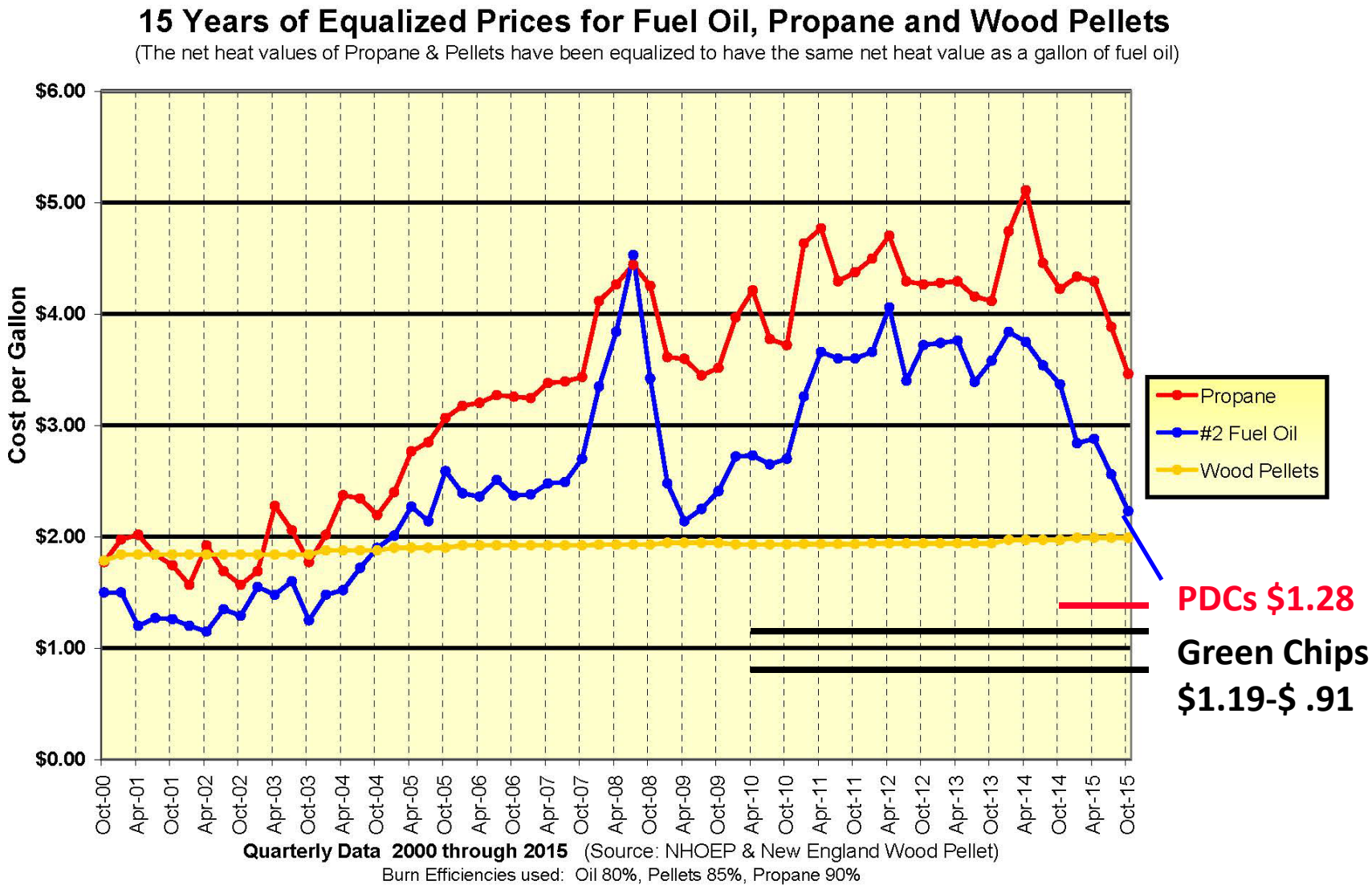
PELLETS — **3.92 RECs per Ton**

PDCs — **3.04 RECs per Ton**

GREEN CHIPS — **2.01 RECs per Ton**

Calculations use HHV energy content of hardwood burned at 84% Efficiency

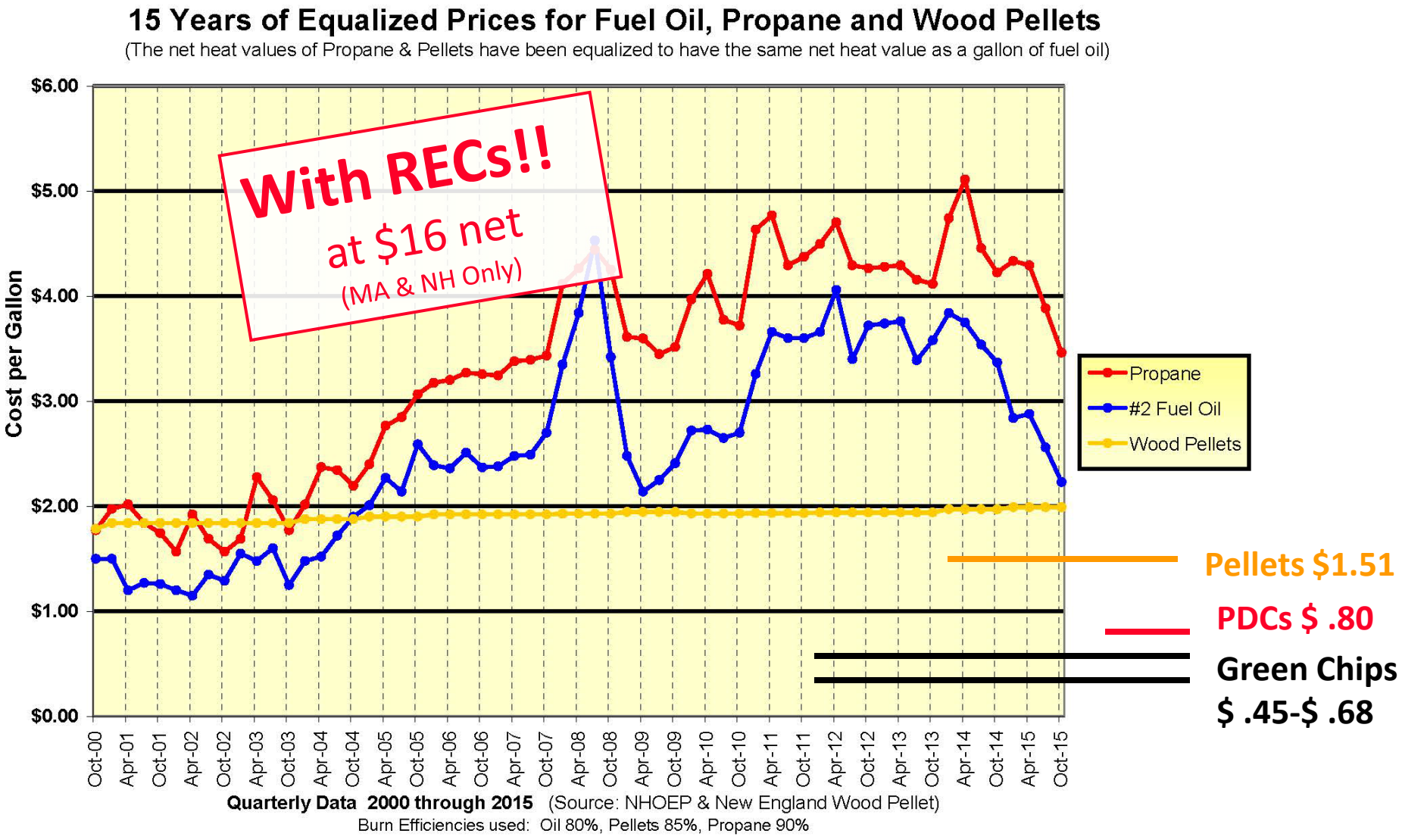
HISTORIC Fuel Prices…..Based on same energy as a gallon of Oil



All prices noted in Net Oil Price Per Gallon Equivalents

HISTORIC Fuel Prices

BIOMASS With RECs!!



All prices noted in Net Oil Price Per Gallon Equivalents

3 BIOMASS FUELS TO CONSIDER

Volume per ton

PELLETS

50 cubic feet per Ton

(Delivery: Blown into silo)

PDCs

133 cubic feet per Ton

(Delivery: Blown into bin)

GREEN CHIPS

83 cubic feet per Ton

(Delivery: Dumped into bin)

Calculations use HHV energy content of hardwood burned at 84% Efficiency

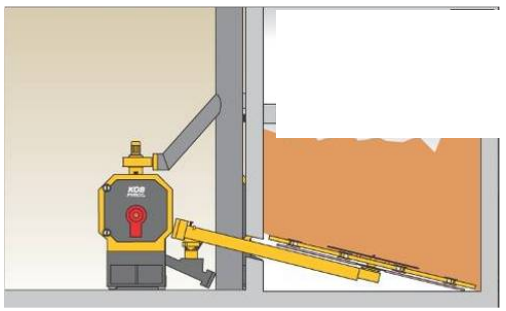
PDCs: A Value Added Product

PDCs

- 25% Moisture Content
- Wood quality is similar to wood pellets
  - Made from Bole Wood (the main trunk of a tree)
- Produced with quality control standards
- Screened to assure no oversized pieces
- Large sticks, rocks and “Tramp metal” are eliminated
- Able to be blown into a bin through a 5” pipe as long as 150’
- Typical bin is 21’ diameter x 20’ high = 40 ton capacity

PDCs

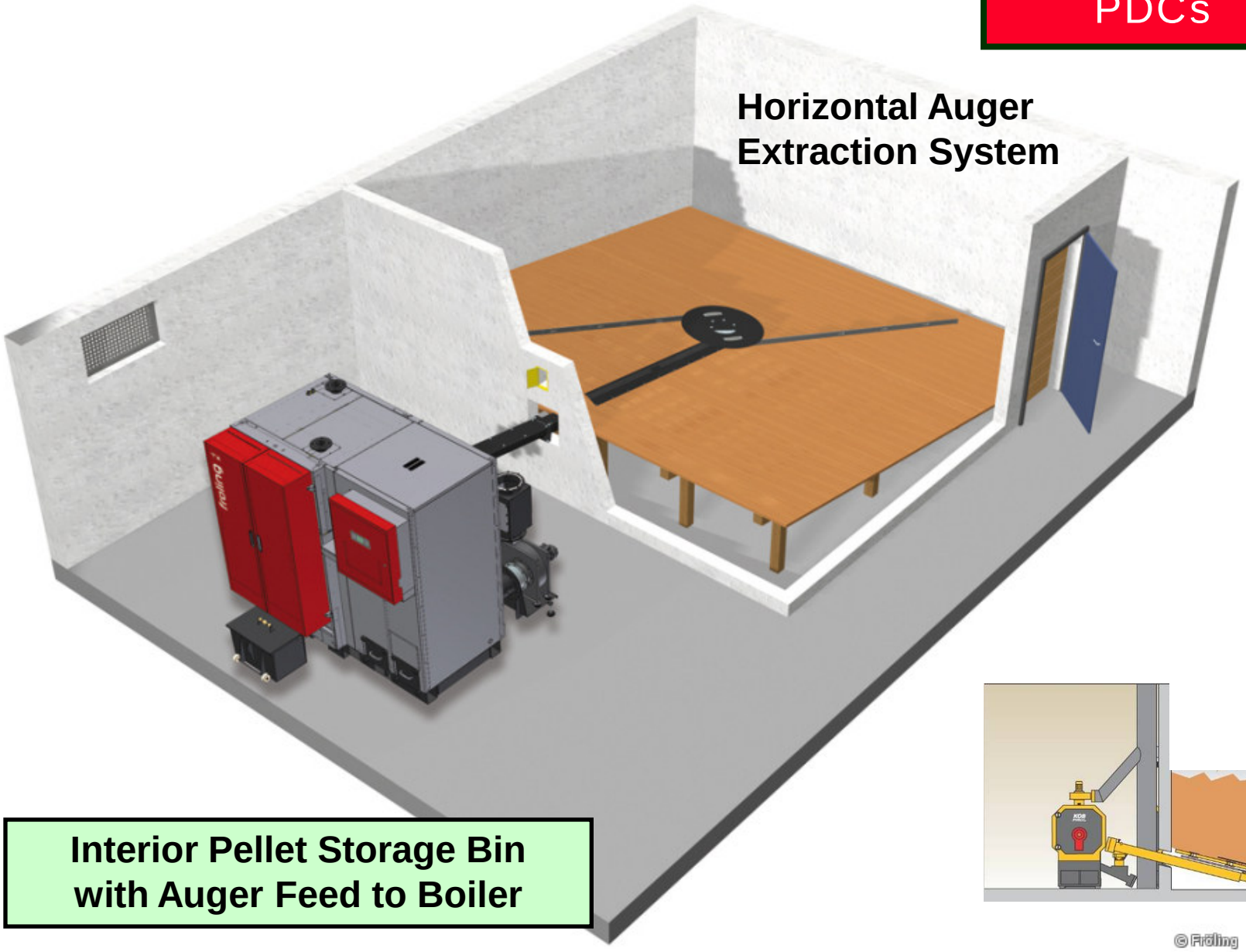
Horizontal Auger Extraction System

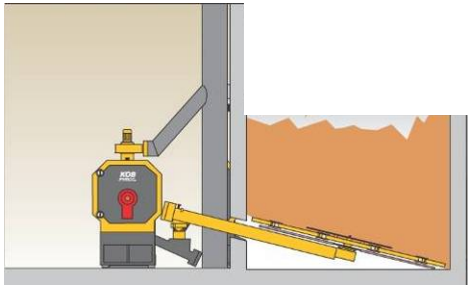


Exterior Pellet Storage Bin with Auger Feed to Boiler

PDCs

Horizontal Auger
Extraction System





© Fröling

Interior Pellet Storage Bin
with Auger Feed to Boiler

PDCs

Garage Pellet Storage Bin with Rake & Auger Feed to Boiler

Perpendicular Extraction Auger at Rear

DESIGN PARAMETERS for PDCs

For 20,000 to 70,000 Gallons of Oil/yr Consumption

Sweeper Arm Storage Bins:

20 to 40+ tons/Bin (Min/Max) 15'x15' to 20'x20' (12' high pile)

Garage Storage Bin(s) with Rake (Javo):

26 to 60+ tons/Bin (Min/Max) 16'x 24' to 20'x 45' (9' high pile)

- **Each Bin supplies one or two Boilers**
  - Boilers are direct fed with rigid auger from Bin
  - Bin should be within 20' of Boiler (back to back)
  - New boiler building often needed due to boiler/bin footprint
- **Boiler Options:** 500,000 to 1,700,000 BTU/hr each *(DES Regs)*
  - ***DUAL FUEL*:** Boiler and Bin can handle wood pellets or PDCs

PELLETS

PDCs

STEVENS HIGH SCHOOL

Claremont, NH

2 Froling TX-150
Pellet/PDC Boilers
500,000 BTU/Hr Each

Steel Interior Silo can hold
70 tons of Pellets
Or 35 tons of PDCs

HIGH MOWING SCHOOL
Wilton, NH

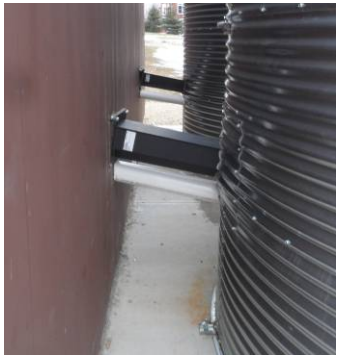
PDCs

2 Froling TX-150 Boilers = 1 Million BTU/hr
Propane Back up = 1.5 million BTU/hr

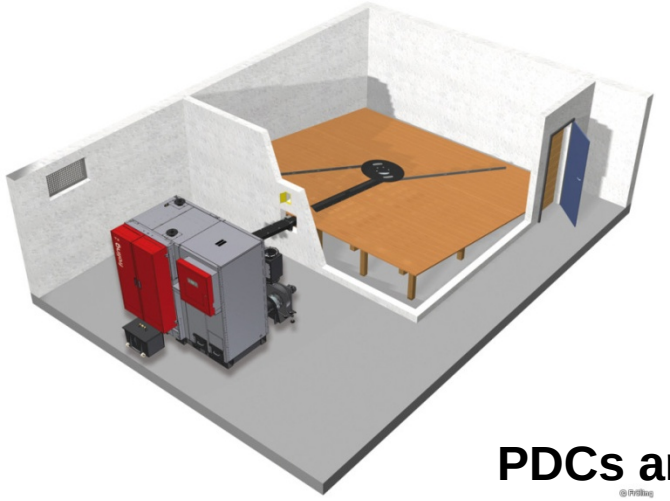
9 Building District Heating System
with Central Biomass Boiler Building
Prior fuel use: 30,000 Gal Oil

HIGH MOWING SCHOOL
Wilton, NH

PDCs



Direct rigid auger feed from bin to boiler



PDCs are blown into the silos from our blower truck

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Thank You!

Jim@FrolingEnergy.com 603-924-1001 *www.FrolingEnergy.com*

3 BIOMASS FUELS TO CONSIDER

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With RECs!!
at $16 net
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PELLETS
…at $240/ton = $12.09
Oil at $1.00/gal = $9.06

PDCs
…at $120/ton = $5.69

GREEN CHIPS
…at $75/ton = $4.37
…at $60/ton = $3.13