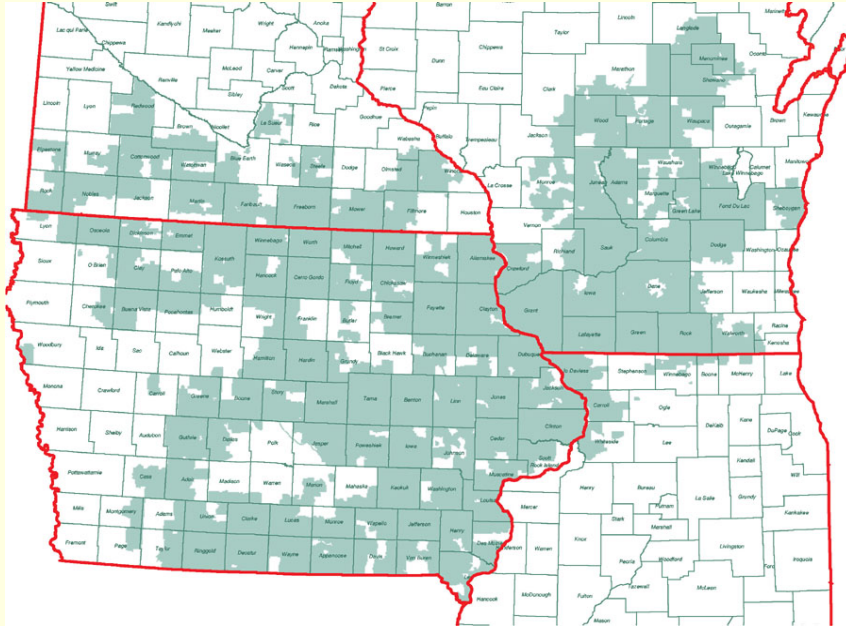


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# **Agriculture Electric and Gas Conservation and Renewable Energy**

**Bill Johnson  
Alliant Energy  
Portage, Wisconsin**

# Who is Alliant Energy?



- Alliant Energy serves 1.2 million customers
- Approximately, 53,000 farm customers
- Agriculture energy efficiency programs over 20 years



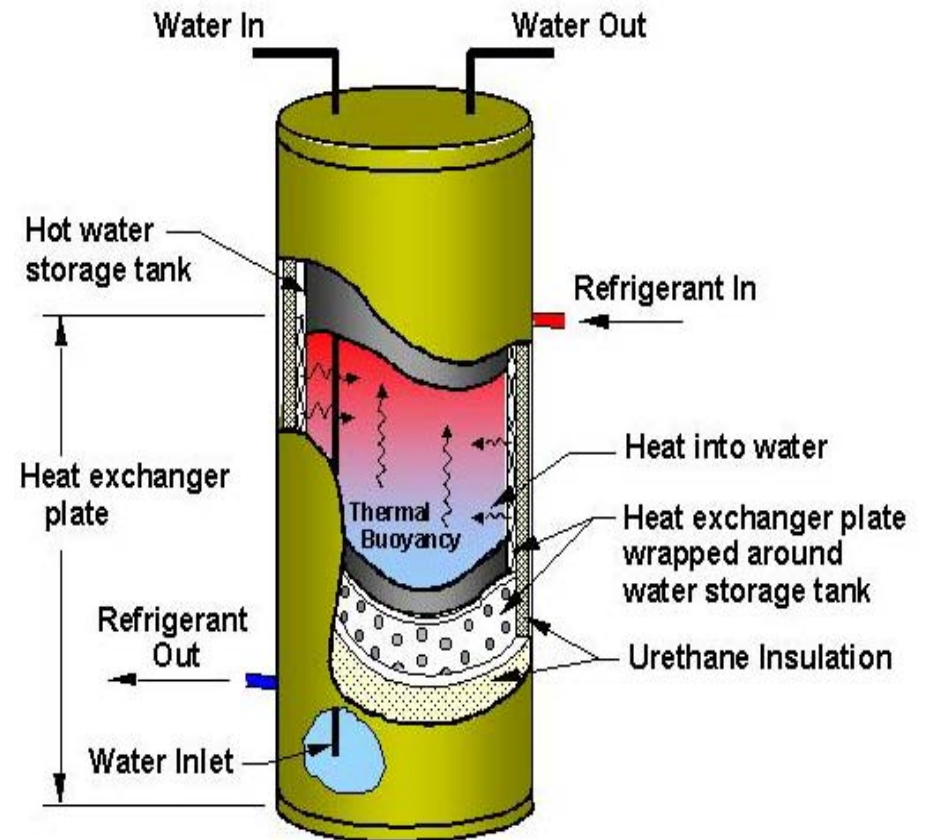
# **Dairy and Livestock Enterprise Energy Efficiency**

# Variable Speed Vacuum Pump Motor

- VSD typically **reduces pump electrical usage by 60%**.
  - Ranges from 30 to 80%.
- Oversized pumps reduce potential savings.
- Pays when milking
  - > 6-8 hours per day
  - 3 times per day milking



# Refrigeration Heat Recovery Unit



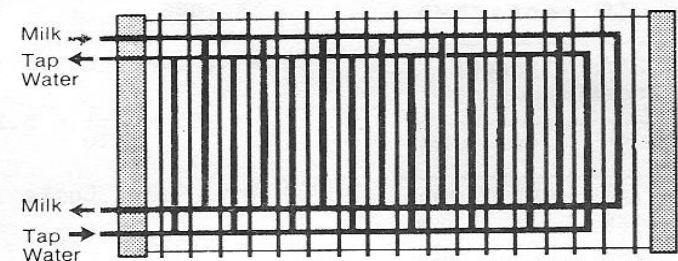
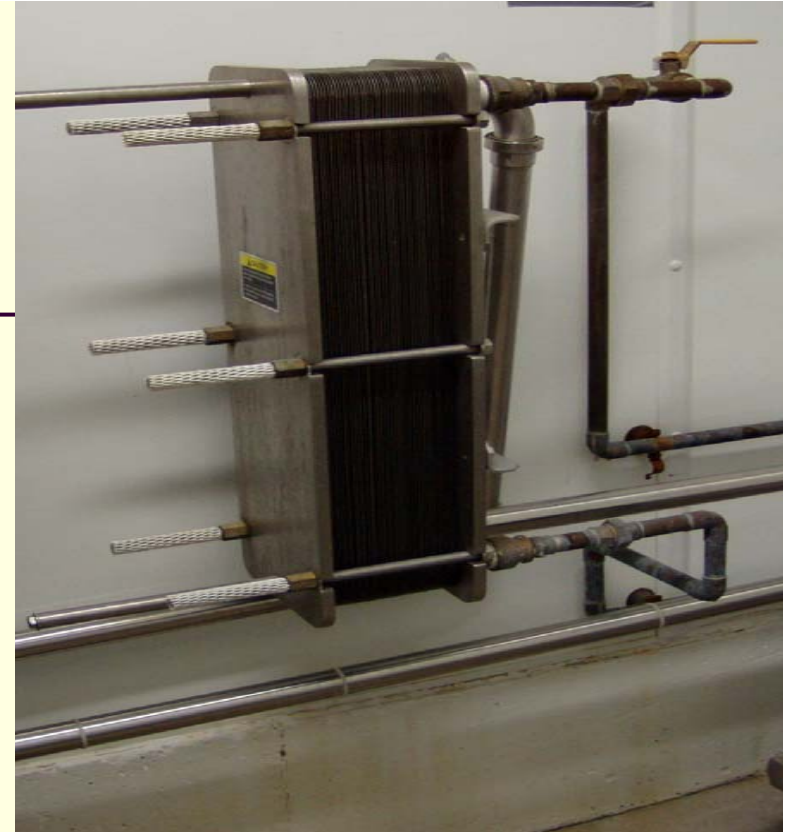
-Captures eject heat from refrigeration system

-Increases compressor efficiency

-Potential to reduce water heating costs <50%

# Well Water Precoolers

- Uses well water as coolant
  - Up to 40°F temperature reduction
  - Potential to **reduce cooling requirements by 60%**
  - Temperature of water supply critical for savings potential
  - Need 1" piping
    - 1:1 water : milk ratio, minimum
  - Herd size 100 >cows
- WORKS WELL IN COMBINATION WITH HEAT RECLAIMER, IT'S CHEAPER TO COOL MILK THAN IT IS TO HEAT WATER**





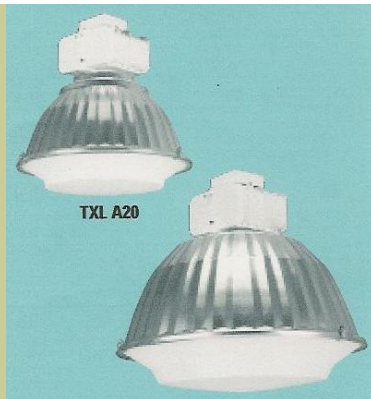
# Frost-Free Livestock Water Fountains

- **Save \$60 to \$200/yr**
- Poorly maintained heated waterer can use \$200+ in electricity/yr



- May not be suitable for low animal stocking rate
  - May require a low wattage heater
- Some require daily maintenance during sub-zero temperatures
  - Check that covers / balls are not frozen open or closed
  - Works well with water from pre-cooler discharge water





# Long Daylighting for Dairy Cows

- 16-18 hours of constant light
- 6-8 hours of continuous darkness
- Light levels required – 10 to 20 foot-candles
- **Increase milk production 5 to 16%** (4.5#/day typical), more milk per kWh
- Increased feed intake , 3 to 4%
- No negative reproductive effects
- Lamp types
  - T-8 fluorescent
  - High-pressure sodium
  - Pulse-start metal halide
- Economical – 6 month to 2 year payback





# Ventilation

- All fans are not created equal
  - 36" and larger box fans recommended
  - Air Flow Ratio – higher is better
    - Ability to perform against pressure
  - Maintenance is very important to efficiency
  - Larger fans more efficient, 24' = 6-12 36" box fans
  - HE fans ~ **20% higher energy efficiency**



## ■ Performance data

- BESS Lab (U of IL) -  
[www.bess.uiuc.edu/index2.htm](http://www.bess.uiuc.edu/index2.htm)
- Air Movement & Control Assoc  
[www.amca.org](http://www.amca.org)



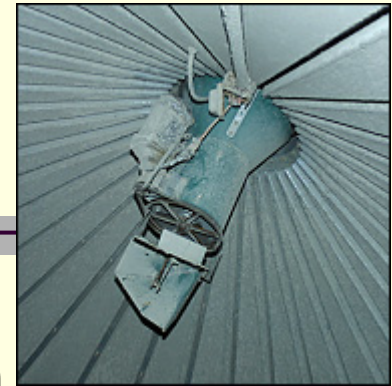


# **GRAIN DRYING**

# Clean Grain

- Screen before drying
- Screen before storage
  - **Less volume to dry**
  - **Increased air flow in dryer**
  - Fines plug screens and aeration floors
  - Insect / Mold growth in fines

- Distributor in Bin
  - Evenly distributes seed and fines



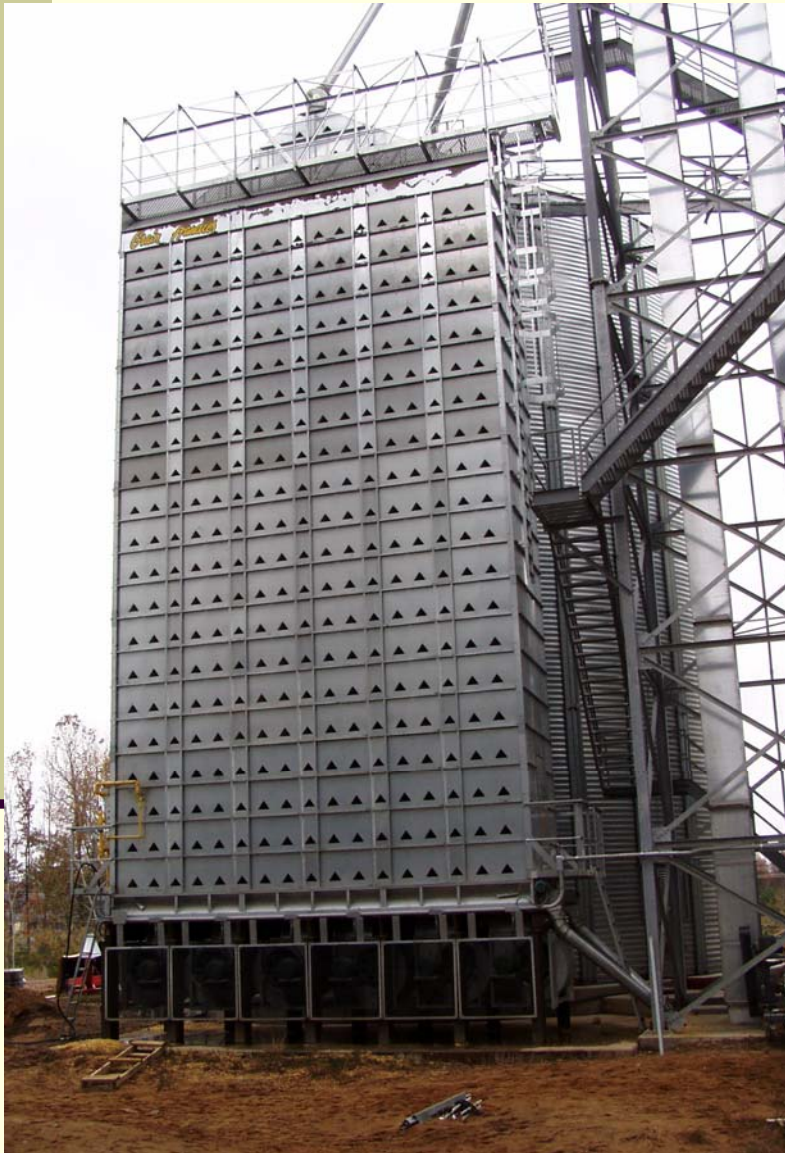
Perforated augers



Rotary Drum Screen



# Mixed-Flow Dryer



# Mixed-Flow Column Dryer

- High efficiency column dryer – 2050 Btu/# H<sub>2</sub>O
- No screens to plug
- Handles wide range of seed sizes
- Continuous flow process
- Multiple heating zones possible
- Longer retention times / Slow cooling
- Uniform drying of seeds – higher grain quality
- Can be used with in-bin cooling or dryeration
- High Capacities: 270 to > 4500 Bu/Hr
  
- Payback
  - **30% - 40% more efficient than typical cross-flow dryer**
  - **1 to 3 years**

# In-Bin Continuous Flow Dryer



# In-Bin Natural or Low Heat Drying

- Forces ambient or warmed air (10°F temperature rise) through grain bed
- Energy efficient if dry weather
  - Early maturing varieties advantageous
- High fan horsepower requirement over extended time
  - 30 to 45 days with good weather - 90+ days if wet
  - 1.25 cfm per bushel minimum
- Maximum grain moisture ~ 22% - 24%
- Only handle grain once
- **Stirring device – saves 20 – 25% in energy costs**
  - Reduces over-drying
  - Increases air-flow
  - Stirring 2 or 3 times maximum recommended





# IRRIGATION

# Low Pressure Center Pivot



# Effects of Lower Pressure

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- **Use lower h.p. motor as much, as 50% reduction**
- Lower pressure reduces throw distance of water
- Smaller wetted diameter
- Nozzle spacing closer together
- Higher instantaneous application rate

## Disadvantage

- Higher risk of runoff and erosion
  - Higher risk at outer edge of center pivot

# Energy Management

## Off- Peak Electrical Use - Why?

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- Alliant Energy - Rates 2006
  - General service
  - June 1 to Sept 30 - \$0.09916 /Kwh
  - Oct 1 to May 31 - \$0.08950 /Kwh
  
- Time of Day Rates (Cg-2 TOD)
  - On-Peak \$0.1717 /Kwh (June 1 to Sept 30)
  - Off-Peak \$0.0414 /Kwh, 108 hours Off-Peak per week
  
- Summer On-Peak Hours
  - 8:00 AM to 8:00 PM - Monday through Friday



# **RENEWABLE ENERGY- BIOGAS**



# Anaerobic Digesters

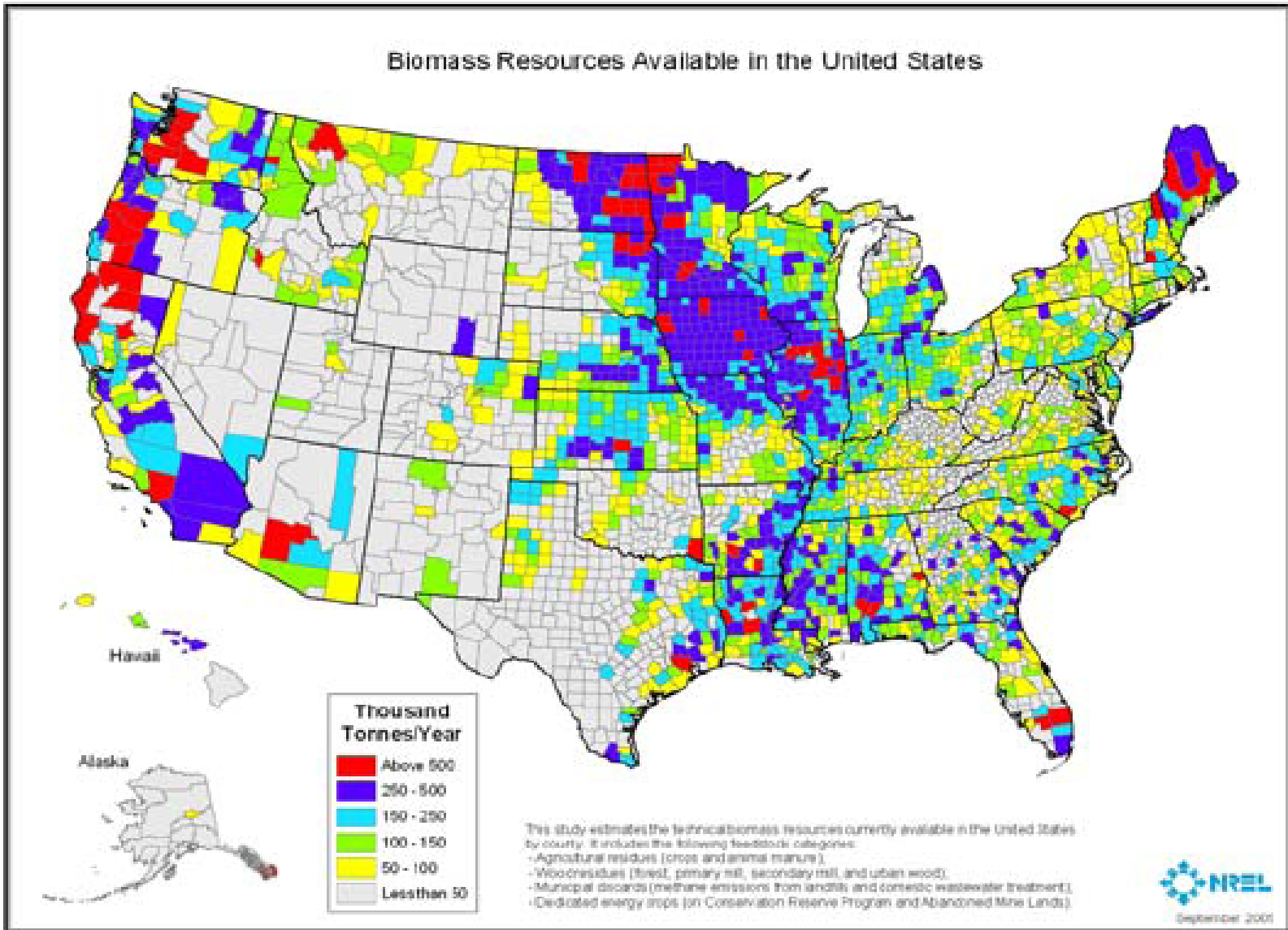




# BIOMASS



# Alliant Energy Is In The Biomass Belt



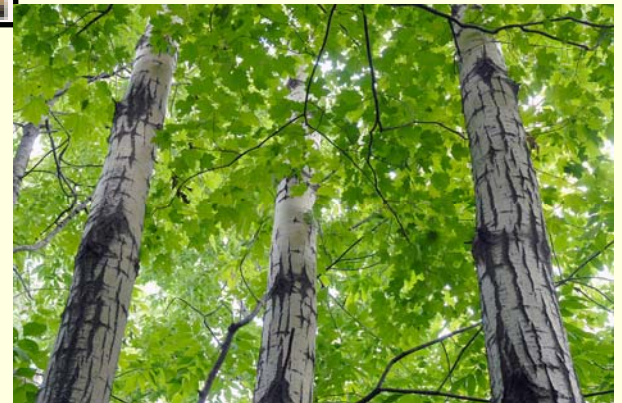
# Biomass - Renewable Resources

- **Native Grasses**



- **Forest Products**

- **Wood forest residues**
- **Dedicated forest fuel crops (Poplar, Willow, ...)**



- **Corn Stover**



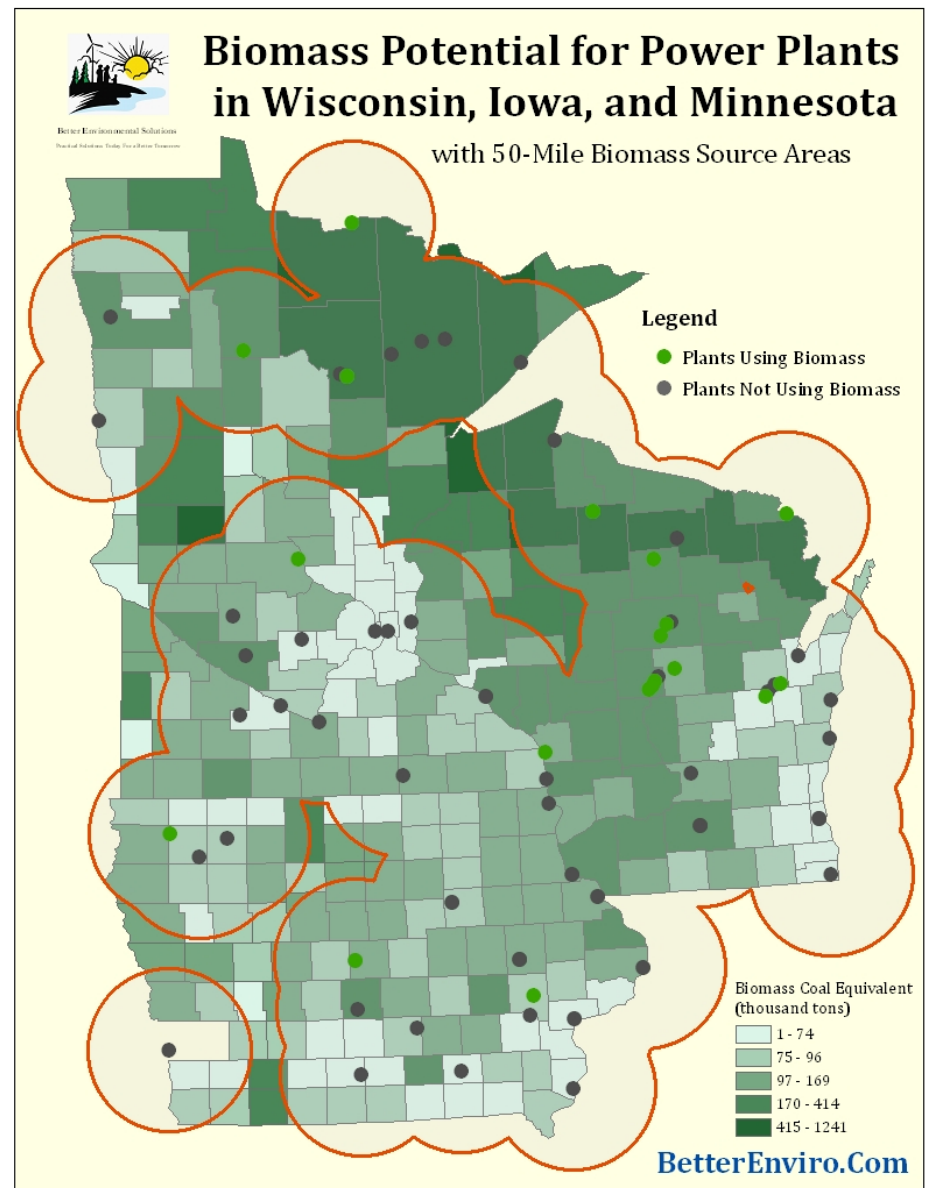
# Potential Biomass Demand from Coal Fired Power Plants in the Upper Midwest

■ Map shows coal fired power plants in three state region

■ The 50 mile circles around each represent the likely hauling radius that biomass is can be collected from.

■ 1735 power plants, 42,487 MW

■ 188 coal plants, at 77 locations, 19,313 MW





# Sustainable BMP's Must Be Defined



# Contact

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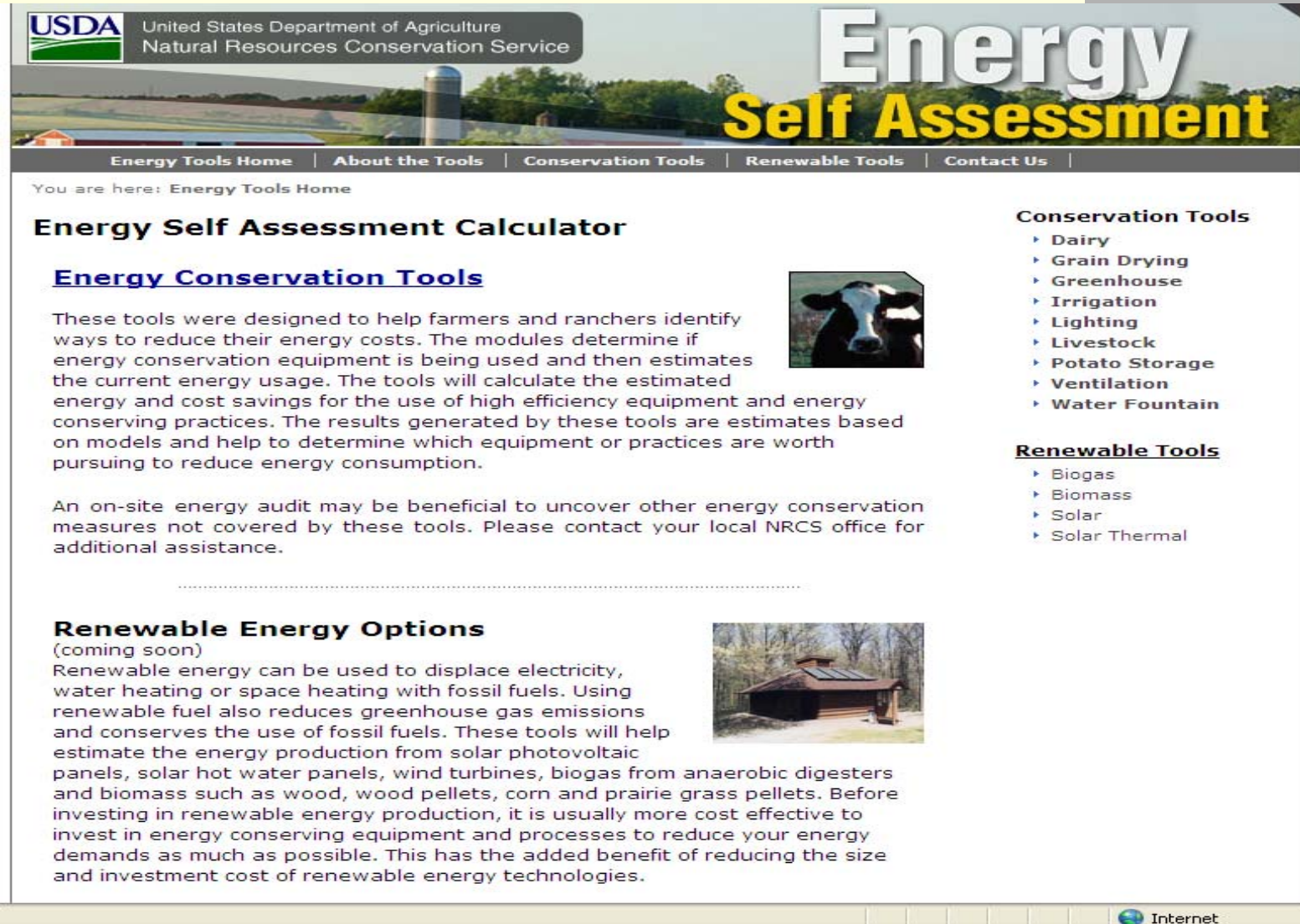
**Bill Johnson  
Alliant Energy  
Portage, WI**

**billjohnson@alliantenergy.com  
(608) 742-0450**



# On-Line Tools

## [www.uwex.edu/energy/esa](http://www.uwex.edu/energy/esa)



The screenshot shows the website for the Energy Self Assessment tool. At the top left is the USDA logo and the text "United States Department of Agriculture Natural Resources Conservation Service". The main title "Energy Self Assessment" is prominently displayed in the center. Below the title is a navigation menu with links for "Energy Tools Home", "About the Tools", "Conservation Tools", "Renewable Tools", and "Contact Us". The page content is divided into two main sections: "Energy Conservation Tools" and "Renewable Energy Options".

**USDA** United States Department of Agriculture  
Natural Resources Conservation Service

# Energy Self Assessment


Energy Tools Home | About the Tools | Conservation Tools | Renewable Tools | Contact Us

You are here: Energy Tools Home

## Energy Self Assessment Calculator

### Energy Conservation Tools

These tools were designed to help farmers and ranchers identify ways to reduce their energy costs. The modules determine if energy conservation equipment is being used and then estimates the current energy usage. The tools will calculate the estimated energy and cost savings for the use of high efficiency equipment and energy conserving practices. The results generated by these tools are estimates based on models and help to determine which equipment or practices are worth pursuing to reduce energy consumption.



An on-site energy audit may be beneficial to uncover other energy conservation measures not covered by these tools. Please contact your local NRCS office for additional assistance.

### Conservation Tools


- ▶ Dairy
- ▶ Grain Drying
- ▶ Greenhouse
- ▶ Irrigation
- ▶ Lighting
- ▶ Livestock
- ▶ Potato Storage
- ▶ Ventilation
- ▶ Water Fountain

### Renewable Tools

- ▶ Biogas
- ▶ Biomass
- ▶ Solar
- ▶ Solar Thermal

### Renewable Energy Options (coming soon)

Renewable energy can be used to displace electricity, water heating or space heating with fossil fuels. Using renewable fuel also reduces greenhouse gas emissions and conserves the use of fossil fuels. These tools will help estimate the energy production from solar photovoltaic panels, solar hot water panels, wind turbines, biogas from anaerobic digesters and biomass such as wood, wood pellets, corn and prairie grass pellets. Before investing in renewable energy production, it is usually more cost effective to invest in energy conserving equipment and processes to reduce your energy demands as much as possible. This has the added benefit of reducing the size and investment cost of renewable energy technologies.



Internet

# Farm Biogas Economics

- 1000 head dairy
- Installed cost ~\$1,250 per head: \$1.25 million
  - USDA incentive: \$250,000
  - 30 % Federal Tax Credit/Grant: \$375,000
  - Cost to Customer: \$625,000
- Supports 200 kW engine, delivers 1.25 million kWh; @6 cents/kWh:~\$75,000
- Payback: ~7-8 years
- Other income streams: bedding, waste heat, depreciation

