

Lessons Learned From Institutional Wood Energy System Projects

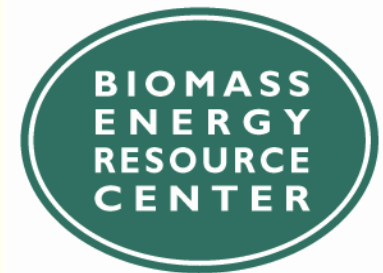


Jeff Forward, Program Manager

**2004 Smallwood Conference
May 18 - 21, 2004
Sacramento, CA**

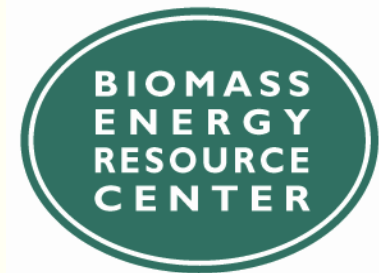
BERC Goal

To promote and facilitate the use of biomass energy technologies in a variety of applications



Benefits of Using Forest Biomass

- **Sustainable renewable fuel source**
- **Hazardous fuels reduction**
- **Local economic development**
- **Greenhouse gas benefits**
- **Low cost fuel**



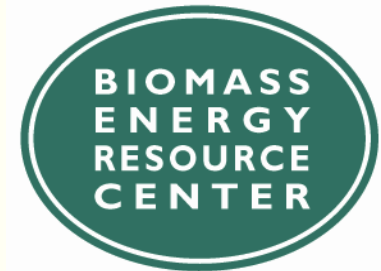
What are “Modern” Wood Biomass Energy Systems?

- **Lower emissions**
- **Increased efficiency**
- **Low staffing requirements**
- **Reliable operation**



Biomass Applications

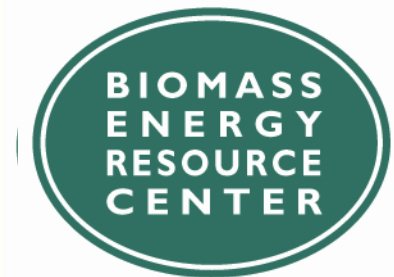
- **Public buildings**
- **Public and private schools**
- **Community district energy projects**
 - Small communities
 - Campuses
 - Hospitals
 - Small cities



Public Buildings



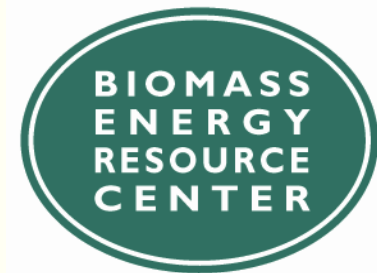
**Emery Hebard State Office Building
Newport, Vermont**



Public Schools

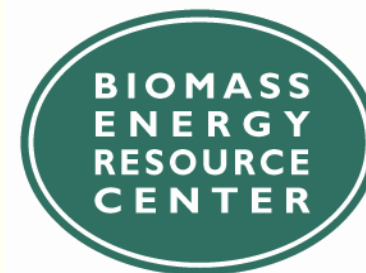


Barre Town Elementary School
Barre, VT



Vermont's School Experience

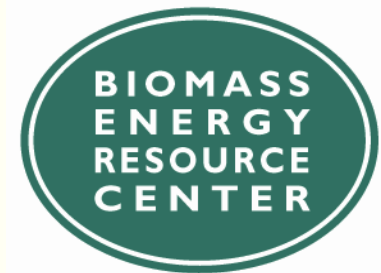
- **25 Schools over 15 years**
- **10% of student population**
- **Schools range in size between 23,000 ft² and 270,000 ft², but average is 110,000 ft²**
- **12,000 tons of wood chips per year**
- **Average annual fuel cost is . 24/ ft²**
- **Woodchip fuel costs:**
 - 50% compared to oil
 - 10% compared to electricity



Lyndon Town Elementary, VT



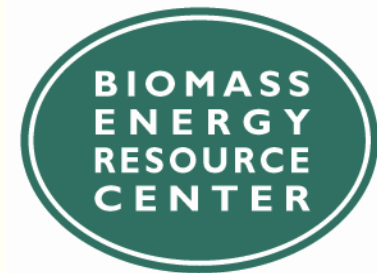
105,000 SF



Calais Elementary School, Vermont



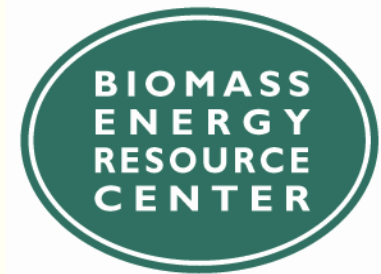
26,600 SF



U-32 High School, Montpelier, VT



200,600 SF



Johnson Elementary School, VT



50,000 SF



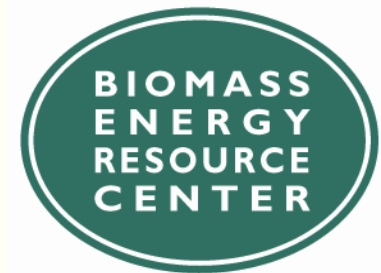
Lessons Learned

- **Biomass fuels**
- **Chip storage**
- **Boiler sizing**
- **Combined heat and power**
- **Community district energy projects**



Biomass Fuels

- **Green woodchips best**
- **Concerns with dry chips**
 - Dusty
 - Easily ignited
- **Avoid bark because of maintenance issues**
- **Do not use dry sawdust or shavings for institutional applications**



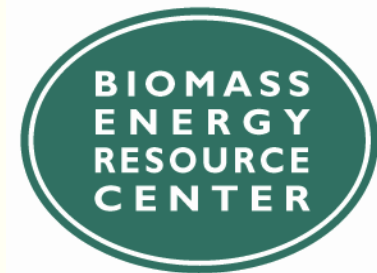
Problem Chips



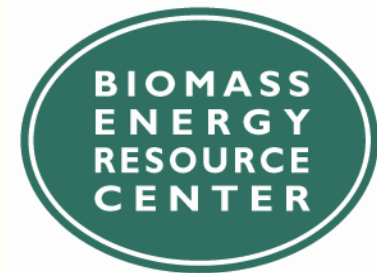
Good Chips



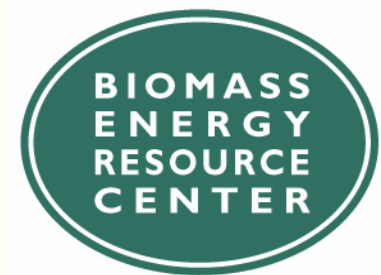
**Consistent size, shape
and moisture content**



Delivery Vehicles



Fuel Delivery and Storage



Chip Storage Lessons

- **Underground storage best**
 - Less prone to freezing
 - Permits faster unloading
- **Bin should be sized to the delivery vehicle not to fuel consumption**
- **Low cost semi-automated alternative**



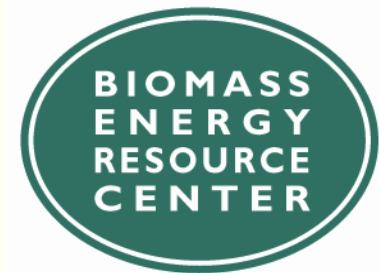
Semi-automated systems

- **Chips stored on slab in simple garage type building**
- **Can cut capital costs by one-third to one-half**
- **Eliminates costly engineered chip storage bin**
- **For smaller applications with staff willing to load a day-in with a small bucket loader**
- **BERC is working with vendors to refine their equipment to meet this market**



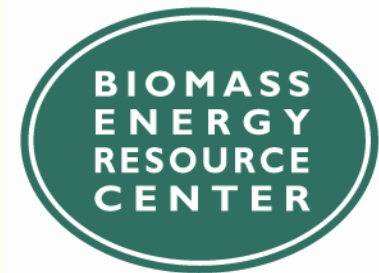
Boiler Sizing Advice

- **Provide full fossil fuel back-up**
- **Project mechanical engineer sizes fossil fuel system using normal methodology**
- **User should make final decision on sizing biomass boiler, at or below peak load**
- **Back-up fossil fuel boilers provide supplemental and swing season heat**



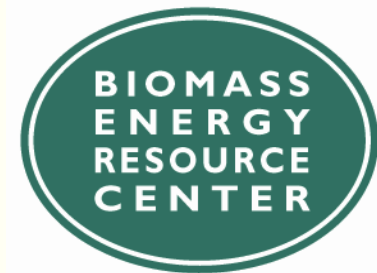
Combined Heat and Power

- **Gasification CHP promising but not yet fully commercialized**
 - Only for R&D and demonstration now
- **Steam CHP is proven but impractical for schools**
 - Maintenance issues
 - Safety issues
- **Public schools not good place to take risks**



Community District Energy Systems

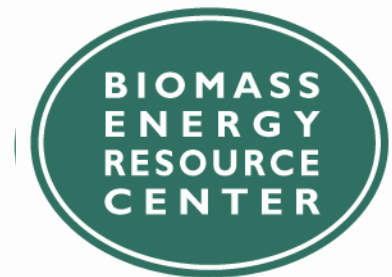
- **Small communities**
- **Campuses**
- **Hospitals**
- **Small cities**



Community District Energy



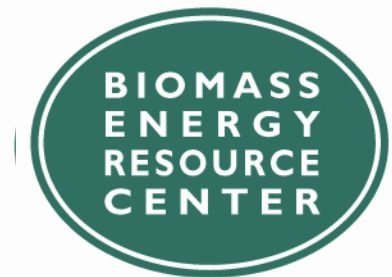
Green Acres Family Housing



Community Energy



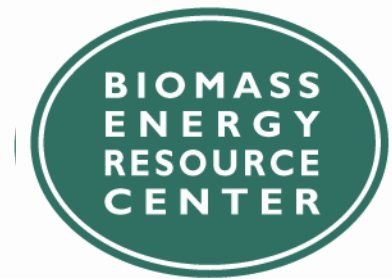
Ouje-Bougoumou
Quebec



Community District Energy



**Charlottetown
Prince Edward Island**



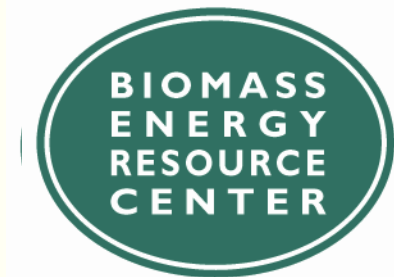
Community District Energy - Campuses



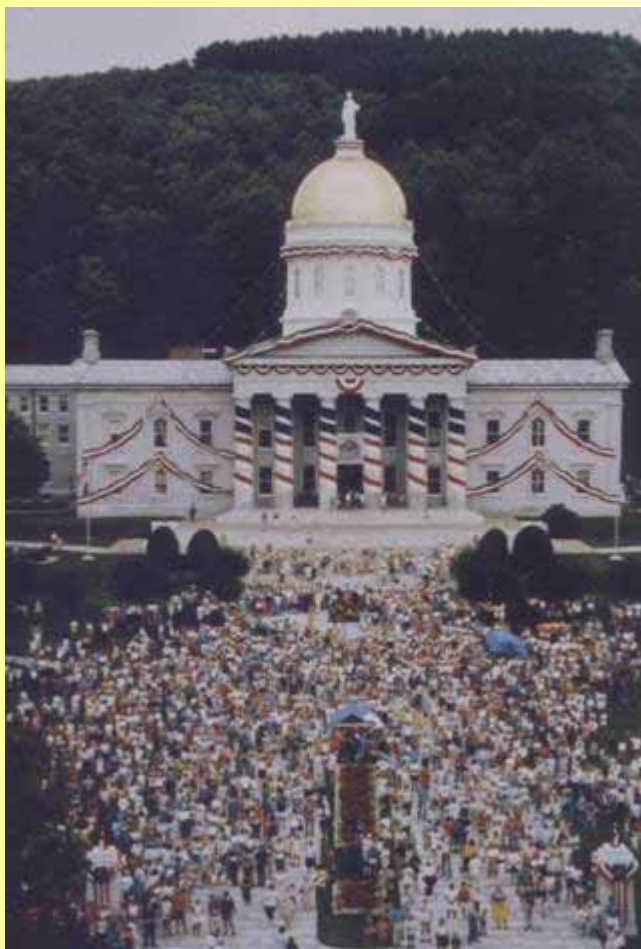
Maryville College
Maryville, Tennessee



Northwest Missouri State
Maryville, Missouri



Community District Energy Under Development



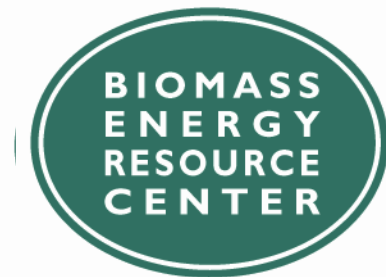
**Montpelier Community Energy System
Montpelier, Vermont**



Community Energy

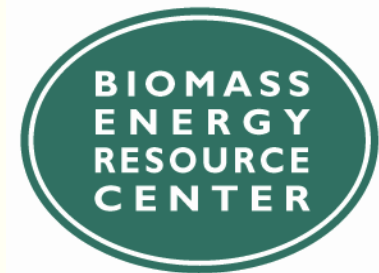


District Energy St. Paul
St. Paul, Minnesota



Lessons from District Energy Projects

- **Terrific benefits, but complex projects**
 - Large upfront capital investment
 - Revenue stream takes time to establish
- **Schools make great anchors, but...**
 - Schools not good candidates for lead
 - Schools not typically entrepreneurial
 - Energy billing is outside schools interest and experience



Conclusion

- **Biomass energy is excellent public policy**
- **Critical that initial projects are successful**
- **Atypical construction process**
 - Don't rely on traditional design team or vendors
 - Detailed performance specifications clarify and allow for maximum competition
- **Have biomass experience on design team**





Wood-Chip Heating Systems

A Guide For Institutional and Commercial Biomass Installations

By Timothy M. Malar



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