Heating Technologies

- **Biomass**
  - Primary fuels are cordwood, wood chips, wood pellets
  - **Pros**
    - Local fuel source means more money stays local
    - Generally require more local labor, which means local jobs
  - **Cons**
    - Can be very labor intensive
    - Typically for lower heating requirements

- **Heat Pumps**
  - Work on refrigeration principals
  - Draws heat from ground, air, water and redirects it inside
  - **Pros**
    - Very low maintenance
    - Can be reversed to provide cooling on hot summer days
  - **Cons**
    - Require lots of electricity
    - Will not work below certain outside air temperatures
    - Still undergoing arctic testing
The 1st Step - Energy Efficiency

• Make our homes, workplaces and communities energy efficient
  – Energy Efficiency appliances
  – Upgraded lighting
  – Tighten the shell (windows, insulation, etc.)
• Energy Efficiency is far cheaper than renewable energy
• Once efficient, pursue renewable energy
Why Biomass?

- Lowers energy costs with a local fuel
- Maintains cash flow within a community
- Creates local jobs and businesses
  - Construction
  - Operation/Maintenance
  - Harvest/Thinning/Resource Management
  - Heat Utilities
- Supports the Forest Products Industry
  - Use for sawmill waste
  - Use for forest health/thinning residue
Alaska – Where Woody Biomass Can Work!
Cordwood Boilers

- Lots of Job Creation
  - Harvesting
  - Splitting/stacking/storing
  - Regular Stoking
- Easy maintenance
- More difficult to integrate into existing heating system
Wood Chip Boilers

- Easy to operate
  - Mostly automated
  - Minimal maintenance

- More complex maintenance

- Relatively easy to produce fuel
  - Fuel Handling requires a lot of planning
  - High quality fuel is difficult to keep consistent
Pellet Boilers

- Easy to operate
  - Mostly automated
  - Slightly more maintenance than oil boilers

- Specialized Fuel
  - Will depend on local suppliers
  - Easy to handle
Heat Pumps

- Based on refrigeration cycle
- Still under research in Arctic environment
- Low Maintenance
  - Runs like a refrigerator, slow and steady
  - Very efficient
- Somewhat complex system
  - May require specially trained service technician
- Can potentially consume a lot of electricity
  - Will displace other heating fuels
Ground Source Heat Pump

- Draws heat from the ground
- Same principle as permafrost foundation stabilization
- Operate with minimal maintenance
- Can create permafrost
  - Being studied by CCHRC

Photos from Molly Rettig, CCHRC
**Air Source Heat Pump**

- Draws heat from the air
  - Condenses fluids to boost thermal energy
- Can operate as both heating and cooling appliance
- Several types
  - Ductless mini-splits
  - Conventional
  - Air-to-water
- Currently being tested and researched throughout the state
  - Performing *very* well in SE Alaska
  - Preliminary results promising in NW region
- Requires cheap electricity to make economic sense
Combining Heat & Power (CHP)

- Generate heat and electricity at the same time
  - Similar to heat recovery on some generation systems
- Efficient use of generation fuel

### Typical Diesel Generation

- **Usable Electrical Output**: 39,000, 30%
- **Recovered Exhaust Heat**: 23,400, 18%
- **Recovered Jacket Heat**: 19,500, 15%
- **Wasted Exhaust Heat**: 19,500, 15%
- **Wasted Jacket Heat Loss**: 5,200, 4%
- **Wasted Mechanical Loss**: 5,200, 4%
Modular CHP Systems

- Various systems on the market
- Volter Oy being tested in Fairbanks