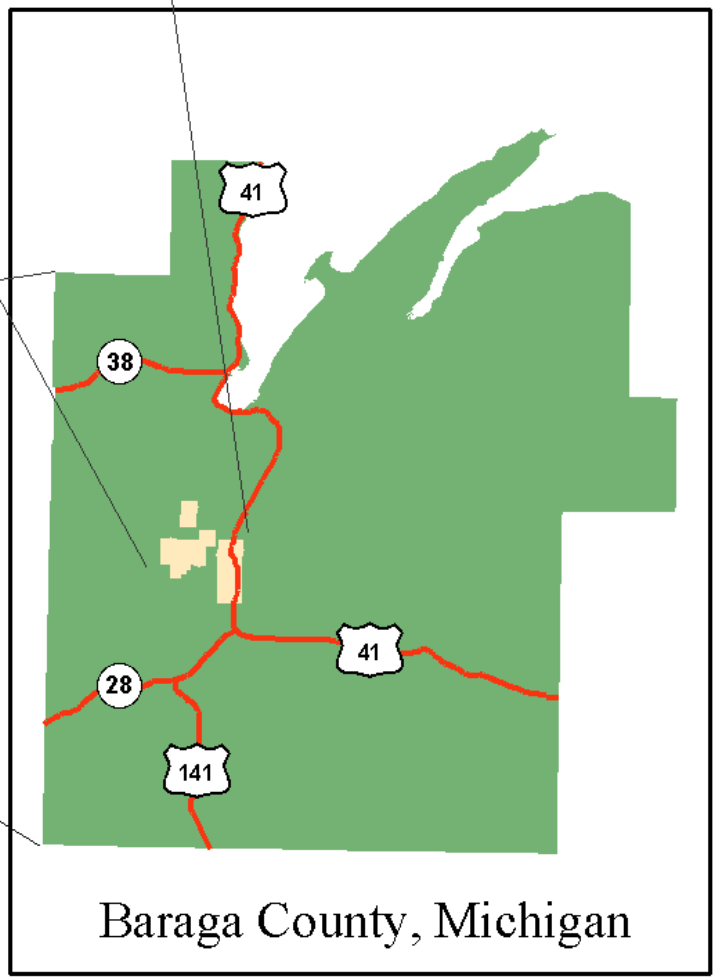
Wood Energy for Michigan Tech's Ford Center

Dr. Andrew Burton (ajburton@mtu.edu)
Professor of Forest Ecology; Former Director of Ford Center
Michigan Tech, School of Forest Resources & Environmental Science
October 12, 2016

Michigan Technological University

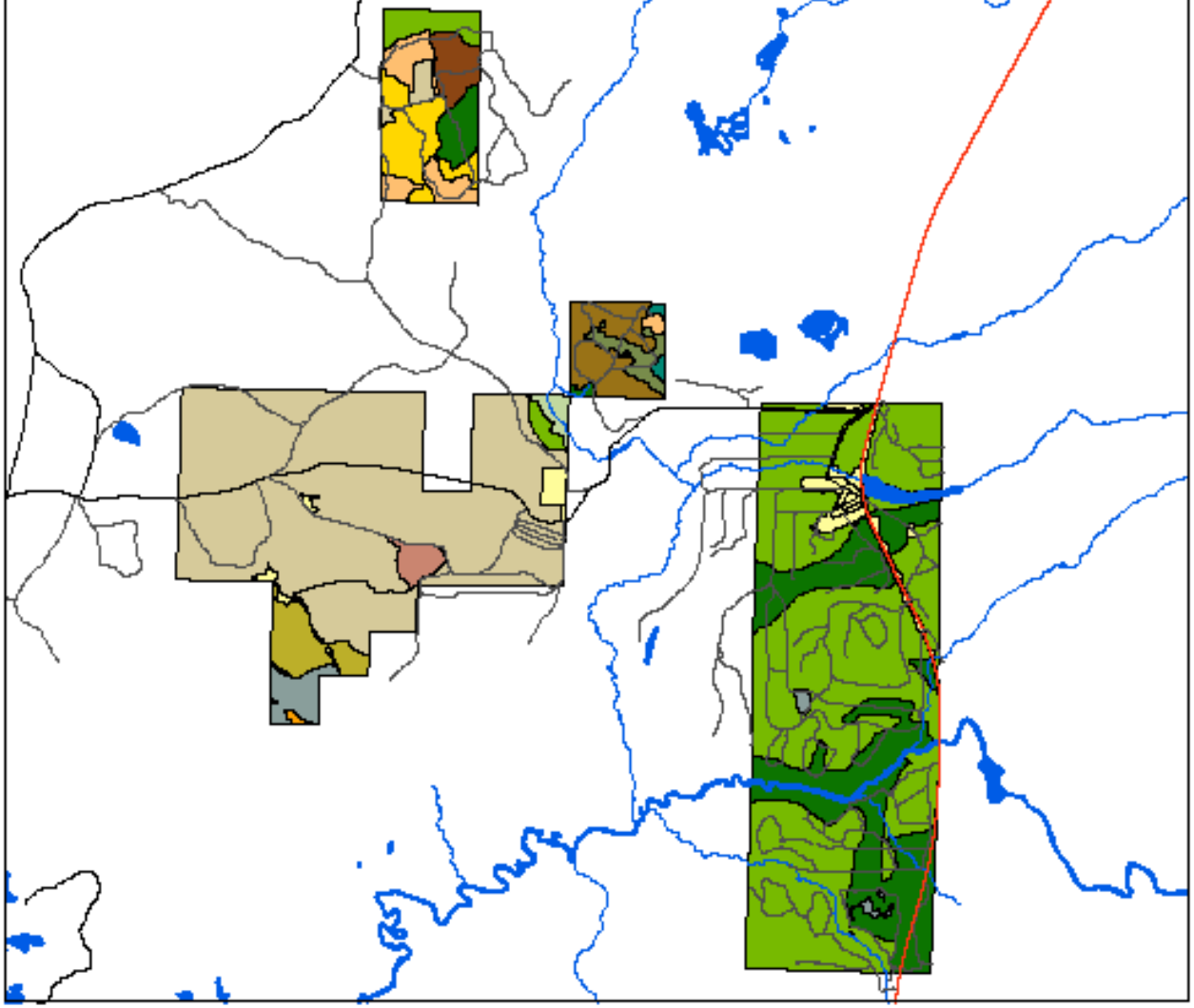
Region

Map date: March 2004
M. D. Hyslop



Baraga County, Michigan

Michigan Technological University
1885



Legend

- Highway
- County Road
- Two Track
- River
- Lake

Stand Cover

- White Pine
- Aspen/Jack Pine
- Black Spruce
- Hemlock
- Jack Pine
- Mixed Conifer
- Mixed
- Aspen
- Northern Hardwoods
- Oak/Birch/Maple
- Open/Grass
- Open/Tag Alder
- Red Pine
- Pine/Oak
- Lowland Conifer

Data source:
Hydrology data from the Michigan CGI,
http://www.michigan.gov/cgi/
Stand cover and road data from the Ford Center GIS,
http://forest.mtu.edu/

0 0.5 1 2 Miles

0 0.5 1 2 3 Kilometers

Michigan Technological University
1885

Historic town site of Alberta was constructed by Henry Ford, beginning in 1935. Its sawmill helped provide lumber for automotive components and while maintaining positive public relation. The town was designed to serve as a model sawmill community.

Village and 1790 acres were donated to Michigan Tech in 1954, and soon after the University began using the site as a training facility for forest industry students.

Additional buildings were constructed from 1956 through 1980, around the perimeter of the original village

Michigan Technological University

Our vision for the Ford Center and Research Forest is to be a recognized home of world-class forestry and environmental field education and research

As developed by Research Forest and Ford Center Management Committee on June 8, 2012

Mission: To provide field-based education, research and demonstration in sustainable use of forest-based natural resources

Michigan Technological University

Cordwood boilers

Maintenance building

Wood shop, machine shop, heavy equipment bay (8,700 sf)

used 20 cords of wood in a wood stove and 2,600 gallons of fuel oil

Econoburn EBW-150-H rated at 150,000 Btu/hr with 600 gallons of thermal storage

Michigan Technological University

Dorm/Dining Hall

32 bedrooms, a dining hall, a kitchen, several conference/class rooms and a laundry facility (9,300 sf)

used up to 10,000 gallons of propane (equivalent) for space heating and domestic hot water

Econoburn EBW-200-H rated at 200,000 Btu/hr with 1,000 gallons of thermal storage

Michigan Technological University

Why Wood?

Ford Center Heating Costs

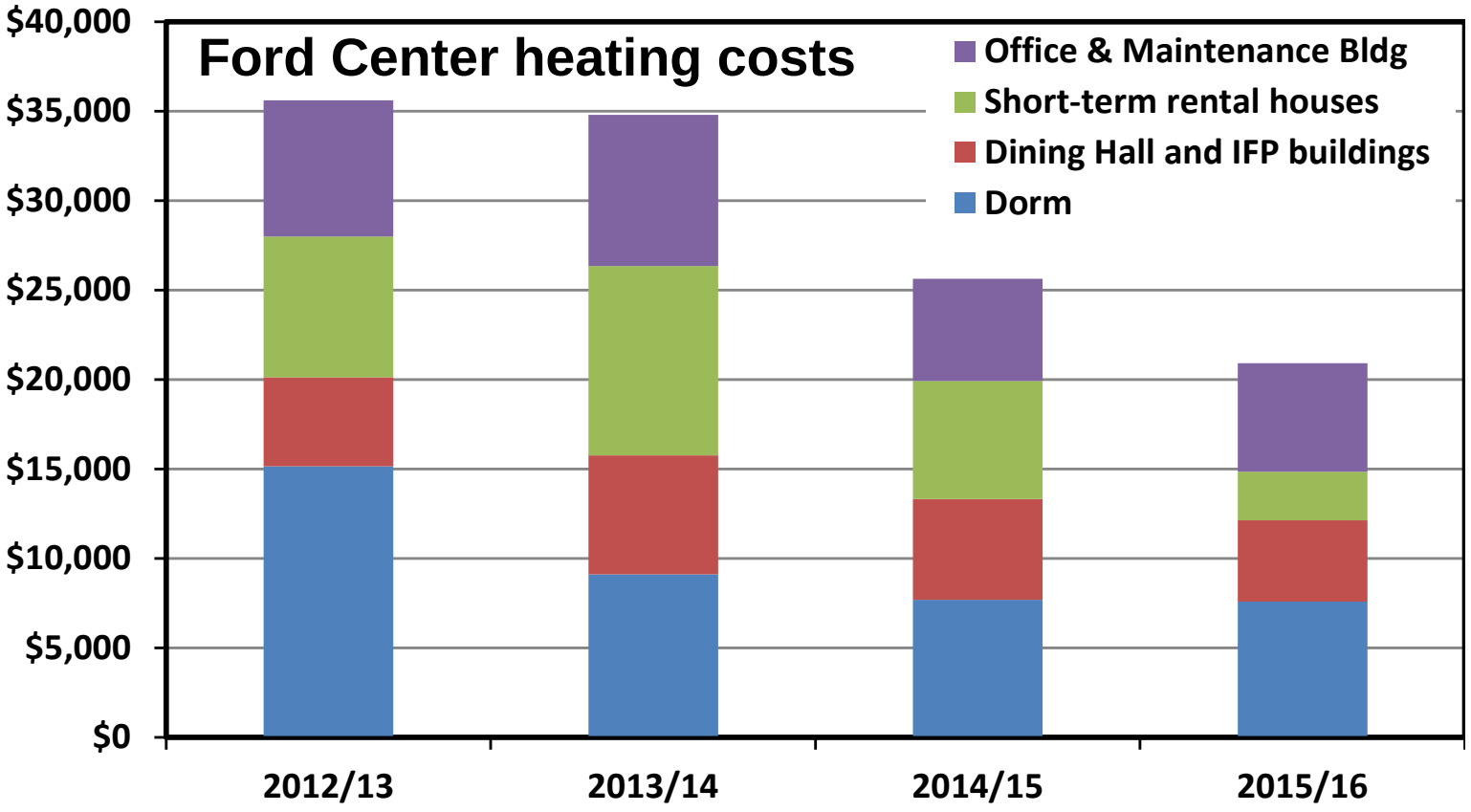
$53,000 in FY09
- had to close dorm from February through April, could no longer offer winter programming

Still $39,000 in FY11

Investigated possibility of wood for entire Center
- cost prohibitive ($1.15 million for district heating)

Michigan Technological University

Reduced energy costs in a variety of ways



- New thermostats (2012) and insulation (2014) in dorm
- New propane boilers in dorm (2013)
- New propane furnaces in eight houses (2014)
- Cordwood boilers in dorm and maintenance building (2016)

Advantages of Wood

Cost savings

- Log-length cordwood from our own sawtimber harvests has an opportunity cost of $23 per full cord
- With cost for cutting and splitting cost approaches $85 per cord
- We generate up to 100 cords of wood per year during sawtimber harvests (we need about 60)

Michigan Technological University


FOREST MANAGEMENT STUDY-5
70 SQ FT BASAL AREA.

Advantages of Wood

Greenhouse gas reductions

- The sawtimber harvests will occur, and they create cordwood from smaller diameter upper stem portions.
- The cordwood from tops can be sent to a pulp mill (100 mile transit, truck comes back empty) or kept on site for energy use.
- Large fossil fuel offset by reducing propane and fuel oil use plus elimination of fossil fuel used in transport of cordwood to pulp mill

How did wood happen?

- Discussed energy improvements with SFRES Advisory Board in March 2013
- Advisory Board member Brenda Owen, Michigan Association of Timbermen, informed us of the MITREE wood energy program with WERC (USFS)
- Applied for grant in December, 2013

Michigan Institute for Timber Resource and Educational Excellence, Inc. (MITREE) and the US Forest Service Wood Education Resource Center (WERC)

How did wood happen?

- Site visit by WERC and Wilson Engineering Services, PC (August 2013)
- $146,000 Grant awarded December 2014 ($73 K from WERC, $73 K cost share from Michigan Tech SFRES)
- Michigan Tech Facilities Engineers prepared design and bid documents, which were reviewed by Wilson Engineering and WERC
- Bids solicited early June 2015
- Contract awarded June 23, 2015

How did wood happen?

- Ordering and construction began July 2015
- Completed late August 2015
- Inspected by Michigan Tech Facilities engineers in September 2015
- Initial testing in October 2015 indicated issues (lots of creosote and condensation)
- Troubleshooting and fixes completed by late April, 2016.
- Operational, but heating season had ended. Currently gathering efficiency data (fall 2016).


WARNING
Econoburn
GASIFICATION BOILERS
prestige
BYRON
WARNING


Econoburn

Issues and Lessons Learned

- mixing valve was installed according to specification and design but did not provide adequate low water temperature protection for the boiler (return water was too cool)
- make up/combustion air opening needed in the maintenance building
- low water cut off safety needed
- inadequate over-temperature protection
- expansion tanks too small

Issues and Lessons Learned

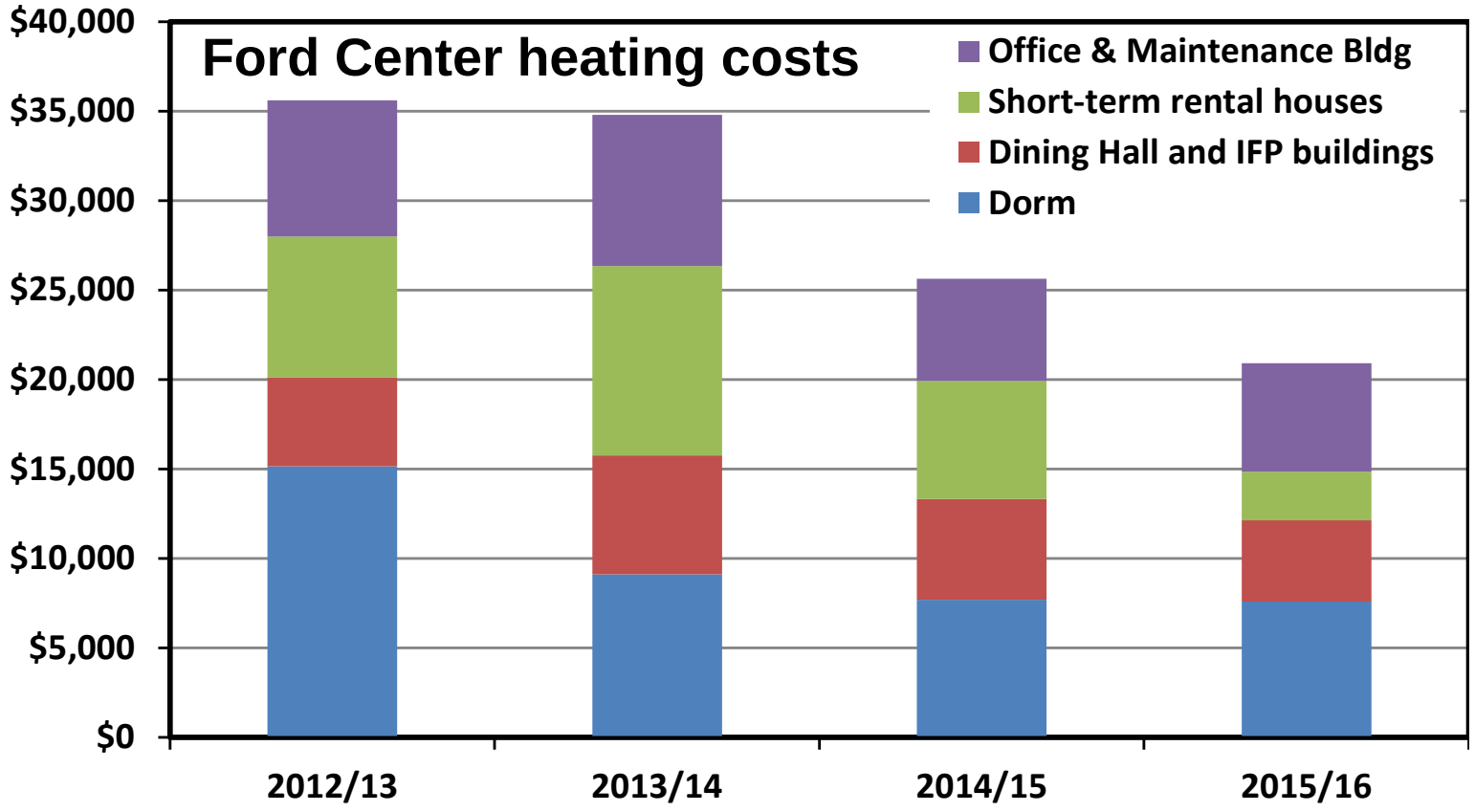
- Majority of issues could have been avoided
- Critical to have engineering design team and installation contractor who are familiar with these types of systems in general and with the specific manufacturer selected
- Take the time to find a qualified contractor, certified by the manufacturer
- A couple of months up front to do so can save you a year or more later in getting efficient operation going

Looking forward

- Wood storage structure needed near dorm.
- Operational efficiency monitoring this winter will be made available on-line.
- Cost savings

  About $5,000 for 60 cords of cut, split wood (mostly sugar maple) will replace about $10,000 in propane and fuel oil and $1,500 in wood. Net savings will increase as fossil fuel costs rebound.

Dormitory kept open for winter of 2015/2016



- Winter education, outreach and research are again possible
- Full wood use in 2016/2017 could reduce annual Ford Center heating costs to less than $14,000

FOREST MANAGEMENT STUDY-5
70 SQ FT BASAL AREA

Michigan Technological University
1885