MEETING NOTICE

A STUDY SESSION

Of The

TRAVERSE CITY LIGHT AND POWER BOARD

Will Be Held On

TUESDAY, April 6, 2010

At

5:30 p.m.

In The

COMMISSION CHAMBERS
(2nd floor, Governmental Center)
400 Boardman Avenue

Traverse City Light and Power will provide necessary reasonable auxiliary aids and services, such as signers for the hearing impaired and audio tapes of printed materials being considered at the meeting, to individuals with disabilities at the meeting/hearing upon notice to Traverse City Light and Power. Individuals with disabilities requiring auxiliary aids or services should contact the Light and Power Department by writing or calling the following.

AGENDA

Roll Call

1. Presentation of Biomass Energy Resource Center's Fuel Study Assessment Results.
2. Public Comment

Traverse City Light and Power
1131 Hastings Street
Traverse City, MI 49686
(231) 922-4942

Posting Date: 04-05-10
9:00 a.m.

EXECUTIVE SUMMARY

The Biomass Energy Resource Center (BERC) was hired by Traverse City Light and Power (TCL&P) to assess the availability and pricing of biomass fuel resources in the northwestern part of the Lower Peninsula of Michigan. TCL&P plans to install several biomass-fired combined heat and power (CHP) systems at multiple possible locations in the greater Traverse City area. The objective of this study is to identify, qualify, and quantify any potential biomass fuel sources including wood fuel, agricultural residues, and dedicated energy crops as potential fuel sources for these facilities. While the exact amount of biomass needed to fuel these projects was unknown at the outset of this study, we assumed these combined facilities would consume less than 300,000 green tons of wood annually for the purpose of comparison.

Supply Area

The scope of this study includes establishing a procurement area from which these biomass fuels can be sourced cost-effectively. Fifty- and 75-mile radius circles and 60- and 90-minute drive time zones around Traverse City, Michigan were examined to identify specific counties within the target wood fuel supply basket. The primary supply region was broken into two categories: Zone 1 (comprised of those counties falling roughly within the 50-mile and 60-minute drive time radii) and Zone 2 (those counties falling roughly within the 75-mile or 90-minute drive time area). This procurement area becomes the *study area* for this assessment.

Zone 1 includes the following counties: Grand Traverse, Leelanau, Benzie, Manistee, Wexford, Missaukee, Kalkaska, Antrim, and Charlevoix.

Zone 2 includes the following counties: Mason, Lake, Osceola, Clare, Roscommon, Crawford, Otsego, Cheboygan, and Emmet.

Biomass Fuels Assessed

This resource assessment included consideration of woody residues from primary mills, urban wood waste, low-grade wood harvested from surrounding forests, agricultural residues such as cherry pits and corn stover, and the potential for using dedicated energy crops such as grasses. Whole-tree woodchips from forest management harvesting were identified as the primary fuel source for the Traverse City CHP plants, but the other potential sources are discussed as well. Although outside of the procurement area described above, this assessment also included the potential for woody biomass fuel to be imported from the Upper Peninsula by truck or barge as an alternate option to sourcing wood fuel from within the procurement region studied here.

Fuel Availability and Pricing

By-product sources of wood fuels within the study area are limited (sawmills and urban wood recycling yards) and are inelastic in their supply, meaning supply will not increase in response to higher prices paid. Modest amounts of harvesting and sawmill residues are available due to a decline in the forest products industry and low demand for wood. Pulpwood and particle board markets have softened and are consuming less wood today than a few years ago, freeing up more low-grade wood for the energy markets - as long as the logging infrastructure and workforce are in place to deliver. All of these residue

wood fuels will be more economical fuel options and so they should be sourced when they are available. TCL&P should begin talking with potential suppliers of these materials. But TCL&P will have to supplement these with other fuel sources.

It is likely that the primary wood fuel for the proposed CHP facilities will be low-grade wood harvested from the forests within the procurement area. BERC calculates that on the forestland that is accessible and actively managed for periodic harvesting, the standing inventory of low-grade (non-sawtimber) wood grows slightly over twice as much new wood annually as is currently harvested. When the firewood, pulp, and other market demands are added up and compared to the estimated annual growth of low-grade wood on available timberland, there is an estimated annual surplus capacity of 1,571,609 green tons of low-grade wood within the procurement area. When the net annual growth of low-grade wood is compared to the annual levels of harvesting of low-grade wood they can be examined as a growth to removal ratio. Zone 1 counties have an average 2.53 to 1 growth-to-removal ratio, whereas Zone 2 counties have an average ratio of 2.12 to 1. The amount of *net available low-grade growth* (NALG) wood is about 1.5 million green tons per year in both Zones 1 and 2 of the procurement area. All of the NALG wood in Zones 1 and 2 of the procurement area could supply a 150 MW power plant.

TCL&P will have greater command over the wood growing and harvested in Zone 1 of the procurement area; facilities closer to suppliers in Zone 2 of the procurement area will be more likely to source the wood being harvested there. Given this, we point to the Zone 1 total of 827,899 green tons per year of NALG wood as a more likely overall wood basket. The annual consumption of wood by any or all of TCL&P's proposed CHP facilities can be compared to this sum to assure availability of supply. All of the NALG wood in Zone 1 of the procurement area could supply an 80 MW power plant.

In Michigan, the cost of raw wood will range from $12 to $26 per green ton, depending on the source. When trucking is added in, the delivered costs for these sources will range from $24 to $38 per green ton. Residue sources like ground up urban waste wood or sawmill chips will be the least expensive, while chipped pulpwood is the most expensive.

Fuel Competition

In general, any CHP facilities sited in Traverse City will have a great competitive advantage when purchasing wood fuels from within Zone 1 of the procurement area identified here. Still, there will be competitors for this material. Existing competitors for wood fuel will include wood-fired power plants, wood pellet manufacturers, pulp mills and OSB mills, and other wood energy users like institutions with woodchip heating systems. As a general illustration, the table below shows average wood consumption rates across a range of electric generating capacities for stand-alone wood-fired power plants.

Electricity Generation Plant (not CHP)	Estimated Maximum Annual Wood Fuel Consumption under Full-time Base-load Conditions
50 MW	500,000
35 MW	400,000
20 MW	250,000
15 MW	175,000
10MW	100,000

In general, the wood consumers that are closest to Traverse City will offer the most significant competition for purchasing low-grade wood. There are three power plants (Cadillac, Viking, and Grayling), one pellet mill (Monarch Millworks), and two mills (Weyerhauser OSB mill in Grayling and the Packaging Corp of America Mill in Filer City) in close proximity to Traverse City.

The pellet mill will consume mostly sawmill residues to make pellets and is therefore not a major consumer of harvested wood. Competition with other power producing plants will be the most significant.

In addition, there are several proposed wood-fired power plants in the region and there is at least one proposed new pellet mill scheduled to come on-line with production in 2010. These are discussed in more detail within the section of this report on potential future competitors.

Current Logger Capacity

Michigan's logging workforce and infrastructure is largely intact but has seen some gradual declines in recent years with reduced timber demand by the forest projects industry. While the annual volumes of wood reported above are estimated to be growing in the forest, the logging infrastructure must be in place to deliver the wood from the forest to the market. There appears to be an intact and capable whole-tree chip supply infrastructure in place to serve the Traverse City biomass CHP projects that would require minimal amounts of "tooling up" to supply the needed amounts of wood fuel. If the project(s) require very large amounts of wood fuel, further supplier investment would be required to tool up to meet the new demand.

Fuel Supply Contracting

In general, the best initial strategy for seeking out woodchip fuel suppliers is to cast as broad a net as possible when soliciting bids. The likelihood of receiving multiple competitive bids is made better by soliciting as many proposals for fuel supply as possible. TCL&P should contact as many of the potential suppliers identified here as possible when requesting proposals to supply.

It is important to note that these suppliers are not always in the business of solely providing wood fuel (perhaps with the exception of woodchip brokers), and that the relationship between supplier and purchaser can be delicate. Each party should take the time to learn about the other's operations and needs to ensure reliable supply. Contract provisions can include specified contract terms, pricing and market guarantees, fuel surcharges, and others. TCL&P can opt to contract their entire supply through a single brokerage entity or can contract directly with multiple suppliers.

In general, wood suppliers are most comfortable with six-month or one- to two-year contracts. Suppliers have cited guarantees in pricing, fuel surcharges, and continued markets as factors that would increase their comfort level with longer-term contracts.

Importing Wood from the Upper Peninsula

Further assessment of the wood resources in the Upper Peninsula was conducted. The Upper Peninsula has abundant woody biomass resources and an active forest products industry. Two options exist for importing the material to the Lower Peninsula: long-distance trucking or shipping across the lake via barge. Both of these delivery options are far more expensive than sourcing wood from within Zones 1 and 2 of the procurement area identified in this study. There is also the potential for significant growth in demand for wood in the Upper Peninsula. Further study may be warranted.

Other Potential Biomass Fuels

Cherry pits from cherry processors are another feasible source of biomass fuel. Cherry pits are frequently dried to 10-11 percent moisture content and so have a higher energy content by weight than green woodchips. Cherry pits typically have higher ash content than wood. BERC estimates there is at least 2,500 tons available annually in the study area, but nearly all of that supply is already dedicated to the residential heating market.

Corn stover (corn stalks, leaves, and cobs left behind after corn grain is harvested) was identified as a feasible fuel source. In the northern portion of the Lower Peninsula of Michigan, corn stover is typically left in the fields. Corn stover has higher levels of nitrogen that result in higher levels of NO_x emissions than wood fuels. Corn stover also contains higher levels of minerals that result in more ash than is produced wood fuels. BERC estimates there is approximately 89,700 green tons of corn stover harvestable annually within the study area.

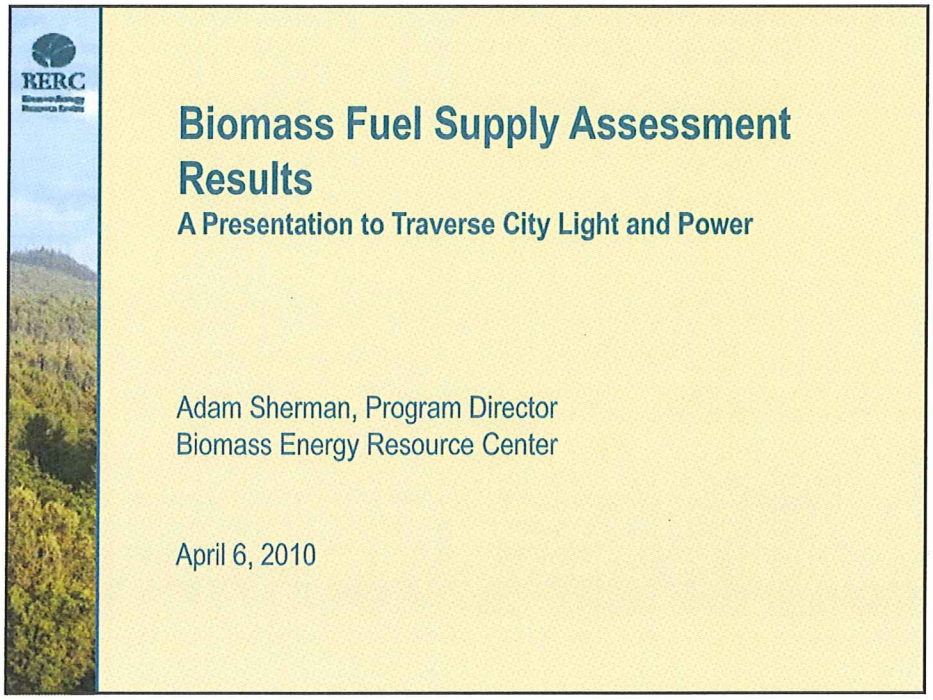
Dedicated energy crops, such as willow, poplar, or even grasses, grown on fallow, marginal farmland have tremendous conceptual potential and numerous advantages for long-term fuel security. However, when all the costs are added up, dedicated energy crops are currently significantly more expensive than wood fuel harvested as part of periodic timber harvests.

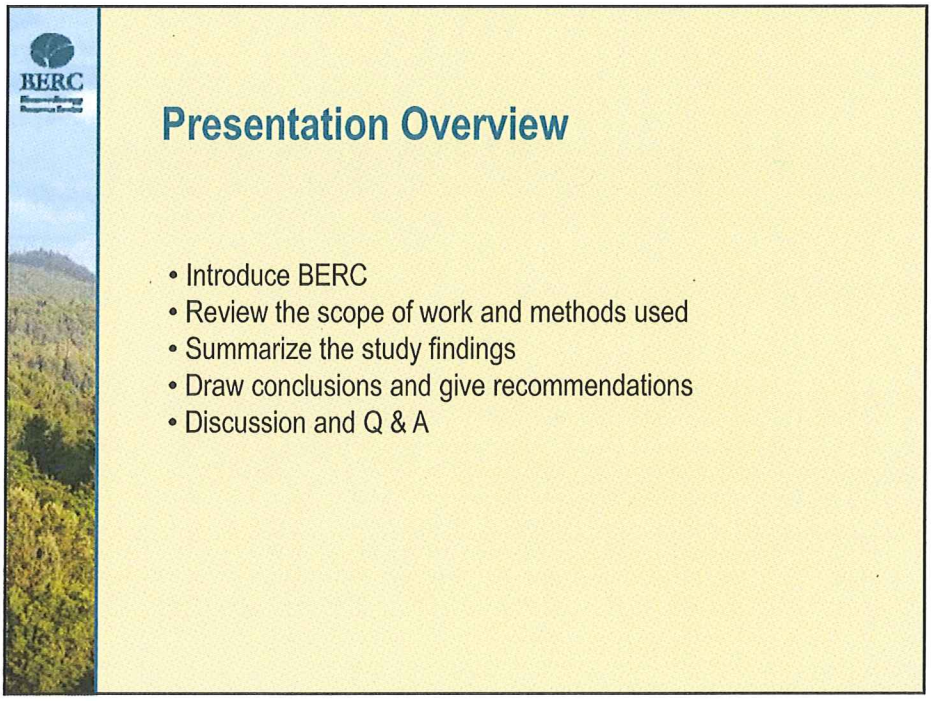
Conclusions and Recommendations

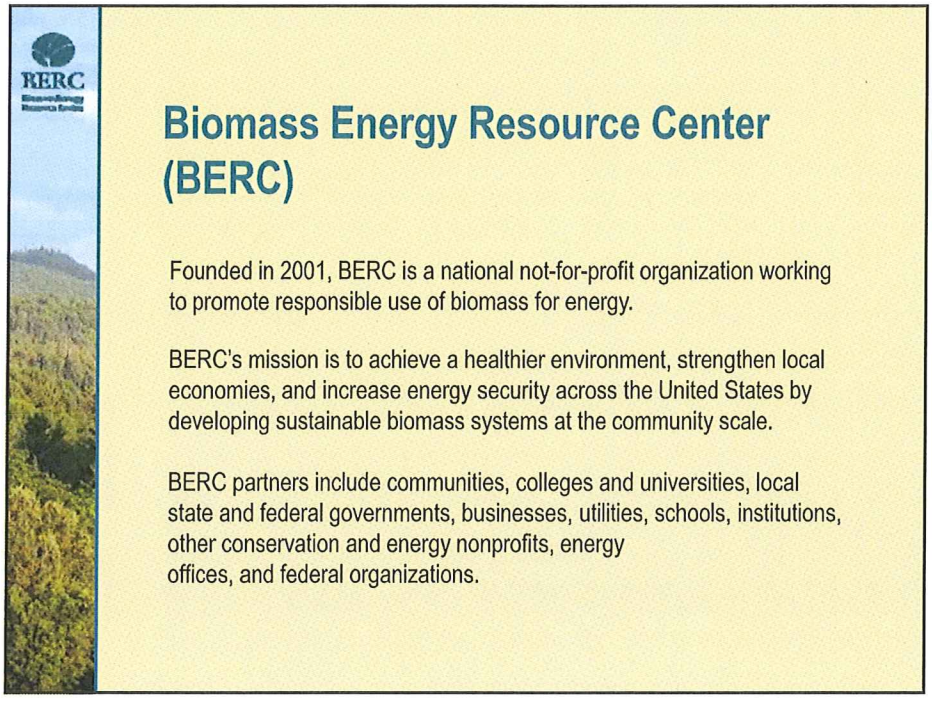
TCL&P may be able to source some residue wood for fuel from sawmills or clean urban and community wood wastes, and these sources should be used to the greatest extent possible. These sources will be limited, however, and should be supplemented with low-grade wood harvested from managed forests within the procurement area. We found here that there is 1.57 million green tons of low-grade wood available annually after current demands are accounted for. Assuming the proposed TCL&P CHP facilities consume a combined 300,000 green tons of wood annually, there would be sufficient quantities of low-grade wood from the forests to supply these facilities with fuel. TCL&P should look for lower-cost whole-tree chips from whole-tree harvesting operations. To maximize fuel supply security, TCL&P should consider also sourcing 5 percent of their annual wood demand as roundwood that can be stockpiled and stored as a hedge against possible interruptions in supply due to bad weather. TCL&P should consider wood imported from the Upper Peninsula only as a last resort; while there appears to be sufficient resource to supply, long distance transport is a very expensive option compared to sourcing wood from within the procurement area closer to Traverse City.

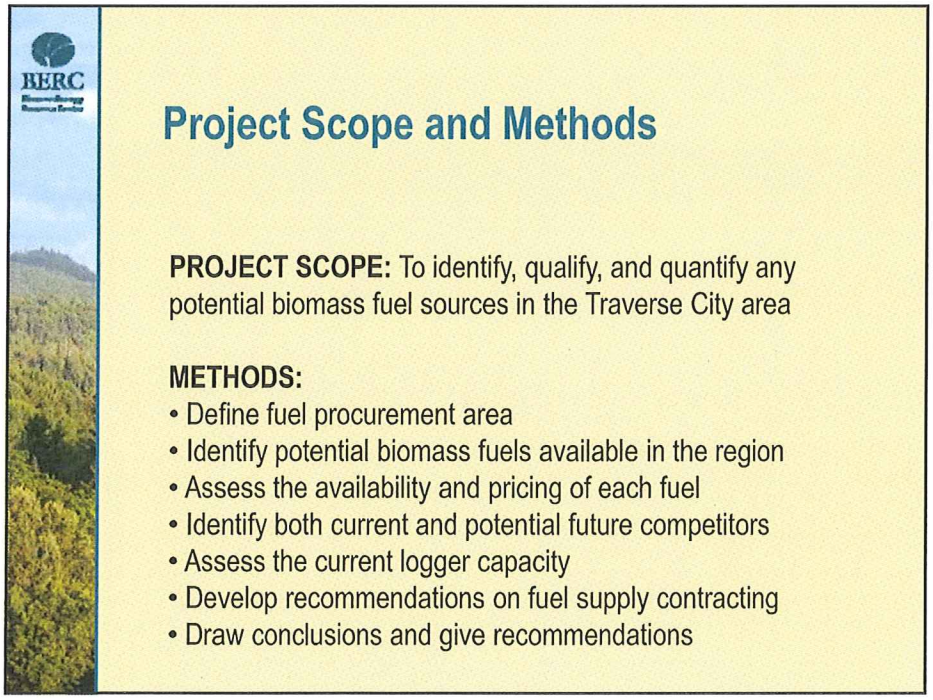
Additionally, agricultural residues like corn stover and cherry pits were found to be available in the area surrounding Traverse City. But these materials are very seasonal in their availability: a year's supply will

accumulate in one month's time. Utilizing these fuels will likely disrupt otherwise steady wood flows, possibly straining relationships with year-round wood suppliers. TCL&P should continue to investigate these potential fuels, looking for ways to best integrate them into the wood fuel stream. And while we found that dedicated energy crops such as grasses and wood coppice plantations could be viable options in the future, TCL&P should wait for the economics to improve.


BERC
Biomass Fuel Supply Assessment Results
A Presentation to Traverse City Light and Power
Adam Sherman, Program Director
Biomass Energy Resource Center
April 6, 2010


BERC
Presentation Overview
• Introduce BERC
• Review the scope of work and methods used
• Summarize the study findings
• Draw conclusions and give recommendations
• Discussion and Q & A


BERC
Biomass Energy Resource Center (BERC)
Founded in 2001, BERC is a national not-for-profit organization working to promote responsible use of biomass for energy.
BERC's mission is to achieve a healthier environment, strengthen local economies, and increase energy security across the United States by developing sustainable biomass systems at the community scale.
BERC partners include communities, colleges and universities, local state and federal governments, businesses, utilities, schools, institutions, other conservation and energy nonprofits, energy offices, and federal organizations.


BERC
Project Scope and Methods
PROJECT SCOPE: To identify, qualify, and quantify any potential biomass fuel sources in the Traverse City area
METHODS:
• Define fuel procurement area
• Identify potential biomass fuels available in the region
• Assess the availability and pricing of each fuel
• Identify both current and potential future competitors
• Assess the current logger capacity
• Develop recommendations on fuel supply contracting
• Draw conclusions and give recommendations

The Fuel Procurement Area

MILAGE: Within a 50- to 75-mile radius around Traverse City

DRIVE TIME: Within a 60- to 90-minute drive time from Traverse City

Potential Sources of Biomass Fuel

WOODY RESIDUES: woodchips from primary mills, urban wood waste, or harvested low-grade wood

AGRICULTURAL RESIDUES: corn stover, cherry pits

DEDICATED ENERGY CROPS: short rotation woody plants (willow or poplar), grasses

Woodchips as Fuel

Characteristics and Specifications

ENERGY CONTENT: HHV of 8,000 to 12,000 Btu per dry pound;8,400 Btu per dry pound on average

MOISTURE CONTENT: ranges, but the target is 30 to 40 percent moisture

CHIP SHAPE: rectangular and consistent in shape and size

ASH CONTENT: ideally below 2.5 percent; higher than 7 to 8 percent could be problematic

CLEAN CHIPS: woodchips for fuel should be free of dirt and other debris

Woodchips as Fuel

Sources

WHOLE-TREE HARVESTING: Commercial harvesting of sawlogs or pulpwood; entire tree is harvested and skidded to the log landing; tops and limbs are removed and piled at the landing; wood can be chipped at the landing

STEM-ONLY HARVESTING: tops and limbs are left scattered in the woods; smaller diameter or low-grade wood is chipped at the landing

SAWMILLS: generate bark, slabs, chips, and sawdust as by-product

TREE SERVICE COMPANIES, WOOD YARDS: Tree trimmings, clean wood recycling yards; C&D material is excluded

CHIP YARDS AND CHIP MILLS: chips yards are small yards where roundwood is stored and chipped periodically using mobile chipping equipment; chip mills are larger facilities with stationary equipment

Fuel Availability

Woodchips from Forest Residues

- Tops and limbs left over from harvesting
- A large portion of this material is inaccessible
- This material is often left in the woods or there are existing markets
- It is costly to extract

County	Residue (green tons/yr)
Antrim	15,373.89
Benzie	8,656.25
Charlevoix	12,913.70
Clare	21,541.95
Crawford	22,667.33
Emmet	11,916.70
Grand Traverse	21,440.74
Kalkaska	46,219.69
Lake	21,197.81
Leelanau	3,116.53
Manistee	13,557.66
Mason	9,441.19
Missaukee	19,173.90
Osceola	11,727.60
Otsego	21,838.03
Roscommon	16,910.04
Wexford	29,240.91
TOTAL	**306,933.90**

Fuel Availability

Woodchips from Sawmills

- Sawdust, bark, and chipped slabs
- In general, sawmills produce 1,000 GT of dust, 500 GT of bark, and 1,000 GT of chips per 1 MMBF lumber production
- This material is well spoken for and it is decreasing in availability
- Within Zones 1 and 2, fewer than one dozen sawmills still operating
- TCL&P should source this material when it is available, but will likely need to supplement with other sources

Fuel Availability

Woodchips from Urban Tree Trimmings and Clean Community Wood Waste

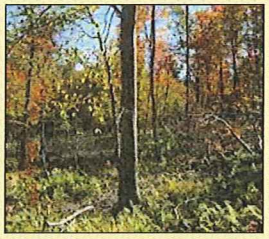
- This is a theoretical per capita approach
- Telephone surveys show there is 10,000 to 15,000 tons of this material available annually
- TCL&P should source this material when it is available
- Careful attention must be paid to fuel quality

County	2007 Population	Estimated Generation (green tons)
Grand Traverse	77,654	7,618
Leelanau	21,119	2,072
Benzie	15,998	1,569
Manistee	24,527	2,406
Wexford	30,484	2,990
Missaukee	14,478	1,420
Kalkaska	16,571	1,626
Antrim	23,110	2,267
Charlevoix	26,090	2,559
Mason	28,274	2,774
Lake	11,333	1,112
Osceola	23,197	2,276
Clare	31,252	3,066
Roscommon	25,469	2,499
Crawford	14,273	1,400
Otsego	23,301	2,286
Cheboygan	26,448	2,595
Emmet	31,437	3,084
TOTAL	**465,015**	**45,618**

* This table assumes a per capita generation rate of 0.0981 green tons of urban wood residues per year.

Fuel Availability

Woodchips from Harvesting



- Zones 1 and 2 are 5.9 million acres
  - 2 million acres of timberland
  - Approximately 1.16 million acres of timberland are accessible and actively managed
- 17.2 million green tons of standing inventory on this timberland, growing 2.52 million green tons of low-grade wood annually
- Existing demands for low-grade wood amount to nearly 950,000 green tons annually
- More than 1.57 million green tons of low-grade wood available annually
- TCL&P will have the strongest command over the roughly 1 million green tons available annually from with Zone 1 of the procurement area

Fuel Availability

Existing and Proposed Competition for Low-Grade Wood

EXISTING COMPETITION:

- Biomass power plants consume a combined 1.15 to 1.2 million green tons annually
- Pellet mills consume an estimated 225,000 green tons annually
- Pulpmills and OSB mills
- Institutional wood energy

PROPOSED COMPETITION

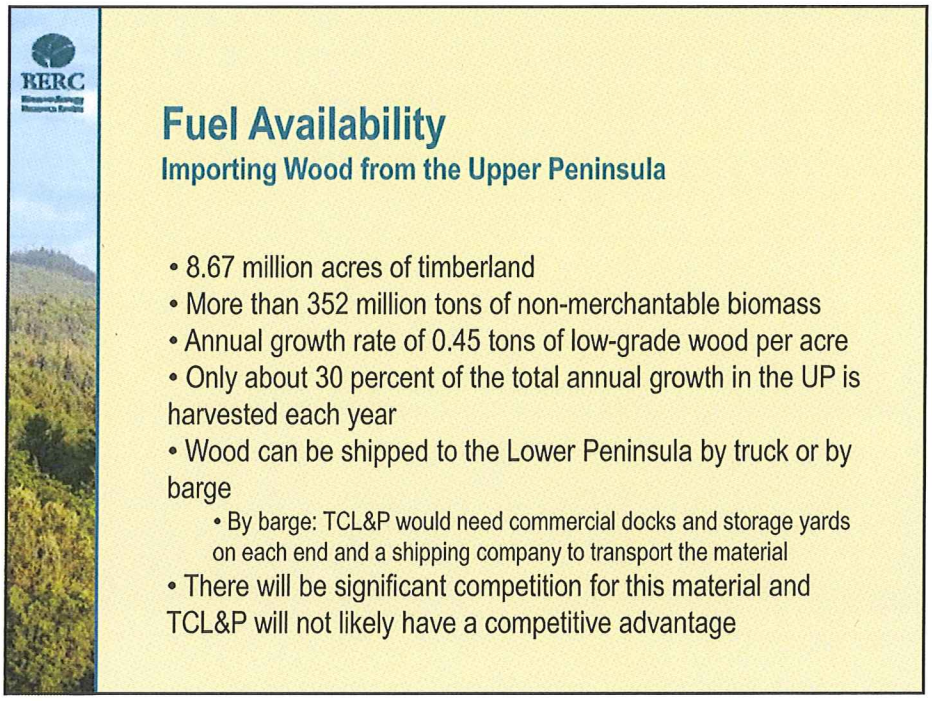
- At least one proposal for a new pellet mill (anticipated annual consumption unknown)
- Several proposed wood-fired power plants

Fuel Availability

Logging and Chipping Infrastructure and Capacity

"Given [the current] capacity, there appears to be an intact and capable whole-tree chip supply infrastructure in place to serve the Traverse City biomass CHP projects that would require minimal amounts of tooling up to supply the needed amounts of wood fuel." (from the BERC final report)

- Michigan's logging workforce and infrastructure is largely intact
- Most whole-tree chippers have the capacity to chip 10,000 to 90,000 tons of wood annually
- Most contractors contacted expressed interest in finding and selling to new markets for chips


BERC
Fuel Availability
Importing Wood from the Upper Peninsula
• 8.67 million acres of timberland
• More than 352 million tons of non-merchantable biomass
• Annual growth rate of 0.45 tons of low-grade wood per acre
• Only about 30 percent of the total annual growth in the UP is harvested each year
• Wood can be shipped to the Lower Peninsula by truck or by barge
• By barge: TCL&P would need commercial docks and storage yards on each end and a shipping company to transport the material
• There will be significant competition for this material and TCL&P will not likely have a competitive advantage


BERC
Fuel Availability
Harvesting Wood from TCL&P-owned Forest or Farm Land
There are several options for self-supply from TCL&P-owned land:
• Managing a woodlot for wood fuel: 1.75 green tons per acre, or 28,571 to 50,000 acres for every 50,000 green tons (depending on yields)
• Growing tree plantations: 10 to 20 times more wood per acre than typical forest management
• Establishing fast-growing willow or poplar grown in short-rotation coppice (discussed later)
• Growing other non-woody dedicated energy crops, such as perennial grasses (discussed later)

Fuel Availability

Agricultural Residues: Corn Stover

CORN STOVER: the above-ground vegetative portion of the corn plant left over after harvesting

ENERGY AND MOISTURE CONTENT: 8,250 Btu per pound, 30 percent moisture

AVAILABILITY:

- Corn stover is available in the procurement region in sufficient quantities:
  - Estimated nearly 23,000 tons annually
- Corn stover is only available seasonally; there are 2 options for using it as fuel:
  - Store on-site and blend with wood fuels throughout the year
  - Interrupt wood supply flows to use corn stover when it is available

Fuel Availability

Agricultural Residues: Cherry Pits

ENERGY CONTENT: 9,250 Btu per dry pound or 19.04 million Btu per dry ton

MOISTURE CONTENT: 10 to 12 percent (meaning 17 million Btu per ton)

AVAILABILITY:

- TCL&P would require bulk quantities, not bagged
- Between 2,500 and 6,800 tons could be available annually within the Traverse City area; this entire quantity would become available within a single month
- Processors are beginning to realize the value of cherry pits as a fuel for sale or for internal use
- TCL&P should continue to investigate this potential fuel source, being careful not to interrupt the flow of wood fuel

Fuel Availability

Dedicated Energy Crops: Woody Plantations

WOODY ENERGY CROPS: Willow and poplar are two examples

- Energy and moisture content similar to other wood fuels
- Grown on marginal or retired agricultural land
- Yield 5 to 10 green tons per acre per year
- These woody crops are intensive and expensive to grow
  - Can cost 2 to 4 times as much as wood harvested as part of normal forest management
- Woody energy crops could be a fuel source in the future as economics improve

Fuel Availability

Dedicated Energy Crops: Grasses

- Grasses have a slightly lower Btu content than wood (dry)
- Lower moisture content than wood, typically 15 to 20 percent
- Grass yields will range depending on soil conditions, soil fertility, weed control, and timing of harvest
  - Switchgrass yields may range from 1.4 to 5.6 tons per acre per year
- Ultimately, availability depends on per-yield acre and number of acres planted
- Grass (either as waste hay or a crop) is more expensive than wood fuel

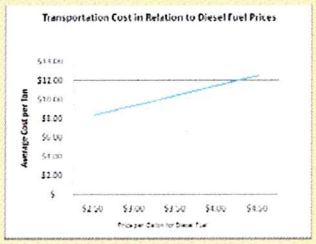
Fuel Pricing

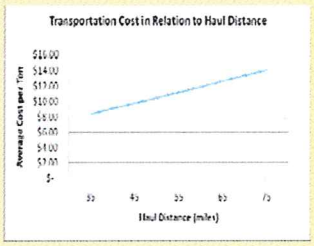
Fuel Type	Availability	Cost per Green Ton	Average MMBtu per dry unit	Average Moisture Content	Av. MMBtu per Green Unit (after combustion)	Fuel Cost per MMBtu	Fuel Cost per MWh(e)
Urban Wood Waste	Moderate	$ 18.00	15.8	37%	6.97	$ 2.58	$ 26.45
Sawmill Chips	Limited	$ 28.00	16.3	40%	6.85	$ 4.09	$ 41.88
Whole-tree chips	Very Good	$ 32.00	16.2	43%	6.46	$ 4.95	$ 50.69
Chipped Pulpwood	Very Good	$ 40.00	16.3	43%	6.50	$ 6.15	$ 62.98
Cherry Pits	Limited	$180.00	19.0	10%	12.00	$15.01	$153.66
Corn Stover	Moderate	$ 45.00	14.8	30%	7.25	$ 6.21	$ 63.54
Perennial Grass	Moderate, but has potential	$ 79.00	16.4	18%	9.41	$ 8.39	$ 85.94
Willow Coppice	None, but has potential	$ 86.00	16.1	42%	6.54	$ 13.16	$134.72

[1] Assumes 10.24 MMBtu required per MWh electricity

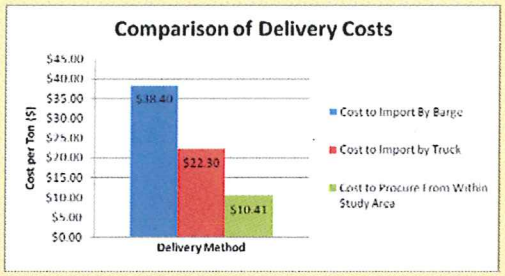
Factors Affecting Wood Fuel Pricing

- Wood source and production costs
- Strength of the sawlog market
- Regional balance of supply and demand for low-grade markets
- Trucking distance from point of generation to end market





Importing Wood from the UP



- Wood fuel could be imported from the Upper Peninsula by truck or by barge, but it will be expensive
- TCL&P should consider this a backup option if ever wood fuel is not available from within the procurement area identified here

Procuring Fuel Supply Contracts

SOLICITING: Send RFIs / RFPs to as many fuel suppliers as possible

CONTRACTING:

- Two options:
  - Direct: purchase directly from multiple suppliers
  - Broker: hire a brokerage entity to aggregate necessary volumes
- Supply contract term: seek a 12-month contract minimum but offer a longer term like 2 to 4 years
- Diesel fuel surcharges: include a mutually agreed upon surcharge schedule that is dependent on diesel prices
- Adjustments for inflation, particularly for longer-term contracts

Fuel Receiving and Storage

- Two configuration options: central storage yard or satellite storage yards
  - Consider truck scales and tippers, especially if more than 10,000 tons will be consumed annually at any one facility
  - If truck tippers cannot be accommodated, be sure suppliers are able to use self-unloading trailers
  - Consider space for on-site chipping of roundwood
- TCL&P should work with any potential wood fuel suppliers when designing wood receiving and storage yards

Conclusions and Recommendations

CONCLUSIONS:

- There are sufficient wood resources within the target supply area to support a few medium-sized CHP projects, and some promising alternative fuel sources as well
- There are willing suppliers interested in new markets with some existing capacity and openness to tool up to meet demand
- Despite possible future competition from other power plants and pellet mills, TCL&P is likely to have strong command of supply within the Zone 1 counties

Conclusions and Recommendations

RECOMMENDATIONS:

- TCL&P should look to source residue wood when it is available, supplementing with chips from whole-tree harvesting operations
- If urban tree trimmings or clean community wood wastes are used, this fuel should be free of contaminants
- TCL&P should source 95 percent of their wood fuel needs as chips and the remaining 5 percent as roundwood to be chipped as needed
- TCL&P could source agricultural residues such as corn stover or cherry pits when they are available, but should pay close attention to minimizing interruptions to wood flows
- TCL&P should continue to monitor alternative fuel sources like woody crops and grasses, looking for lower production costs

Contact Information

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