

Heating Demand in the Mohawk Trail Woodlands Partnership Region

In support of the
Mohawk Trail Woodlands Partnership

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Prepared by

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1. Introduction

1.1 Project Overview

This report presents an analysis of the heat demand of the 21-town Mohawk Trail Woodlands Partnership (MTWP) region. This analysis will be used to set the benchmark for current heating demand in the region from which renewable thermal market potential can be evaluated.

Renewable thermal potentials will be related to the key applicable technologies eligible for the state incentives under the state Department of Energy Resources (DOER) Alternative Portfolio Standard and the Mass Clean Energy Center (MassCEC) Clean Heating and Cooling rebate program. Applicable market scenarios can be used to evaluate potential fossil fuel reduction, greenhouse gas emission trajectories, air quality impacts, and regional economic impacts.

1.2 Clean Energy Extension Role

The Clean Energy Extension (CEE) at the University of Massachusetts Amherst has been engaged by the state Department of Energy Resources to work with the Franklin Regional Council of Governments (FRCOG) and Berkshire Regional Planning Commission (BRPC) to support the MTWP to assess the viability, efficacy and potential air quality impacts of regional development of renewable thermal energy economic activity. In collaboration with FRCOG and BRPC, CEE has engaged many of the MTWP participating communities to evaluate municipal energy use, and continues to engage with the MTWP Advisory Committee to provide technical support to help the region make well-informed decisions. The current activities in the CEE scope of work are provided below, and include evaluation of renewable thermal options for the region including solar thermal, cold-climate air source heat pumps, as well as modern wood heat.

- Heating Demand and Potential Renewable Thermal Market Opportunity
- Modern Wood System Emissions and Public Health Assessment
- Renewable Thermal Regional Economic Analysis

This report partially fulfills the scope under the first activity.

2. Methodology

This analysis offers an estimate of the annual heat load demanded by the MTWP region. The purpose of this estimate is to reasonably scale the heating sector in terms of energy use and economic expenditures, and to allocate the proportion of heating energy used across different sectors – residential, commercial, municipal, etc.

To build up the regional heating demand, building and facility types were divided based on category. The categories were chosen based on available data sources and characterization of different sectors energy needs. The following categories are used in this analysis.

Building/Sector Category	Sub-Category
Residential	1-4 units Over 4 units
Commercial	--
Industrial	--
Public / Tax Exempt	Municipal Facilities Schools (public and private) State Facilities
Other	--

Data for number of buildings, square feet of buildings, and energy use for the categories were found using the best available sources for that category, so the sources and methods used to calculate heat demand differs between each category. The method for each category is summarized below.

2.1 Residential, Commercial, Industrial Facilities

Residential, commercial, and industrial heat demand was calculated using assessor’s parcel data for the selected towns available through MassGIS, which provided the building area. Given the large number of buildings in question, an aggregate average heat demand was estimated on a square foot basis. Using available data from known buildings and industry standards, a conservative estimate of 60 BTU per square foot per year was used to estimate the heating load.

The data was then sorted by “use codes” to differentiate the building sector sub-categories. Use Code are guidelines that are intended to assist the Board of Assessors in determining the proper classification of property according to its use. The coding structure has a three digit level of detail. The first digit indicates a major classification. The second digit is a major division and the third digit is a subdivision, both within the major classification of property. The major Use Code categories include Multiple-Use, Residential, Open Space, Commercial, Industrial, Personal Property, Forest Property, Agricultural/Horticultural Chapter 61A, Recreational Property, and Exempt Property. Only those that include building structures were included in this assessment.

Lastly, the floor areas and associated heat loads of all of buildings in each of the categories were summed to provide an aggregate level of heat usage for the MTWP region for each sector.

2.2 Municipal Buildings

Heat demand in municipal buildings was calculated using weather normalized fuel consumption data from Massachusetts Energy Insight (MEI) for seven towns that had data and MEI accounts available to CEE. For the remaining towns, information was provided directly from town officials or sourced from the Local Energy Action Dashboard (LEAD), a tool developed by the Metropolitan Area Planning Council (<https://lead.mapc.org/>). Fuel oil and propane consumption were found on LEAD and was consistent with our internal estimates. For the towns with MEI data, the percentage of town energy consumption related to heating was determined and averaged across towns. This percentage was applied to the total energy consumption from LEAD for towns without MEI data in order to estimate the energy used by their municipal buildings. For the few towns that did not have data on LEAD, their energy consumption was estimated based on the consumption of towns with similar populations.

2.3 School Buildings

A list of all of the schools in the selected towns was obtained from the ReferenceUSA database (<http://resource.referenceusa.com>). For each of these schools, building square footage data was used from the Massachusetts School Building Authority (<http://www.massschoolbuildings.org>). The square footage was then multiplied by the same 60 Btu per square foot space heating factor discussed above in order to calculate the school heat demand.

2.4 State Owned Buildings

A database of state facilities in the selected towns was obtained through the Annual Real Property Report produced by DCAM. This database ([link](#)) includes square footage for each facility. The building area was multiplied by 60 Btu per square foot, as discussed above, to calculate state facility heat demand.

2.5 Other

There were some buildings left after sorting the assessor's parcel data by use codes that did not fall under any of the chosen categories. These buildings represent about 6%-7% of the regional total heat load, and include facilities related to recreational, agricultural, and energy infrastructure use. For these facilities, space heating was assumed to be the dominant thermal load, thus the square footage data was multiplied with 60 Btu per square foot to calculate heat demand as it was in other building sectors.

3. Regional Heat Load Estimates

The analysis estimates that the 21-town Mohawk Trail Woodlands Partnership region has a heat load of 2.26 million MMBtu per year. About 70% of the regional heat load comes from residential use.

Tables 1 shows the estimated heat load for the MTWP region. The table provide the number of building units, building floor area, heat load and portion of total heat load for each of the building categories. Figure 1 provides the breakdown of the heating load by building categories for the MTWP region.

Table 1. Heating Load Estimate for the MTWP Region

Building Category	Number of Building Units	Building Floor Area	Heat Load	Portion of Regional Total Heat Load
		million ft ²	MMBtu/yr	%
Residential	17,005	26.42	1,584,912	70.0%
1-4 units	16,647	24.26	1,455,585	64.2%
over 4 units	358	2.16	129,327	5.7%
Commercial	41	3.62	217,206	9.6%
Industrial	11	2.56	153,562	6.8%
Tax Exempt	221	-	182,505	8.1%
Municipal Facilities	21	-	27,606	1.2%
Schools (K-12)	29	1.44	86,132	3.8%
State Facilities	171	1.15	68,767	3.0%
Other	40	2.12	127,395	5.6%
TOTAL	17,278	-	2,265,580	100%

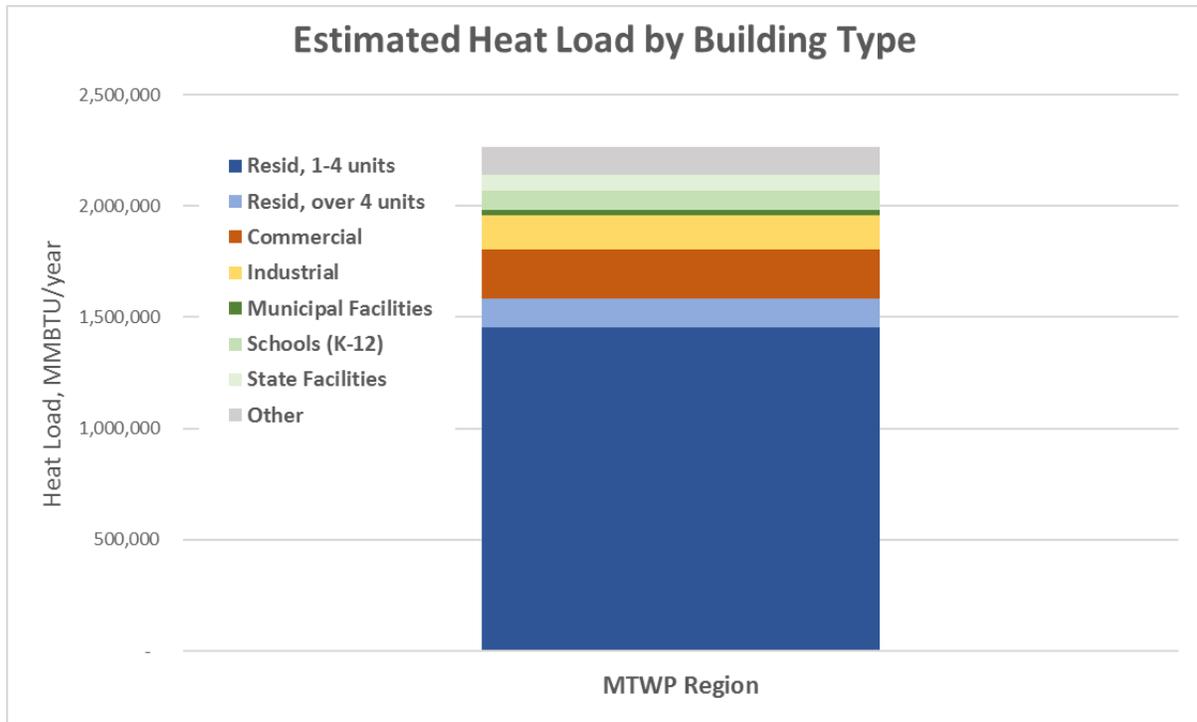


Figure 1. Estimated Heat Load by Building Category for the MTWP Region

4. Validation of Estimates

The results of this study were compared to the energy consumption reported on the LEAD tool by the Metropolitan Area Planning Council and were found to be in similar ranges. However, the LEAD tool is for total energy usage, so the electricity data was left out of comparisons while the fuel oil and natural gas data were used to compare to heat load. Our method of using building area and an assumed heat load density (BTU/ft²/year), was found to align closely with the data found in LEAD.

5. Discussion and Next Steps

The Clean Energy Extension has provided an estimate of the current heating load across building sectors in the MTWP region.

The heat load estimate will be the basis for further analysis by CEE to consider a range of market demand scenarios for renewable thermal technologies. The demand scenarios can be used to consider the potential impacts of renewable thermal on the region's fossil fuel usage, energy costs and expenditures, greenhouse gas emission trajectories, air emissions, and regional economic impacts.