City of Montpelier, VT

Final Report: Montpelier District Energy Project

U. S. DOE Award Number: DE-EE0003071

DISTRICT HEAT MONTPELIER
AN ENERGY INDEPENDENT DOWNTOWN

March 30, 2015

Distribution: Unlimited

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[1] Many individuals, too numerous to list, contributed to the development of this project.

[2] At the start of the Project, the principle contractor for the State of Vermont was D&S Engineering Inc. During the course of the project D&S Engineering merged with Mid-South Engineering.

Final Report

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Executive Summary

Introduction

Vermont's Capital City, Montpelier, is deeply committed to leading the region and the nation in implementing replicable strategies to deploy renewable energy technologies and reduce its carbon footprint. The City has committed to a goal of reducing greenhouse gas emissions and fossil fuel consumption by the City, its citizens and its business community by at least 80% by 2030. The energy plan the City has adopted includes residential and commercial energy efficiency improvements, renewable energy generation, transportation alternatives, bicycle and pedestrian improvements, and a new multi-modal transit facility. A key element of the City's plan to replace non-renewable energy with renewable energy is the construction and operation of a district heating system fueled with renewable biomass energy.

It has long been a vision of the City of Montpelier to join with the State of Vermont in rebuilding and expanding the State's central heating plant so that it could continue to serve the collection of state buildings known as the Capitol Complex and have the capability to support a district heating system serving buildings of downtown Montpelier. This vision has been the subject of discussion for nearly twenty years. And subject to many studies over that period of time.

Table 1. History of Project Development

Early 1990s	Montpelier Community Energy System first conceived
Late 1990s	Community Renewable Energy (CORE); funds development of community energy concept
2000/2001	CORE works with City to collect building information
	CANMET completes district energy study
	Capital District Master Plan identifies district heat as element of plan
2002 – 2004	Three studies completed with funding from DOE and USFS
2003	Montpelier citizens vote $250,000 bond for district energy
2005 – 2006	State of Vermont complete engineering and cost studies on using existing central heat plant to provide energy to City
2006	DOE funds update of Montpelier downtown build survey of 2000
2008	CANMET study updated to consider "Montpelier Only" option
2010	City of Montpelier awarded $8 M DOE grant to design/construct project

In January 2010, the City of Montpelier was awarded a federal Department of Energy (DOE) Community Renewable Energy Deployment program (CRED) grant. The grant was part of the American Recovery and Reinvestment Act (Recovery Act) of 2009 and represented a DOE priority to support the planning and installation of community-scale renewable energy projects across the United States, thereby diversifying the Nation's energy supply options, while increasing national security and improving the environment. The CRED program empowers local communities to make strategic investments to meet

the nation's long-term goals for energy independence and leadership on climate change by supporting the planning and deployment of community renewable energy projects in communities nationwide.

Enabled by the grant, the City of Montpelier, Vermont, in collaboration with the State of Vermont, reconstructed the State of Vermont's aged central heat plant and constructed a network of hot water distribution pipes throughout the central core of Montpelier, Vermont. The project included the design, construction and operation of a 40.2-MMBtu biomass renewable energy facility. The project is located on the site of the existing State heating plant; however the existing building was significantly expanded to accommodate two modern biomass boiler trains and associated biomass fuel storage. The biomass and back-up oil-fired boilers provide a combination of steam to the existing State thermal energy distribution system and hot water to the new district heating system which provides thermal energy to the downtown area of Montpelier. This project will provide the security and economic benefits of increasing reliance on locally harvested wood rather than fossil fuels while supplying a reliable and affordable heating solution for City buildings.

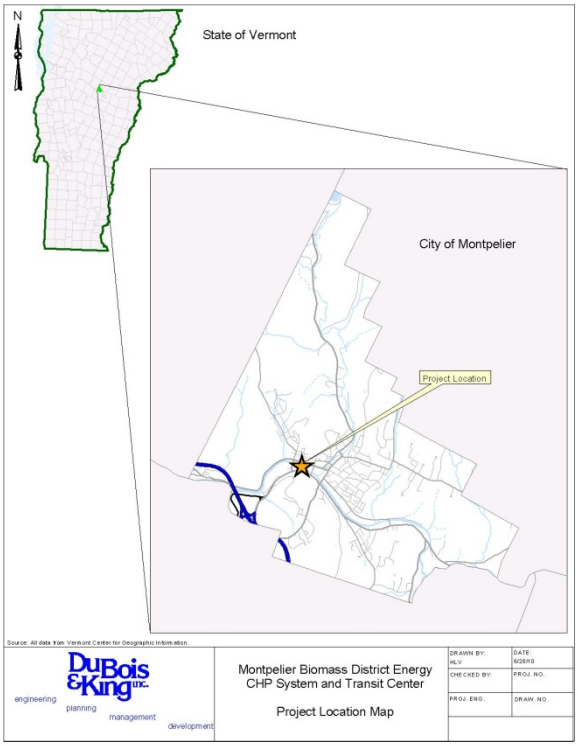

Figure 1 Project Location Map (from EA by Dubois & King)

The Central Heating Plant

The Central Heating Plant is owned by the State of Vermont. It was constructed in 1946 distributing steam to heat state buildings in the Capital City, including the State Capitol building. First built as a coal burning plant, it was converted to operate on heavy oil in the 1960s. In 1982, one of the two boilers was converted to burn wood chips.

Figure 2a Original central Heating Plant c. 2010

Figure 2b Rebuilt Central Heat Plant 2014

The original heat plant's two Dillon boilers were removed and a new larger building was built around the original building. The original building was incorporated into the new building and is used for wood chip storage. The design provides approximately 377 tons of fuel storage, which would support 72 hours of hours of operation if both boilers are firing at their maximum firing rate.

The new heat plant houses two AFS boiler train systems. Each boiler is rated at a heat capacity of 20.1 MMBTUH. Figure 3 presents an isometric of the boiler train system for the two boilers and a photograph of wood chip storage and the built boilers.

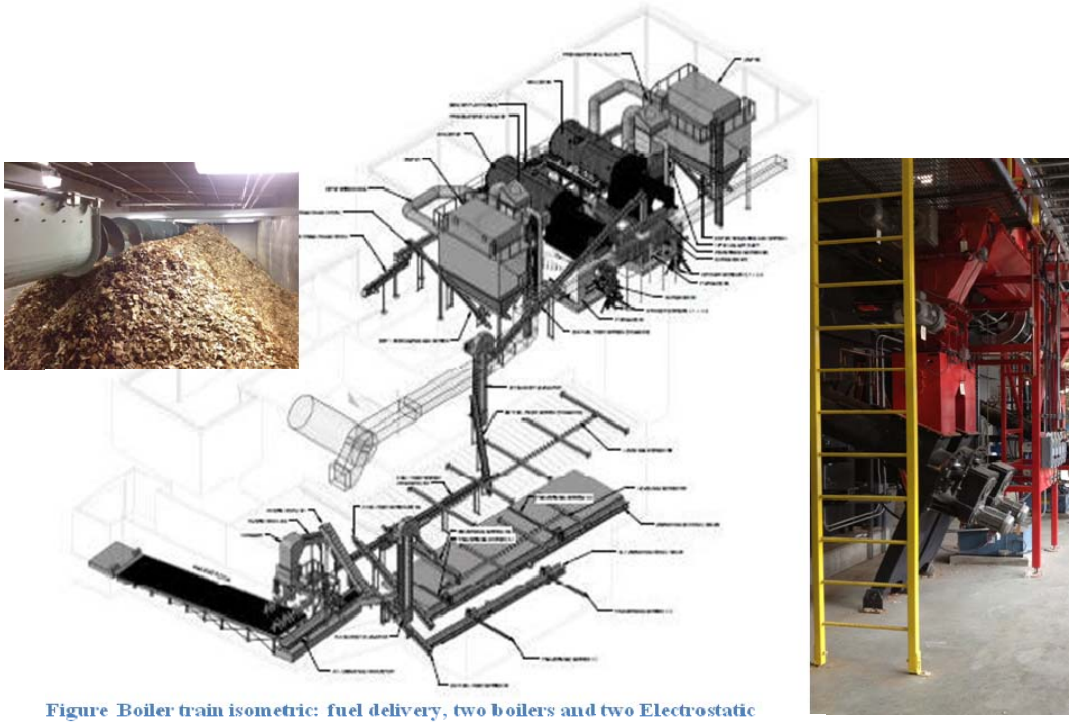

Figure Boiler train isometric: fuel delivery, two boilers and two Electrostatic Precipitators (for particulate matter removal), and photograph of boilers as built.

Table 2. Boiler Specifications

Parameter	Boiler #1	Boiler #2
Type	Hybrid Water/Fire Tube	Hybrid Water/Fire Tube
Rating	600 BHP	600 BHP
Rated Pressure	450 psig	450 psig
Operating Pressure	55 psig	55 psig
Net Heat Output	20.09 MMBTH	20.09 MMBTH
Weight, Dry	76,000 lbs	76,000 lbs
Weight, Wet	111,600 lbs	111,600 lbs
Fly-ash Re-injection	Yes	Yes
Combustion Units	AFS Versa grate	AFS Versa grate
Stack gas clean up	ESP	ESP

Thermal Energy Distribution Systems

The rebuilt central heat plant serves two thermal energy distribution systems. One is the original steam distribution system which serves the Capitol Complex. This system was built in 1946 with the central heat plant. No work or modifications were made to that system as part of this project. The buildings served by the State of Vermont's steam distribution system are listed in Table 3.

Table 3. State of Vermont Buildings of the Capitol Complex

Building	Building Area, ft.^{2}
Vermont State House	68,700
Vermont Supreme Court	42,000
120 State Street	76,500
133 State Street	104,700
6 Baldwin Street	32,750
116 State Street	2,500
110 State Street	11,675
109 State Street	124,880
128 State Street	9,250
132 State Street	3,950
118 State Street	4,400
4 Aiken Avenue	5,700
2 Aiken Avenue	9,500
136 State Street	3,525
134 State Street	3,000
112 State Street	35,172
1 Baldwin Street	5,379
122 State Street (heat plant)	3,482
132 State Street (shop)	113
TOTAL	553,076

The other thermal energy distribution system which the central heat plant supports is the hot water distribution system constructed by the City of Montpelier. This system replaces the individual building fuel oil fired furnaces and boilers with renewable energy from the central heat plant.

Figure 3 Example photograph of construction activity to build the hot water distribution system

The constructed distribution system is comprised of 8,000 feet of pipe located in 4,000 feet of trench which runs through the core of downtown Montpelier. Over 900 welds connect the highly insulated pipe into a closed loop system for the supply and return of thermal energy to heat twenty-one buildings. The route of the City's thermal energy distribution system runs from the central heat plant to Taylor Street, north on Taylor Street, then east on State Street to Elm Street. The system continues north on Elm Street to Langdon Street, where it crosses the North Branch River attached to the underside of the Langdon Street Bridge. At the intersection of Langdon and Main Streets, the route splits, with a branch heading north on Main Street then east to

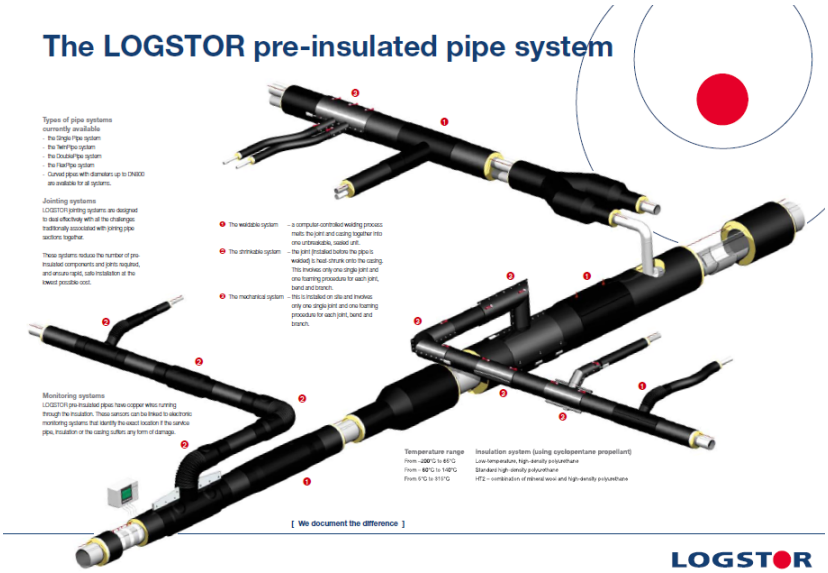

Figure 5 Product literature of the piping 'system' used to construct the Montpelier district heating system (www.logstor.com)

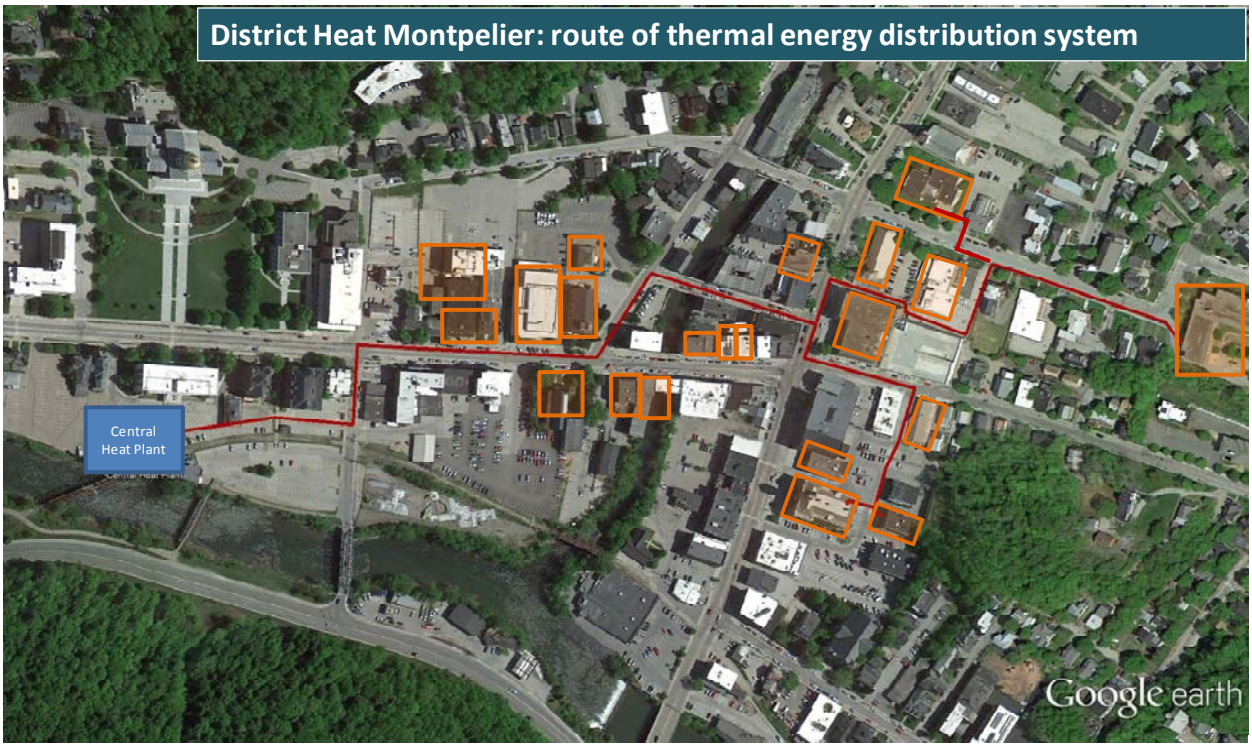

Figure 6 Montpelier District Heat routing with building served outlined

eventually terminate with service to Union Elementary School. The other branch turns south, then east providing service to the municipal complex of City Hall, Fire Station and Police Station. Table 4 lists the

buildings served by City of Montpelier's district heating system and Figure 6 presents the route of the piping system.

Twenty-one buildings are served by the system, which represent 18 individual accounts. All of these building have historically been heated with individual furnaces or boilers fueled by distillate fuel oil.

Of the twenty-one buildings, three are municipal buildings, one is an elementary school, another is a federal building, two are county buildings, two are churches, one is a library and eleven privately owned commercial buildings made up of office buildings, restaurants and a cafe.

Table 4. Buildings Served by District Heat Montpelier

No. of Bldgs.	Address	Building Area, ft.^{2}
2	City Hall/Fire Station	34,166
1	Police Station	9,300
1	Union Elementary School	60,804
1	Federal GSA Building	50,996
1	Washington County Courthouse	9,800
1	Washington County Sheriff's Office	6,845
2	89 State Street	37,419
1	52 State Street	8,217
1	46 State Street	12,730
1	27 State Street	11,519
1	15 State Street	8,682
1	17 State Street	7,191
1	118 Main Street	14,033
1	89 Main Street	71,718
1	15 East State Street	8,852
1	115 Main Street	13,037
1	64 State Street	15,866
1	23 School Street	13,495
1	135 Main Street	17,082
21	TOTALS	411,752

System Operations

'Commercial operation' commenced with the 2014-2015 Heating Season (October 1 of the current year through April 30 of the subsequent year). Starting October 1, 2014, the re-built central heat plant provided heat to the 20 Capitol Complex buildings plus ten of the twenty-one buildings to be served by District Heat Montpelier. As the Heating Season progressed a total of sixteen of the eighteen buildings were receiving heat from DHM by the end of February 2015. This represented over 95% of the subscribed customers. The remaining two buildings, 18,710 square feet of heated area to achieve the subscribed 411,752 square feet, are expected to be receiving heat before the end of the Heating Season.

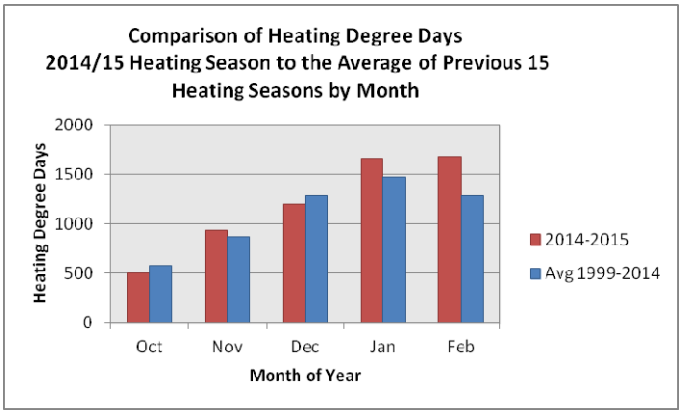

Figure 4 Comparison of first five months of the current Heating Season to those of the previous fifteen

The Heating Season was off to a mild start. On a Heating Degree Day basis, October was 14% milder than the average of the previous fifteen Octobers, November was 8% colder than its respective average and December was 7% milder. However, as the calendar turned to 2015, winter came on strong with January 12% colder than the long term average and February 31% colder. Several cold weather records were broken during the first two months of 2015. For example, for the 59 day period from January 1 to February 28, 2015, the outdoor air temperature rose above the freezing temperature for only two periods; and the minimum temperature recorded during this period was -23°F. The Heating Degree Day data are presented are in Figure 7 and Figure 8, and time series of temperature for the 59 day period in Figure 9.

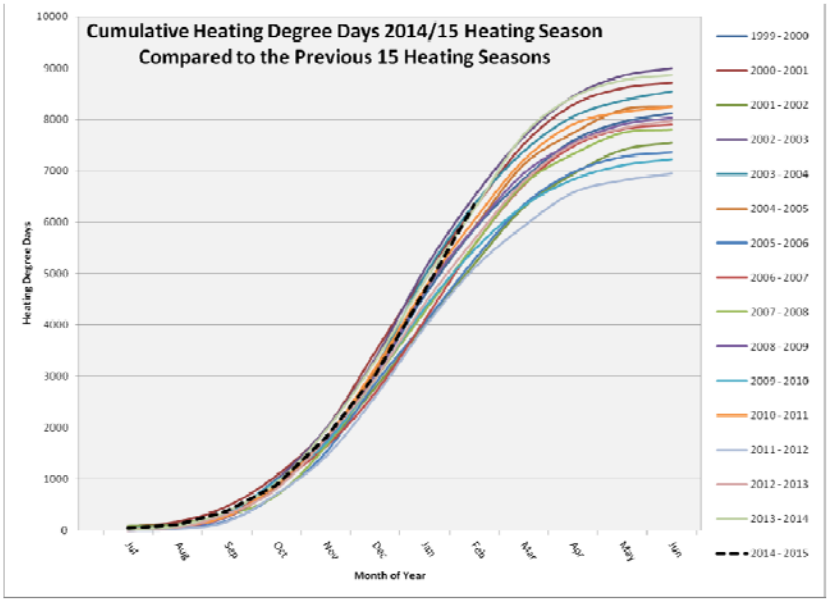

Figure 8 Cumulative Heating Degree Days for Current Heating Season (to date) and Previous fifteen

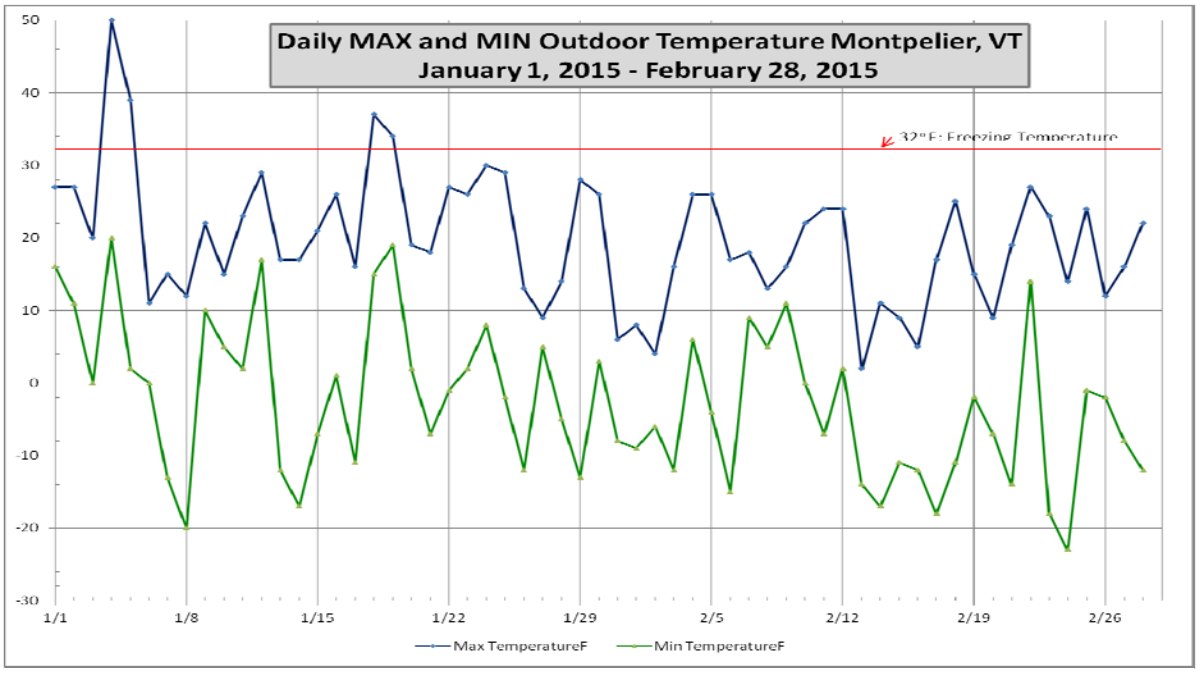

Figure 9 Daily Maximum and Minimum outdoor air temperature, January and February, 2015

To meet the heating needs of the City and State connected load, the central heat plant fuel consumption included 4,819.9 tons of wood chips and 27,503 gallons of fuel oil between October 1, 2014 and

February 28, 2015. Consumption of wood chips by month on a weight basis is presented in Table 5 and on an estimated heat input basis in Table 6:

Table 5. Central Heat Plant Wood Chip Consumption by Month and Boiler, tons			
Month	**Boiler #1**	**Boiler #2**	**Total**
October	61.50	92.26	153.76
November	572.26	37.00	609.26
December	245.60	777.56	1,023.16
January	736.97	824.41	1,561.38
February	677.29	795.07	1,472.36
TOTAL	2,293.62	2,526.30	4,819.92

Table 6. Central Heat Plant Wood Chip Consumption by Month and Boiler, MMBTUs (est. Heat Input)			
Month	**Boiler #1**	**Boiler #2**	**Total**
October	473.55	710.40	1,183.95
November	4,406.41	284.90	4,691.30
December	1,891.12	5,987.21	7,878.33
January	5674.7	6,348.0	12,022.6
February	5,215.1	6,122.0	11,337.2
TOTAL	17,660.9	19,452.5	37,113.4

Fuel oil is used during those periods when the load is not sufficient enough to operate the biomass boilers efficiently, or used for load stabilization, or as a back-up heat source. With October being warmer than usual, 64% of the fuel oil consumed was consumed in October as it was too warm to operate the wood-fired boiler efficiently.

Historical fuel oil consumption by the central heat plant to service the Capitol Complex has been identified as 186,000 gallons per year. Data collected for the buildings which elected to be served by DHM identified that typical annual fuel oil consumption summed to an estimated 150,000 gallons. Accounting for the continued use of fuel oil for light season loads at the central heat plant, back-up operation and thermal energy that the City of Montpelier will provide from boilers located at City Hall for periods when the central heat plant is unavailable, it is estimated that some 300,000 gallons of fuel oil will be replaced annually with local renewable biomass.

Conclusion

The heating demands of the 2014-2015 Heating Season to date have been a good test of system operations. Throughout this Heating Season the State of Vermont's re-built central heating plant and the City of Montpelier's district heat system have met all heating challenges. The systems performed as designed and proved to be a source of reliable renewable heat to the served buildings.

Table 7. Project Objectives and Accomplishments	
Project Objective	**Accomplishment**
Design and construct a state of the art biomass-fueled district energy system that will provide clean, efficient production of renewable, sustainable, biomass energy for heat and electric power for Montpelier's downtown buildings.	A state of the art biomass-fueled district energy system which is a source of clean efficient renewable heat from sustainable forest wood was built and is in operation. The facility is fitted with capacity to co-generate electricity when it is shown to be economically feasible.
This system will be:	
o Designed and built in partnership with the State of Vermont, the Biomass Energy Resource Center and Veolia Energy;	The facility was built in partnership with the State of Vermont. The Biomass Energy Resource Center played a technical support role early in project development, and Veolia Energy completed a feasibility study. As the project advanced, the capacity within the City and the State were sufficient to see the project to fruition.
o Complementary of the existing, but dated, system that currently provides the State Complex with heat;	The built system is complementary to the system which existed to heat the State Complex (Capitol Complex).
o Constructed with state of the art technology and equipment to maximize efficiency, minimize emissions, and ensure long-term system durability;	The central heat plant is a state of the art biomass heat plant, with modern efficient and well controlled boilers. Each boiler is fitted with state of art Electrostatic Precipitators (ESPs) for stack gas clean-up. The City of Montpelier's district heat system was constructed with the most advanced insulated pipe system. This highly insulated pipe installed with advanced construction techniques and operated with corrosion protection is engineered to be a very long lived and durable system.
o Constructed and implemented in compliance with all permits and with processes and systems that are verified and documented during construction, start-up, and commissioning in order to ensure quality, and allow for ease of replication in other communities.	The facility obtained all required local, state and federal permits and completed all required assessments in support of these permits. The boilers were emissions tested in March 2014 and documented to have emissions much less than the applicable emission standard. On a net basis, the larger new central heat plant replacing the older existing central heat plant and the individual boilers/furnaces at buildings connected to the City's distribution system result in less health threatening emissions being emitted in the local air-shed. The project is well documented and City representatives have presented the project at national meetings and frequently respond to inquiries from interested communities.

Table 7. Project Objectives and Accomplishments… continued	
Project Objective	**Accomplishment**
To implement a seamless delivery and financing system that encourages property owners to undergo energy retrofits, and install renewable energy technologies where appropriate, so that by 2015: o 50% of Montpelier's homes will have implemented deep energy retrofits; o 50% of the buildings in the designated downtown will have undergone energy retrofits and be positioned to make maximum use of the district energy system; o Property owners seeking to install renewable energy technologies will have access to financing that can be repaid on their property tax bills. o State energy legislation in 2009 authorized a minimum of $100,000 toward district energy system connection fees for businesses and homeowners	Summary statistics are not currently available as to the number of deep retrofits completed to date. Building energy retrofits are very active and several initiatives are ongoing. The Vermont Legislature did pass legislation which allows towns and cities in Vermont to adopt programs that allows repayment of energy retrofits through an assessment on their property tax (Property Assessed Clean Energy; PACE). The City of Montpelier did amend its City Charter authorizing a PACE program, and the program has been developed. The adopted legislation allows for one statewide entity to provide the 'back-room' services necessary to run a PACE program (Vermont Energy Investment Corp.; VEIC). A State Program, known as the Village Green program, did authorize $100,000 to incent connection to a district heat system. The City of Montpelier did apply to the Village Green Program for $100,000 to incent connections to its system and was successful in receiving the $100,000. The funds were used to cover the cost that customers would have to have paid for a thermal metering system in connecting to the district heat system. This provided an important incentive to those connecting and at the same time yield high quality consistent data on energy consumption by customers.

Summary of Project Activities/Project Chronology

The award to the City of Montpelier was granted January 21, 2010, and the period of the grant ended December 31, 2015.

FFY 2010 Q3
1 April 2010- 30 June 2010

Highlights—

- Developed and issued an RFP for Project Management services
- Received feasibility study of expanding the State of Vermont's central heat plant and the construction of a downtown Montpelier hot water heat distribution system
- Developed and issued an RFP for services to complete NEPA Environmental Assessment
- Commence Environmental Assessment

Details --

The DOE project award was made on January 21, 2010. The award was structured into two budget periods. Budget Period one was an evaluative phase, leading to a Go/No Go decision. Budget Period 2 was for the anticipated Go decision.

An RFP was developed and issued seeking proposals for project management services. Responses to the request were reviewed by a committee composed on community members who had been involved with energy matters, City staff and a member of the Montpelier City Council. After review and scoring of the submitted proposals the committee invited the top candidates to interview. The successful entity was Energy & Environmental Analytics.

A feasibility report providing the results of studying the technical and financial feasibility of expanding the existing State of Vermont's existing central heat plant and adding a hot water thermal energy distribution system into the Montpelier downtown area was received from Veolia Energy. The report identified that it was feasible to rebuild the existing site with two 20.1 MMBTUH wood-fired boilers to support providing heat to 17 state buildings of the Capitol Complex that currently receive their heat for the State's central heat plant, along with an estimated 220,000 ft^2 of municipal buildings and have capacity for additional growth. The report further identified permitting requirements to build such a facility and a planning level assessment of the forest resource in the immediate area to support fueling this sized facility.

As the project is the recipient of major federal grant, an Environmental Assessment (EA) is required under the National Environmental Protection Act (NEPA). To complete this assessment an RFP was developed and issued to secure a firm to complete the necessary evaluations. An RFP was developed identifying the necessary services and issued for public competitive bid. The responses received were reviewed by a team whose members were city staff (planning and public works department), representatives from a citizen advisory group and the project manager. The committee scored the proposals received and invited representatives of the top scored proposals to interview. The result of

the team review was to recommend to the Montpelier City Council to award a contract to Dubois & King to complete the EA. The City Council accepted the team's recommendation on May 26, 2010 and a contract issued on June 1, 2010.

FFY 2010 Q4
1 July 2010- 30 September 2010

Highlights –

- Feasibility study recommends phasing district heat development
- EA underway
- DOE site visit
- Section 106 Review Completed
- RFP for Project Design/Build Developed
- City Charter amendments Proposed
- Citizen advisory committee formed

Details --

Further study of the feasibility report concluded that phasing the development of the distribution system was a sound way to bring district heat to downtown Montpelier. The first phase would be the existing buildings of the Capitol Complex plus key municipal buildings. It was estimated that this would represent about 32.6 MMBTUHs of the 40.2 MMBTUHs the two 600 boiler horsepower (BHP) would represent.

The EA was well underway. To obtain comments on the scope of the EA a public meeting was held on August 3, 2010. Additionally letters were sent to potentially interested local, state and Federal agencies, including the Governor of Vermont, Vermont Division of Historic Preservation, U.S. Fish and Wildlife Service, U.S. Forest Service, Vermont Agency of Natural Resources, and other public entities. The letter was also published on the DOE website. As the Quarter closed a first draft of the EA document was provided to DOE.

On August 3, 2010, DOE Project Manager, Jason Randall, performed a site visit. The site visit afforded the DOE Project Manager the opportunity to meet representatives of the major partner to the Project - the State of Vermont - to see the existing heat plant that would be replaced, to walk the potential route of the district heat system and conduct the public meeting on the EA. These first-hand experiences provided the Project Manager with a more complete understanding of the project, a context to understanding technical and programmatic issues that may arise, and to have a working relationship with key personnel involved with project development.

The City of Montpelier has a designated historic district on the National Register. This designated district contains the state Capitol Complex, in which the existing state boiler plant is located. As such a Historic Buildings Evaluation Report was completed in accordance with the standards set forth in 36 C.F.R. 800, regulations established by the Advisory Council on Historic Preservation to implement Section 106 of the

National Historic Preservation Act. The existing boiler plant is considered a contributing structure, where the boiler plant stack is considered an historic structure. The evaluation concluded that demolition of the existing boiler plant is justified as it has outlived its useful life, that it is unsafe as the current boilers are located below flood level, that the site will retain its historic function, the existing chimney would be retained, and a new facility would be designed to be compatible with the surrounding historic resources.

The evaluation did make the following recommendations:

1) Develop a Memorandum of Agreement (MOA) between the City, the Department of Energy and the Division for Historic Preservation (SHPO) that will outline the recommended treatment to handle the adverse effect that will result from demolition of the historic Boiler Plant. The MOA will define the process for moving forward with the Project.

2) Photographic Documentation Report as a record of the past. Prior to demolition of the Boiler Plant, the historic building will be documented following procedures adopted by the Vermont Division for Historic Preservation titled *Photographic Documentation Requirements for Historic Structures*. The documentation must be undertaken by or under the supervision of a qualified historic preservation consultant. And that the photographs will be deposited in the Vermont Historical Society with a copy provided to the SHPO.

3) Retain and reuse the chimney that is currently in use and maintained.

4) Define design guidelines for the new biomass facility to assure the facility will comply with *The Secretary's Standards* as a compatible new resource in the Montpelier Historic District.

In accordance with the recommendation of the Historic Buildings Evaluation Report, a Memorandum of Agreement was drafted among the State Historic Preservation Office, the DOE, the City of Montpelier and the State of Vermont.

A performance based Design/Build Request For Proposal (RFP) to design and construct the heat plant and hot water distribution system was developed and released to solicit proposals to acquire services to design and build the Montpelier Community Renewable District Energy Project. Respondents would need to put together a team of firms with full service capabilities to design the facilities, obtain necessary permits and build the facilities to meet the desired objectives of the project.

The structure of the RFP required proposes to respond to a "base bid" specified in the RFP and then allowed for respondents to provide alternative(s) that they believe, and could document, would achieve the outcomes specified with superior characteristics of cost and efficiency.

The RFP was publically released on August 5, 2010. On August 19, 2010, a bid meeting was conducted. During this meeting the project site was walked and questions from potential bidders received. The period to ask questions on the RFP was left open until August 23, 2010. On August 25, 2010 responses to the questions received during the bidders meeting and the question period were posted on the City's web site.

In the RFP released on August 5, responses to the RFP were due September 22, 2010. As work continued on project development after release of the RFP staff decided to separate the community vote of needed amendments to the Montpelier City Charter from the vote of the financing of the facility. The plan had been to have both these issues voted on November 2, 2010. The amendments to the City's Charter are necessary for the City to own/operate an energy facility (much like the City's Charter authorizes them to own/operate sewer and water facilities; see following section). And the original goal was to vote the financing before the end of the year in order to obtain special low interest bonds authorized by the American Recovery and Reinvestment Act which expire on December 31, 2010. Discussions with the Vermont Bond Bank concluded that there would not be sufficient time from November 3, 2010 and the end of the year to process an application and have access to the low interest bonds. Given this finding, it was decided to vote the charter changes on November 2, 2010 and schedule a vote of the financing on Town Meeting Day which occurs March 1, 2011.

With the vote on financing re-scheduled to March 1, 2011, the date for returns to the RFP was extended. This provided bidders more time to complete their responses. The bid response date was extended to October 20, 2010. This decision, the reasons for it and other technical amendments to the RFP was issued on September 2, 2010.

Vermont is not a "Home Rule" state. All municipalities are "creatures" of the State. State statute provides the authority for municipalities to exist. For those municipalities that wish authorities beyond that provided in statute, a Charter must be developed, adopted by the community and approved by the Vermont Legislature.

The City of Montpelier, as most larger municipalities in Vermont, has a City Charter. The Montpelier Charter provides, among other things, the City with the authority to operate a sewer plant, a water supply treatment plant and water supply distribution system. The district energy plant was found to have many similarities to that of a sewer or water plant, as a matter of enabling authority, and therefore the matter of the City owning/operating a district energy plant was integrated as an extension of the sewer and water authorities. The charter amendments also included authorization for the City to operate a PACE program.

A change to the City Charter was discussed with the Montpelier City Council on July 28, 2010. The Council voted to conduct public hearings and place the item on the November 2, 2010 ballot. The first of two public hearings was conducted by the City Council on September 8, 2010. The second public hearing was held on September 22, 2010.

To ensure community understanding and engagement of the project, a citizen advisory committee was formed (Montpelier Energy Advisory Committee, MEAC). The committee is made up of interested citizens from the community at large. The committee was authorized by the Montpelier City Council and was tasked to advise the Council on energy matters, including the district heating project. The Council believed that a citizen advisory committee would be an efficient and effective means to ensuring that the community at-large had a means to be involved with the development of important energy

initiatives. Committee meetings would be a forum for objective and thoughtful dialogue on projects. The committee first met on September 21, 2010.

The current boiler plant is owned by the State of Vermont. It is operated by the Division of Buildings and General Services (BGS). The Montpelier Community Renewable District Energy Project is a partnership of the City of Montpelier and the State of Vermont. In the project, the services of the current boiler plant would be maintained, and capacity would be provided to heat city buildings – growth capacity would be provided for both. To ensure the coordination of project development, weekly meetings were initiated between city and state representatives.

FFY 2011 Q1
1 October 2010- 31 December 2010

Highlights –

- Community votes charter changes
- Responses to Design/Build RFP received
- Integration of city and state analyses
- EA nearly complete

Details --

The changes to the Montpelier City Charter providing the City with the authority to operate a thermal utility and PACE program went before before the voters on November 2, 2010. The article received overwhelming support, passing 2,826 to 755. Following the successful outcome of the community vote, the charter changes were submitted to the Vermont State Legislature for their consideration and approval on November 17, 2010.

Responses to the Design/Build RFP were due October 20, 2010. Three proposals were received. A review team was assembled to review the proposals. The team was made up of members of city staff (planning and public works departments), the State of Vermont, technical consultant to the city, and the citizen advisory group. At the close of the quarter, reviews of the proposal was under continuous active review with the understanding that the teams of bidders had made excellent proposals, however the costs of the proposals were of a cost that exceeded planning expectation and a means to explore ways to reduce costs needed to be explored.

As this project represents a unique city-state relationship, weekly meetings were being held between city and staff to develop the details of the project and move it forward. A high level of coordination is essential as each party has a legislative body to report to and many institutional processes that need to be adhered to. These requirements and obligations are in addition to the federal processes that guide and govern a DOE grant.

Much work was completed on the EA during the Quarter. However the Design/Build RFP process identified some important siting issues and issues of governance between the city and the state as well as a potential appearance of a conflict of interest, as one of the RFP respondents included a team

member of the firm that was completing the EA. The conclusion of these considerations was to continue work on the Historic Preservation (sec. 106) elements of the EA and address governance and appearance of conflict of interest before making any additional decisions on the project.

FFY 2011 Q2
1 January 2011- 31 March 2011

Highlights –

- Project Governance Decided
- Technical Design Advances
- Initial Financial Analysis of Montpelier Thermal Utility complete
- Sec. 106 process

Details –

As the project has developed, various owner/operator models were considered. These ranged from City own/operate the heat plant and distribution systems, State own/operate the heat plant and distribution systems and a Third Party own/operate the heat plant and distribution systems. During this Quarter the State of Vermont concluded that it does not wish to relinquish owner/operation of the heat plant, regardless of what compensation or arrangements for providing heat in the future might be. Based on this, it was further decided that the project would be developed with the State retaining ownership of the heat plant, modifying it to supply heat to not only its current distribution system, but to the City developed hot water distribution system. The City would develop and operate the new hot water distribution system to serve downtown Montpelier.

This decision settled the owner/operator model and allowed the project to begin to establish governance roles and terms of reference for project development and ultimately operation. The initial division of technical responsibilities has the State responsible for developing the reconfigured heat plant. This heat plant would provide thermal energy of stated specifications to a City developed/operated distribution system.

With governance decided, the State of Vermont included $7 million for rebuilding the central heat plant into its Capital Bill (the legislation authorizing the state to complete capital projects). Also, with governance decided an initial draft financial analysis of a city thermal utility was completed. The general conclusion of the analysis was that the cost of energy would be greater in the near term, but less expensive in the long term, with an estimate of the savings having a net present value (NPV) of $477,426 over twenty years of operation. A critical element of the analysis was identified as the future price of fuel oil.

During the Quarter a final draft of a MOU that would be signed by the stakeholders to the Sec. 106 process was distributed.

FFY 2011 Q3
1 April 2011- 30 June 2011

Highlights –

- City Charter Amendments Finalized
- Montpelier Special Election
- Proposed FONSI Released
- State of Vermont Capital Bill passed
- City and State Enter into MOU
- Sec. 106 MOU Signed
- Worked Began on Budget Period II

Details –

In November 2010, the City of Montpelier proposed amendments to its City Charter that would authorize the City to own, operate and deliver thermal energy services and create and an energy improvement district (Property Assessed Clean Energy, PACE Program). The proposal received the requisite community support. The Charter amendment was submitted to the Vermont State Legislature as House Bill H. 294 on February 22, 2011. On May 6, 2011, Vermont Governor Shumlin signed into law Act M-006, an Act amending the Montpelier City Charter providing authority to the City to operate a district heating system and creating an energy improvement special assessment district.

On April 27th, the Montpelier City Council voted to set a community vote on June 14, 2011 for bonding authority to develop the district heating project. The specific wording of the ballot item to be put before the community was set at a Special City Council meeting held on May 11, 2011.

On June 14, 2011 the City of Montpelier held a special community election. The purpose of the community vote was to authorize bonding authority up to $2.75M toward the development of the Capital City District Heating Project. The bonding authority successfully passed with a vote 963 Yes to 609 No.

The Department of Energy completed the draft Environmental Assessment on the project. The document proposing a Finding of No Significant Impact (FONSI) was released on May 19, 2011. On July 7, 2011 DOE issued the final FONSI.

On May 20, 2011 Governor Shumlin signed into law Act 40, an Act providing $7M of State capital funds toward the development of the District Heat Plant. On June 9, 2011 The City of Montpelier and the State of Vermont entered into the MOU specified in Act 40. The MOU sets out the broad terms of the City-State relationship of the Capital City District Heating Project.

A Memorandum of Agreement (MOA) on the matter historic preservation has been under development since the issue was first identifies as part of the EA process. On June 20, 2011 the MOA was finalized among the DOE, the City of Montpelier, the State of Vermont Department of Buildings and General Services, and the Vermont Department of Historic Preservation.

The SOPO identified two Budget Periods (I and II), with the following “stage gates” for advancing from Budget Period I to Budget Period II;

- Completion of an EA supporting a decision of a Finding of No Significant Impact;
- Completion of a MOA on the matter of Historic Preservation; and
- A successful community bond vote

The "stage gate" criteria were met and therefore the project can advance to a "Go" decision. With this decision, work commenced on developing the documents necessary for DOE to authorize Budget Period II.

FFY 2011 Q4
1 July 2011- 30 September 2011

Highlights –

- Budget Period II Authorized
- City-State Relations
- Final Design Services for City Heat Distribution System
- State Boiler System Rebuild RFP

Details –

With the Stage Gate requirements met during FFY11 Quarter 2 and materials to support a request for DOE to authorize Budget Period II were developed, submitted and accepted during this Quarter. On September 28, 2011, DOE notified the City that Budget Period II was authorized.

As part of Budget Period II deliberations with DOE, DOE indicated because of the amounts of funds the State, through its Division of Buildings and General Services, will be receiving for the construction of the central heat plant for the City and State, it is appropriate for the State to be a sub-recipient to the DOE grant for which the City is the recipient. This necessitated the development of a "sub-recipient agreement" between the City (Recipient) and the State (Sub-Recipient).

Over the course of this Quarter several meetings were held to develop the content of an agreement and several drafts of a proposed agreement were exchanged between the parties. In the course of developing the Sub-recipient agreement, it was identified that two other agreements were necessary for the parties to develop. One would address the supply and sale of energy from the State to the City. The others would address that portion of the central heat's plants capacity for which the City would have a right to and how the City could acquire additional future capacity. As with the Recipient/Sub-Recipient agreement, meetings were held during the Quarter to discuss the content of these agreements and drafts exchanged.

To acquire services for final design of the City's distribution system, an RFP was developed by the City to acquire these services through an open competitive bid process. On July 15, 2011 the release of an RFP was authorized by the Montpelier City Council, with a response date of August 12, 2011. A Bidder's meeting was conducted on July 22, 2011 and responses to questions received at the Bidder's meeting responded to on July 24, 2011. Among the questions and informational requests from the Bidder's was a request to provide greater time to develop responses to the RFP. In consideration of the request, the due date for responses was extended to September 9, 2011.

In response to the RFP seven proposals were received. All proposals were comprised of engineering teams. A review team comprised of technical experts, content specialists and community members was assembled to review the received proposals. The review team reviewed the proposals and identified the top 3 responses and invited those respondents to interview. Interviews were conducted between September 30 and October 4, 2011. After review of references and previous projects, the review team deliberated on the body of information compiled and recommended to the City Council to engage the Hallam-ICS lead team on October 12, 2011.

As the State of Vermont through its Department of Buildings and General Services is the lead on the redeveloping the central heat plant, an RFP for the Design and Supply of Two Biomass Boilers & All Associated Equipment was released by BGS on September 9, 2011, with a response date of October 12, 2011.

FFY 2012 Q1
1 October 2011- 31 December 2011

Highlights –

- City-State Relations
- State Boiler System Rebuild RFP
- Project Permitting

Details –

The vast majority of project activities during this quarter were in support of developing the agreements between the City and the State. These agreements include a “sub-recipient agreement” between the City (Recipient) and the State (Sub-Recipient), an agreement that would address the supply and sale of energy and sale of additional capacity from the State to the City and an agreement that addresses the initial capacity assignments of the heat plant.

Two bids were received by the State of Vermont for the re-build of the central heat plant, and these bids were processed through the State’s contract review procedures. However, the State received a protest from an entity challenging the pre-qualification process used. The entity was one of the twenty-two entities reviewed during the pre-qualification process. The State followed the guidelines of its bid review process and determined that the bid process for the boilers was in line with State procurement procedures as outlined in Administrative Bulletin 3.5.

The technical review of the two bids that were received concluded that both submissions were technically deficient. The bidders were notified that their submissions were deficient, and no further review would be conducted. The boiler RFP would be re-issued in the next Quarter.

Permitting requirements for the City distribution system were the responsibility of the City and those of the central heat plant the responsibility of BGS. BGS retained the services of EverGreen Environmental Health & Safety, Inc.

FFY 2012 Q2
1 January 2012- 31 March 2012

Highlights –

- City-State Relations
- Final Design for City Heat Distribution System
- State Boiler System RFP

Details –

On January 23, 2012 the City and State entered into three agreements: a Sub-Recipient Agreement, a Thermal Energy Purchase and Sales Agreement, and a Procurement Agreement.

On February 23, 2012 Hallam-ICS on behalf of the City's Final System Design Team submitted a Basis Of Design (BOD) document. The BOD sets the specifications upon which the final design of the thermal energy distribution system will be based.

The system design engineering team concluded that the most technically advanced and best performing thermal energy system is one based on the European EN253 Standard. This is a thin walled pre-insulated pipe system designed for direct burial. The use of the system required a waiver of ARRA provisions. An application was developed documenting the reasons a waiver is justified, and submitted it to DOE. A waiver was granted on March 27, 2012.

The RFP for the new expanded boiler system was re-released on January 13, 2012. The RFP identified a due date of February 16, 2012.

FFY 2012 Q3
1 April 2012- 30 June 2012

Highlights –

- Final Design Services for City Heat Distribution System, route selected
- State Boiler System RFP, review concluded

Details –

A route was selected for the City's hot water distribution system. With this, work began on a route survey to support piping design and construction. A timeline was identified that had final design begin May, 2014 and construction completed October 2013.

A review team completed a technical review of the proposal received for the boiler train system. The proposal reviews included site visits to representative facilities in addition to technical review and scoring of the technical specifications and designs submitted. The review recommended to the Commission of Buildings and General Services that the proposal presented by AFS Corporation was the superior proposal.

FFY 2012 Q4
1 July 2012- 30 September 2012

Highlights –

- City Heat Distribution System: 80% Final Design Received
- City Council Authorizes Project to Advertise For Construction Contractor
- Third Party Review of City's Financial Model Completed
- Progress made on identifying buildings that would connect to City System
- Purchase order issued for State Boiler Train System
- State selects form for construction management

Details –

The 80% final design and cost estimates where received on August 17, 2012. The information brought forward the 80% cost estimates of $4,115,914.

Comments received from the engineering review were provided to the design engineering team for incorporation into the 100% Final Design. Final Design (draft) was completed on September 28, 2012. This technical package was reviewed with Montpelier Department of Public Works staff to review the subsurface environment to capture the institutional knowledge of those details that long term staff carries. With this input the drawings and specification of the 100% Design was finalized and posted for bid on October 3, 2102.

On August 29, 2012 the Montpelier City Council authorized the project to advertise for construction bids. This 5-1 vote came after a 4-3 vote which defeated a similar measure on August 22, 2012. The issues for the Council were: project timing, boiler size selection and relationship issues with the State of Vermont. Between the August 22, 2012 vote and the August 29, 2012 vote, several meetings were held between the parties to address and resolve the issues satisfactorily.

As a quality assurance check, an independent review of the financial viability of the thermal utility the City proposed was contracted for. A contractor was acquired to review the financial model the City had developed and was using to guide project development was conducted. The review concluded that the methods and data the City used is consistent with general utility analysis practices.

To develop a detailed understanding of the technical issues that might be associated with connecting non-city buildings to the distribution system, site visits of the buildings whose owners had indicated an interest in connecting to the systems was completed. These site visits collected detailed data as the type and size of the current heating system, fuel type and consumption, and identifying unusual issues of providing service laterals to the building. The detailed data collected during these visits informed the development of the Model Customer Agreement and the Connection Guidelines.

Customers are being asked to enter into long term service agreements with the City for the supply of thermal energy. This follows the long term agreement that the City and State have entered into for the State to supply thermal energy to the City. The customer agreements set the terms and conditions of the City providing service, and the responsibilities of the customers in receiving service.

To provide a standard for connection to the mains of the distribution system, a guideline document was developed. This document will guide connections to the mains and will be provided to all connecting customers to the system. The Guideline will also be made available to local plumbers and heating contractors. It is planned that training based on this document will be developed and presented to aid in creating an institutional capacity to support district heat.

The final Purchase Order was issued to the boiler vendor. The boiler vendor was released to prepare detailed engineering calculations and drawings for review by the State and for permitting application purposes.

The State released an RFP for construction management (CM) services for the facility to house the boilers. Six responses were received to the CM RFP. Three of these responses were disqualified by BGS. The RFP review committee reviewed the proposals and made a recommendation to the Commissioner of BGS for selection of Engelberth Construction Inc. as the construction manager.

FFY 2013 Q1
1 October 2012- 31 December 2012

Highlights –

- Construction authorized for City heat distribution system
- EA updated
- Storm Water Permit received
- Master Customer Agreement developed
- State Boiler System: drawings received
- State Boiler System: Permitting Update

Details –

During the Quarter the distribution system design and specifications were finalized. Based on the final design and specifications a RFP to construct the system was developed and noticed on October 5, 2012. The original due date of November 1, 2012 was extended to November 5th because of the disruptive effects of Hurricane Sandy throughout the region.

The bids received were reviewed and at the November 28, 2012 City Council meeting a recommendation was presented to proceed with the project. The City Council Meeting voted 5 to 1 to proceed with the project and the vote authorized the City Manager to enter into a contract with Kingsbury Construction Company to construct the distribution system. On December 28, 2012 a contract was entered into to build the system.

The NEPA FONSI was based on the preliminary project design. As project details have been finalized a review of the final design to the proposed designed identified changes worthy of review to determine if these changes are sufficient to justify developing a supplemental analysis to the original Environmental Assessment. The changes from the preliminary project do not alter the capacity of the biomass fueled boilers that will be installed, nor the amount of load connected to the central heat plant. Details of the project that have changed is that the emission control system will be an electrostatic precipitators rather than the anticipated fabric filters (the particulate matter emissions control performance will be identical), the building footprint will be based on the actual boilers selected rather than generic boilers

and while the boilers remain capable of generating electricity through the production of high pressure steam condensate and the building sized to house the necessary equipment, the most recent economic analysis of electric generation did not justify installation of that equipment at this time. Further, the building design originally envisioned razing the current boiler house, while the final design builds upon the current building. For the distribution system, the final design sets the western leg to a future expansion of the system and replaces the load that the western leg would have supported with additional load on the eastern leg, such as to maintain an equivalent design load on the system. While the preliminary routing of the underground piping was completely in the City's Right of Way, the final routing travels in three areas that are not. These areas are all disturbed areas where existing utilities run in parking lots or the like. As the razing of the current boiler house is specifically identified in the Memorandum of Agreement with Vermont Division of Historic Preservation (VDHP), the final design that incorporates the existing building into the redeveloped boiler house was reviewed with VDHP. They have no objection to the final design and a letter circulated to the signatories for their affirmation of the MOA accepting this change.

The City applied for and received the one state permit required by the construction of the distribution system. It is Construction General Permit under the Departmental of Environmental Conservations Storm Water Program.

A master Customer Agreement was developed during the quarter. This document sets out the terms of service from the district heat project to buildings along the route. The basic agreement has the City's contractor constructing the Service Lateral with the customer paying for that construction ('connection'); the customers are responsible for conversion of their building's heating system ('conversion'); and the customers pay for the thermal metering system. The customer and the Project benefits from having all the underground piping installed by one contractor and the City bid the heat exchanger units and thermal metering system separately so as to control the quality of these items, while obtaining the best price through bulk purchase.

The boiler vendor delivered several detailed drawings for the State engineering team's review and comment. Some of these detailed drawings were used in the permit applications. The boiler system vendor was released to commence manufacture of large equipment with a long lead time.

The State environmental permitting team completed permit application filings with the appropriate State agencies as a precursor to the State land use permit filing. A final meeting was held with the Capitol Complex Commission in which final approval for the building design was received from the Commission.

On December 28, 2012, the State of Vermont Department of Environmental Conservation released for public review a proposed draft Air Quality Control Permit. The action proposed approval of construction under the Vermont Air Pollution Control Regulations. On January 9, 2013, a final permit was issued.

FFY 2013 Q2
1 January 2013- 31 March 2013

Highlights –

- City Council meeting hears of higher costs to rebuild boiler plant
- City places order for district heat piping

- Community votes bond to connect Union School to DHM
- Customer webpage developed

Details –

The Montpelier City Council conducted a special meeting on February 7, 2013 to receive a report from the State of Vermont Buildings and General Services Division on the status of the central heat plant project. Commission Obuchowski reported to the Montpelier City Council that the central heat plant project was $2.3M over budget (later increased to $3.3M), bringing the current estimate to develop the heat plant to $18.1M (later to $20.2M). The State argued that the City share should be 24% of the cost overrun, as that is the portion of the plant's capacity dedicated to support the City's District Heat System. The City Council's retort was that was not the case as language regarding cost overrun that would have provided for such formulation was explicitly removed from the agreement and replaced with alternative language to address the potential of cost overruns. Talks continued and an agreement in principle was reached that there would be a reconciliation process after construction when actual costs are known: any surpluses would be applied to the overruns and the City would consider increasing the payment for future capacity it may want to acquire from the plant.

The distribution system piping is a specialty item. The manufacturer identified the pipe as an eight week delivery item; assuming no upsets in the production and delivery system. To ensure adequate time for manufacture and delivery the strategy was to place a main order of known components and then to place a supplemental order for any additional components that would be needed. This approach allowed production to begin and items added without compromising the anticipated delivery date. The initial pipe order consisting of the mainline and signed customers was placed on January 15, 2013. A supplemental order to cover the piping needs of addition customers that signed after that date was placed on February 15, 2013.

The cost of connecting Union Elementary School (UES), the largest customer to the District Heat System, was incorporated into a general obligation bond for overall school building improvements. The bond, totaling $2.3M, was a ballot item before the community on Town Meeting Day March 5, 2013. The ballot item passed with a vote of 1401 Yes and 875 No.

To support customers to the system, a webpage on the City website was developed. The page contains information useful to customers. It will be updated to remain current. It should be a useful and efficient way to provide information to customers.

FFY 2013 Q3
1 April 2013- 30 June 2013

Highlights –

- Construction on City district heat system commences
- Sec. 106 photo documentation of existing heat plant completed
- Central heat plant construction RFPs issued and contracts awarded

Details –

On April 17 2013, ground was broken for construction of the thermal energy distribution system that will serve the core of downtown Montpelier. Construction would occur over the course of the summer, with the goal of substantial completion by October 1, 2013 – the start of the Heating Season.

Groundbreaking for the City of Montpelier's thermal energy distribution system

Stipulation 1 of the Memorandum of Understanding between the Department of Energy and Vermont State Historic Preservation Officer regarding historic preservation identified that the City of Montpelier would complete photo documentation of the existing State Boiler Plant prior to demolition of the building. A final photo documentation report was filed with the Vermont State Historic Preservation Officer on May 14, 2013.

During the Quarter, a package of RFPs which included the architectural and mechanical scopes, installation of the boiler and chip delivery system and the electrical and fire protection system for the building that would be the rebuilt central heat plant were released, responses received and contracts awarded by BGS.

FFY 2013 Q4
1 July 2013- 30 September 2013

Highlights –

- Construction of District Heat Montpelier continues
- City staff visits District Heat St. Paul
- Revised construction schedule issued by BGS

Details –

Construction which began in April continued through the Quarter. Many construction challenges were encountered including underground utilities that were not as mapped in the design process, underground utilities that were not included as a matter of record (these were mostly communication utilities) and a particularly extended period of heavy rain. The project schedule had called for substantial completion by October 1, 2013. Overcoming the challenges and the delay of weather moved the projection of substantial completion to the end

District heat piping service to 15 East State Street being installed

of October/beginning of November.

A team of Montpelier staff comprised of the City Manager, Assistant City Manager, and department heads of Finance and Public Works traveled to St. Paul MN for training in developing a thermal utility management plan and operations of a central heat system from the operators of District Heat St. Paul. The trip was very productive and strengthened the communication between the City and District Heat St. Paul. District Heat St. Paul has operated a district heat system for over thirty years and has been providing technical support to the City as it brings on its district heat system.

While construction progressed on the central heating plant (biomass boilers and ESPs received and set on their foundations), a revised schedule for the central heat plant was issued. Activities are progressing behind schedule. This revised schedule has the plant achieving initial start-up January/February 2014. As this would be well into the Heating Season, BGS arranged for and had installed a temporary boiler.

District heat piping to serve municipal complex being installed

FFY 2014 Q1
1 October 2013- 31 December 2013

Highlights –

- City achieves substantial completion on heat distribution system
- City decides to operate “mini-system”
- Steam to hot water heat exchanger received at central heat plant
- Construction continues on central heat plant
- U. S. Senator Sanders visits project

Details –

On December 6, 2013 the initial flowing of heat occurred in the City’s district heating system. Over the seven and one half month period, approximately some 8,000 feet of pipe was installed in approximately 4,000 feet of trench designed to distribute hot water to heat some twenty-one buildings that will eventually be connected to the system.

As the central heat plant is not completed and available to provide heat to the City’s distribution system, the City decided to operate a ‘mini-system’ until such time that the central heat plant could support the entire distribution system. The idea of the mini-system was to accomplish three things: 1) operate the completed distribution system rather than let it remain idle over the winter (this


Site preparations for central heat plant re-build

represented a number of risks), 2) demonstrate the functionality of the system and identify to the contractor any deficiencies in constructions, and 3) provide a 'soft launch' to the City's thermal utility – thereby introducing the City to this new enterprise with a limited number of customers, allowing it build-out the necessary infrastructure of customer service and billing in a manageable way.

Buildings considered for service by the mini-system were public buildings along with a limited number of private buildings that had completed their interior building heating system work and could go off-line and heat by themselves should problems arise during initial start-up of the system or during period when there would not be sufficient capacity provided by the City Hall boilers to carry the load.
The buildings that constituted the mini-system were:

City Hall
Fire Station
Police Station
Union Elementary School
FairPoint Communications
Vermont Mutual Insurance Companies

Initial heat was provided to City Hall, Fire Station, and Police Station on December 6, 2013. Union Elementary School was added on December 19, 2013. Vermont Mutual was initially added on December 30. As of the end of the Quarter, FairPoint Communications was not added until the next Quarter as final work needed to be completed within the building to accept the heat.

"City Room Skid": Steam to Hot Water Heat Exchanger (SHWHx)

The piece of equipment that sits between the central heat plant and the City's thermal energy distribution system is the steam to hot water heat exchanger (SHWX). This equipment was skid built and delivered to the site as an integral unit. The unit receives steam from the central heat plant, converts it to hot water and distributes via controlled pumps to meet the load on the distribution system. While the skid was received during the Quarter it was not operational.

Construction continued on the central heat plant. As the Quarter closed, the glass walls on the biomass boiler building addition were being installed and all work on the building was expected to be completed by the end of January. Roof insulation and membrane are being installed on the delivery addition and biomass addition. The masonry work is 90 percent complete; the last 10% is being delayed to allow the remaining equipment to be delivered into the building.

FFY 2014 Q2
1 January 2014- 31 March 2014

Highlights –

- Mini-system operates at 100% uptime
- SHWX initial start-up
- Initial firing of central heat plant

Details –

The mini-system operated at 100% availability through the quarter. To manage peak load within the capacity of the boilers at City Hall, Union Elementary School operated its boilers during morning building heat up and periods when the outdoor temperature was below 20^{O}F. Service to FairPoint Communication commenced on February 5, 2014. Operation of the mini-system has allowed the development of protocols for managing the thermal energy data and development of billing procedures for invoicing customers for the thermal energy delivered.

The temperatures experienced during this period were colder than average. This proved to be a strong challenge to the operation of the system: the system operated without major incident.

During the week of March 10, 2014 the start up engineering team from Spirax-Sarco, the vendor for the steam to hot water heat exchange system, was on site to start up the system. The system was successfully started up and operated for sixty-one and a half hours during the month of March. Steam 'hammering' was experienced in the State's steam distribution system. The cause of the 'hammering' was unknown; however it was lessened when the steam to hot system was offline. The State concluded that it was not prudent to operate the steam to hot water system until the hammering issues was understood and corrected.

Approximately 95% of the construction work is complete. Major work still to be completed are control room cabinetry, roof flashing, finish grading and seeding, paving and top to bottom cleaning. Initial firing of the boilers occurred on March 5, 2014. Emission testing was completed in accordance with the State of Vermont Air Pollution Control Permit during the week of March 17, 2014. Final report expected during the nest Quarter. An estimated 700 tons of wood fuel was consumed by the biomass boilers during the quarter.

Central heat plant 95% completed

FFY 2014 Q3
1 April 2014- 30 June 2014

Highlights –

- Mini-system distributes 3,864 MMBTUs
- Central heat plant construction complete

Details –

The mini-system operated through May 15, 2014. The system performed well and provided a nice 'soft launch' to operating the distribution system. The mini-system distributed 3,864 MMBTUs of energy during its operation from 06 December 2013 through 15 May 2014. The system was put in stand-by mode for off-season: water was treated for low temperature condition and constantly circulated and filtered.

All construction is complete on the central heat plant. All major equipment has been installed. Testing of the oil burner on boilers No. 1 and 2 remain outstanding, all other systems have been tested. Testing of the burners delayed until October/November of 2014 when a load can be placed on the system. Operation and training of all equipment, except for the oil burner on boilers No. 1 and 2 was completed. The contractor was working on assembling the O&M manuals. Commissioning check list had been completed. Any outstanding or non-complete items were added to a punch list. Performance testing of the biomass boilers was approved by the State of Vermont/Agency of Natural Resources. Performance testing on the boiler and chip delivery system was completed before the end of Quarter.

FFY 2014 Q4
1 July 2014- 30 September 2014

Highlights –

- District heat enhancement implemented
- City Council set rates
- Central heat plant prepares for 'commercial operation'

Details –

The mini-system provided the opportunity to develop infrastructure and institutional mechanisms to support the City's thermal utility. Additionally it identified opportunities for system enhancements. These included modifications to the piping leak detection system, the integrating data and controls for the operation of the SHWX to the City's SCADA system. This brings all City enterprises (waste water treatment plant and water supply plant operations) on to one SCADA system, providing one central location for these data and controls.

The City Hall heat exchangers serve two purposes; they can take heat from the distribution system to heat City Hall and the Fire Station, and they supply heat to the distribution system for those periods of time when the central heat plant is off-line. As such, the thermal metering system located in City Hall needs to record this bi-directional operation. In order to accomplish these dual tasks most efficiently the thermal metering system (TMS) in City Hall was modified so it would record 'positive' and 'negative' flow. The convention adopted was that when City Hall and Fire Station are taking heat from the central distribution system, flow would be 'positive'; when the boilers in City Hall are supplying heat to the

distribution system, flow would be 'negative'. This convention was adopted so that all system data was positive when taking heat from the distribution system throughout the system (all customers). As the City Hall meter is the only one that operates bi-directionally, the negative convention was deemed appropriate for when it was operating opposite all other TMSs. TMSs were configured and commissioned for eight additional customers during the quarter. The remaining systems would be configured and commissioned as those customers came on-line.

At the July 30, 2014 meeting of the Montpelier City Council rates for District Heat Montpelier were set for Fiscal Year 2015 (July 1, 2014 – June 30, 2015). There are two components to the rates charged to customers: a Capacity Charge and an Energy Charge. The Capacity Charge is designed to recover fixed costs associated with operating the district heat system. Examples of these costs are re-payment of the bond, personnel and the like – costs that are fixed regardless of the level of operation. The Energy Charge is designed to recover the variable costs associated with operation of the district heat system. Examples of these costs are the cost of fuel to produce the heat, electricity to circulate the water, and the like – costs that scale with the level of operation. The Capacity Charge is determined by multiplying the Capacity Rate times the initial capacity assigned to a building within the building's Customer Agreement. The rational being that the capacity (demand on the system) that a building represents scales to the capital burden and other fixed costs necessary to meet that customer's requirements for heat. The Capacity Charge is assessed monthly during the seven months of the heating season (October through April).

The Energy Charge is determined by multiplying the energy taken by a customer, as recorded by the thermal metering system, times the established Energy Rate. The Energy Charge is assessed any time throughout the year a customer may take heat. The rates adopted by the Montpelier City Council are as follows:

Adopted Capacity and Energy Rates for District Heat Montpelier: FY 2015 (July 1, 2014 – June 30, 2015)	
Capacity Rate, $ per Thousand BTUs/h ($/MBTUH)	**Energy Rate, $ per Million BTUs ($/MMBTUs)**
4.84	8.82

The central heat plant was in summer shutdown. Staff attended to the many details of cleaning up after construction and preparing for the coming heating season.

FFY 2015 Q5
1 October 2014- 31 December 2014

Highlights –

- City-State Coordinating Committee operational
- Commercial operations begin
- DOE grant completed

Details –

Operational coordination between the City and the State for the central heat plant and the City's district heating system occurs through a Coordinating Committee. The Coordinating Committee is established under the Thermal Energy Purchase and Sales Agreement (TEPSA) between the City and the State (section 8.6, 8.7 & 8.8). The committee is made up of three (3) representatives and three (3) alternate representatives from the State and two (2) representatives and two (2) alternate representatives from the City. The committee will continue after the period of the DOE grant and through the life of the TEPSA, which has an initial term of twenty years.

Both the City's district heating system and the State central heat plant commenced 'commercial operation' on October 1, 2014. All systems were ready to supply heat to the connected buildings, and provided heat without major incident throughout the quarter.

On December 31, 2014 the DOE grant period closed. All project work was completed successfully and all systems were in full operation.