CITY OF MONTPELIER
MONTPELIER, VERMONT

Agenda for Special City Council Meeting
City Council Chambers, City Hall
Wednesday, July 30, 2014
5:30 P.M.

1) Call to Order by the Mayor

2) 14-181. Consent Agenda:

a) Approve Minutes from the July 9, 2014 Regular City Council Meeting.

b) Approve request from Montpelier Alive for the closure of State Street (from Main to Elm) from 11:00 A.M. to 10:00 P.M. on Saturday, September 6th, to celebrate Montpelier Alive's 15th Anniversary.

c) Approve request from Montpelier Alive for the closure of State Street (from Main to Elm) from 6:00 A.M. to 11:00 P.M. on Saturday, October 18th, for an Arts Festival. This event will be held in partnership with ArtsRiot.

3) 14-182. Consideration of a request to extend the "Truck Stop" event dates.

a) Staff received an e-mail from organizer Jesse Jacobs, seeking Council approval to extend the use of the 60 Main Street parking lot to Saturday, August 9th; 16th; 23rd; and 30th.

b) The same parameters, previously approved, would remain in place with parking closed to the public beginning at 2:00 P.M.; the actual Truck Stop event would run from 5:00 to 9:30 P.M.

c) Mr. Jacobs will be present to discuss this request with the Council and to answer any questions they might have.

d) Recommendation: Following the discussion, direction to Mr. Jacobs, and possibly staff.

4) 14-183. Consideration of District Heat Rates for the 2014-2015 Heating Season.

a) These rates are in-line with the projected rates shared with the customers when they signed on to District Heat Montpelier.

b) Recommendation: Staff recommends that the Council establish the District Heat Montpelier capacity rate at $4.84 per MBTUH and the energy rate at $8.82 per MMBTU for the 2014-2015 heating season.

5) *Adjournment*

CITY OF MONTPELIER
MONTPELIER, VERMONT

Addendum to Agenda for Regular City Council Meeting

July 30, 2014

Additional Items for Agenda:

5) 14-184. Consideration of a request from EF Wall on behalf of the State of Vermont for a waiver of the City's Noise Ordinance to accommodate work after 9:00 PM through the end of September at the Pavilion Office Building.

a) EF Wall will be repairing and painting window trim on the Pavilion Building. They had planned to start work on July 29th.

b) Work is planned to start at 4:30 PM and continue until 1:00 AM on weeknights and 7:00 AM to 3:30 PM on weekends.

c) Recommendation: Discussion, direction to staff.

6) 14-185. Discussion of process for City Council appointments to Boards and Commissions.

a) The Council has four Planning Commission and two Development Review Board appointments scheduled in August and September.

b) The Council had requested time to discuss the criteria and process used to appoint members to these boards.

c) Recommendation: Discussion, direction to staff, communication to Board and Commission members.

Minutes of the Montpelier City Council Meeting
July 9, 2014
Montpelier City Hall Council Chambers

In attendance: Mayor John Hollar (presiding), City Councilors Tom Golonka, Anne Watson, Thierry Guerlain, Jessica Edgerly Walsh, Justin Turcotte, Dona Bate, and City Manager William Fraser. City Clerk John Odum acted as Secretary of the meeting.

The Mayor called the meeting to order at 6:30 PM.

14-169. Paul Somerset made a statement to the council regarding a claim against the city relating to business flooding involving a city-maintained catch basin.

Councilor Turcotte took a moment to speak about the July 3rd decision to curtail Independence Day celebrations and its impact on vendors.

14-170. Councilor Guerlain moved approval of the consent agenda. Councilor Edgerly Walsh seconded. The motion carried unanimously at 6:30.

14-171. Finance Director Sandy Gallup approached the council for the consideration of setting the FY 2015 Municipal Tax Rate of $0.9767, the Water/Sewer Benefit Charge of $.02 and Sewer Separation Charge of $.07. A brief discussion followed. Councilor Edgerly Walsh moved approval of the tax rate as recommended. Councilor Bate seconded. The motion carried unanimously at 6:48.

14-172. The Council opened discussions on appointments to the Development Review Board. Candidates Kevin O'Connell and Glennie Sewell addressed the Council to discuss the position and answered councilors' questions.

Councilor Guerlain moved the Council go into executive session to discuss the appointments Councilor Watson seconded. The motion carried unanimously at 7:01.

At 7:20 Councilor Bate moved the council return to open session. Councilor Edgerly Walsh seconded. The motion carried unanimously.

Councilor Guerlain moved that the council appoint Kevin O'Connell and Jack Linley to the Development Review Board. Councilor Watson seconded. Councilor Bate encouraged Mr. Sewell to consider applying for an upcoming alternate position. The motion carried 5-1 (Councilor Bate voting nay) at 7:21.

14-173. The Mayor opened a discussion of the One Taylor Street redevelopment, focusing on both potential uses, as well as the appropriate role of the council. Erik Hoekstra and Larry Williams of Redstone joined in the discussion.

Nancy Sherman addressed the Council in favor of housing at the site. Ben Eastwood had questions about environmental remediation at the site. Jack McCullough (Chair of the Housing Task Force) introduced a memo supporting the housing option. Finally, Daniel Dickerson discussed parking at any potential housing development.

14-174. Councilor Golonka shared a brief update on the Public Safety Authority. Councilor Guerlain moved the Council formally appoint Councilors Bate and Golonka to the PSA governing body. Councilor Watson seconded the motion, and the motion carried unanimously at 8:02. A short discussion followed.

14-175. Planning Director Michael Miller introduced a discussion of Council Goal #3 and the related action step of "Explore(ing) (the) feasibility of parking structures in Montpelier." The council indicated to the Planning Director that they remained interested in a further pursuit of the possibility.

14-176. Mr. Miller remained at the table for a review of Council Goal #5 ("Create a hospitable environment for development") moving from his initial recommendation (that the city hire a consultant to work on the development of an Economic Development Strategic Plan) into a broader discussion.

Councilor Bate moved the council direct Planning Department staff to pursue a planning grant to fund an Economic Development Strategy plan. Councilor Edgerly Walsh seconded. Further discussion followed. The motion carried unanimously at 8:48.

14-169. Councilor Turcotte advocated for the city to refund the $25 portion of the July 3rd vendor fees that went to the city. Councilor Golonka moved that the city waive its $25 portion of the July 3rd vendor fee next year for vendors who participated in 2014, and include a letter explaining the decision and encouraging them to return in 2015.

14-177. Councilor Bate commended the decision to close July 3rd celebrations early, and indicated she enjoyed herself. She also announced an August 16 Citizens to Protect Berlin Pond rally

Councilor Guerlain reported on the July 3rd event positively.

Councilor Turcotte encouraged any TV viewers having audio/visual troubles with the broadcast to contact him directly. He also had questions about District Heat, which the City Manager responded to.

Councilor Watson asked the Assistant City Manager about the bike committee's progress in developing a plan.

Councilor Edgerly Walsh echoed praise of the July 3rd event before offering a CIP committee report.

14-178. The Mayor reported on July 3rd, and shared an anecdote regarding the evening's storm in support of the decision to close early. He also reported on his appearance on A&E's "Tiny House Nation" program. He also noted that The New Republic was working on a report on District Heat, before noting the coming Food Truck event. Finally, he referenced a letter he received expressing concern about the adequacy of handicap parking around the statehouse.

14-179. The City Clerk reported that overseas absentee primary ballots would go out on Friday.

14-180. City Manager Fraser noted July 3rd, supporting the call to curtail the celebration due to weather.

Councilor Edgerly Walsh moved the council adjourn. Councilor Watson seconded. The motion carried unanimously at 9:05PM.

VERMONT

Department of Buildings & General Services
Office of the Commissioner

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July 25, 2014

Mr. William J. Fraser
City Manager, City of Montpelier
39 Main Street
Montpelier, VT 05602

RE: Thermal Energy Purchase and Sale Agreement (TEPSA)

Dear Bill,

On Monday, July 21, 2014 the State of Vermont Department of Buildings and General Services sent the City of Montpelier rate information and updated cost estimates for the State Heat Plant in accordance with Sections 4 and 5 of the Thermal Energy Purchase and Sale Agreement (TEPSA).

This letter serves as notice of the rate schedule to establish the Energy Payment Rate and the Fixed Payment Rate for the upcoming heating season in accordance with Section 4.2(v) of the TEPSA.

The rate schedule for the 2014-2015 heating season is as follows:

Fixed Payment Rate	$82,184
Energy Payment Rate	$8.82
City Unit Cost of Energy Delivered ($/MMBTU)	**$14.62**

Supporting documentation for the above rates was included in the materials sent to you on the 21st. Updates to the cost estimates for the Heat Plant resulted in decreases to the estimated delivered cost of energy to the City of Montpelier. The City unit cost of energy delivered of $14.62/MMBTU for this heating season represents a decrease of $.23/MMBTU compared to June 2014 estimates (a 1.5% decrease), and a decrease of $1.04/MMBTU compared to the March 2011 forecast (a 6.6% decrease). We are pleased that the unit cost is lower than previous estimates.

Sincerely,

Michael J Obuchowski

Michael J. Obuchowski
Commissioner

cc: Jessie Baker, Assistant City Manager, City of Montpelier
John Hollar, Mayor, City of Montpelier
Wanda Minoli, Deputy Commissioner, BGS
Julie Gutgsell, Operations, BGS
Lawrence Copp, EPR

DISTRICT HEAT MONTPELIER

AN ENERGY INDEPENDENT DOWNTOWN

Business Plan

JULY, 2014

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Executive Summary

District Heat Montpelier ("DHM") is being developed to provide a local, renewable, reliable and cost effective heating solution to the City of Montpelier and its businesses. In development for a number of years, the system is in the final stages of construction and expected to achieve full commercial operation for the 2014-2015 heating season. City staff has worked tirelessly to develop DHM and has now identified the need to update the business plan for the system based upon current market conditions and system needs. This plan attempts to identify all of the critical needs of the business as it transitions from a project to a commercially operating system.

The primary areas of focus identified in this business plan have been noted to include:

- Develop a system growth plan that benefits DHM as well as the local community.
- Development of an integration plan between DHM and the State steam operation.
- Establishment of a System Advisory Group.
- Develop summer and winter operating protocol for full-load operation.
- Develop a maintenance and monitoring program for the system.
- Develop customer education and training programs, along with customer relationship management.
- Develop a community outreach program for operation of the system.
- Develop a rate and reserve management program.
- Update the system's operating budget

A number of steps have been taken by City staff already to address many of the needs above, but focus should be applied on these high-priority items now so that the business is properly prepared for full commercial operation in October, 2014. For certain items, it may be beneficial for DHM to solicit outside expertise specialized in the development, operation and management of district energy systems so that DHM may leverage that expertise as its district heating system is started up.

This Business Plan attempts to provide an outline for DHM to follow as the system and the business begin commercial operations.

The Business

Background

District Heat Montpelier was developed by the City of Montpelier to provide local renewable energy to downtown Montpelier. With the rebuilding of the State's existing central heating plant, modern wood-fired boilers will heat the Capitol Complex and connections will be put in place to provide hot water district heat service to City and school buildings as well as connect to private buildings in downtown Montpelier. Once built out, benefits of the District Heat Montpelier will include:

- Reduced health threatening air emissions from fuel combustion in downtown Montpelier by as much as 11 tons per year.
- Replacement of approximately 300,000 gallons of oil per year between the State and downtown buildings as a prime fuel source with locally/regionally produced wood chips keeping that economic activity in the northeast.
- Fuel cost stabilization for city government and the school department allowing tax dollars to potentially be redirected toward services or infrastructure rather than to pay rising oil prices.
- An economic development opportunity in downtown Montpelier by providing a cleaner and potentially cheaper source of heat for private building owners.
- The removal of many private oil furnaces and underground fuel oil storage tanks from potential flood areas.

Mission

District Heat Montpelier will provide renewable, local, affordable heat to the capital city's historic downtown and adjacent neighborhoods with long-term price stability.

Objectives

The following objectives have been established for DHM:

1. Reduce the demand for and use of fossil fuels in the city.
2. Provide stable thermal energy rates.
3. Increase the energy efficiency of the buildings that are connected to DHM to maximize the efficiency of DHM.
4. Grow DHM to reduce heating costs, increase the efficiency for all users of the system and increase the utilization of renewable energy in the community.

Project Status

DHM is currently in the final stages of construction and remains on schedule for commercial operation in October, 2014. The State's heat plant is scheduled to be online and producing biomass-generated heat by October, 2014. The City developed a plan to run a "mini-District Heat Montpelier" system heated by the boilers at City Hall during the 2013-2014 heating season. During this heating season, the "Mini-System" provided reliable district heat to six buildings in downtown Montpelier, including two private customers and four public buildings. Operating this "Mini-System" provided a unique opportunity to learn about system functionality with fewer customers online and understand the administrative realities of this new utility.

The basis of design for the system is attached in Exhibit A.

State Biomass Boiler

The State's heat plant is constructed on the site of the State's existing boiler plant behind 120 State Street on the Capital Complex. Two new 600 BHP dual fueled boilers, each with a rated capacity of 20.1 Million BTU/hr have been installed. In addition, the newer of the pre-existing oil boilers has been relocated in the rebuilt Heat Plant and modified to operate on #2 fuel oil (the Heat Plant previously used # 6 fuel oil).

The total capacity of the State plant is 40.2 Million BTU/hr (not including backup boiler capacity). The allocated share of the City's capacity of this total is a maximum of 9.71 Million BTU/hr. Thermal conversion unit(s), which are owned, operated and maintained by the City, are located at the State plant inside a room allocated specifically to DHM. These units receive the steam generated by the State plant and convert it to hot water for distribution through the City's district heating system.

Financing

The following sources of funds have been established for DHM:

Sources of Funds		
Bond 2009		$250,000
CEDF Grant 2009		$75,000
Bond 2011		$2,000,000
CEDF Loan 2011		$750,000
CEDF Grant 2011		$1,000,000
DOE Grant		$2,193,218
Village Green Grant		$100,000
Forest Service Grant		$248,556
Total Current Project Funds for the City's Distribution System		***$6,616,774***

The project is projected to be completed on budget using the funds currently available as noted above. In the event of a cost overrun, the City will work with the customers of DHM and the City Council to present a financing plan in the best interest of the DHM fund.

The Organization

Business Structure

DHM is a fund within the municipal operations of the City of Montpelier. Much like the Water/Sewer fund, the DHM fund is financially managed as its own entity separate from the general fund. To the extent that municipal resources are called upon to run DHM (such as financial oversight, billing, public works maintenance, and system leadership) these costs are charged back to the DHM fund. DHM is designed to operate independently and not use general fund dollars from the City of Montpelier coffers.

Business Management

The City Manager has the ultimate authority for the operations of DHM. The City Council has budgetary authority over the appropriation of funds to DHM and this will need approval of the Montpelier voters through the regular budget process.

Staffing

The following City staff will be the primary individuals working on DHM:

William Fraser, City Manager: The City Manager has ultimate authority for the operations, both financial and operational, of DHM. The City Manager tasks City department heads with carrying out the functional activities of DHM. Additionally, the City Manager, guided by the City Council, provides policy direction to DHM and works with customers on their experience with DHM. The City Manager will also convene the DHM system advisory group.

Jessie Baker, Assistant City Manager: The Assistant City Manager supports the City Manager in executing the responsibilities associated with DHM.

Todd Law, Public Works Director: The Public Works Director is responsible for the operations of DHM including system start-up, preventive maintenance, 24/7 customer support, and system monitoring. The Public Works Director is responsible for working with customers to understand their connections and manage the efficiency of their use of DHM.

Sandy Gallup, Finance Director: The Finance Director is responsible for the financial operations of DHM including the billing of customers, developing the operational budget, adhering to municipal accounting standards, and ensuring the DHM fund operates independently of the municipal general fund.

State Steam Agreement

The State and the City have entered into a memorandum of Understanding dated June 9, 2011 and a Procurement Agreement dated January 23, 2012, both of which identify specific responsibilities of the State and the City as it relates to the sources and uses for the construction of the State heat plant and DHM. At the conclusion of construction of both systems, the City and State will evaluate their respective actual costs and to the extent appropriate, reconcile any cost overruns or underruns.

On January 23, 2012, the City and State also entered into a 20-year Thermal Energy Purchase and Sale Agreement ("Agreement"), which detailed the structure for the transfer of thermal energy once the systems are functional. All above referenced Agreements are attached as Exhibit B.

Agreement Structure

The City has committed to procure, and the State has committed to sell 9.71MMBtu/hr of capacity from the State, or 24.16% of the State plant capacity. As such, DHM has established its initial customer peak capacity as 9.71 MMBtu/hr. As the current State thermal load is approximately 50% of the overall boiler plant capacity (approximately 20 MMBtu), the State plant does have additional capacity to support expansion. Should expansion of the system occur, the City must follow certain protocol as outlined in the Agreement to procure any additional needed capacity. The City is required to notify the State if it intends to procure additional capacity; however the cost of peak demand above 9.71 MMBtu/hr does not incentivize DHM expansion.

DHM may also rent "Reserve Capacity Units" from the State to manage peak demand, assuming that the State plant capacity is available to fulfill that capacity. DHM may not procure energy from any source other than the State unless the State cannot supply that energy. In the event that the State plant does not have additional capacity available, DHM may procure that capacity from alternative means. As an alternative to renting capacity, the City may operate the boilers at City Hall for up to 200 hours per heating season.

State Obligations

The obligations of the State as stated in the Agreement include the following:

- Design and construct the thermal conversion unit in the State plant for the DHM, with a design capacity of 13.5 MMBtu/hour.
- Provide 9.71 MMBtu/hour peak capacity from and including October 1 through April 30 each year.
- Not later than June 1 annually, provide the City with estimated production costs for the generation of steam delivered to DHM in the next three heating seasons.
- Provide a reconciliation of actual production costs for the generation of steam delivered to DHM in the previous heating season.
- Not later than July 1 annually, provide an energy payment rate and a fixed payment rate for the upcoming heating season.
- Prepare and provide an annual maintenance schedule. Also review the City maintenance schedule.
- Establish operating protocol which will be followed for the operation of the State heat plant and provide an independent engineer's review of the operational protocol every five years.

- Lead a Coordinating Committee, staffed by three representatives of the State and two representatives of the City, which shall meet quarterly and review the performance of the systems and their interrelations.
- Meter energy consumption on the State side of the thermal conversion unit. Also test for accuracy and calibrate the meters on an annual basis.
- Work in a collaborative manner with the City so that each entity may optimize the efficiency and reliability of its respective system.

City Obligations

The obligations of the City as stated in the Agreement include the following:

- Annual reconciliation of actual State energy production costs with the State.
- Monitoring and reporting on system capacity and use and provide an annual estimate of system load to the State by July 1 each year.
- Prepare and provide an annual maintenance schedule. Also review the State maintenance schedule.
- Establish system operating protocol and provide an independent engineer's review of the operational protocol every five years
- Own, operate & maintain the thermal conversion unit in the State plant.
- Participate in a Coordinating Committee, staffed by three representatives of the State and two representatives of the City, which shall meet quarterly and review the performance of the systems and their interrelations.
- At the City's option, meter energy consumption on the City side of the thermal conversion unit. Also test for accuracy and calibrate the meters on an annual basis.
- Work in a collaborative manner with the City so that each entity may optimize the efficiency and reliability of its respective system.

State Plant Integration Timing

As a result of the completion of the City's thermal energy system in the fall of 2013 and a delay in the completion of the State Plant, DHM operated under a scaled-down model for the 2013-2014 heating season. During that winter, DHM was fed thermal energy by the City Hall boilers and only served the loads of the Police Station, City Hall, the Fire Station, Union Elementary (partial), FairPoint Communications, and Vermont Mutual Insurance Co. Other DHM customers were notified that they should plan on managing their heating needs with existing assets through the 2013-2014 heating season. DHM will methodically startup and commission all other customers once the State plant is operational on biomass in mid-2014. This will occur during the period May 1 through September 30, 2014.

System Operation and Maintenance

Operational Strategy

DHM will be operated and maintained by the DPW staff as part of their day to day operations. Currently, the DPW staff operates the City sewer and water systems and is well equipped to add the DHM system to its responsibilities. While DPW staff has the necessary experience to operate and maintain traditional water systems, a hot water district heating system is unique. A program should be put in place to provide DPW staff with the necessary training they need to operate and maintain this system. The City staff should also be provided with ongoing access to personnel experienced in the operation and maintenance of district heating systems so that assistance may be provided when circumstances arise that are new and unfamiliar to Montpelier DPW staff.

An on-call schedule that enables notification to and response by a knowledgeable individual 24/7/365 is a necessity for production or distribution system upsets. Ideally, that notification is done automatically by the system controls based on pre-established deviations from normal system parameters. This on-call schedule should be shared with the staff at the State plant so that they can make timely notification in the event of a system upset observed by their staff.

A critical aspect of the operation is routine rounds by a person familiar with the system. During these rounds (on a frequency established based on operational experience) system pressures, temperatures, and flows are recorded, critical equipment inspected, and overall operation verified. The purpose of these rounds is early detection of a system problem or impeding equipment failure so that appropriate corrective and compensatory measures can be employed. Rounds should be comprehensive in scope, especially during the initial system operation when the normal system operating conditions and vulnerabilities unique to the system have not been fully established. As operating experience is gained and the trends on the various operating parameters and equipment performance become familiar, the extent of rounds can be reduced or the frequency reduced for those parameters that are demonstrated to be stable for long periods or for equipment whose failure is not of a critical nature.

Seasonal Operation

The system will be operated differently based upon the time of year. During the winter months (generally October 1 through April 30), the primary energy source for the system will be thermal energy from the State Heat Plant. During the summer months (generally May 1 through September 30) when the primary load will be domestic hot water at a few customer buildings, the primary energy source will be the boilers in City Hall. As the dynamics of the load and the production facilities are significantly different in those two seasons, separate operating protocol should be established for each period:

Winter Operation

Operating protocol need to be established that, at a minimum, address the following subjects:

- Routine and emergency communication between the State plant and the City staff. Access by DPW or City staff to operate the heat transfer station at the State plant.

- Shoulder season switch-over between City Hall boiler production and State plant production as well as switchover of the bypass/shunts to winter mode.
- Emergency response and off-normal operations guidelines for loss of steam production, power outage, distribution water loss, and chemical spill.
- Differential Pressure monitoring at selected points on the system.
- Water treatment.

Summer Operation

Operating protocol need to be established that, at a minimum, address the following subjects:

- Shoulder season switch-over between City Hall boiler production and State plant production as well as switchover of the bypass/shunts to summer mode.
- Emergency response for loss of boiler operation.
- Differential Pressure monitoring at selected points on the system.
- Water treatment.
- Shunt schedule.

DHM needs to establish these protocols prior to the system becoming operational in the fall of 2014.

System Maintenance

As the system will be required to be fully functional for the duration of the winter months, it is expected that the majority of maintenance will need to be scheduled for the summer months when the system is primarily serving domestic hot water load in a few buildings. The following items will require the development of a periodic maintenance program that is diligently followed on an annual basis with responsibilities assigned to appropriate personnel:

- Direct-buried valves should be exercised twice per year and lubricated annually by DPW staff.
- Flash chambers should be inspected for cleanliness and valves should be exercised annually by DPW staff.
- Shunt assemblies should be properly positioned at the beginning and end of each heating season by DPW staff. They should also be managed during periodic system isolation and/or shutdowns. This is critical for system protection from corrosion and freezing that would otherwise be likely in stagnant areas of the system. The shunt schedule should be adjusted as operating experience is gained and customer usage patterns affirmed. As a rule of thumb, if a section of pipeline will be idled for any length of time, shunts must be opened.
- Hot water leak detection and remote sensors should be inspected and tested annually for functionality by qualified personnel.
- Above-ground pipe and pipe insulation should be inspected annually by DPW staff for integrity.
- Inventory management should be monitored on an ongoing basis by DPW staff.
- All system makeup water should be softened water so as to minimize the potential for scale to form and foul heat exchange surfaces within the system.
- System pumps, boilers, and other auxiliary equipment must be included in a periodic preventive maintenance program. Predictive analytical methods that permit early detection and correction of equipment degradation (vibration analysis, thermographic scanning, and other non-destructive tests) should be incorporated to minimize potential for unanticipated service interruptions.

A schedule should be developed to monitor and/or maintain each of the above items and that program should be followed diligently to maintain the integrity of the distribution system.

System Monitoring

The pre-insulated steel hot water pipe comes equipped with two copper wires embedded in the insulation between the steel pipe and the HDPE jacket. These wires measure the electrical resistance between the wires and the steel pipe. During normal operation, the resistance measures close to infinity, because the insulation separates the wires from the pipe. When there is moisture within the insulation, due to a leak in the steel or damage to the HDPE jacket, this resistance lowers until it approaches zero. The two wire system allows for the monitoring and location of leaks or jacket damage on branches, tees, and other fittings. The two wire system also has a redundant characteristic, so that if one wire is damaged, or incorrectly connected, the second can provide the monitoring.

In the event of pipe leaking or jacket damage, the wires can then be used to locate the moisture reading. The leak detection scheme gives a location within 5' of the leak. The leak detection system measures the impedance of the wiring and piping system, referencing baseline impedance established at initial construction. This leak detection and location system will allow DHM to enact repairs effectively and efficiently before a catastrophic failure of the system occurs. It will also allow DHM to test the integrity of the system immediately prior to contractor warranty expiration so that the general contractor may be held responsible for any defects in the installation.

In order to optimize the utilization of this alarm wire system, a baseline test must be performed shortly after construction has been completed and the system has been circulating water. This baseline will provide the comparative basis for annual reviews of the alarm wiring system and, as noted above, help to identify any moisture condition in the insulation prior to catastrophic failure.

System Shutdowns

Periodically, portions (or all) of the system will need to be shut for purposes of a routine repair, system expansion or a major repair. Although these instances should be minimized for DHM due to the system size and the ability to "hot tap" service laterals, it is prudent for DHM to develop a shutdown plan template that may be used in the event that a shutdown is necessary. The purpose of this template is to establish the strict protocol that will be followed during the shutdown process so that down time may be minimized, communication lines are strictly followed and the repair or extension is completed safely and to the quality standards expected by DHM.

Although not expected, it is possible that the system may incur a major failure in its operation at some point over the life of the business. It is further possible that this failure would occur at a point of the heating season where customers cannot afford to be without heating for a prolonged period of time. More likely is the possibility that a major flood could affect the operation of the system or service to specific customers. In the event that such an occurrence were to happen, it will be important for DHM to have an emergency response plan developed that may be implemented. This plan could include the mobilization of temporary boilers, auxiliary power generation or construction teams and necessary materials to make pipeline repairs. DHM should develop a plan for the most likely occurrences and also develop the response plans that will be implemented in the event of any given situation.

System On-Call Program

As DHM will not be staffed on a 24/7 basis, certain protocol will need to be put in place to manage the need to operating the system off-hours. Similar to the other systems that Montpelier Public Works manages, situations may arise that require off-hours response to service calls in the City room of the State plant, on the distribution piping system or in a customer's building. A program should be developed that will formalize exactly how the on-call program will be managed and what the proper procedure will be for contacting Public Works personnel, outside consultants and outside contractors.

Conclusions

As DHM will be the primary heating source for a number of buildings in the Montpelier community, it is important to establish procedures and protocol that will be followed during operation of the system and in the event of service disruption. These procedures and protocol will be important contributors to DHM providing reliable energy services to its customers and growing its customer base.

Customer Load

Current Customers

Over 403,000 square feet of heated space has been committed to the system via Thermal Energy Customer Agreements. These committed buildings currently consume approximately 150,000 gallons of fuel oil, based upon customer records. Of the customers signed, the dominant heating demand is that of space heating, therefore the heating demand is driven by climate; specifically the severity of any given winter.

The following customers will be served initially by the system:

Building	Name	Energy, MMBtu/Yr	Capacity, MMBtu/Hr (1)
1	City Hall/Fire Station		
2	Police Station		
3	Union Elementary School		
4	Federal GSA building		
5	County Courthouse & Sherriff's Office		
6	Vermont Mutual (1)		
7	Everett - 52, 46 & 27 State St		
8	Hood/Ayer/Ribolini – 17 State St		
9	NECI – 118 Main St		
10	City Center		
11	Beard – 15 East State St		
12	Bethany Church		
13	Christ Church		
14	FairPoint		
15	Library		
	TOTAL	**15,938**	**9.97**

(1) Capacities as assigned in the individual customer agreements. These assignments were developed based on review of fuel use records, boiler size and engineering judgments.

The load information above is based upon historical customer data. Actual district heat energy peak consumption is expected to be less when accounting for system efficiency and load diversification (currently calculated at 80%). Depending upon the actual peak consumption at the customer buildings, additional capacity may be freed up to sell to other customers on the network. It is the intent of DHM to serve the current customers through one full heating season prior to expanding to any further customers. Given the fact, however, that the system will be serving a small concentration of

customers in the 2013-2014 heating season, DHM could entertain adding additional load in the summer of 2014 if it is found that the actual peak of buildings 1, 2, 3 and 6 is less than identified above.

Conclusions

During the initial years of operation, it will be important for DHM to reliably serve its customers throughout the heating season. It will be equally important that the customers operate their buildings in the proper manner so that they may optimize the benefits of a district energy system and so that the efficiency of the system itself may be optimized.

Lastly, DHM will need to closely monitor the actual energy consumption of each of its customers, as well as the peak load of the system. This will allow DHM to understand how much system capacity is available to support expansion of the customer base without procuring additional capacity from the State.

Customer and Community Relations

Customer Relations Strategy

Customers of DHM are signed to twenty-year contracts for the supply of thermal energy to their buildings. The system will deliver the hot water to a connection point in the mechanical rooms of building basements, with customers responsible for any modifications necessary for proper system performance inside their buildings. Customers will be charged an energy charge and a capacity charge, with the energy charge based upon actual energy consumption and the capacity charge based upon the customer building's peak demand. Customers' peak demand is estimated for the first three years of operation, and then is based upon actual peak usage thereafter. It will be important for DHM to interact with customers on an ongoing basis so that they understand their utilization profiles along with opportunities for improving their energy efficiency. Frequent visits to customer buildings to ascertain the operations performance are necessary early in the system operation. Inspection of customer conversions equipment for leaks, meter malfunctions, and indications of heat exchanger fouling will be very important for system reliability. As confidence in stable operation is achieved, the frequency and scope can be relaxed. As part of the customer service, DHM should provide assistance to customers in troubleshooting building performance issues to enable problems to be quickly resolved.

Customer Education

DHM will benefit by working with all customers to establish a diversified peak demand schedule so that overall system peak may be minimized to the greatest extent possible. Customers should be educated on the operating dynamics of the system, how it interfaces with each individual building, and how operational decisions in one building may affect the performance of the overall system. As such, it would be beneficial to provide all customers with an initial training session that educates customers on the primary components of the district energy system:

- System functionality and controls
- Proper equipment maintenance
- Typical system challenges and troubleshooting steps
- General system controls

DHM should also work with customer building managers so that the system peak demand will be properly managed. Assisting customers to find ways to minimize peak loads and to avoid coincident peaks among multiple buildings through timing of reset thermostats, etc. will benefit the entire system by avoiding high peak load spikes, which will help to keep customers' energy rates down. This sequencing may allow DHM to add additional customers to the system and improve the overall economics for all customers.

Energy Efficiency Improvements

Long-term, all customers of DHM will benefit from efficiency improvements made within each individual customer building to ensure energy transfer occurs efficiently with no losses and with a minimum of hot water volume consumed. To the extent that the temperature differential ("delta T") between the hot water supply and return lines can be increased (i.e. customers extract more heating energy out of the hot water), the overall efficiency of the system will improve and the cost for pumping will decrease. DHM should implement a program for tracking the delta T of each customer, a program for helping customers increase their delta T and a response plan in the event that specific buildings experience a declining delta T.

Metered Data Collection, Analysis and Customer Billing

Energy consumption will be tracked by measuring the flow of water and the temperature differential between supply and return lines at each building. On a monthly basis, DHM should evaluate each individual customer's energy consumption for the previous month and compare it to that building's past consumption. Anomalies should be further investigated prior to invoices being distributed so that they may be validated or corrected. This also creates an opportunity for DHM to work with customers to identify and correct any building concerns that may be arising. This analysis should occur prior to invoice being distributed to customers

Customer Troubleshooting

As DHM will be new for most, if not all of the customers connected to DHM, it is important that they will feel comfortable contacting DHM when they have a problem with their heating system and its interaction with the system. Just as importantly, DHM needs to have a qualified representative available to meet with customers to address their concerns and correct any issues that may arise. DHM should implement a customer response program that provides customers with 24-7 access to qualified and educated individuals that can assist the customers through any challenges that occur.

Reactive support will be important, particularly during the initial years of customer connection. However, DHM should also continue a customer education program to keep building owners informed and to enable building managers and their contractors to solve many of their challenges on their own. An annual building owners or operators seminar sponsored by DHM will benefit customers and provides a forum for DHM to emphasize the need to do proactive maintenance and will aid the process of educating customers. DHM can also share the environmental, economic, and other benefits that the system provides to the community in aggregate and for the individual customer.

Customer and Community Collaboration

District energy systems, by definition, are community energy systems. As such, it is in the best interests of all stakeholders (customers, the community and the City) to operate and manage the system in a collaborative manner. To the extent that customers may be reasonably involved in the strategic direction of the system, DHM has determined that a System Advisory Group would foster the development of a business that meets the needs of customers today, while establishing a strategic direction for the business that remains in the best interests of customers, the community and the environment.

It would also be beneficial to have industry expertise within this advisory group so that DHM may benefit from the experience of others who have developed and grown district energy systems in the past as strategic decisions are discussed. A membership that includes customer representatives, community members, a representative from the State, and district energy system experts could provide a broad perspective to the group.

DHM will work with key stakeholders to establish the structure of this group and its governance.

Community Relations

On an annual basis, it will be important for DHM to stay connected with the community it serves, including customer and non-customers. As such, a plan should be developed for educating the broader community on the benefits of district energy and how it serves the Montpelier community. Outreach should include:

- Education at the local schools on how district energy systems function and the benefits DHM brings to the community.
- Participation in local business, community, and environmental forums.
- Host one roundtable per year for community, environmental, and business stakeholders to discuss the development of the business, its performance, and the environmental benefits gained from its operation.

While DHM will be integrated into the current Public Works Department, which has a strong reputation in the community, this service will be new and it will be important to emphasize the unique nature of this new service.

Conclusion

Customer and community education is a critical component of a successful community energy program. Decisions made within one building on the district heating system can have impacts on all other system customers, both financially and service-based. As such, it is very important that all customers understand how their buildings' integrate with the district heating system and how they may fully utilize the benefits of being connected to the system. DHM should focus additional resources in the early years of operation on customer education to accomplish this goal.

DHM will be serving both private and public buildings in the Montpelier community. While customer education is a very important component of system development, community education is nearly as important, both for purposes of connecting future customers as well as educating the overall community of the benefits of the system as well as keeping it apprised of the ongoing dynamics of the business.

Financial

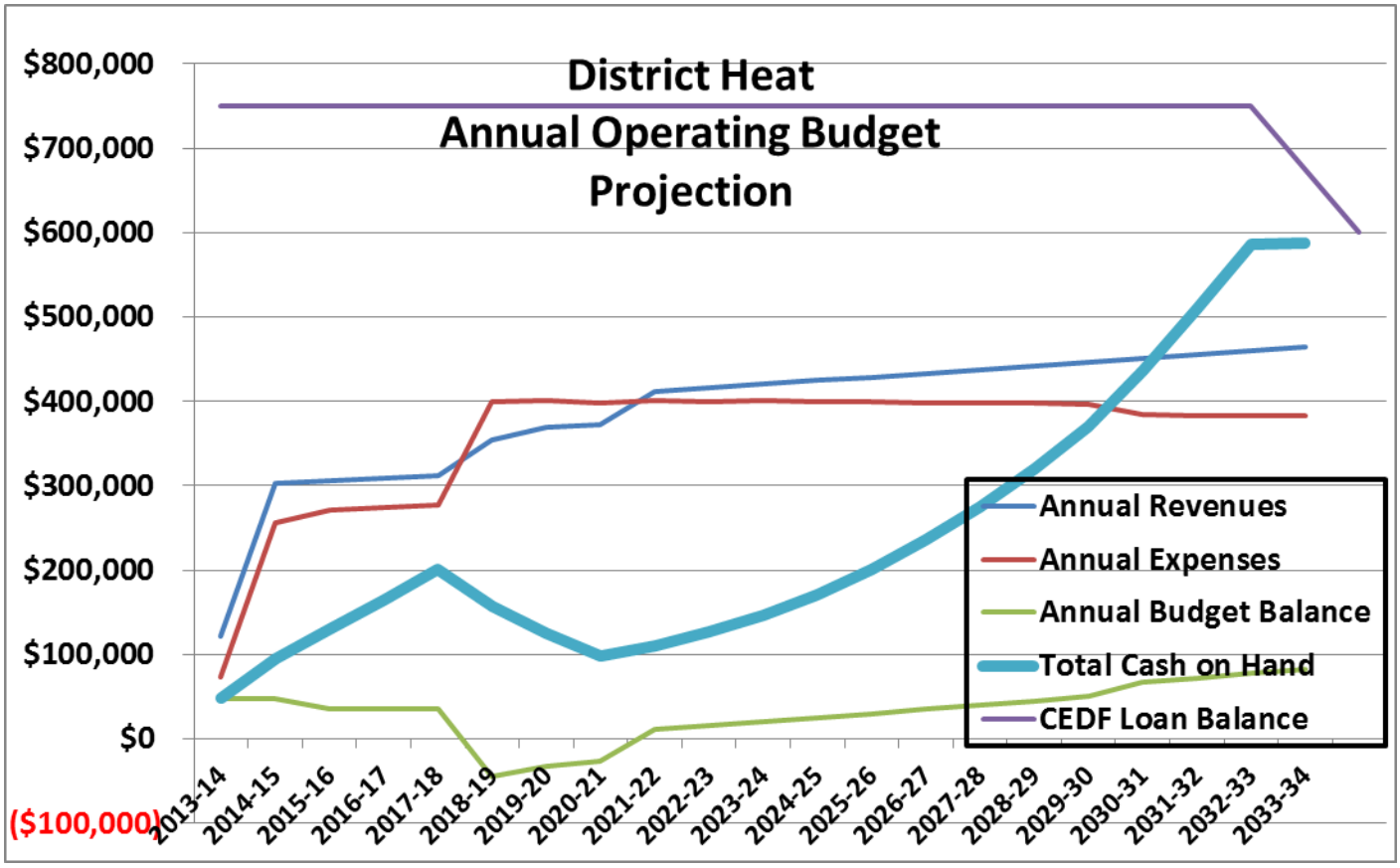
The majority of the financial reporting requirements stipulated in the State Agreement and customer service agreements are due at the conclusion of each heating season (May through July). In addition, much of DHM's financial projections are based upon heating seasons. As such, the business will operate with a fiscal year the starts July 1st and ends June 30th.

Financial Projections Overview

Investment in DHM is a long-term proposition and should be viewed in that manner when reviewing the financial projections. Building the infrastructure for the system is capital intensive and requires significant up-front investment, with the financial benefits being gained over the life of the customer energy service agreements rather than immediately. Exhibit C provides a projection of DHM's pro forma over the 20-year life of the initial business model.

It should be noted that the above projections are based upon a peak system capacity of 9.71 MMBtu/hr and do not include any projections of system expansion.

The following table provides a representation of the annual operating budget for DHM, along with the cash balance for the business.



The business will operate on a fiscal year that begins July 1 and ends June 30. This will allow a heating season to coincide with the fiscal year. On an annual basis, typically in March, DHM should review the following components of its business finances to plan for the next year's plans:

- Expected capital, maintenance and general and administrative budgets
- Debt service costs
- Costs and cash flow requirements in the State Steam Agreement
- Upcoming staffing plan
- Expected cost of energy
- Possible system expansion
- Possible significant increases or decreases in individual customers' consumption
- Review of system reserve account balances including a repair & replacement and capital reserve, operating accounts and overall working capital
- Possible funding needs
- Review of cash flow requirements by month including customer revenue projections
- Review of collection history of customer accounts and determine if certain accounts should be considered uncollectable

Once these costs have all been taken into account, DHM should evaluate its overall projected financials for the year and determine if a rate adjustment is necessary for the upcoming heating season. This is required to be submitted to the City Council by June 15 each year.

Customer Energy Rates and Savings

While the environmental benefits of the district energy system are substantial, it is important that customers of DHM realize a financial benefit for connecting to the system. DHM energy rates are developed as cost-based rates and include a capacity charge and an energy charge. The capacity charge, which will be established based upon customer's peak demand, is intended to offset all costs of the business other than energy charges. Capacity charge related costs include operating and maintenance costs, general and administrative costs, debt service costs, reserves, capital expenditures and other miscellaneous costs. The energy charge, which will be established based upon customer's actual consumption, is intended to offset fuel and electricity costs.

Rate and Reserve Management Strategy

As one of the objectives of DHM is to stabilize the cost of energy for all DHM customers, the business should employ a rate management strategy that mitigates the impact of annual fluctuations in system operational costs. In addition, it may be valuable to track the cost of DHM energy against that of fuel oil so that customers may understand the savings they are realizing as a result of being connected to the system. As annual costs will vary depending upon a number of factors, sufficient reserves should be managed to maintain a stable rate that doesn't fluctuate with every deviation in operating costs. Alternatively, DHM may want to utilize periodic spikes in oil prices as an opportunity to build up reserves for times when operational costs are higher and/or capital improvements are needed and the business would prefer not to raise rates. DHM should establish appropriate reserve goals and also a rate management strategy so that guidelines are in place to help make some of these decisions.

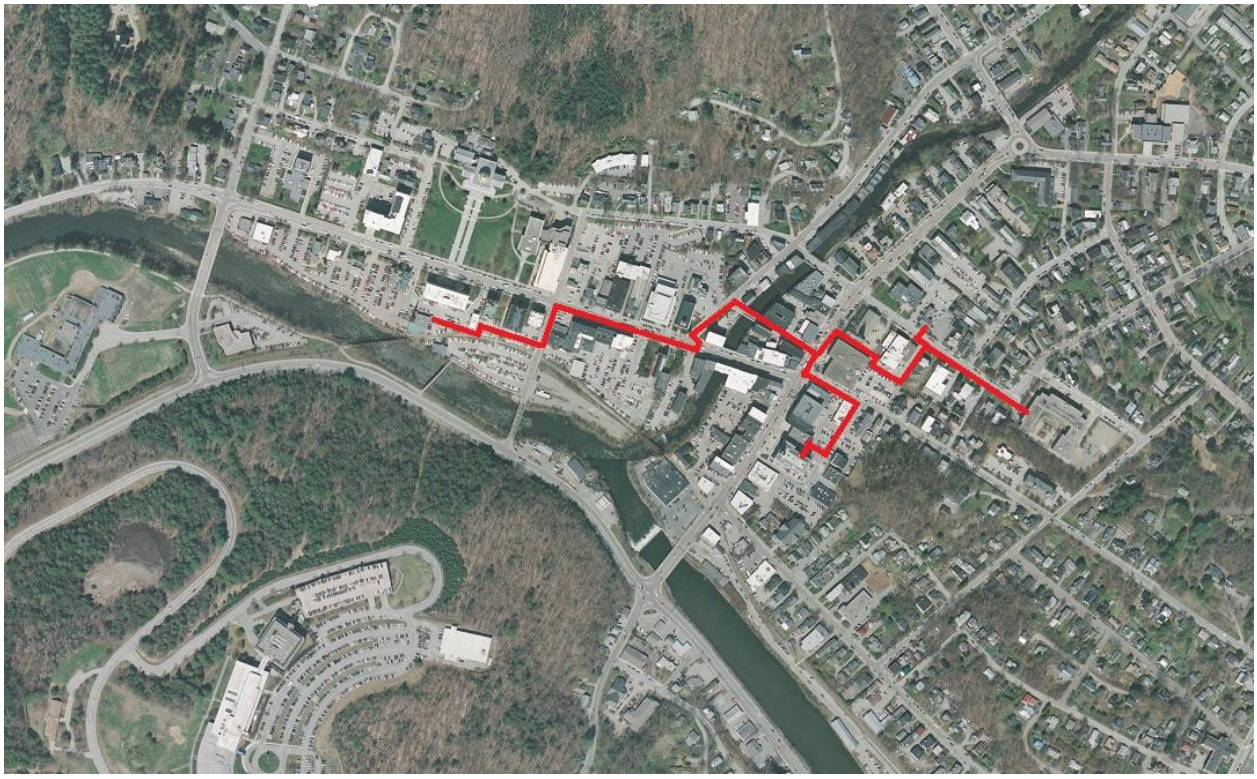
Conclusion

DHM was established to provide stable, competitive energy rates to its customers over a long period of time. As the system's rate structure is cost-based, it will be important for the business to maintain a

proper strategy for preparing for unforeseen costs that might otherwise create a spike in customers' rates. Equally as important will be to restructure the State Agreement so that DHM may economically expand the overall customer base.

Expansion

The DHM distribution system is routed through much of downtown Montpelier, and passes by or near a number of buildings that will not originally be connected to the system. The current configuration of the distribution system is shown below.



Distribution system route

While most buildings along the distribution route that should have connected to DHM did connect, some buildings could be added without a significant capital investment. In addition, technologies have emerged in the district energy industry that allow for more cost effective expansion to serve additional customers. Specifically, lower-cost piping systems and packaged substations have been effectively utilized on district energy systems in Saint Paul, MN and could be leveraged to expand the reach of DHM.

Lastly, if market conditions were to change and the cost of oil increased, some additional prospective customers may be financially incentivized to connect to DHM.

District Energy System Expansion

The development of district energy systems is a capital intensive endeavor that requires significant up-front investment. As such, the economics of the system and for all of its customers can be improved through system growth. By growing the load on the system, the debt service payments may be spread over a larger amount of customers and thus the capacity charge may be decreased. System growth is also important for the long-term sustainability of the system so that the impact of any one customer leaving the system may be reduced. Lastly, adding additional customers with diverse load profiles may

allow DHM to increase its energy sales while having less of an impact on the peak consumption of the system. It should be in the best interests of both DHM and the State of Vermont to increase the customer base of DHM.

Potential Short-Term DHM Expansion

The following buildings could be added to the system with minimal additional distributions system costs, and have shown an interest in becoming customers of DHM:

- 90 State Street
- 95 State Street
- 93 State Street (Capitol Theatre)
- 58 State Street
- 41 State Street
- 22 Elm Street
- 13-15 State Street
- 7-9 Langdon Street
- 8-20 Langdon Street
- 90 Main Street
- 100 Main Street
- 79 Main Street

Potential Long-Term Customers

As noted above, a limiting factor for the expansion of the system is the current agreement with the State. Until the actual consumption of the existing customers is known, expansion of the system is less attractive of a proposition because of the increased incremental cost of the additional energy, along with the additional capital cost to reach any buildings not currently on or near the network.

In the event that it is found to be economically feasible to expand the customer base, the following customers/areas appear to be the greatest opportunities for system expansion:

- High school/Credit Union/Union Mutual
- Barre Street Corridor
- Expansion north on Main Street toward Main Street Middle School
- Commercial block across from City Hall

Conclusion

Before DHM can expand its customer base, it first needs to establish an adequate record of its current actual peak demand. Once the actual system peak demand has been stabilized and tracked, DHM should determine how much peak capacity below 9.71 MMBtu/hr that is available and then decide what buildings could be connected while remaining under 9.71 MMBtu/hr. Based upon market conditions at that time, DHM should also look at opportunities of growing its peak demand in an economically feasible manner.

Initial Areas of Focus

The following areas of focus have been identified in this plan as warranting additional focus, and are broken out by category:

ITEM	DESCRIPTION	REQUIRED DATE	RESPONSIBILITY
Business Management			
BM1	Develop a strategy for growing the system, both from a customer base perspective, as well as a system peak load perspective.	5-1-15	
BM2	Develop State and customer reporting templates so that information may be tracked properly throughout the heating season.	10-1-14	
BM3	Establish a System Advisory Group and develop a charter for the Group.	8-29-14	
Operations and Maintenance			
OM1	Establish winter and summer operating protocol including: • Operator daily and weekly rounds on production and distribution system and recordkeeping. • Bypass/shunt schedule to ensure continuous flow through any piping that does not have active customers using heat.	10-1-14	
OM3	Develop and implement a system maintenance program that includes preventive maintenance schedule and predictive tools.	10-1-14	
OM4	Develop and implement an alarm wire monitoring program.	9-1-14	
OM5	Develop shutdown and emergency response plans for the system including contractor response and inventory of critical spare parts.	9-1-14	
OM6	Develop an on-call program for the system, including a 24/7 customer response plan. Communicate to customers and the state how to initiate a response by DHM.	9-1-14	
Customer and Community Relations			

CCR1	Develop and implement a customer education and training program for initial and ongoing system operation.	9-1-14	
CCR2	Develop and implement a peak management plan.	10-1-14	
CCR3	Develop a community education program for district heating systems and the DHM system.	9-1-14	
CCR4	Develop and implement a delta T management plan which should include periodic customer visits to verify proper utilization of the system.	9-1-14	
CCR5	Establish a program for monitoring actual energy consumption prior to invoices being submitted.	10-1-14	
Financial			
F1	Develop a rate and reserve management strategy for the business.	8-1-14	
F2	Establish a cost savings tracking program based upon oil prices through the heating season and actual customer consumption.	10-1-14	
F3	Develop protocols for creating customer invoices, mailing invoices and tracking payments	10-1-14	

EXHIBIT A

Hallam-ICS

ENGINEERING

COMMISSIONING

CONTROL SYSTEMS INTEGRATION

Montpelier District Heating
Basis of Design

Owner
City of Montpelier
39 Main Street
Montpelier, VT 05602
Department of Energy Grant Number EE0003071

Lead Design Firm
Mechanical, Electrical and Controls Engineer – In-Building
Hallam-ICS
38 Eastwood Drive
South Burlington, VT 05403
802-658-4891
Hallam-ICS Project Number 16442.000 and 16442.001

Distribution Piping Design
Ever-Green Energy
1350 Landmark Towers
345 St. Peter Street
Saint Paul, MN 55102

Civil/Structural Design
DeWolfe Engineering Associates
81 River Street
Montpelier, VT 05602
802-223-4727
DeWolfe Project Number 11258

Permitting and Environmental
DuBois and King
28 North Main Street
Randolph, VT 05060
802-728-3376

Revision History

Revision	Date	Description of Change
0	December 2011	Partial release to support routing choices
1	February 01, 2012	Initial release
2	February 23, 2012	Expanded allotment of project costs, included additional distribution system options
3	August 17, 2012	80% design milestone

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2	Details, Sketches and Information
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1 Introduction

1.1 General

The City of Montpelier, in coordination with the State of Vermont Department of Buildings and General Services, and with technical and financial support from the U. S. Department of Energy is planning to construct a district heating system in the City of Montpelier. The City of Montpelier hired Hallam-ICS and its sub-consultants to provide design documentation for the project. The project's baseline elements are:

- Construction of a buried, insulated, piped hot water distribution system serving the heating and domestic hot water needs of buildings in the downtown of the city, including City Hall, the Fire Station, Police Station and the Union Elementary School
- Customer connections to the system
- Connection and conversion of Union Elementary School from steam to hot water heat
- Coordination with the State of Vermont on their design for the district heat plant, from which the State's steam will be used to generate hot water for distribution to the City
- Design of the heat exchange system, which will be built as part of the State of Vermont's district heat plant

The principal goal of the City is to benefit public and private building owners though lower, stable heating costs over the long term.

1.2 Involved Entities

1.2.1 City of Montpelier

The City is the project owner and is responsible for engagement of the design team, bidding the work to contractors, coordination with the State of Vermont and the federal Department of Energy.

Individuals involved in this project from the City include:

William Fraser, City Manager

Todd Law, Director of Public Works

Gwen Hallsmith, Director of Planning and Community Development

Harold Garabedian, Project Manager

1.2.2 Hallam-ICS

Hallam-ICS is the lead design firm on this project and the official engineer of record. Hallam-ICS is the lead author of this document. Our work includes directing the activities of sub-consultants, mechanical, electrical, control design for the work inside buildings and conversion of Union Elementary from low pressure steam heating to hot water.

Individuals from Hallam-ICS include:

Christopher Wilkins, Project Principal

William Neuburger, Project Manager

1.2.3 Ever-Green Energy

Ever-Green Energy is the designer of record for all the underground work including the piping design, specification and modeling. Individual contributors from Ever-Green Energy include:

Michael Ahern, Project Manager

Sean McFarling, Project Engineer

1.2.4 DeWolfe Engineering Associates

DeWolfe Engineering is providing all the civil and structural design for this project. Additionally, they are directing the activities of the survey and underground locating firms. Contributing individuals include:

Rick DeWolfe, Project Principal

John Svagzdys, Civil Engineer

Nathan Phillips, Structural Engineer

1.2.5 DuBois and King

DuBois and King is providing guidance on permits and environmental concerns. In parallel to working with Hallam-ICS, D&K is also engaged directly with the City for managing the Environmental Assessment work associated with this project. John Benson is the lead engineer for this project.

1.3 Document Purpose

This Basis of Design document describes the engineering intent for all systems included in the design. This document's purpose at this stage is to document the decisions that the design team made during the design's development. This document builds on previous revisions and on a variety decisions and directions the City has given our design team.

The use of the term "we" throughout this document means the design team (Hallam-ICS, Ever-Green Energy, DeWolfe Engineering Associates and DuBois and King).

1.4 Key Findings

- Depending on what capacity distribution heating system the team selection, the cost estimate of the City's contribution to the project ranges from $4.6 million to $4.9 million.
- There are a number of open questions and issues both within the design team's control and requiring input or action from the City.

2 Project Requirements

2.1 Owner's Requirements

We have reviewed the engineering services request for proposals, previous district heating studies and the City's grant application to the federal Department of Energy. We also have engaged actively with the City and related entities during the development of this BOD. From this work we developed the following project requirements.

A. The project must connect at the minimum these four City owned buildings:
    a. City Hall (which supplies heat to the Fire Department)
    b. Police Department
    c. High School
    d. Union Elementary

B. The City Hall hot water system must have appropriate piping, valves and controls to allow these distinct operating modes:
    a. District heat only – the boilers are in a cold shutdown mode with no water flowing through them
    b. Demand limiting – the boilers will run to heat the building and use no district hot water
    c. District heat supplementing – the boilers will run to the heat building and the district hot water
    d. Summer district heating – the City Hall boilers will be the generation heat source for the district during non-winter times when the State's boiler plant is offline

C. The Union Elementary boiler project must include conversion of one of the existing hot water boilers (the Smith 28A unit) to steam and be piped to serve as a backup to the district heating

D. The district heating system must include standby electrical power for the heat exchange equipment and controls to assure constant water flow in the buried piping and to assure heat to customers

E. The routing should allow comment and action by Montpelier citizen groups with respect to opportunities to improve the flora, especially trees

F. The four City-owned buildings will have metering and controls for the district heat side that is more expansive and expensive than that for future non-City customers. This requirement puts the correct system sensing in place (for differential pressure) and allows the City to enforce the leaving water condition. See other sections for further discussion of system temperature change. Non City buildings will Future buildings may or may not have such expansive meter-controllers in their buildings.

G. The City has put the connection of the High School off for a future project, due to budget constraints this project includes

2.2 City-State Interactions

The City and State have signed agreements that define the contractual relationship for the purchase and sale of energy and the various responsibilities during design, construction and operation of the heating plant. Some key feature of those documents include:

A. The City is permitted to operate their own boilers (the contract defines the city's boilers as any boiler that is not the state's boilers) for certain durations and for certain reasons.

B. The City is permitted to install their own thermal energy meters in the heating plant, but they must provide access to those meters to the state

C. The City must provide its own electrical service and water service to their equipment in the heating plant. This requirement will require the City to provide its own standby generator for the City's equipment in the heating plant.

D. The City-State procurement agreement entitles the City to 9,710,000 btu/hour of heating of the State's heating plant (capable of 40,200,000 btu/hour total output) in this initial phase. The City is entitled to purchase additional capacity in 1,000,000 btu/hour increments. The State heating plant has up to a total of 16,300,000 btu/hour available for the City to purchase.

E. The City-State contract for Thermal Energy Purchase and Sale defines the dates of State operation (provision of steam to the City) as between October 01 and April 30 of each year

2.3 Codes and Standards

The codes governing work for this project are those defined by the Vermont Division of Fire Safety. Find their official listing here:

http://firesafety.vermont.gov/Standards

2.4 Governing Codes

These are the codes that are enforceable by the local Authority Having Jurisdiction (AHJ). We reviewed these codes and provide some narrative discussion of the salient parts.

2.4.1 Building Code

The official publication governing the building of this project is the Vermont Fire and Building Safety Code (VFBSC), 2006 with amendments dated June 01, 2011. This code references the majority of the International Building Code (2006 edition) and defines the other applicable codes.

2.4.2 Seismic Concerns

While this project's work in-buildings does not include new structures, the seismic design category is of consequence for the project mechanical and electrical installation. The following describes our analysis of the design category.

2.4.2.1 Building Occupancy

Consulting table 1640.5 in the International Building Code, 2006 Edition, we find:

Table 1 Building Occupancy Categorization

Building	Occupancy Category	Notes
City Hall/Fire Department	IV	The City Hall heating plant supplies the Fire Department and the FD is clearly defined as category IV in the table; it is appropriate to apply category IV to the heating system work in City Hall
Police Department	IV	The table clearly defines police buildings as category IV
High School	III	The table clearly defines schools as category III
Union Elementary	III	The table clearly defines schools as category III

2.4.2.2 Acceleration Response

From the International Building Code, 2006 Edition we find the following information:

Short Period (0.2 sec) Response Acceleration Parameters:

a. SS = 0.312
b. Fa = 1.55 (based on an assumed Seismic Site Class of D, from Table 1613.5.3(1)
c. SMS = 0.484 g
d. SDS = 0.323 g

Long Period (1.0 sec) Response Acceleration Parameters:

a. S1 = 0.088
b. Fv = 2.4 (based on an assumed Seismic Site Class of D, from Table 1613.5.3(2)
c. SM1 = 0.212 g
d. SD1 = 0.141 g

2.4.2.3 Building Seismic Design Category Definition

With the above acceleration values and tables 1613.5.6(1) and (2), we define:

Table 2 Building Occupancy Categorization

Building	**Seismic Design Category**
City Hall/Fire Department	D
Police Department	D
Union Elementary	C

2.4.2.4 Effect of Category Definitions

The Building Code refers to ASCE-07 to understand the meaning of these categories on the design of mechanical and electrical components. From ASCE-07, 13.1.3 requires the designer to assign a Component Importance Factor to the feature under consideration. This section mandates the mechanical and electrical systems (components) in this project to include the following factors:

Table 3 Building Occupancy Categorization

Building	**Component Importance Factor**	**Notes**
City Hall/Fire Department	1.5	The heating equipment is “attached to an Occupancy Category IV structure and is needed

Building	Component Importance Factor	Notes
		for continued operation of the facility"
Police Department	1.5	The heating equipment is "attached to an Occupancy Category IV structure and is needed for continued operation of the facility"
High School	1.0	"All other components shall be assigned a component importance factor equal to 1.0"
Union Elementary	1.0	"All other components shall be assigned a component importance factor equal to 1.0"

2.4.2.5 ASCE-07 Application

Part 13.1.4 exempts certain nonstructural components from ASCE-07. For the Category C buildings, the non-structural components are exempt from seismic design features under exemption 3 "Mechanical and electrical components in Seismic Design Category C provided that the component importance factor is equal to 1.0." This exemption covers Union Elementary and the High School.

Item 5 in the same section exempts "Mechanical and electrical components in Seismic Design Categories D, E and F where the component importance factor is equal to 1.5 and either:

a. Flexible connections between the components and associated ductwork, piping and conduit are provided.

b. The Components are 20 pounds or less or, for distribution systems, weighing 5 pounds/foot or less"

This section of the code does not exempt City Hall and the Police Department as the new piping and equipment will exceed both of these exemptions. The installation will include bracing for the equipment and MEP systems in these two buildings.

If the City operates/considers the High School and/or Union Elementary as emergency shelters, then the installation in those buildings will not likely be exempt.

2.4.2.6 Potential Ramifications and Open Questions

In addition to requiring the contractor to provide the appropriate bracing in City Hall and the Police Department the State's plant designer should consider the ramifications of the Seismic Design Category on the State Heating Plant. We believe the fact this plant serves the City Hall (Fire Department heating system) and the Police Department the State's heating plant should include an Occupancy Category IV and Component Importance Factor of 1.5.

2.4.3 Electrical Code

The VFBSC adopts of the National Electrical Code by the National Fire Protection Association and refers to the Vermont Electricians Licensing Board. The Vermont Electricians Licensing Board defines these as the relevant codes:

A. Vermont Electrical Safety Rules, 2011

B. NFPA 70 - National Electrical Code, 2011 Edition, as amended

C. NFPA 73 - Residential Electrical Safety Code, 2011 Edition

D. NFPA 780 - Lightening Protection Code, 2011 Edition

E. ANSI - C2 National Electrical Safety Code, 2007 Edition

2.4.4 Plumbing Code

The VFBSC defines the Plumbing Code to be as adopted by the Vermont Plumbers Examining Board. The VPEB adopted the 2009 edition of the International Plumbing Codes and also promulgates the Vermont Plumbing Rules. The current edition of the Rules is 2009 (effective as of December 15, 2010).

2.4.5 Boiler Code

Vermont has adopted the National Board Inspection Code, National Board of Boiler & Pressure Vessel Inspectors, 2004. This code covers installation, inspection and repair of boilers, pressure vessels and pressure relief devices.

2.4.6 Energy Code

The governing energy efficiency code is the 2011 Vermont Commercial Building Energy Standards. This will apply to all commercial projects that start after January 3, 2012. It is based on the 2009 International Energy Conservation Code.

2.4.7 Mechanical Code

The statutory minimum standard is the 2002 edition of NFPA 90A Standard for the Installation of Air-Conditioning and Ventilating Systems (defined in the VFBSC). Additionally, we will use the 2009 edition of the International Mechanical Code for guidance in areas not covered by NFPA 90A. We will also use guidance from the American Society of Mechanical Engineers and the American Society of Heating, Refrigeration and Air Conditioning Engineers for the piping and equipment design. Finally, we will use the design guidelines and handbooks for the underground piping system manufacturer to properly design and analyze those piping systems.

2.4.8 Environmental Codes and Standards

The Federal Emergency Management Agency (FEMA), through its subsidiary program, the National Flood Insurance Program (NFIP) regulates construction within the regulatory floodway. This regulatory authority prohibits Encroachments within the regulated floodway.

Encroachments are activities or construction within the floodway including fill, new construction, substantial improvements, and other development. These activities are prohibited within the adopted regulatory floodway unless it has been demonstrated through hydrologic and hydraulic analyses that the proposed encroachment would not result in any increase in flood levels. The hydrologic and hydraulic proof can be documented by completing a NO RISE Flood Certification. These certifications tend to be fairly time consuming and expensive exercises using computer modeling. In order to obtain a No Rise certification, your computer model must show that the river elevation does not rise at all. A rise of 0.01 feet in the 100 year storm event would not be allowable in a No Rise certification.

The system requires periodic “flash pits” which are basically catch basins which enable discharge of the water in the piping system to be drained for maintenance or service. The water within the heat distribution piping will be approximately 220 degrees F and will contain chemical treatments which reduce the oxygen content of the water within the piping system. It is our understanding that this connection is not a concern in the Saint Paul, Minnesota system. These connections may require a permit from either the Vermont Agency of Natural Resources or from the EPA. Potential programs which may regulate this connection include National Pollutant Discharge Elimination System (NPDES) permits, 401 Water Quality Certifications or a Municipal Separate Storm Sewer System (MS4) permit. We will begin discussions with the Vermont Agency of Natural Resources this week to determine how best to proceed with either permitting these connections or coming up with design alternatives. We may have to make these

connections to the Montpelier Sanitary Sewer system and these connections may require the installation of lengths of ductile iron piping prior to connection or some other alternative method for allowing heat to dissipate from the discharge water prior to connection to PVC or some other pipe material not specifically designed to accommodate water at these temperatures.

The City of Montpelier, Department of Public Works is responsible for insuring that work within the city streets is restored properly. We are recommending a typical pavement patch of 4" of bituminous concrete over an 18" base of crushed gravel meeting the Vermont Agency of Transportation standard for Dense Graded Crushed Stone.

3 Distribution System Design

3.1 Description

The distribution system for the Montpelier District Heating system is used to transmit the heated water from the plant to the customer for the space heating and domestic hot water usage by the customer. The system will be constructed using a European style system for construction and operation. Hot water district heating has been used for over 50 years in many communities in Northern Europe, and nearly 30 years in Saint Paul, MN to provide building heat. As a result, this style of system has established a reliable reputation for being a high quality, efficient system. This means that the water will be effectively the same temperature when it reaches the customer as when it leaves the plant, with minimal maintenance and operation costs.

The distribution piping system will cross through downtown Montpelier, providing service to the core downtown district and City buildings along the route, and will connect to Montpelier High School and Union Elementary School on the western and eastern ends of the system, respectively. Through the course of the route, the system will cross the Winooski and North Branch rivers by being suspended underneath the Bailey Avenue and Langdon Street bridges. See Section 10 Risks and Mitigation for a discussion of freezing risks.

The distribution system will consist of two pre-insulated steel pipes, ranging from 1.5” to 6” or 8” in diameter. The pre-insulated piping components are constructed from seamless or spirally welded steel pipe, which is then placed into the center of a larger diameter high density polyethylene (HPDE) jacket (5” to 18” outside diameter), and the space between the steel pipe and the HDPE jacket is then filled with polyurethane (PUR) foam insulation. Encased inside the insulation are two bare copper wires that are used to monitor the system for moisture within the insulation.

The hot water distribution pipes will be generally buried with 2.5’ – 3’ between the top of the pipes and the ground surface. This depth may increase or decrease (minimum of 18” burial depth with a concrete slab above), depending on the number and complexity of conflicts with other utilities that are encountered during the design and construction of the system. Because of the insulation, and the flow of hot water through them, there is essentially no possibility that the pipes will freeze, even in the coldest temperatures. The pipes are considerably robust, and when buried at least 2’ below a pavement surface, are rated for highway traffic loading (AASHTO H-20).

The system will be controlled by means of shut off valves for maintenance, customer connections and other infrequent system shutdowns. These valves will also be pre-insulated and directly buried in the ground with the distribution system piping. The valves will be accessible from the surface, and will be organized for system maintenance and expansion possibilities. Venting and drain valves will also be included into the system at all high points and low points to facilitate the filling and draining of the pipes. The drained water will be diverted through a concrete “flash chamber” where the hot water has a chance to release a large percentage of the heat before being discharged into the storm drainage system.

The distribution system will branch off from the larger size hot water main pipes to serve the customer buildings. These branch lines will be smaller sized hot water pipes, constructed with the same materials and methods as the distribution main pipes. The service branch lines smaller than 4” will connect to the main lines through a “hot tap” connection. This type of connection allows the service branch connection to be made while the hot water main pipes are still in service, thus removing the need for the entire section of the system to be shut down to connect a single customer. A 4” line size will be adequate for any future customer.

The service branch pipes will run from the main line connection to the customer building wall. At the wall, the service branch pipes will pierce through the building foundation wall or floor near to the building mechanical space. The service pipes will be placed inside steel sleeves, which will be inside a core-drilled hole in the concrete, stone, or block foundation, through the wall to a point roughly six inches inside the wall. The space between the core-drilled hole and the steel sleeve will be filled with non-shrinkable grout. The space between the steel sleeve and the service pipe will be filled with oiled oakum, and flexible

insulation material. The entire affected exterior wall will be coated with asphalt cement material to seal the wall from any ground water. At the point of termination of the pre-insulated pipe inside the building, service valves will be installed, marking the point of interconnection between the customer owned pipes and the system piping.

3.2 Routing

RDA Engineering provided a routing plan as part of their contract with the City to provide a future customer assessment and a cost estimate of the installed system (the prime consultant on that project was Tim Maker of Community Biomass, Calais, VT). They presented their routing in a drawing set dated April, 29, 2011. This section details the route, comparing and contrasting the RDA preference with that of the Hallam-ICS team (Team). It also memorializes the rationale and concepts the City and their consultants used in their process (including DuBois and King acting as the environmental engineer to develop the Environmental Assessment).

3.2.1 High School to Bailey Avenue

The RDA route indicates running in the driveway from the foundation wall to the sidewalk just west of Bailey Avenue, turning north and running to the bike path. At one point during the development of the project in early 2011, DuBois and King discovered the grassy parking area to the north and east of the high school building is “archeologically sensitive” and the team would be wise to avoid running through that area. The team then used their judgment to run the piping through known-disturbed earth (driveway and sidewalk).

We believe there will be cost savings associated with running the piping east (perpendicular to the high school wall) across the driveway into the grassy area to the south of the driveway, then turning north with a 90 degree elbow to cross the driveway again, to the north. From here the route would be the same as RDA proposed to the bike path. This routing has advantage as the piping system design guidelines indicate 90 degree elbows are preferable to 45 degree elbows.

The disadvantage of this routing is we have to cross the driveway twice and we are uncertain about the archeological sensitivity of the southern grassy area. DuBois and King advises we can clear this concern (and update the Environmental Assessment) if we can discover documentary evidence (drawings, photos, etc.) this soil has already been disturbed by previous construction. The other alternative is to engage with the archeological consultant to perform inspection and soil borings. DuBois and King will have to investigate this issue further as part of their work with the City.

3.2.2 Bailey Avenue to Plant

The RDA route runs within the bike path to the pedestrian bridge, then crossing the Winooski on the pedestrian bridge and through the State’s parking lot to the eastern wall of the plant. This route offers the advantage of using land already within the City’s control. Also, it positions the City well to one day connect to National Life (and their existing wood chip steam boiler plant) to serve as a non-heating period wood-source of hot water. Connection to National Life is not a project requirement at this time, but it is important the design consider this future connection.

This routing offers some complications worth noting:

A. The pedestrian bridge is currently closed to traffic due to significant structural deterioration of the supporting steel and is not available to this project for piping. See Figure 2 Underside of Pedestrian Bridge for an image of the steel supports.

B. Running to National Life (via an existing utility trail between Memorial Drive and the northern edge of National Life’s campus) will require over 2,000 feet of trench and about 4,000 feet of pipe (see Figure 1 Potential National Life Routing).

C. The National Life building is roughly 200 feet higher in elevation than the City’s downtown, adding a static pressure to the district heating system of about 100 pounds per square inch (psi). In a customary piping configuration, this pressure will add to the cold fill pressure of the system and the

distribution pump discharge. We previously were expecting to operate with a pump discharge pressure below 100 psi. This connection would increase the pressure in the piping and heat exchangers appreciably. The wiser option to connect National Life's system will be to run dedicated hot water lines from a new National Life steam-to-water heat exchanger to the City's Heat Exchange room in the State's plant. This direct line will exchange heat with the district heating system, keeping the high pressure off the City's distribution system. This approach is common in tall buildings for heating and cooling systems.

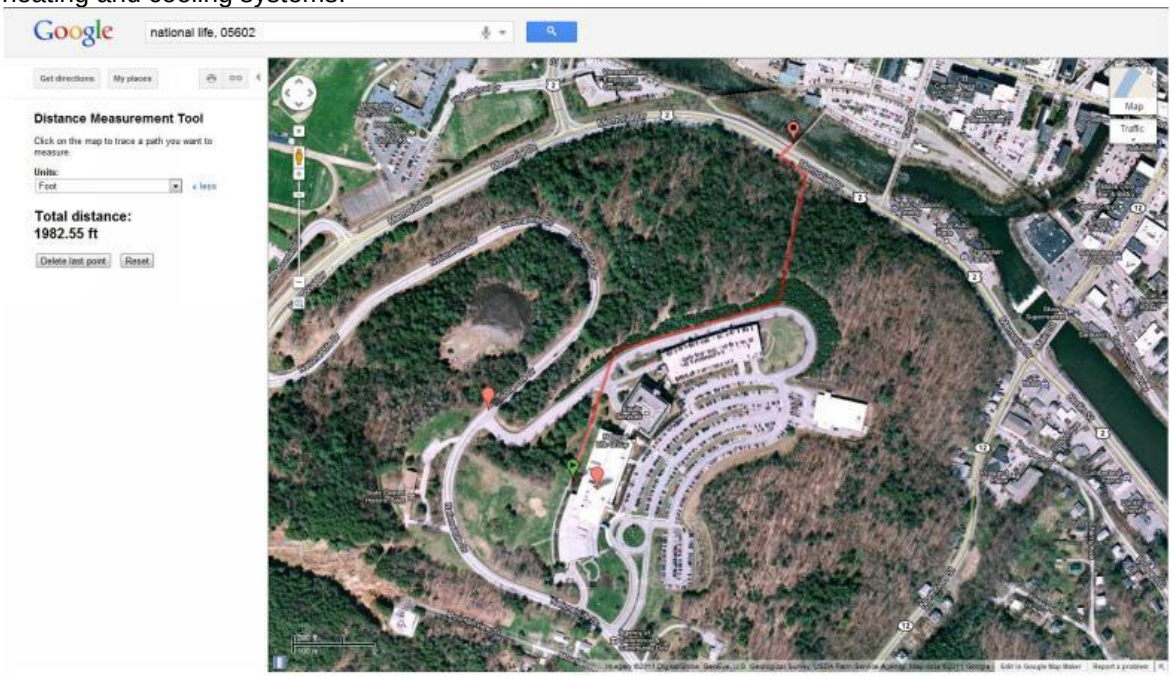

Figure 1 Potential National Life Routing

Figure 2 Underside of Pedestrian Bridge

D. The bike path routing would require crossing the railroad right of way in two places. The City of Montpelier and DeWolfe Engineering just completed a similar rail crossing as part of the flood mitigation project. Based on the recent FEMA force main jack and bore crossing, we estimate that the

total cost for two crossings (four pipes with steel sleeves) would cost approximately $150,000.00 In addition, the City would have to make annual payments to the State (railroad owner) in perpetuity for each crossing.

The design team proposes that rather than running to the High School on the south side of the Winooski, the pipe may be routed through the State's parking lots (and through 146 State Street, owned by Vermont State Employee Credit Union). This routing offers some advantages and challenges.

Advantages:

A. It avoids the pedestrian bridge and associated decking replacement challenges. If the City preferred, we could incorporate a decking replacement design into this project's design efforts to be sure the design is coordinated (technically and schedule). If the City prefers to renovate this bridge outside of this project's scope, we need to understand the schedule and design plan for that work to be sure our design coordinates technically and the construction is complete in the autumn 2013 timeframe.

B. Our suggested route crosses the river on an existing, good-condition bridge (Bailey Avenue Bridge) where we can install the piping suspended below the downstream sidewalk, providing good protection from any debris carried in a flooding river.

C. Our suggested routing is about 240 feet shorter than the RDA proposed routing.

D. This preferred routing eliminates two rail crossings; conserves cost and reduces complexity.

Challenges:

A. The routing for a future National Life should be a separate pipeline (due to static pressure concerns identified above), so the routing the high school's piping across the pedestrian bridge offers no advantage and in fact, running the high school piping on the pedestrian bridge increases the suspended load (two runs of piping instead of just National Life's piping).

B. Our suggested routing through the State's parking lot requires additional easements with the State (beyond the plant and near-plant that the RDA routing identified). We do not have any reason to believe the City and property owners cannot come to a resolution for easements.

C. Our suggested routing requires an easement from VSECU at 146 State Street. A meeting in January 2012 with the facility manager from VSECU indicates VSECU is willing to grant an easement to the City provided the City provide:

    a. The City and contractor will make efforts to control dust in the vicinity of 146 State during construction.

    b. The City will make alternate parking facilities available; the High School parking lot will be acceptable to VSECU.

    c. The City will ensure VSECU has access to their building during the entire construction project.

    d. The City will repair the parking lot in the areas they damage it.

    e. The City will repair any underground structures that are damaged due to construction.

    f. At VSECU's option, the City will rebuild the entire parking lot, storm drainage structures and curbing with VSECU funding the extra cost to the City.

D. Our suggested piping does extend the length of branch piping needed for the future, potential 1 Bailey Avenue VSECU property. The additional distance is less than the 240 feet of trench we save compared to the pedestrian bridge route. Also, it is uncertain at this time if VSECU will participate as their desire to connect is driven by a financial improvement.

E. DuBois and King did not evaluate the State's parking lot during the Environmental Assessment development. DuBois and King states this routing will require some research from the archeological consultant; even though it is a parking lot, DuBois and King believes imported fill used to create that

parking lot lies above undisturbed soils. DuBois and King does not think this area will be deemed archeologically sensitive.

3.2.3 Plant to State Street

The RDA plan includes leaving the plant going southward, crossing below the rail within the State's property, running east through the State's parking lot and then running North in Taylor Street, crossing below the rail again on as the route heads towards State Street. On State Street, the piping runs to the east and turns north at Elm Street.

The Team believes running through the People's Bank parking lot (112 State Street) easterly from the plant directly to Taylor Street will conserve cost in the rail crossing and pipe length in general. We have not discussed an easement with the owner, however we expect the owner to allow an easement with terms similar to the VSECU. The State is evidently a partial owner of this property as a condominium.

The Team considered running behind the Capitol Plaza Hotel (100 State Street), but the owner unequivocally stated he will not grant any easements for this project.

3.2.4 State Street to Union Elementary

The RDA proposal includes running on Elm Street to Langdon Street, crossing the North Branch on the bridge (refurbished in 2007) and then easterly to Main Street. At Main, the pipeline runs south to East State Street, then east along East State Street to Cedar Street. The pipeline runs down (northerly) Cedar to School street, turning east and then into the school's basement. A branch drops off East State and runs south through the parking lot (between 11 and 15 East State Streets) to supply City Hall (and the Fire Department) and the Police Department.

The Team considered an alternate approach, instead of turning east from Elm Street on Langdon, we considered running to School Street, crossing the North Branch on that bridge (rehabilitated within recent past) and then straight to Union Elementary. The piping would either run down Main Street to East State and have the same path to City Hall as RDA recommended, or it could run on Cedar and East State to City Hall. This routing offers some advantages over RDA's routing:

A. Langdon Street is relatively narrow and poses challenges with excavation while maintaining access to business, School Street is relatively wide in comparison

B. Langdon Street has at least 5 commercial business store fronts this work will interrupt during construction, this project would only interrupt one commercial storefront on School Street (on the corner of Elm)

C. This routing brings the main distribution system closer to the commercial and multi-tenant properties on Elm and Main streets north of School than the RDA routing; also this routing is closer to the group of churches and the library near the intersection of School and Main streets.

During the evaluation of the Langdon versus School routing options, the following challenges to the construction of the system across the North Branch at School Street were identified:

A. School Street is more expensive from a first-cost perspective

B. The School Street routing removes the potential advantage of supplying State Street business (on the north side) from the alley between State and Langdon

C. There are extensive communication lines on School Street in the vicinity of the Fairpoint Communications Central Office

In light of these challenges and potential for immediate service connections, the team recommends proceeding with the Langdon routing.

3.3 System Design Basis

3.3.1 General Philosophy

Once we had the pipeline routing decided (see section 3.2) we had to forecast a connected load to design the pipe diameters (directly related to capacity).

When we started this project, we developed a heating system to serve the geography, based on our experience with other district heating systems and understanding. We developed a distribution piping system to accommodate a future, fully-built out load. Our estimate is this future, eventual load might be 40,000,000 btu/hour. We developed a conceptual design and cost estimate for this configuration.

We also approached the distribution system design to match the available State plant capacity without purchasing an additional boiler. This value is approximately 16,300,000 btu/hour. We used that value as the peak available at the heating plant and developed a potential connected building list that could use that capacity. This list is in Appendix 3. This list does not represent committed customers, but buildings we used to help design the heating system. There is no way to predict the future connected customers.

Our last approach to the hot water system distribution is to define a hot water system that meets the absolute minimum criteria of serving the four City buildings. We do not recommend this system as it allows for little growth, however we evaluated it simply to understand the cost impact of including growth in the system design.

3.3.2 Customer Energy Loads

The customer energy loads for the distribution system were estimated using energy consumption usages based on the building's occupancy type. The loads were derived from the Department of Energy's Commercial Building Energy Consumption Survey (CBECS) Natural Gas Consumption Tables (2003). See Appendix 3 for the source details. The calculations are based on the following assumptions:

A. The natural gas usage for a building is primarily for space heating.

B. For single family residential building occupancies, an additional 20% usage factor was added to the space heating natural gas usage. This is based on Energy Information Administration Residential Energy Consumption Survey (RBECS), Tables WH7 and SH8 (2005). These tables list the Average Consumption for Water Heating by Major Fuels Used, and the Average Consumption for Space Heating by Main Space Heating Fuel Used, respectively.

C. Because a district heating system inputs the thermal energy directly into the building HVAC system, without the losses in efficiency due to the combustion of natural gas to transfer heat to the building heating medium (air, steam, water, etc.), a 20% reduction in the energy consumption is assumed.

D. The estimated energy use factors were derived from the Natural Gas Energy Intensity (ft^3/ft^2) for Zone 1 on EIA Table 30A. These energy use factors were then converted into the correlating kilowatt-hour per square foot (kWh/ft^2) factors based on building occupancy type as shown in the following table. These use factors were then used with the building square footages and occupancy types to calculate the energy usage in Million British Thermal Units per Hour (MMBTUH).

Table 4 Occupancy Types

Occupancy Type	Estimated Use kWh/sq ft (80% of CBECS/RBECS Consumption)
Education	12.4
Grocery	15.0
Restaurant	9.5

Inpatient Health	26.7
Outpatient Health	15.0
Lodging	13.0
Mercantile Non-mall	10.8
Mercantile Mall	9.9
Office	11.3
Public Assembly	11.6
Public Order/Safety	13.0
Religious Worship	11.5
Service	16.6
Warehouse	8.1
Parking	0
Multi-family Residential	9.8
Industrial	14.1
Single Family Residential	10.9

3.3.3 Distribution System Sizing Parameters

- 220 degree F Maximum Supply Temperature
- 170 degree F Return Temperature
- 40 degree F Design Temperature Difference
- 70% Market Penetration for Buildings Served
- Total future building area this plant will serve is 1,800,000 square feet (based on the Department of Energy grant for this project) and this area breaks down as follows:
    - 544,000 square feet for existing State buildings
    - 10,000 square feet for future State buildings
    - 194,117 square feet for existing City buildings (City Hall and Fire Department, Police Department, High School and Union Elementary)
    - 1,051,833 square feet of future district heating loads (customers)

The City and the design team must discuss the service area and likely connected buildings before the start of the detailed design to best define the present and future loads. There are a variety of factors affecting this final choice including the City's preferences, interested land owners, the viability of the State expanding the system to their buildings on Green Mountain Drive or new construction on Green Mountain Drive. The total future load can easily exceed the 9,710,000 btu/hour capacity the City currently owns.

3.3.4 Distribution System Materials

The distribution piping system is assumed to be designed for the dual European standard, thin-walled, pre-insulated district heating piping systems. These systems include the valves, bends, fittings, vents, and drains, etc. All of these system components are constructed to the same rigorous European Committee for Standardization (CEN) standards that regulate the manufacture, design, and construction of the district heating system. During the course of design, the smaller diameter pipes may be revised to be twin pipes (two pipes within a single jacket), revising the design in this manner could possibly reduce construction costs and will increase the efficiency for the system operation.

3.3.4.1 ARRA Buy American Provisions

The Montpelier District Heating project has received funds from the Department of Energy for the design and construction of the district heating system, and therefore, the project is subject to the Buy American provisions of the American Recovery & Reinvestment Act (ARRA) of 2009. The City has applied for a waiver from these provisions for the hot water distribution system on the basis of non-availability, due to the inability of domestic manufacturers to meet the performance specifications established for this project. Should this waiver request be denied, the distribution system specification and design would change to allow materials that are available from domestic manufacturers.

3.3.5 Labor Wage Rates

For cost estimating purposes it is assumed that all laborers, pipe fitters, welders, insulators, and electricians will be paid according to the least prevailing wage (Davis Bacon wages) promulgated by the Vermont Department of Labor. This wage rate is used with the estimated number of hours it takes weld the hot water pipe together, insulate the welded joints, test and connect the alarm wiring system, and seal the joint. As the pipes are 40 feet in length, with two pipes, there will be two joints every 40 trench feet in the system. There will also be additional joints located at fittings and valves that will add into the total to estimate the cost for construction of the hot water district heating system.

3.3.6 System Bury Depth and Backfill

It is assumed that the hot water heating distribution system will be installed at an average depth of 2.5’ – 3’ to the top of the preinsulated pipes. This will reduce the amount of excavation that is required for the system installation, subsequently, reducing the amount of surface restoration that is necessary.

The buried hot water pipe system will be supported in the ground by a six inch layer of blended gravel and sand. This bedding material provides a suitable load bearing surface so that the pipes, when filled with water will not settle into poor soils. The pipe zone, one foot above and on each side of the pipes, will be backfilled with clean sand. This sand has two beneficial effects on the system, first the sand is non-cohesive, meaning that there is no additional factor to the soil that increases the resistance to the thermal expansion, and thus increasing stress in the pipe. Secondly, the sand provides a well-drained corridor for the pipe, so that the system is not placed in a saturated soil condition, thus increasing the surface pressure on the pipe from the soil.

An important concern with such a shallow bury-depth is frost and the freeze-thaw cycles that cause frost heaves. The design and installation of this system minimizes the effects of earth movement due to frost heaving. In fact, District Energy St. Paul has never experienced an issue or failure in a pipe due to soil freezing. Also, discussions with a pipe manufacturer’s representative in Canada reveals the same experience. The reasons for negligible impact include:

- The hot water pipe is bedded and buried in clean sand, and therefore the effects of the water expansion are cushioned in the soil porosity properties of the sand
- The hot water pipes are flexible (compared with traditional heavy wall piping), the effects of frost heaving are absorbed within the pipes without yielding any portion of them
- The heated water in the pipe creates a minimal portion of relatively warmer soil around the pipes, thus creating another small cushion against frost heave

3.3.7 Service Connections

The distribution system will be defined as the buried hot water piping system from the exit from the plant to six inches inside the customer building, and will include all piping, valving, vents, drains, flash chambers, stand pipes, structures, and other appurtenant works in the system. The building service entries will be constructed according to the detail shown in Appendix 3. The wall penetration will consist of a core drilled opening through the building foundation wall or floor space, a steel sleeve with a 2” annular flange, non-shrinking grout, oiled oakum, and asphalt cement sealing material. This building penetration allows for the thermal expansion of the pipe, as well as providing a waterproof seal for the

building to prevent any water from infiltrating into the building space, and thus potentially causing damage. Oakum is preferred in this installation as it allows for some pipe movement without losing its water proofing seal.

3.3.8 Future Service Connections

We assume that the future service connections to the district heating distribution system that will take place after the initial construction of the system will be made with hot tap connections. Hot taps are preferable for this system as they eliminate the installation of superfluous branch connections for services that may never be connected to a customer. These unused tees would fill with corrosive sediment, and eventually would cause leaks in the pipes. Hot tap valves and tapping equipment are available and customary for this type of water distribution system for branch lines up to 4" in diameter, which will capably provide heating service to any of the buildings proposed to be on this system. Also, by using a hot tap connection, the distribution mains will be able to remain full and provide service to the customers on those sections of the system while the connection is made.

3.4 Special Codes or Standards

The district heating system will be designed and constructed to the following standards:

A. European Committee for Standardization (CEN) EN13941 – Design and Installation of Preinsulated Bonded Pipe Systems for District Heating (dependent on ARRA Buy American waiver approval)

B. American Society of Mechanical Engineers (ASME) B31.1 – Power Piping

C. ASME Boiler & Pressure Vessel Code (BPV)

    a. Section II – Material Specifications

    b. Section IX – Welding and Brazing Qualifications

D. American Welding Society (AWS)

    a. A2.4 – Symbols for Welding and Nondestructive Testing

    b. A3.0-76 – Welding Terms and Definitions

E. City of Montpelier, Department of Public Works, Design Standards for Road and Utility Construction

F. Vermont Agency of Transportation, 2011 Standard Specifications for Construction

3.5 District Water Temperature

Montpelier's July 2011 request for proposals to engage the design firm suggested 195 deg F as the leaving water temperature and a 65 deg F temperature change in a customer's HX. Considering this differently, the RFP suggests 195 deg F entering temperature and 130 deg F leaving temperature in a customer's site. This drop is unlikely considering the majority of the space heating equipment in the geography of the district work with hot water in the 160 to 200 deg F temperature range. Few loads are available with such low return water temperature.

In a previous revision of this document we described the method to define the system temperature range of 170 to 210 degrees F. Since that revision, we have increased the supply temperature for the times the State's heating plant is active range to 220 degrees F and kept the return water temperature at 170 degrees F. The goal of this change is to increase the heating capacity of the district hot water piping. This increased supply water temperature does not change the underground piping design or require additional or larger expansion control measures.

Table 5 Design District Heating Temperatures

Attribute	Value

District heating supply water temperature at customer interface	220 degrees F
District heating return water temperature at customer interface	170 degrees F

3.6 District Water Quality

It is important the construction project fill the system with water of an adequate quality at the start of the project and maintain the quality levels over the life of the system. Logstor (a manufacturer of the preinsulated piping system that is this project's design basis) recommends these water quality parameters:

A. pH 9.5-10

B. no free oxygen

C. Total salinity < 3,000 mg/L

In addition to those water quality measurements, we have discovered these other facets that should govern the water quality:

A. Annual makeup <5% of total volume

B. Hardness < 200 ppm

C. Chloride < 150 ppm

D. Total solids < 1000 ppm

E. Other contaminants < 1 ppm

The maintenance of an oxygen free system is of the utmost importance as the piping system's thin walls (which provide many benefits) do not have significant corrosion tolerances (as a heavy wall piping system would). We will specify a water treatment system to meet these standards; we expect the City's Department of Public Works to provide valuable insight into the variations of domestic water quality across the year. One way to reduce City and State cost might be to use treated water from the State's boiler system as water for the City's distribution system.

3.7 European Distribution Piping System

European style thin-wall steel district heating systems have several characteristics that provide greater design precision, construction efficiencies and operational characteristics.

3.7.1 Design

Design of the European style district heating system is regulated by the European Committee for Standardization (CEN) through the EN 13941 standard. This standard provides a comprehensive, uniform basis for the design, construction, and operation of district heating systems. This helps to ensure that the system is reliable, efficient, and safe for the surrounding area, public health, and the environment. This standard, in conjunction with the other applicable EN standards, are able to predict the overall long term behavior of the system under sustained high temperatures, which leads to more precise stress calculations and understanding of the physical reactions within the system.

3.7.2 Wall Thickness

The thinner wall section of the European specification thin-wall piping enables the system to be more efficiently constructed, and more manageably operated, because of the thermal expansion characteristics this steel exhibits when exposed to elevated temperatures. The thermal expansion characteristics of steel pipe are a function of the steel cross-sectional area of the pipe. The cross sectional area of the steel within European thin-wall pipe is generally about 1.7 times thinner than that of standard weight US pipe. The decreased wall thickness does not, however, reduce the safety and performance of the system. The

steel used within the European made thin-wall pipe is effectively equivalent to ASTM A53 standards, and conforms to the requirements of ASME Boiler and Pressure Vessel Codes (B31.1). This reduced steel thickness results in lessened thermal expansion when exposed to increased temperatures, and therefore has a number of resulting effects on the design, construction, and operation of the system. In normal installations, the decreased thermal expansion creates less stress in buried piping systems as the steel expands with the soil resisting this expansion. This resulting decreased stress alleviates the requirements that the system be designed and constructed with excessive expansion loops or fittings, bends, and large concrete anchors to ensure the pipe does not become over stressed and rupture during operation. During design we must be mindful not to install the thin wall pipe at depths which exceed the standard bury depths for excessively long lengths because over stressing of the pipe can occur.

3.7.3 Valves

The European style system utilizes pre-insulated valves; these valves are able to be buried directly with the rest of the distribution system. These valves have weldable ends, and thus there are no additional parts (flanges, gaskets, bolts, etc.) that have the potential for failing in the future. These valves also reduce the construction installation efforts. Pre-insulated, directly buried valves maintain a homogenous piping system, which operates in the same manner throughout the entire system. Another benefit of the direct buried valves is that they do not require placement in a large underground concrete vault structure, or placement above ground inside a protected, fenced in, enclosure. Either of these enclosure requirements adds elements to the system that add greater complexity to the design, construction, and operation of the hot water heating system.

3.7.4 Leak Detection & Monitoring System

The European standards for pre-insulated district heating materials require that manufacturers construct system components with two leak detection and location wires embedded within the insulation of the components. These wires measure the electrical resistance between the wires and the steel pipe. During normal operation, the resistance measures close to infinity, because the insulation separates the wires from the pipe. When there is moisture within the insulation, due to a leak in the steel or damage to the HDPE jacket, this resistance lowers until it approaches zero. The two wire system allows for the monitoring and location of leaks or jacket damage on branches, tees, and other fittings. The two wire system also has a redundant characteristic, so that if one wire is damaged, or incorrectly connected, the second can provide the monitoring.

In the event of pipe leaking or jacket damage, the wires can then be used to locate the moisture reading. The leak detection scheme gives a location within 5’ of the leak. The leak detection system measures the impedance of the wiring and piping system, referencing baseline impedance established at initial construction. This leak detection and location system will allow the City to enact repairs effectively and efficiently before a catastrophic failure of the system occurs.

3.7.5 Insulation

All European specification manufactured hot water district heating system components are insulated with CFC free polyurethane foam that is injected into the cavity between the steel pipe and the HDPE jacket. This insulating material minimizes the heat that escapes from the hot water in the course of the distribution system, increasing the cost effectiveness of maintaining a consistent temperature within the system. The thermal efficiencies of the polyurethane foam, combined with the lower temperature of the hot water (compared to high pressure steam), meaning that even though the piping system will only be a few feet below the ground surface, there will not be a “heat signature” effect on the surface, thawing out the soil around the pipes during the dead of winter. Correspondingly, the frost depth in the soil will not transfer into the pipes to cause lower water temperatures or freezing within the pipes.

3.7.6 HDPE Jacket

The outer jacket of the preinsulated piping materials is constructed of High Density Polyethylene plastic. This is the same material that is used in many locations for the underground distribution of drinking water,

natural gas, storm drainage, and sewer mains. The HDPE jacket is thoroughly bonded with the insulation within the pipe so that all components of the system react as a single unit. This resilient material provides protection for the insulation, and a surface that interacts with minimal soil to pipe surface resistance. Therefore, it is only the weight of the soil restricting the thermal expansion of the pipe, instead of the surface friction from the jacket.

3.7.7 Communications Conduits

Two, two inch diameter PVC conduits will be buried between the dual district heating pipes, and approximately one foot above the heating pipes. The installation will include the appropriate ancillaries to allow expansion and modification of the conduit system. These communications conduits will provide a means of collecting and measuring the energy usage from each individual customer. This data will be used to accurately bill customers, but also to monitor the operation of the system within each individual building in the event of an issue that needs to be corrected.

3.8 District Heating Service Areas

The information presented in this section represents our current understanding of the system. We can achieve an improved project design direction, more accurate cost estimate and a more complete understanding of the City's goals after the design team and the City meet for an extended discussion of the district heating geometry and heating rate.

RDA Engineering identified and laid out a potential ultimate future system plan in the Customer Connection Information report that was submitted to the City in 2011. The map that was included in this report showed large areas of the City that would eventually connect into the district heating distribution system. Included within these connection areas are large sections of the City that are generally lower density, Single-family residential buildings. Single-family residences do not generally possess the high energy usages that make district energy an economically feasible option for their heating needs. Most single family residential buildings also would require extensive, and expensive, retrofitting of the HVAC systems within the buildings to be able to utilize the energy provided to the building through a district heating system. The costs of extending the distribution system and retrofitting the interior HVAC systems of the customers generally make the inclusion of large clusters of single-family residential buildings into a district energy system too cost prohibitive.

From an energy usage position, this design team identified roughly 116 buildings in large residential clusters that abut the RDA proposed future piping layout. These buildings account for roughly 37% of the total potential buildings that could connect to the district heating system, but these buildings would only account for 19% of the total building square footage of the system, and only 15% of the total energy load. The average square footage of these buildings is almost half the square footage of other buildings proposed to be on the system, and the average energy usage is estimated to be almost 60% less than the average building proposed to be on the system. As single family residential buildings are historically unlikely to connect to a district heating system, this design team recommends that these clusters be excluded from the total load calculations. This exclusion should not be detrimental to the goals set forth by the City in the Department of Energy narrative.

Those areas where construction of a district heating system would not be economically feasible are outlined below.

3.8.1 Mather Terrace/Hopkins Street

One area that was identified in the RDA proposed system that has been excluded from design of the distribution system total loading is the area immediately east of the capitol building on Mather Terrace. These buildings were included in the RDA proposal because of the proximity to the State's steam district heating system, which will be converted to hot water in the future. While these buildings (offices and single-family residences) are close to the State's system, they are very isolated from the remainder of the hot water system that is being constructed by the City. Thus, the large cost for extending the distribution piping to these few buildings would be very cost prohibitive, if the distribution system extension did not come from the State system.

3.8.2 Loomis Street/Jay Street/Liberty Street/St. Paul Street

At the northeastern end of the RDA proposed future piping map is the residential section of Montpelier that is bordered by Jay Street to the northeast, Hubbard Street to the southeast, School Street to the southwest, and Main Street to the northwest, encompassed by these boundaries are portions of Liberty Street, and St. Paul Street. This section of the RDA proposed future piping map (42 homes) accounts for a total energy load of 2,960,000 btu/hour, or roughly 20% of the 16,300,000 btu/hour potential City plant capacity.

3.8.3 Hubbard Street (Between Barre Street and East State Street)

From a maintenance and operations standpoint, Hubbard Street between Barre Road and East State Street would be an appealing loop between the two streets to provide service from either direction in the event of a system shutdown or emergency. Unfortunately, Hubbard Street is entirely single-family homes, which historically do not connect to a district heating system due to the costs outlined above. Hubbard Street is a long loop to construct for a high potential of having zero service connections, and therefore would be an inefficient use of construction funds.

3.8.4 East State Street (east of Hubbard St.) and Vermont College of Fine Arts

The Vermont College of Fine Arts has a significant rate of energy usage. The challenge would be that to get to the College, the distribution system would have to go a significant distance with very few possible customers, due to the high ratio of single-family residential homes between the intersection of East State Street and Hubbard Street. The expense for the extension of the distribution system, from its end point on East State Street to only serve the College, make it improbable that a connection to the College would be financially viable.

3.9 River Crossings

3.9.1 Pipe Material and Insulation

The pipe materials used for the river crossings on the Bailey Avenue and Langdon Street bridges will be the same pre-insulated piping material that is used for the buried distribution piping. The piping used on the river crossings will have thicker insulation (e.g. 10” steel carrier pipe with 5” of insulation instead of 4”) than the buried distribution piping, and will use fuse-welded joint sealing components, instead of heat shrinkable joint sealing components to protect the insulation from the infiltration of water into the insulation in situations where the pipes are submersed due to flooding situations. The thicker insulation aids in energy loss and extends the time between a catastrophic plant failure and pipe freezing.

3.9.2 Expansion Chambers

Because the bridges and the distribution system piping will expand and contract at different rates, and often in counteractive directions because of the nature of district heating systems, expansion chambers will be installed at one end of each bridge to allow for the movement and expansion of the suspended piping. The pipes will also be installed on specially constructed brackets installed on the underside of the bridges that allow the bridge to move while the pipes are stationary, or vice versa.

3.9.3 Structural Design

Our suggested route crosses the Winooski River on the Bailey Avenue Bridge. This bridge is in good condition and underwent a full deck replacement in approximately 1995. The concrete sidewalk slab overhangs the 36" deep steel edge girder by more than 3'-0". We recommend the pipes be installed adjacent to the steel girder within the sheltered area beneath the cantilevered sidewalk. Installation on the downstream (west) side of the bridge would provide substantial protection from debris during a flood event. Sketch SK-1 in Appendix 3 is a conceptual support detail for the pipes. This detail assumes that the pipe supports could be spaced to match the approximately 14'-6" spacing of the existing diaphragm

braces. If additional supports are required, a support similar to SK-1 would be used, with the addition of a kicker angle from the bottom of the edge support girder to the top of the adjacent support girder.

Our suggested route crosses the North Branch of the Winooski River on the Langdon Street Bridge. This bridge was completely rebuilt recently. The bridge is constructed of a precast concrete deck supported by large steel girders. We recommend the pipes be installed between the 2 girders nearest the center of the bridge. The pipes would be centered on the mid-depth of the 27 inch deep girders giving them good protection from debris during a flood event. In addition, a removable steel closure plate could be installed continuously between the bottom flanges of these two girders to provide essentially total protection from debris.

This route would require the removal of the five existing C15x33.9 solid steel diaphragms between the center girders. We propose replacing these solid diaphragms with a rigid frame type diaphragm that has holes in it to accommodate the pipes, see attached SK-2 in Appendix 4. These frames would be in the same locations as the existing diaphragms and would be connected to the existing steel gusset plates using the existing bolt holes. Holes will need to be cored at each end of the bridge to allow the pipes to pass from below the bridge into the roadway.

Based on our review of the original design drawings for this bridge, the portion of concrete we would be coring through is a precast concrete “curtain wall” which has little structural function other than closing off the end of the bridge from the soil below the paved roadway. Because the pipes will be very close to the roadway when they go through this “curtain wall”, we will need to provide a vertical pipe drop at each end of the bridge. This drop would occur with a small concrete structure (precast or cast-in-place) in order to protect the pipes from vehicle loads in this area of low cover, and to simplify future access of these points. See SK-3 in Appendix 4.

4 In-Building Design

4.1 City Hall – Fire Department

4.1.1 Heating Load

The existing plant includes two Buderus G602 hot water boilers. Each boiler is capable of approximately 2,370,228 btu/hour gross output. At this phase of the project, we are assuming (based on owner conversation) that the maximum load is one boiler's output.

4.1.2 Existing Equipment and Configuration

The two boilers connect to the main header in a primary/secondary fashion. Each boiler has its own pump for transferring water between the header and the boiler. Additionally, each boiler has a shunt pump to increase the temperature of the return water at the boiler connection.

A branch from the header serves a mixing valve for the Fire Department system. Two inline pumps serve the Fire Department heating system; the mixing valve maintains a temperature setpoint for the Fire Department building. The hot water piping for the fire department runs under the alley between City Hall and the Fire Department. The header supplies the City Hall hot water pumps which pump hot water to the various heating loads in the building. The returns from City Hall and the Fire Department join together in the boiler room. The Fire Department snow melting system connects to the combined return line in a primary/secondary fashion to provide hot water to a heat exchanger for the snow melt system installed in the apron in front of the Fire Department.

4.1.3 District Heat Connection

Schematically we will install the new heat exchanger as a boiler, connecting in a primary-secondary fashion into the existing header. Our lines will be between the Fire Department snow melting connections and Boiler 1. We will install a new variable speed pump to move a variable amount of water between the header and the heat exchanger, maintaining the header setpoint.

We intend to size the district heat exchanger for the building's heating load. We considered making it large enough to accept the full output of both boilers while operating to heat the district hot water. We realized this would not be wise as if the City Hall plant is called to provide heating to the district hot water, it would not be able to provide the entire boiler capacity to the Heating District; it would only be able to supply the difference between the total installed capacity and the heating load of City Hall (and the Fire Department).

4.1.4 Controls

A Buderus controller is present in the boiler room to command the boilers on and off, maintaining the setpoint. We have not investigated the possibility of expanding this controller to control the new variable speed pump. We suspect it is not capable of the needed input/output and control sequences to allow the complicated scheme described below. We will design a new controller to replace the existing for the boilers, pumps and heat exchanger.

As the City Hall plant may be required to supply heat to the district heating system during times of failure or insufficient plant capacity, we expect there are three different modes for this boiler plant:

4.1.4.1 Normal Heating Operation

During normal operation, the building controls will command each boiler off and adjust the speed of a new hot water pump moving water between the heat exchanger and the building main piping. The building controls will maintain the existing setpoint strategy and adjust the speed of the pump to match the building's needs. The district heating controller-meter will position the control valve to maintain both a minimum flow of district water and to maintain the return water temperature leaving City Hall.

4.1.4.2 No District Heat Operation

If the heating district entity requires the City Hall/Fire Station to disconnect from the district (either because of a plant failure or the City's demand is above their allotted amount), the district heat controller will signal the building controls to disable the heat exchanger pump and operate the boilers as before the district heating system was installed. The meter-controller will shut the district heat control valve off.

4.1.4.3 Supply Heat to District System

During this scenario, the City Hall boilers will provide heat to City Hall and to the District. During this operation, the district heat controller will signal the building controls to engage all boilers and pumps. The building controls will operate the heat exchanger pump to maintain the building hot water supply temperature (adjusting it this way assures the City Hall/Fire Station has adequate heating and all the available remaining heat goes to the district heating system). The district meter-controller will position the control valve to maintain the leaving water temperature to the district at a desired level.

4.1.5 Domestic Hot Water

A 40 gallon, electric water heater is present in the boiler room. This water heater will remain in place and active. If the City desires, we can add a small heat exchanger and pump for domestic hot water, retaining the existing tank for storage.

4.1.6 Electrical

The existing circuit panel in the boiler room has no spare breakers. We intend to source power from the existing electrical service equipment and install a new load center in the boiler room. This will power the pump variable frequency drives and the new controls.

4.2 Police Department

4.2.1 Heating Load

A 1999-vintage, Bryan brand, 360,000 btu/hour output hot water boiler serves the heating and domestic hot water heating loads in the Police Department. We will use this value for our heat exchanger selection.

4.2.2 Existing Equipment and Configuration

A single heating pump transfers water through the boiler and to the building's HVAC distribution pumps (the same HVAC pumps move chilled water through the building during the cooling season). A second pump is present to heat the storage type domestic hot water tank.

A modern, direct digital controls system by Automatic Logic is present in the boiler room and controls the boiler staging and pump operation along with the domestic hot water production and the water chiller.

4.2.3 District Heat Connection

Schematically we will install the new heat exchanger parallel to the existing boiler. We will pipe it so the existing pumps (heating and domestic hot water supply) will move water through the building-side of the heat exchanger. Manual valves will allow the Police Department to line up their boiler instead of the district heating system in case of a district outage or for non-heating period domestic hot water.

The boiler room does not have an obvious location for the new heat exchanger. The current plan is to fit it between the existing boiler and the adjacent electrical panel; remaining mindful of the panel's clearance requirements. If that layout proves unworkable, we propose to install in in the space roughly west of the boiler room, where the Police store the patrol bicycles. The meter-controller and control valve will be in the vicinity of the heat exchanger.

4.2.4 Controls

The existing building controls will command the hot water pumps (heating and domestic) on and off as they do currently, taking heat out of the heat exchanger as needed to make heating and domestic setpoints. Since the District meter-controller will maintain both a return water temperature and a minimum flow, we do not expect any issue with non-coordination between the two control systems. We intend no automated switching between the existing boiler and the heat exchanger.

4.2.5 Domestic Hot Water

During times when the district heating system is active, the existing pump will heat the domestic hot water just as the existing boiler does. If the district heating system does not operate in summer months, City staff will manually line up the existing boiler to provide domestic hot water.

4.2.6 Electrical

We are not installing any new equipment. We plan to source single phase power for the meter-controller from the existing circuit panel in the boiler room.

4.3 139 State Street (Union Mutual)

4.3.1 Heating Load

The City will construct a remote heat exchange room in the ground level of 6 Baldwin Street. This space within this State building is currently used for miscellaneous storage. A State Buildings and General Services representative explained during the development process that whenever the State has renovated this space for continuous human occupancy, the occupants have expressed dissatisfaction with the space due to temperature, location and air quality.

We will wall off a portion of this space to house a heat exchanger, pumps and related components, electrical panels and controls. We will run new district hot water piping from this space to the basement of 139 State Street akin to other District Heat customers.

4.3.2 Heating Load

We are designing this system for the sum of the existing 139 State Street boiler capacity. This project contains no design or provisions to modify the equipment in 139 State to make use of the district heat hot water.

4.3.3 Services from the State

Spalding will fill in these bulleted items and add others as necessary.

A. Steam
B. Condensate
C. Domestic water
D. Fire protection
E. Ventilation
F. Floor drain

4.3.4 Planned Equipment and Configuration

Spalding will write this.

4.3.5 Controls

Spalding will write this.

4.3.6 Electrical

Spalding and Neuburger will write this.

4.3.7 Design Choices

A. We are designing the hot water pumping system and the heat exchanger only for the 139 State Street Load. The underground piping has capacity for appreciably more connected load. If the City wants to expand this system in the future, they can supply approximately 1,700,000 btu/hour of load from this room, but they will have to replace the pumps and possibly the heat exchanger for that additional capacity. We designed the main electrical pane to accommodate the potential future larger pump size.

4.4 Union Elementary

The connection of the district heating piping, metering and district heating controls for this building will be similar to the High School. The work in Union Elementary is complicated by the need for the conversion. For the complete project information, see section 6 Union Elementary.

4.5 Design Options

4.5.1 Use of City Hall or High School Boilers

The operations plan at this time includes allowing these boiler plants to provide heat to the district system during periods when the City's load on the State's plant is near or above the contracted limit. This operation requires thoughtful piping layout and complicated control strategies in that there are various modes and multiple control systems involved.

One approach would be for the district heating system to install controls on the various building equipment and control them. While this is effective in creating the needed sequences and works in this initial phase as the buildings are all City owned so there are few issues with ownership or operation. We are also looking into the future when there may be a non-City entity operating and/or owning the district heating system. In that case it will be a simpler and cleaner operation if the district entity has no controls or equipment on the customer side of the heat exchanger.

We chose (for budget reasons) to add little mechanical equipment to allow this dispatch; instead we plan to pump water in the same direction and with the same equipment that supports the normal operation. The operation during dispatch will help the district heating system, but not contribute in a significant way; particularly in City Hall (due to the existing piping configuration).

Weighing these options, we have decided to install controls and metering on the district heat side of the heat exchanger only. We will interface commands between the district heating controller and the building controller with discrete points (known by many as "dry contacts") to signal different operating modes. Our work will also require changes to operations and programming within the existing building controllers to enact the needed sequences.

4.5.2 Redundant Pumps in City Buildings

For the High School and City Hall we are designing with two pumps in mind to transfer water between the building heating system and the heat exchanger. While the existing boilers only have one pump each, the building distribution systems all have redundant pumps. Also, providing redundant pumps is customary in the region.

5 Heating Plant

5.1 Design Responsibilities

The City-State contract assigns the design and construction responsibility of the City's heat exchange equipment to the State and their engaged contractors. Hallam-ICS has met with the State's design firm, D&S Engineering. We jointly agreed for Hallam-ICS to provide requirements for the City's equipment and equipment selections. D&S Engineering will design the installation based on the criteria we provide. The City-State contract provides a review opportunity for the City. We expect to participate in that review to ascertain D&S Engineering complied with our design intent.

5.2 Heating Load

While the existing City-State contract provides for only 9,710,000 btu/hour of thermal capacity, we understand from conversations with City staff the ultimate design for the City's equipment should be 16,300,000 btu/hour reflecting the maximum capacity available to the City without expanding the plant's size. We will specify heat exchange equipment for this value. If the City expands the connected load beyond this value, they will install additional heat exchange equipment coincident with the State's boiler construction.

5.3 Equipment and Configuration

As the State's project is early in its development, we expect a variety of changes to affect this project's direction. However, this section lays out our plan in light of the current State situation. We recognize our plan may change to suit the State's activity.

We will provide a customary system in the State's plant including two pumps, two heat exchangers (with manual valves to allow any combination of active heat exchanger and pump), an air separator, expansion tanks, a makeup water treatment system and a control and monitoring system. We will provide piping and electrical connections for a third heat exchanger and a third pump.

We will deploy variable frequency drives for each distribution pump (controlled by differential pressure throughout the district). We will use a dual control valve scheme for each steam-to-hot water heat exchanger and an intelligent control scheme to limit any control valves operating at low "percent open" positions. Depending on the sizing and equipment configuration scheme, we may intentionally install smaller-than-equipment size control valves; this would improve control stability in the near term but require the City to replace the control valves if they subscribe many customers in the future.

We will to design/specify equipment associated with the installation of mechanical equipment. The State's designer will provide the architectural and fire protection work to the City's room. The State will provide space conditioning for the City's room (ventilation and heating) and human comforts for City staff (hand washing, restroom and emergency facilities).

5.4 Equipment Sizing

There are a variety of ways to approach the individual equipment sizing at this point in the design. If the entire 16,300,000 btu/hour load was connecting at the time of installation we would approach this aspect of the project differently than the current understand; that of less than 9,000,000 btu/hour of connecting peak load. If the entire load was connected, we would provide three pumps and three heat exchangers, each of about 8,000,000 btu/hour of capacity. This would provide good part-load performance and excellent redundancy, provided the piping and valves supported an "any HX, any pump" operation.

Since the contracted level of heating load is 9,710,000 btu/hour and the likely, actual peak load of the plant is less than 8,000,000 btu/hour (considering the non-coincident timing of peak heating loads), we propose to size each heat exchanger and pump for one half of the 16,300,000 btu/hour load or 8,150,000 btu/hour. This provides full redundancy and allows the City to expect to operate only one pump and one

heat exchanger until they are able to subscribe an expanded customer base. If the City is able to subscribe additional customers and heating loads to their system, they can add the third pump and heat exchanger (sized for 8,150,000 btu/hour) to the existing system.

5.4.1 Design Requirements of State Plant Designer

The calculations contain the detailed development and rationale associated with the values Hallam-ICS shared with the State's boiler plant designer; D&S Engineering. Some important points to understand:

A. We selected a cold fill pressure of 15 psig at the heating plant. This selection allows the City to connect any customer with a high point (of the district piping) 30' or less above the heating plant. If in the future the City opts to connect customers with elevations above this value, the district will have to re-evaluate the cold fill pressure, expansion tank volume and relief valve settings. We chose this value to keep the operating pressure in the district heating piping and expansion tank volume at reasonable levels.

5.5 Electrical

5.5.1 Normal Power

The City-State contract requires the City to obtain its own electrical service and provide its own standby power. We believe there may be a conflict between the contract and the governing electrical code. Article 230 of the National Electric Code, 2011 edition states:

"230.2 Number of Services: A building or other structure served shall be supplied by only one service unless permitted in 230.2(A) through (D). For the purpose of 230.40, Exception No. 2 only, underground sets of conductors, 1/0 AWG and larger, running to the same location and connected together at their supply end but not connected together at their load end shall be considered to be supplying one service.

A. Special Conditions. Additional services shall be permitted to supply the following:
    1. Fire pumps
    2. Emergency systems
    3. Legally required standby systems
    4. Optional standby systems
    5. Parallel power production systems
    6. Systems designed for connection to multiple sources of supply for the purpose of enhanced reliability

B. Special Occupancies. By special permission, additional services shall be permitted for either of the following:
    1. Multiple-occupancy buildings where there is no available space for service equipment accessible to all occupants
    2. A single building or other structure sufficiently large to make two or more services necessary

C. Capacity Requirements. Additional services shall be permitted under any of the following:
    1. Where the capacity requirements are in excess of 2000 amperes at a supply voltage of 600 volts or less
    2. Where the load requirements of a single-phase installation are greater than the serving agency normally supplies through one service
    3. By special permission

D. Different Characteristics. Additional services shall be permitted for different voltages, frequencies, or phases, or for different uses, such as for different rate schedules.

It is unclear if the current plant for the State's heating plant meets any of these requirements. However, we are not the design professional for the heating plant and cannot state with authority if or how the plan conforms to the National Electrical Code. One approach might be to define the City's heat exchange room as a separate structure from the Sate's heating plant. If the State intends on this approach, they will likely have to provide particular construction details between the two spaces.

Section 708 of the Vermont Utilities Service Requirements Manual encourages Joint Metering. In fact, section 708.B states "In all new buildings or structures, the Utility will provide each customer and/or individual unit with a separate meter and bill."

Regardless of how the power comes to the City's room, we expect a 480 VAC, 3 phase, 4 wire panelboard to supply the pump variable frequency drives. We also expect a transformer to power a small 120/208 circuit panel for the controls and metering equipment.

5.5.2 Standby Power

The City-State contract does not specifically address use of the State's standby power generator to provide power to the City's equipment. It is clear a standby power generator will be required for the City to provide reliability and all-weather operation to the district heating system. We classify the electrical system as an Optional Standby System governed by article 702 in the National Electrical Code. We understand the City will not provide their own standby electrical generator, but will pay the incremental cost to the State for them to provide an adequately sized generator to serve State and City loads.

5.6 Controls

We expect to provide a robust control system in the heating plant. We will specify the control system around an industrial programmable logic controller (PLC) with an industrial personal computer providing an interface and historian features. We further recommend the software include a web-accessible component (with the appropriate passwords) to allow the City to observe the operation of the heating plant from locations other than the plant.

The control system will also include control panels in each of the City buildings to coordinate the operation of a control valve (for district hot water return temperature and flow control) and to communicate via discrete points (dry contacts) with the existing building control systems for different operating modes. The remote panels will communicate via the new fiber optic network we are installing as part of the distribution piping. The remote panels will also report the system differential pressure for use in controlling the capacity of the distribution pumps.

We recommend integrating the City's control system with the State's plant control system. This connection will require coordination and confirmation with the City and the State.

5.7 Metering

We have not designed a particular metering scheme at this phase. We believe the City should identify an operating entity before choosing a particular technology or system. We can share some important features for the metering system:

A. It should include appropriate communications protocols to allow the meters to communicate with a central metering panel

B. The communications protocols should allow polling by the plant control system for information gathering; or at least the meters should have programmable outputs to impart information to the City's control system

C. The metering system should interact with the district heating entities enterprise network to automate bill generation and coordinate with customer information

D. The metering system must include auditing features

E. The metering system should mimic the best practices and standards of the electric metering industry, including the nascent standards in the realm of smart metering

F. The meters should include some ability to operate for periods of time without normal power

G. The meters should have a display for use by the district heating entity and the customer

H. The meters should have programmable outputs for use by customers (including their own energy monitoring systems)

6 Union Elementary

6.1 Introduction

This project includes conversion of the existing elementary school from a low-pressure steam system to a hot water, hydronic system. This type of work is always disruptive to the building and exposes unexpected situations during construction. The addition (some classrooms and a cafeteria/kitchen) has a hot water system and is of relatively modern construction. Our effort and documentation of Union Elementary is intentionally focuses in the original 1938 construction building.

We recognize the chance this project's direction may change based on the preferences and budget constraints of the project and of the City Schools. This Basis of Design proceeds forward with our recommendation and acknowledges some of the trade-offs advantages and disadvantages. We expect the Public Schools will modify our direction after review of this BOD.

6.2 Project Requirements

We started the design with these project requirements:

A. The hot water system should retain existing assets as much as practicable to conserve project costs, particularly the 2006-era unit ventilators and the same vintage controls by Honeywell

B. The hot water system design must respect the hazardous materials (mainly asbestos containing materials or ACM) in the building

C. We should consider opportunities to improve the thermal performance of the building

D. The project should re-pipe and re-trim the newer, existing steam boiler to provide hot water as a backup

E. The project should minimize exposed piping

F. The project should consider thermal comfort

6.3 Hazardous Materials

While abatement or abatement design is not part of our project, we did engage with a local, experienced environmental consultant to understand the impact and scope of ACM in the building with respect to our project's planned scope. The consultant (Crothers Environmental) provided a summary and cost estimate for two options of abatement.

The first abatement option removes all the ACM in the vicinity of our new piping and equipment. This option allows our piping to run in the existing sand cellar portions of the building to minimize exposed piping. The second is focused on a more selective abatement and requires us to run the new hot water piping in the first floor ceiling and running exposed lines down to each unit ventilator.

The Crothers report is in Appendix 2. We chose to design with the more comprehensive and aesthetically pleasing first option. We understand from the Public Schools they would abate and manage the ACM outside of this project.

6.4 Union Design Basis

6.4.1 Heating Load

When we complete the detailed design, we will size the heat exchanger to meet the load of the renovated portion of the school and the existing, hot water heated addition. The existing boiler room is spacious and offers no problem with physical space for new equipment. We expect to convert the exiting Smith steam boiler to a hot water design and allow it to serve as backup to the district heating system.

6.4.2 Hot Water Piping

Our plan is to run new hot water piping through the basement and sand cellar areas of the building, re-feeding first floor unit ventilators, pocket radiators and cabinet heaters from below. Additionally, we will run new hot water piping in the first floor ceiling to the second floor heating loads. We included a single hot water main up to the second floor air handler room for the gymnasium and auditorium units there. See the drawings in Appendix 4 for details.

6.4.3 Plant Equipment

6.4.3.1 District Heat Connection

The district heat exchanger will serve the new heating system via a primary-secondary connection, with a variable speed pump moving water between the heat exchanger and the system to maintain a setpoint. We will create a hot water zone with a mixing valve for the addition and keep the existing control valve output from the addition's control system to position the mixing valve. The boiler will pipe in via a primary-secondary connection to heat the building water parallel to the heat exchanger.

6.4.3.2 Boiler Room Controls

We will amend and expand the existing modern, Honeywell building control system to operate all the equipment on the Union Elementary side of the heat exchanger. A district heating meter-controller will position a control valve to enforce return water temperature and maintain a minimum flow in the district piping.

6.4.4 Domestic Hot Water

Currently the building includes tankless coils in the steam boilers for domestic hot water during heating season and electric water heaters for the non-heating season. The kitchen has an electric booster water heater. We intend to keep the tankless coils in the boiler and to provide a new heat exchanger and pump to heat domestic water from the district hot water system.

6.4.5 Electrical

There is no available circuit panel in the boiler room. We intend to source power from the existing, modern 1,200 amp 208/120 panel in the electric room for a new panel we install in the boiler room. This panel will power the new pumps and controls.

6.4.6 Terminal Equipment

6.4.6.1 Unit Ventilators

Unit ventilators supply heating to vast majority of the building's space and all the classrooms. We worked with the original unit ventilator manufacturer to understand the existing unit's ability to serve the heating loads. We discovered we can retrofit the existing units with new hot water coils to meet the heating load. In this plan, we would abandon-in-place the existing low pressure steam radiators.

This plan includes a thermal comfort reduction during very cold times for the classrooms. Currently each classroom has a unit ventilator and a column-style radiator. In this plan we are providing heating only from the unit ventilator. The radiator enhances thermal comfort by heating people and objects through radiation rather than convection (which is how the unit ventilator heats the space). We do not think this will be objectionable to space occupants; some classrooms already have covers over the radiators to minimize or eliminate their output entirely.

We considered and rejected connecting the new hot water system to the existing radiators. Those units are from approximately 1938 and have not experienced pressures above about 3.0 psig. Our new hot water system may have pressures approaching 30 psig. We do not want to risk leaks in such old equipment. Also, connecting to this equipment expands project cost.

6.4.6.2 Vestibule Equipment

There are three cabinet heaters at the single east side entrance and two west side entrances. We plan to replace one heater in each location with a hot water unit and abandon in place the other two. In the front vestibule we will install new heating equipment on both sides.

6.4.6.3 Air Handlers

There are two air handlers present in the second floor mechanical room. These units are original, from 1938. We intend to replace the existing heating coils with new hot water coils and make no changes to the existing fans, ductwork and dampers. This is the low cost solution that provides little investment in the infrastructure of the building.

6.4.6.4 Gymnasium and Auditorium Pockets

There are pockets below each window in these spaces with steam coils. The steam heats the air taken at floor level and it rises through convective action to a grille below the window, overcoming much of the space's heat loss. We intend to replace the existing coils with hot water coils of similar geometry (likely with a smaller output). We believe the reduction in output is acceptable as the 1938 design likely included keeping the windows partially open during occupancy for ventilation as that was the practice then.

6.4.6.5 Controls

For the unit ventilators and selected other loads we will retain and enhance the existing building control system. For certain other loads (pocket heaters for example) we plan to provide simple self-contained control valves to maintain space temperature.

6.5 Energy Efficiency Improvements

The Public Schools have identified the poor thermal performance of this building as an important issue to consider during this renovation and upgrade project. Our efforts are mainly focused on the conversion of the existing building equipment to hot water, but we can offer some information in this document and would gladly discuss other ideas with the Public Schools.

6.5.1 Performance Contract

The City Public Schools and Honeywell are partially through a multi-year performance contract that began in 2006 with new equipment and controls in Union. We propose to review the original contract and period reports to understand if the equipment and system performance to date to conforms to the contract.

6.5.2 Thermal Envelope

The walls in the 1938 building do not appear to have significant insulation and the windows are original. There is 6 inches of blown-in cellulose insulation between the second floor plaster ceiling and the roof deck.

6.5.3 Ventilation

The 1938 exhaust equipment on the rooftop is all defunct. There 1938 construction included units present to exhaust the general building, bathroom groups, the gymnasium and the auditorium. If the Public Schools renovated those and restarted their operation, they would observe an increase in heating costs associated with additional outdoor air entering the building.

The unit ventilators appear to be bringing in some amount of outdoor air during operation. The ventilation path for the classrooms is into the room, through a plenum above the coat closet, through a louver into the hallway. From the hallway the air travels to a grille and damper in the second floor ceiling, then through ductwork discharging on the back of the tower (with the weather vane). We observed the damper in the second floor ceiling closed.

We also observed the outdoor air inlet damper for the gym and auditorium air handlers closed. There is a modern, functioning exhaust fan for the second floor, east bathrooms. It exists in the plenum space above the bathrooms.

We offer these observations of the ventilation system and the differences between the design and current operations solely for the owner's information. This project's scope does not include a code review of the current building or comparison with the original design and current operation.

6.6 Important Design Features and Choices

Full height radiators - avoids old footprint, costs extra

Leaving cabinet heaters at vestibules for owner removal and wall repair

No box around hot water piping in main entrance vestibule, covering with PVC jacket, could add $ and put in a box

For other instances of vertical piping in exposed areas (approximately 4 locations) using PVC jacket only, we don't recommend having a box there

Not removing existing boiler, not repiping it either

Sized boiler pump based on the boiler output, 180-140 deg F.

Need to improve the DHW side of the drawing (circulation pump, mixing valve, etc)

7 Project Management

7.1 Schedule

The project schedule memorialized in the City's contract with Hallam-ICS is:

Milestone	**Date**
Signed agreement	December 01, 2011 or earlier
Provide conceptual cost estimate for Union Elementary Hazardous Material Management	January 02, 2012
Complete Basis of Design and Conceptual Cost Estimate	February 01, 2012
Complete Construction Documents for Bidding	July 09, 2012
City Awards Construction Contract	August 27, 2012
Contractor Orders Equipment and Material Ordering	September 03, 2012
Contractor Commences Construction	Spring 2013
Contractor Completes Construction	Autumn 2013
Commissioning Complete	Winter 2013

7.2 Permits

The current heating plant and surrounding property are owned and is operated by the State of Vermont through the Department of Buildings and General Services. The streets, City Hall, Fire Station and Police Station are owned/controlled and maintained by the City through the City Council/City Departments. The Union Elementary School and High School are owned and maintained by the City through the Montpelier Public Schools. The pipeline will cross the Vermont State Employees Credit Union property, People's Bank and State properties. Thus, there are a number of entities involved. Many permits run with the land and are, therefore, generally issued to the landowner.

We assume the property owners (State, Education Department, Others) will participate as the Co-Applicant where necessary.

We anticipate the following permits/approvals will pertain to this project.

7.2.1 Local Permits

A. Development Review Board and Development Review Committee
No permits/approvals will be required. We confirmed in a conversation with the City Planning and Zoning Administrator, Clancy DeSmet.

B. Building Department
Building Permit – for modification to the building heating systems served by the distribution system. Applicants will be submitted/coordinated with Glenn Moore, Assistant Building Inspector.

C. Public Works Department
Construction & Access - To facilitate the review process, we propose to hold a pre-application meeting with the City Departments. We will hold these meetings early in the design process with the intent of informing the Departments about the project, our design approach and to obtain preliminary feedback. We will use this information will be used to advance the design and prepare the various permit applications.

7.2.2 State Permits

A. Agency of Natural Resources, Department of Environmental Conservation, Water Quality Division
Construction Stormwater Permit - This permit is required from ANR, DEC, Water Quality Division for projects that involve one or more acres of disturbed soil during construction. We anticipate the area of soil exposure for pipeline installation will be close to one acre. If required, we expect the project will qualify for coverage under the statewide General Permit as a low risk project. As such, the application will consist of filing an application with ANR, public posting, and adherence to the state's Low Risk Handbook during construction.

B. Act 250
The project is a municipal project involving less than 10 acres, as such we do not expect an Act 250 permit is required. When the final piping route is established, we will request a Jurisdictional Opinion (JO) from the District Coordinator.

C. Stream Alteration Permits
The proposed pipeline will cross both the Winooski River and the North Branch. However, the plan is for these crossings as suspended pipes on existing bridge structures. Thus, we do not anticipate a need for a Stream Alteration Permit.

7.2.3 Federal Permits/Regulatory Actions

A. NEPA – Environmental Assessment
The project is funded in part through an American Recovery and Reinvestment Act (ARRA) grant through the Department of Energy (DOE) and an Environmental Assessment (EA) was completed for the project. Deviations from the project as it was described in the EA will require a review of potential impacts that were not included in the EA analysis. The level of additional review and documentation required to satisfy NEPA will be coordinated with the City and DOE. We expect that this coordination will be undertaken by the City and DuBois and King outside of this project.

7.2.4 Contaminated Soils

We continue our previous assumption that the level and type of contamination that may be encountered during construction will be consistent with that already identified in the EA. Revisions to the pipeline route will be reviewed with ANR to ensure that the methodology described in the EA remains appropriate. Based on communications with ANR, that methodology includes remediating contaminated soils on-site. This is accomplished by taking any contaminated material that is excavated out of the trench and backfilling the trench with the same material. Contaminated soil displaced by the pipe or bedding material that cannot be placed back in the excavation will need to be disposed of as contaminated waste.

We will develop a plan that will specify the testing, monitoring, treatment, and disposal of contaminated soils during construction.

8 Cost Estimate

8.1 Basis of Estimate

The estimate basis is contained in this document's sections, the drawings in the Appendix and the estimate pages itself. Some features not described elsewhere include:

A. We used copper tubing for the work in-building as the design basis, including the conversion work in Union Elementary

B. We used steel pipe for the work in the heating plant as the design basis

C. All the electrical cost estimate use NEMA 1 rated enclosures

8.2 Items to Reduce Cost

A. We can also reduce pipe diameter by considering higher water temperatures (and higher system water temperature change). This has unintended consequences of increases the complexity of the system to deal with the additional expansion. But we believe we can achieve a net decrease in the system cost.

B. We estimated costs for an expansive and complete control and monitoring system in the heating plant, including sensors that provide useful information for operation, but not critical for control. Also, the controls estimate includes industrial grade instruments and controllers. Commercial grade controls will be less expensive and would provide a similar level of service.

C. Consider smaller pumps and heat exchangers in the State Heating plant.

D. Omit redundant pumps and electrical service in the High School and City Hall.

E. Instead of a new electronic control panel in the City Hall boiler room for the existing boiler, existing hot water pumps and the new heat exchanger, we could provide a small new control panel with simple controls to control the new heat exchanger pump and disable the existing boiler controller. This method would save cost, but increase complexity and lose the remote monitoring capability the City would experience with a new control panel.

F. Negotiate an agreement with the State for normal and standby electrical power instead of burdening this project with the cost of a separate electrical service and standby generator.

G. Negotiate an agreement with the State for treated makeup water instead of burdening this project with the cost of water conditioning equipment.

H. Delay the procurement of the leak locating system software. The software and necessary building components that enables precise leak locating capabilities could be purchased at a later date for implementation by the operating entity of the district.

8.3 Scope Items of Additional Cost

We understand the City would not want to expand the scope to include additional items, but we offer these ideas/suggestions below for City consideration:

A. Provide a publically accessible web page revealing the operation of the district's heating system. There are specialty firms who specialize in collecting data from facility and plant control systems and displaying the data via a secure web service. This might be interesting to allow City residents to see the system in operation and would be similar to the system present for the City's wastewater plant photovoltaic system.

B. Modify the existing piping City Hall to allow for expanded dispatch capability

C. Provide additional piping, controls and valves in the High School and City Hall to provide additional dispatch capability

D. Upgrade the mechanical and electrical systems in the vicinity of this project's work to include appropriate seismic bracing

E. Include the pedestrian bridge renovation into this project and use it for routing pipes across the Winooski

F. Connect to National Life's low pressure steam boiler for summer production

G. Install new air handlers (mixing dampers, hot water coils, fans and motors) in Union Elementary

H. Replace the existing, defunct and non-functional exhaust fans in Union Elementary (approximately four)

I. Replace all or some of the existing controls in the Union Elementary addition with the Honeywell system controls in the original building

J. Clean up the Union Elementary boiler room by demolishing and removing defunct controls, equipment and ancillaries. Repaint the walls and ceiling, provide a coating for the floor and new light fixtures.

8.4 Other Commentary

In the appendix are various breakouts of different pieces of the distribution system and estimates for short extensions. We developed these other cost estimates with less rigorous analysis than the base project. They serve to indicate the order of magnitude of costs the City can expect if they modify the distribution system configuration.

9 Issues Requiring Discussion and Development

This section outlines some items our team believes deserves additional conversation and development before detailed design.

9.1 General Issues for Discussion

A. Review of the pipe sizing, district geometry and district heating loads to define the design direction and project cost estimate.

A. How much controls and automation should this project include at this time to allow the district energy entity to dispatch the boilers in either the High School or City Hall? One path to conserve cost will be to omit those additional controls during this phase, if the City believes their peak load will be safely below the contracted limit. As the entity begins to subscribe customers they can invest in the dispatch controls for a reasonable cost as the piping and equipment design for dispatch is built into this project.

B. If the City is interested in laying additional communications conduits, this is an ideal time to bring additional communication resources between City buildings or a potential future time when the District Heating entity offers communication services to customers.

C. Discuss the sizing and cost allocation of equipment in the City's space in the State's plant.

9.2 Union Elementary Issues for Discussion

A. What is the Public Schools preference for pipe routing in Union Elementary? The full asbestos abatement offers a superior aesthetic and removes hazardous materials from the building but increases construction costs.

B. What is the Public Schools preference for heating terminals in classrooms? The unit-ventilator only approach is functional but will offer low thermal comfort during very cold times; the fans will likely have to run at their highest speed which is the noisier than the current low or medium speed settings. Adding fin-tube radiation is a relatively low cost method of increasing thermal comfort. This solution occupies space in the classrooms and adds to the construction cost. Another option is ceiling mounted radiation panels. These improve thermal comfort and do not occupy space in the classroom, but they are more expensive than fin tube radiators and increase the amount of visible pipe (from the unit ventilator up to the ceiling).

C. Should this project include replacing the steam trim and controls on the existing Smith steam boiler to serve as a backup heating source?

9.3 Design Team Actions

A. Develop a plan for cold layup of the Police Department boiler and fuel oil storage system

B. Develop a scheme for layup of the City Hall, Union Elementary and the High School boiler and fuel oil storage systems; this work requires significant engagement with the City relative to their planned operation of the district heating system and non-heating domestic hot water production.

C. Assist DuBois and King in their efforts to update the Environmental Assessment (under the city's existing contract with DuBois and King)

D. Expand the design and detail concerning the location and configuration of system drain flash chambers and connections to the City's drainage system. We also must determine the amount and rate of discharge allowable, if any, into the City's drainage system needs to be determined for valve locations.

E. Investigate the environmental effects of and permissions required for the infrequent (only in the case of a system repair) drainage of high temperature water into the City drainage system that connects to the Winooski River.

F. Investigate of the domestic hot water system for the Fire Department; if it is currently electric there may be a good opportunity for the City to reduce utility costs.

G. Develop a water treatment system for makeup water in the heating plant respecting the City's water quality, the requirements for the district heating system and good engineering practice.

H. Investigate further the issue of seismic design category on this project and the State's project.

9.4 City Actions

A. Engage a firm to provide commissioning services. This is an ideal time to bring this team member on board as they will have the benefit of a clear project Design Basis and will be able to comment on the design portion of the project just as it is beginning.

B. Define the entity that will operate the district heating system to enable additional customer commitment and can engage with both the design team and the State for layout, design and other preferences.

C. Develop a plan for providing district hot water during times when the state will not provide steam so customers can make domestic hot water during all times of year.

D. Draft and sign a memorandum of understanding with the Vermont State Employee Credit Union for an easement across their property at 146 State Street.

E. Draft and sign a memorandum of understanding with the State of Vermont for an easement across their property along State Street.

F. Draft and sign a memorandum of understanding with People's Bank (and potentially the State of Vermont) for an easement across their property at 112 State Street.

G. Engage DuBois and King to update the Environmental Assessment for this project

H. Provide guidance if the City can purchase standby electric power from the State or if the City must provide its own standby power

I. Decide what contracting method the City intends to pursue for the project construction

10 Risks and Mitigation

10.1 Pipeline Freezing

There is a risk of freezing a district heating pipeline if the water flow and heating source become unavailable during cold weather. The most likely place to experience a freeze is the bridge crossings as those pipes have only the thermal insulation and no ground cover. In addition to these locations, the lines can freeze if there is a no-flow condition for an extended period in a branch and the ground is frozen.

There are a few ways to mitigate freezing. The first and simplest is to have a reliable system of heating and pumping in the heating plant, assuring constant flow of water through all pipelines during all freezing times. The City's system will include standby electrical power at the heating plant for the hot water pumps and we understand the State's plant will have standby electrical power for their equipment, assuring steam during electrical outages.

Another technique would be to include in-situ temperature sensors in the pipeline to monitor and alarm if the temperature is approaching freezing. City staff could then respond to the alarm with either temporary heating measures or drains strategic portions of the system until they can restore hot water flow.

A third method is to include electrical heat tracing in those areas where freezing might be most likely (bridge crossings). We do not recommend heat tracing as the cost, maintenance and complexity is great compared to the low chance of freezing. Heat tracing our lines (high temperature water, well insulated, constant circulation) is non-customary.

A fourth technique would be to add propylene glycol (an anti-freeze) to the district system, in a low concentration to prevent pipe burst. This method is non-customary for district systems. Drawbacks to this approach include the cost associated with the anti-freeze, the continuous maintenance required to upkeep the system and the challenge associated with handling periodic drainage of the system as one cannot discharge propylene glycol directly to a waste line.

We recommend and are designing around the first mitigation method; a reliable source of flowing hot water.

11 Change from Previous Revision

A. Changed supply hot water temperature from 210 to 220 degrees F to increase the capacity of the budget-constrained pipe sizes.

B. Removal of the High School, other than in Section 1.

C. Addition of 139 State Street (Union Mutual)

EXHIBIT B

Memorandum of Understanding
Between
The State of Vermont Department of Buildings and General Services
and
The City of Montpelier

Purpose:

The purpose of this Memorandum of Understanding is to confirm the mutual understanding of the parties with respect to the potential development of a business relationship between the State of Vermont (the "State") and the City of Montpelier (the "City") The State and City are sometimes referred to individually as a "Party" and collectively as the "Parties."

The State and the City have been working together for the purposes of developing and obtaining the necessary legislative, administrative, municipal and regulatory approvals and permits for the development of a biomass fueled heating boiler plant and related system (the "Heat Plant") and district heat distribution system (the "Distribution System") to provide the thermal energy requirements of State owned and City served buildings located in downtown Montpelier. The Heat Plant and Distribution System are sometimes collectively referred to as the "District Heating Project."

Background:

The overriding goal by both Parties is to reduce reliance on fossil fuels, support regional economic activity and reduce the cost of space heating in the Capital Complex and City of Montpelier.

The District Heating Project will be developed in phases. The first phase calls for the accelerated replacement of the State's Capital Complex present district heating boiler plant (Heat Plant) and the expansion of system capacity to accommodate the City of Montpelier's own heating requirements, plus an initial expansion of the City's district heating capability to include downtown commercial and residential properties.

On the occasion of approval of capital funding for the State's portion of the Heat Plant by the Legislature, consistent with the requirements of the State's authorizing legislation (Section 2(e) of Act No.40, Laws of 2011) and recognizing the shared and individual responsibilities of the Parties going forward, the Parties enter into this Memorandum of Understanding at this time.

Specific Conditions and Legislatively Required Items:

Responsibilities of the Parties:

<u>On the Part of the State:</u>

The State will have the sole responsibility to plan, design, construct, own, operate and maintain the Heat Plant consistent with policies and procedures established and implemented through the Vermont Department of Buildings and General Services; however, the State may involve the City in this process to the extent desirable by the State. For its part, the State will update its existing Heat Plant to a modern biomass

fueled facility with sufficient capacity to serve the State's own current and projected load plus the initial identified load of the City.

The State agrees to negotiate in good faith with the City a 20-year thermal energy purchase and supply contract, and such extensions as the parties agree up to a maximum of 10 years, whereby the State will supply thermal energy to the City's Distribution System. The State will design, construct and operate a reliable and efficient Heat Plant consistent with good engineering standards to serve the identified needs of the State and City.

The State will be responsible for obtaining all State and Local permits and approvals required for construction and operation of the Heat Plant. The Parties agree to work together to obtain all necessary Federal approvals. The City will cooperate with the State in obtaining required regulatory permits and approvals. The State is solely responsible for all safety and environmental regulations relating to the construction, operation and maintenance of the Heat Plant assets.

On the Part of the City:

The City will have the sole responsibility to plan, design, construct, own, manage, operate and maintain the Distribution System consistent with policies and procedures established and implemented by the City. Upon completion of construction, the City will own, manage, operate and maintain the steam-to-hot-water energy conversion equipment (thermal conversion unit), which will thereafter be a part of the City's Distribution System. For its part, the City will plan, design, construct, own, operate and maintain the Distribution System suitable to serving the needs of public and private buildings in downtown Montpelier.

The City agrees to negotiate in good faith with the State a 20-year thermal energy purchase and supply contract, and such extensions as the parties agree up to a maximum of 10 years, whereby the City will purchase energy for the City's Distribution System. The City will design, construct and operate a reliable and efficient Distribution System consistent with good engineering standards to serve the identified needs of the City and State.

The City will be responsible for all State and Local permits and approvals for construction of the Distribution System. The Parties agree to work together to obtain all necessary Federal approvals. The State will cooperate with the City in obtaining required regulatory permits and approvals. The City is solely responsible for all safety and environmental regulations relating to the construction, operation and maintenance of the Distribution System assets.

The Proposed System:

The Heat Plant will consist of the necessary boilers, boiler auxiliary equipment, fuel conveyance and storage, ash collection and disposal systems, thermal conversion unit(s), which will be owned, operated and maintained by the City upon completion of construction, and building structures necessary to the safe and efficient operation and maintenance of a modern steam boiler plant. The Heat Plant will be designed to

primarily be fueled by biomass and use #2 fuel oil as a secondary and emergency fuel source.

The Heat Plant will be constructed on the site of the State's existing boiler plant behind 120 State Street on the Capital Complex. Two new 600 BHP dual fueled boilers, each with a rated capacity of 20.1 Million BTU/hr will be installed. In addition, the newer of the existing oil boilers will be relocated and modified to operate on #2 fuel oil (the Heat Plant currently uses # 6 fuel oil).

A space will be reserved in the new Heat Plant to accommodate at a later date an additional boiler with a rated capacity of 600 BPH as a means to serve long-term growth in the State and City heating loads. The plant design will, to the degree reasonable, incorporate the necessary auxiliary equipment and fuel handling systems for this subsequent capacity. The steam boilers will be rated to operate at 400 PSIG, but will be operated at no more than 100 PSIG until such time as electric power-producing equipment is installed in the plant. The 400 PSIG rated pressure will support electric generation via a backpressure turbine generator at a later date. The State, in its sole discretion and at its own incremental cost, may elect to add and operate electric generating equipment to the Heat Plant. The Heat Plant systems will be designed to deliver energy to the City's Distribution System at 50 PSIG. The total net capacity of the Heat Plant will be 40.2 Million BTU/hr (not including backup boiler capacity). The allocated share of the City's capacity of this total is a maximum of 9.71 Million BTU/hr.

The Distribution System will consist of the City's piping system and equipment to distribute the hot water including the thermal conversion unit, which shall be owned, operated and maintained by the City upon completion of construction, and all other equipment and machinery necessary to connect and distribute the energy to the City's load, which may include the City's customer load.

State and City Funds and Allocation of Federal Grant Funds:

The total budgeted cost of the Heat Plant, exclusive of City owned equipment and structures, is $15.047 million. The Vermont Legislature has approved at total of $7.0 million and the State will contribute another $1.164 million of in-kind and asset value to the total cost of the Heat Plant. The proceeds of the $8.0 million Department of Energy grant will be allocated as follows: 1) $3.249 million directly to the State for its share of the total Heat Plant cost, 2) $2.558 million directly to the State for a portion of the City's contribution to the total Heat Plant cost, and 3) the balance of $2.193 million to the City as a contribution to the cost of the Distribution System. The City will contribute another $1.077 million to the State for the balance of the City's portion of the Heat Plant cost. The parties acknowledge that the amounts recited in this paragraph are for budgetary purposes and that the actual amounts will be known once final engineering estimates and bid responses are known.

The Mechanism for Establishing the Wholesale Thermal Energy Price:

The State will sell thermal energy to the City at rates and on a schedule established to permit the State to recover its cost of production. The State will provide the City with information that allows the City to confirm the cost of production. After consulting with

the City, the Commissioner of Buildings and General Services shall establish the rate schedule. Energy sold to the City will be metered at the point of delivery to the City's thermal conversion unit. The point of delivery will be at the City equipment room attached to the Heat Plant. Both Parties shall have access to read the meter(s). The City shall be responsible for maintenance and proper operation of the thermal conversion unit.

Cost of production is defined to include all expenses incurred to meet the energy production and delivery requirements of the City including but not limited to fixed and variable operation and maintenance expenses, fuel cost at prices delivered to the Heat Plant, and reasonable maintenance reserves. The pricing mechanism will include procedures to reconcile any difference between budget and actual production expenses. The Parties acknowledge a mutual desire for a simple reconciliation process.

Continuity of the District Heating Project:

Each Party will exercise good faith toward the other in connection with the tasks required by each to advance the business relationship contemplated by this Memorandum of Understanding. In the event that either Party is unable to proceed with the contemplated business relationship for any reason, the Party unable to proceed agrees to provide prompt notice to the other Party identifying the reasons for its inability to proceed and to cooperate with the remaining Party to enable the remaining Party to benefit from the efforts of the business relationship to such point in time. The City agrees that regardless of the outcome of the City's bond vote, the City will cooperate with the State to aid the State in retaining the benefit of federal grant funds for this Heat Plant. Accordingly, benefits include but are not limited to the use of the Department of Energy grant funds, engineering designs and drawings, and permit applications and permit approvals. If either Party is unable to proceed, each Party agrees to cooperate with the other to assist in the recovery of any Department of Energy grant funds that the Party may be entitled to receive. Other than Department of Energy grant funds, each Party agrees to be responsible for its own expenses and costs to that point in time, as well as any remaining residual costs and expenses to terminate its participation in the District Heating Project.

Project Milestones:

The Parties acknowledge the compressed timeline related to the purpose and goals of this Project and agree to work cooperatively to diligently accomplish the tasks contemplated by this Memorandum of Understanding. Project milestones include:

A. June 09, 2011-- Legislative deadline to execute this Memorandum of Understanding
B. June 14, 2011-- Scheduled date for City bond vote
C. July 01, 2011-- Target date to submit amended Department of Energy Statement of Project Objectives (SOPO) to Include State Heat Plant activities
D. July 18, 2011 – Target date for State to issue RFP for Heat Plant major equipment supplier

E. August 15, 2011 – Target date to execute Thermal Energy Purchase and Sale Contract
F. August 16, 2011 – Target date to complete selection of Heat Plant major equipment supplier
G. December 20, 2011 – Target date to receive all major permits required to construct Heat Plant
H. December 21, 2011 – Target date to release Heat Plant major equipment supplier to manufacture equipment
I. February 14, 2012 – Target date to release RFP for Heat Plant construction
J. May 9, 2012 – Target date to commence physical construction of Heat Plant
K. April 15, 2013 – Target date to complete Heat Plant construction

General Conditions:

Reliance/Good Faith:

Each Party shall exercise good faith toward the other in connection with the tasks specified within this Memorandum of Understanding, including providing complete and accurate information necessary to cornplete the District Heating Project in a timely manner. The Parties agree to coordinate their relationships with third parties involved in the development of the District Heating Project. Should there be a disagreement the Parties agree to work out the arrangements between them in good faith.

Expenses of the Parties:

Unless otherwise agreed to in writing by the Parties, each Party shall be accountable for the costs and expenses associated with performing and carrying out the responsibilities assigned to it under the terms and conditions of this Memorandum of Understanding.

Final Agreement:

The Parties agree to work toward an Energy Purchase and Sale contract pending the City's bond vote and any other steps necessary to finalize their agreement. The State agrees to provide a form of an Energy Purchase and Sale contract to the City for its review, approval and execution. Both Parties agree to pay for their own legal and technical expenses in drafting and reviewing the final contract.

Insurance:

Before commencing work on the Project, the City must provide certificates of insurance satisfactory to the State. The City shall name the State of Vermont and its officers and employees as additional insureds for liability arising out of this Memorandum of Understanding. The State will afford liability protection in accordance with the Vermont Tort Claims Act set forth in 12 V.S.A. Chapter 189. The State will provide the City with a certificate of insurance upon request.

Transfer and Assignment of Benefits:

Neither Party may assign or transfer to any other person or entity this Memorandum of Understanding in whole or in part or allow any other person or entity to succeed to any or all of their rights under this Memorandum of Understanding without the prior written consent of the other Party.

Notices:

A notice given by either Party to this Memorandum of Understanding shall be sufficient if sent by registered mail or certified mail, return receipt requested, to either Party at the address specified below. Any notice shall be effective on the date mailed.

State of Vermont
Commissioner,
Vermont Department of Buildings and General Services
2 Governor Aiken Ave
Montpelier, Vermont 05633

City of Montpelier
City Manager
City of Montpelier
39 Main Street
Montpelier, Vermont 05602

The designation of such person(s) and/or addresses may be changed at any time by either Party upon written notice given pursuant to the requirements of this Section.

Authority of the Signatory:
Each of the Parties to this Memorandum of Understanding represent and warrant to the other that it has the authority to bind itself to all of the commitments set forth in this Memorandum of Understanding. This Memorandum of Understanding and any subsequent Energy Purchase and Sale Agreement will be governed by the laws of the State of Vermont.

Entire Agreement:
This Memorandum of Understanding constitutes the entire agreement between the Parties and shall not be modified or amended unless in writing and signed by both Parties.

STATE OF VERMONT
DEPARTMENT OF BUILDINGS
AND GENERAL SERVICES

Michael J Obuchowski

Title Commissioner Date 6/9/11

CITY OF MONTPELIER

Title City Manager Date 6/9/11

PROCUREMENT AGREEMENT
BETWEEN
THE STATE OF VERMONT
AND
THE CITY OF MONTPELIER

THIS AGREEMENT, dated the ___ day of January, 2012, by and between the State of Vermont, acting through its Department of Buildings and General Services ("the State"), and the City of Montpelier, Vermont ("the City"), sometimes referred to collectively as "the Parties" or individually as "Party."

Recitations

WHEREAS, on June 9, 2011, the Parties executed a Memorandum of Understanding (the "MOU") that provided, *inter alia*, that the State would replace and update the existing heating system that serves the Capital Complex with a biomass fueled heating boiler plant and related system to be fueled primarily by biomass and use #2 fuel oil as a secondary and emergency fuel; and

WHEREAS, on even date herewith, the parties are entering into a Sub-recipient Agreement (the "Sub-recipient Agreement") which provides, *inter alia*, for the City's administration of and the State's reimbursement from the DOE Grant (as defined in the Sub-Recipient Agreement) and a Thermal Energy Purchase and Sale Agreement (the "Purchase and Sale Agreement") which provides, *inter alia*, for the sale by the State to the City of the City's initial allocated share of the State Heat Plant Capacity of 9.71 Million BTU/Hour (the "Initial Contracted Capacity") and associated Energy (as defined in the Purchase and Sale Agreement); and

WHEREAS, the Sub-recipient Agreement further provides for the allocation of a portion of the DOE Grant for the construction of the State Heat Plant.

NOW THEREFORE, in consideration of the mutual covenants contained herein and intending to be legally bound hereby, the Parties hereto agree as follows:

Capitalized terms used but not defined herein shall have the meanings given to them in the Purchase and Sale Agreement.

Section 1. Purpose

The purpose of this Agreement is to describe and set forth the terms by which the City will make payment to the State for the Initial Contracted Capacity, which is 24.16% of total State Heat Plant Capacity.

Section 2. Construction Obligations

(a) The State

The State will have the sole responsibility to plan, design, construct and own the State Heat Plant in accordance with its policies and procedures, consistent with good engineering standards to serve the identified needs of the State and City. For its part, the State will update its existing heat plant to a modern biomass fueled facility as described in Section 3 below.

The State will be responsible for obtaining all State and local permits and approvals required for construction and operation of the State Heat Plant. The State is solely responsible for all safety and environmental regulations relating to the construction, operation and maintenance of the State Heat Plant.

(b) The City.

The City will have the sole responsibility to plan, design, construct, own and manage the City Distribution System in accordance with its policies and procedures, consistent with good engineering standards to serve the identified needs of the City and State. Upon completion of construction, the City will own, manage, operate and maintain the steam-to-hot-water energy conversion equipment (thermal conversion unit), which will thereafter be a part of the City's Distribution System. For its part, the City will plan, design, construct, own, operate and maintain the City Distribution System suitable to serving the needs of the City Owned and Served Buildings.

The City Distribution System will consist of the City's piping system and equipment to distribute the hot water including the energy conversion equipment (thermal conversion unit), and all other equipment and machinery necessary to connect and distribute the Energy to the City Owned and Served Buildings.

The City will be responsible for all State and Local permits and approvals for construction of the City Distribution System and for all safety and environmental regulations relating to the construction, operation and maintenance of the City Distribution System.

Section 3. The State Heat Plant

The State Heat Plant will consist of the necessary boilers, boiler auxiliary equipment, fuel conveyance and storage, ash collection and disposal systems, thermal conversion unit(s) (which will be owned, operated and maintained by the City upon the completion of construction), and building structures necessary to the safe and efficient operation and maintenance of a modern steam boiler plant. The State Heat Plant will be designed to primarily be fueled by biomass and use #2 fuel oil as a secondary and emergency fuel source.

The State Heat Plant will be constructed on the site of the State's existing boiler plant behind 120 State Street on the Capital Complex. Two new 600 HP dual fueled boilers, each with a rated capacity of 20.1 Million BTU/hour will be installed. In addition, the newer of the existing oil boilers will be relocated and modified to operate on #2 fuel oil (the existing heat plant currently uses # 6 fuel oil).

A space will be reserved in the new State Heat Plant to accommodate at a later date an additional boiler with a rated capacity of 600 HP as a means to serve long-term growth in the State and City heating loads. The plant design will, to the degree reasonable, incorporate the necessary auxiliary equipment and fuel handling systems for this subsequent Capacity. The steam boilers will be rated to operate at 400 PSIG, but will be operated at no more than 100 PSIG until such time as electric power-producing equipment is installed in the plant. The 400 PSIG rated pressure will support electric generation via a backpressure turbine generator at a later date. The State, in its sole discretion and at its own incremental cost, may elect to add and operate electric generating equipment to the State Heat Plant. The State Heat Plant systems will be designed to deliver energy to the City's Distribution System at 50 PSIG. The total net capacity of the State Heat Plant will be 40.2 Million BTU/hr (not including backup boiler capacity).

Section 4. Cooperation.

(a) The Parties agree to work together to obtain all necessary federal approvals. The Parties agree to cooperate with each other in obtaining required regulatory permits and approvals.

(b) Each Party shall provide the other Party with any information that the Party may have that is reasonably required by the other Party in planning, designing, constructing, owning, managing, operating, and maintaining its portion of the Project.

(c) The State and the City shall mutually agree on the final engineering design of each of the State Heat Plant and the City Distribution System, but shall only have that right to the extent required to ensure compatibility between the State Heat Plant and the City Distribution System and the timing of the estimated initial

delivery of Energy to the City, whether for purposes of start-up, testing or otherwise.

(d) Each Party will exercise good faith toward the other in connection with the tasks required by each to advance the business relationship contemplated by this Agreement.

(e) In the event of termination of this Agreement, each Party shall deliver to the other such engineering designs and drawings, and permit applications and permit approvals as may be required by the other Party. Further, each Party agrees to cooperate with the other to assist with the continuation of its respective portion of the Project and the recovery of any Department of Energy grant funds. Other than Department of Energy grant funds, and subject to Subsection 5(c) hereof, each Party agrees to be responsible for its own expenses and costs through the date of termination, as well as any remaining residual costs and expenses to terminate its participation in the Project.

Section 5. Construction Costs

(a) The Parties agree that the total estimated budgeted cost of the State Heat Plant, exclusive of City owned equipment and structures, is $15,293,698. This amount is estimated to be comprised of the State Contribution (defined below), the DOE Grant Allocation (described below) and the City Contribution (described below). The State contribution shall be comprised of a $7,000,000 appropriation and additional State contributions of $1,163,744 of in-kind and asset value and $246,373 in feasibility study work (together, the “State Contribution”) equal to 54.99% of the budgeted cost of constructing the State Heat Plant. The Parties further agree that the total estimated cost of the City Distribution System is $ 4,866,419. This amount excludes the costs of the heat exchangers to be constructed by the State, but includes the cost of conversion fort the High School and the Elementary School.

(b) DOE Grant Allocation. The $8,000,000 DOE Grant will be allocated as follows: (i) $3,248,664 to reimburse the State for its share of the total State Heat Plant cost (equal to 21.24% of total State Heat Plant cost); (ii) $2,558,118 (equal to 16.73% of the budgeted cost of constructing the State Heat Plant), constituting a portion of the consideration for the City’s Initial Contracted Capacity; and (iii) the balance of $2,193,218 to reimburse the City for its costs of the City Distribution System.

(c) City Contribution. The City will pay to the State from City funds $1,076,799 equal to 7.04% of the budgeted cost of constructing the State Heat Plant (the "City Contribution"). The State will provide an accounting of the cost of construction of the State Heat Plant as design and construction progresses on the same schedule as the State requests reimbursement from the DOE Grant funds in accordance with the Sub-Recipient Agreement, but no less than quarterly. The State's accounting will take the form of an invoice to the City for the City's allocated share of State Heat Plant costs. In the event that the Project is terminated and the State's accounting indicates a balance due the City, the State will return any unallocated balance to the City.

(d) Installments of the City Contribution shall be made to the State by wire transfer not less than ten (10) Business Days following receipt of the State's request for payment. The State will provide the City with the appropriate electronic funds transfer information.

(e) The City may contribute the City Contribution (as defined in subsection (c) above) in whole or in part in advance of design and construction expenditures by the State. Payments made in advance by the City will be accounted for by the State as a credit balance with expenditures deducted for the City's allocated share of State Heat Plant costs as work progresses. The State will maintain an accounting of City payments and make that accounting available to the City at the time the State requests reimbursement from the DOE Grant in accordance with the Sub-Recipient Agreement.

(f) The City shall have an Initial Contracted Capacity of 9.71 MMBTU/Hour, or 24.16% of the total net capacity of the State Heat Plant.

(g) If at any time during the development of the Project a Party determines that the total estimated budgeted costs of the State Heat Plant and/or the City Distribution System are likely to be above or below the total estimated budgeted amounts set forth above in Section 5(A) and 5(B), the Parties shall promptly meet and in good faith attempt to mutually agree upon budget adjustments appropriate to the Project.

(h) Reconciliation of Construction Cost.

(i) Upon completion of construction and commercial operation of the State Heat Plant, the State will prepare a final accounting of the cost of construction and placing the State Heat Plant into service.

(ii) In the event that the final accounting indicates a higher than budgeted cost, the State and City shall promptly meet and in good faith attempt to mutually agree upon the best course of action for sharing such cost

overrun, taking into account such factors as State and City budgets, available sources of funding, the potential for adjusting the cost of future Capacity purchases by the City and the potential for adjustment of the respective shares of State and City Capacity.

(iii) In the event that the final accounting indicates a lower than budgeted cost, the State and the City will share the difference as follows: 1.) first, to the extent the State Contribution exceeds 50% of the total State Heat Plant construction cost , the State will retain an amount of the difference between the budgeted and final cost necessary to reduce the State Contribution to an amount equal to 50% of total State Heat Plant cost, 2.) At the point that State has recovered construction cost savings such that the State Contribution equals 50% of the total construction cost, any balance remaining will be allocated to the State and City in proportion to their pro-rata share of total State Heat Plant Capacity.

(iv) The State and the City each reserve the right to seek additional funding from any other source in connection with the completion of the Project.

(v) The percentage shares of total State Heat Plant cost set forth herein shall be used for purposes of requesting DOE Grant reimbursement and may be restated only as the Parties may otherwise agree in accordance with subsections (g) and (h)(ii) and (iii) above.

Section 6. Notices

A notice given by either Party to this Agreement shall be sufficient if sent In accordance with Section 18 of the Purchase and Sale Agreement.

Section 7. Authority of the Signatory

Each of the Parties to this Agreement represents and warrants to the other that it has the authority to bind itself to all of the commitments set forth in this Agreement. This

Agreement is governed by the laws of the State of Vermont.

STATE OF VERMONT DEPARTMENT OF BUILDINGS AND GENERAL SERVICES	CITY OF MONTPELIER
Date:_____	Date: _____
By: _____	By: _____
Name: _____	Name: _____
Title: _____	Title: _____

THERMAL ENERGY PURCHASE AND SALE AGREEMENT

This Agreement is made between the State of Vermont, Department of Buildings and General Services ("State") and the City of Montpelier ("City") (the State and City sometimes referred to collectively as "Parties" or individually as a "Party").

RECITALS

WHEREAS, Section 2e of Act No. 40, Laws of 2011 (the "Act") (i) authorized the State of Vermont to own and operate a capital district heat plant; (ii) directed the State and the City to engage in discussions regarding capacity; and (iii) authorized the Commissioner of the Department of Buildings and General Services (the "Commissioner") to enter into contracts with the City regarding the sale of thermal energy; and

WHEREAS, in accordance with the Act, the State and City entered into a Memorandum of Understanding dated June 9, 2011, for the purposes of planning, developing and obtaining the necessary authorizations, votes, approvals and permits for a biomass fueled heating boiler plant and related facilities and equipment to be owned and operated by the State and a district heat distribution system to be owned and operated by the City; and

WHEREAS, partial funding for the Project will be provided by a grant by the United States Department of Energy; and

WHEREAS, the State intends to build and own a new State Heat Plant; and

WHEREAS, the State desires to sell to the City Capacity and associated Energy from the State Heat Plant for City Owned and Served Buildings and the City desires to purchase the same from the State in accordance with the terms of this Agreement.

NOW THEREFORE, in consideration of the mutual promises hereinafter contained, and subject to the terms and conditions of this Agreement, the City and the State hereby agree as follows:

SECTION ONE

1. DEFINITIONS

1.1 **Definitions.** The definitions set forth above are incorporated as given herein, as well as the following:

"Account Agent" means a federally insured financial institution agreed to by the Parties to hold any disputed funds under this Agreement.

"Agreement" means this Thermal Energy Purchase and Sale Agreement, as it may be amended.

"Business Day" means any day other than a Saturday or Sunday or other day recognized as a State or Federal Holiday.

"Capacity" is the ability to produce Energy measured in BTU/Hour.

"City Boilers" means the existing oil boilers, as they may be replaced or supplemented located at the Montpelier High School and City Hall, or elsewhere on the City Distribution System where the boiler is sufficiently under the control of the City of Montpelier to maintain thermal energy production in support of the City Distribution System and operated by the City in accordance with City Operating Protocol.

"City Distribution System" means the distribution system to be planned, designed, constructed, owned, managed, and maintained by the City, consisting of piping, heat exchanger(s) (thermal conversion unit(s)) and associated equipment and facilities necessary to receive and distribute Energy to City Owned and Served Buildings.

"City Operating Protocol" means the document(s) developed by an independent third party insured engineer to establish the procedures and staffing requirements for the prudent maintenance and operation of the City Boilers and City Distribution System by the City.

"City Owned and Served Buildings" means the City Hall, the City Police Department, the City Fire Department and such schools within the City and such other buildings within the City that are connected to the City Distribution System.

"City's Thermal Energy Requirements" means all thermal energy distributed through the City Distribution System.

"Commercial Operation Date" means the date when the State Heat Plant is ready for regular, daily operation, has been connected to the City Distribution System, has satisfied all applicable Legal Requirements and necessary testing and commissioning and is capable of producing Energy in accordance with this Agreement.

"Commissioner" means the Vermont Commissioner of Buildings and General Services, and his or her successors in office.

"Contracted Capacity" means the Capacity sold by the State to the City and purchased by the City from the State in accordance with this Agreement.

"Energy" means thermal energy produced by the State Heat Plant measured in BTU.

"Energy Payment Rate" shall have the meaning set forth in Section 4.2 of this Agreement.

"Effective Date" shall have the meaning set forth in Section 2.1.

"Fixed Costs" means that portion of Production Costs comprised of labor costs, labor overhead costs, insurance costs and contributions to the Maintenance Reserve.

"Fixed Payment Rate" shall have the meaning set forth in Section 4.2 of this Agreement.

"Governmental Authority" means the Vermont General Assembly, a public agency, city council, board, commission or authority, including any local, state or federal department or agency.

"Heating Season" means the seven (7) month period from and including October through and including April of the following year during the Term of this Agreement, unless otherwise agreed by the Parties.

"Initial Contracted Capacity" means the 9.71 Million BTU/Hour of Capacity initially sold by the State to the City and purchased by the City from the State in accordance with Section 3.1(i) of this Agreement.

"Legal Requirements" means any laws, rules, regulations or orders promulgated by a federal, state or local governmental authority or decision or order issued by an administrative body or court of competent jurisdiction.

"Maintenance Reserve" means the schedule established by the Commissioner to cover maintenance expenses associated with the State Heat Plant, as more specifically described in Section 8.5.

"Material Project Document" means this Agreement, the Procurement Agreement of even date herewith and the Sub-recipient Agreement of even date herewith and any Permit issued or required by any Governmental Authority relative to this Agreement or the subject of this Agreement.

"Metering Devices" means all BTU meters and associated transducers installed by the State and used to measure the City's Energy usage at the Thermal Point of Delivery for purposes of monthly invoicing, as further described in Section 12.

"Permit" means any permit, license, approval, authorization, consent, waiver, variance, certification, franchise or other authorization issued by or required from any Governmental Authority or regulatory or administrative body that pertains to the subject matter of this Agreement.

"Project" means the State Heat Plant and the City Distribution System, including City Boilers.

"Production Costs" shall include all costs and expenses (estimated and actual) of the State that are necessary to operate the State Heat Plant, including Fixed Costs and Variable Costs.

"Reconciliation" shall have the meaning set forth in Section 4.3.

"Reserve Capacity" means the Capacity the State makes available for a rental fee to the City when the City exceeds its Contracted Capacity as set forth in Section 3.2.

"Reserve Capacity Unit" shall mean 1.0 Million BTU/Hour of Reserve Capacity rented to the City from the State Heat Plant for one continuous hour.

"State Boilers" means two (2) 600 HP dual fuel boilers and associated auxiliary equipment and facilities capable of generating 40.2 Million BTU/Hour of Energy (and one (1) 400 HP oil fired boiler as back-up), and additional biofueled boiler(s), if any.

"State Distribution System" means the piping and associated equipment and facilities necessary to deliver Energy to State owned or occupied buildings.

"State Heat Plant" means the facility to be planned, designed, constructed, owned, operated and maintained by the State consisting of the State Boilers, wood and oil storage and handling equipment, venting facilities, including a stack, and associated auxiliary equipment and facilities necessary to the operation of the State Heat Plant.

"State Operating Protocol" means the document(s) developed by an independent third party insured engineer to establish the procedures and staffing requirements for the prudent maintenance and operation of the State Heat Plant by the State.

"Term" shall have the meaning set forth in Section 2 of this Agreement.

"Thermal Point of Delivery" means the point where the State Heat Plant connects to the City Distribution System to allow the City Distribution System to operate interconnected with the State Heat Plant, being the point at which the delivery of Energy to the City Distribution System is measured.

"Unit of Capacity" for purposes of the purchase of additional Capacity, a Unit of Capacity shall mean 1.0 Million BTU/Hour of Capacity.

"Variable Costs" shall mean those Production Costs other than Fixed Costs including, but not limited to, regulatory charges, operation and annual maintenance expenses and the cost for fuel delivered to the State Heat Plant.

1.2. **<u>Interpretation</u>**. In this Agreement, unless a different intention clearly appears:

(i) The singular includes the plural and vice versa; and

(ii) Any term or word(s) used but not defined herein shall have the meanings ascribed to such term or word(s) within the biomass heating industry, or if not used therein with any known specificity or commonality then it shall have such meaning given to it within the everyday usage of such term or word(s).

1.3. Attachments; Order of Precedence.

(i) This Agreement consists of 31 pages including the following attachments, the terms of which are incorporated herein:

(a) Attachment A-Schedule for the Purchase of Additional Capacity;

(b) Attachment B-Rate Schedule for the Rental of Reserve Capacity Units;

(c) Attachment C-Standard State Provisions for Contracts and Grants;

(d) Attachment D – Procurement Agreement dated January __, 2012;

(e) Attachment E –Sub-recipient Agreement dated January __, 2012.

(ii) Any ambiguity, conflict or inconsistency among this Agreement and the Attachments shall be resolved according to the following order of precedence:

(a) Attachment C;

(b) This Agreement;

(c) Other Attachments.

SECTION TWO

2. TERM AND TERMINATION

2.1. Effective Date. The Effective Date of this Agreement is the date upon which both Parties have signed this Agreement.

2.2. Commercial Operation Date. The State and the City agree that the Commercial Operation Date is estimated to occur on or before October 1, 2013. The State and the City shall each certify agreement to the actual occurrence of the Commercial Operation Date. Unless terminated earlier in accordance with its terms, this Agreement shall continue in effect for a period of twenty (20) Heating Seasons from the first day of the Heating Season in which the Commercial Operation Date has occurred (the "Initial Term").

2.3. Renewal. Provided that the City is not then in default beyond any applicable grace or cure period, at the expiration of the Initial Term, the City shall have the option to extend this Agreement for

up to two (2) periods of an additional five (5) Heating Seasons each. Collectively, the Initial Term and any extensions thereto shall be referred to hereinafter as the "Term." The City shall notify the State of its election to renew or terminate no later than one year prior to the expiration of the Initial Term or any extension thereof then in effect.

2.4. Termination.

(i) This Agreement shall remain in full force and effect until the last day of the last Heating Season of the Term and a final accounting and settlement has been made of any obligations resulting from this Agreement

(ii) Except as provided in Subsection (i), this Agreement shall be terminated in the event that:

(a) The Parties mutually agree in writing to terminate this Agreement; or

(b) In the event Department of Energy grant funds become unavailable or reduced, the State or the City may suspend or cancel this Agreement; or

(c) A non-Defaulting Party declares the termination of this Agreement in accordance with Section 14.

2.5. Continued Purchase and Sale of Capacity and Energy Beyond Termination of this Agreement. Upon the expiration of the Term of this Agreement, the City shall have the option to continue to receive Capacity and purchase associated Energy at an initial Capacity of no less than the Contracted Capacity from the last Heating Season of this Agreement. If the continued operation of the State Heat Plant makes economic sense for the State and the City, then the State shall agree to sell and the City shall agree to purchase Capacity and associated Energy from the State Heat Plant upon such terms as may be mutually agreeable at the time. If the City desires to exercise this option, it shall notify the State at the time this Agreement is extended for the second five year renewal period as set forth above in Section 2.3. The Parties shall begin negotiations at least three (3) years before the expiration of the Term of this Agreement to determine the terms upon which the purchase by the City and the sale by the State of Capacity and associated Energy shall continue. The Parties shall endeavor to reach agreement at least one (1) year prior to the expiration of the Term of this Agreement. The price of additional Capacity shall permit recovery by the State of the additional capital costs incurred by the State to place the Contracted Capacity into service, or continue such Contracted Capacity, but only to the extent that such costs have not previously been paid by the City. The costs and expenses associated with the continued use of Contracted Capacity include, but are not limited to, Maintenance Reserve expenses not previously charged, land lease for the land and stack, rebuild and replacement, engineering, permitting, construction, deconstruction, reclamation, or any other costs and expenses associated with the continued use of the State Heat Plant.

SECTION THREE

3. PURCHASE AND SALE OF CAPACITY; RESERVE CAPACITY; ADDITIONAL CAPACITY

3.1. Purchase and Sale of Initial Capacity; Purchase and Sale of Additional Capacity.

(i) **Initial Contracted Capacity.** Provided that the City is not in default beyond any applicable grace or cure period under the Memorandum of Understanding, dated June 9, 2011, the Procurement Agreement or Sub-recipient Agreement, each executed on even date herewith, the City shall be entitled to receive the Initial Contracted Capacity.

(ii) **Purchase of Additional Capacity.** The City may purchase additional Capacity from the State Heat Plant to the extent the State has additional Capacity to sell, as set forth herein. Not later than May 1 of each year, the City shall provide written notice to the State of its desire to purchase additional Units of Capacity for the upcoming Heating Season. Not later than June 1 after the receipt of any such notice, the State shall advise the City, in writing, as to whether the requested Capacity is available or is not available due to the State's need (i) to service the State's load (estimated or actual) or (ii) for the State to maintain reasonable reserves and system redundancy. If the requested Capacity is not available, the State shall provide the reason(s) for its inability to sell additional Units of Capacity to the City.

If the requested Capacity is available, not later than July 1 prior to the Heating Season for which additional Capacity is requested, the City must make a single lump sum payment to the State for each additional Unit of Capacity, in accordance with Attachment A. If payment for the additional Units of Capacity is made not later than July 1 prior to the Heating Season for which the additional Units of Capacity have been requested, the additional Units of Capacity will be made available to the City at the start of the upcoming Heating Season.

(iii) **State's Inability to Sell Additional Capacity.** If the State is unable to sell additional Capacity to the City upon request in accordance with this Section 3 due to the State's need (i) to service the State's load (estimated or actual) or (ii) for the State to maintain reasonable reserves and system redundancy, then the City may make alternate arrangements from another source, including from City Boilers, to meet the City's Thermal Energy Requirements, but only to the extent the State is unable to meet the City's Thermal Energy Requirements.

3.2. Reserve Capacity Rental; Reserve Capacity Unit Rental Rate.

(i) **Rental of Reserve Capacity Units.** If the City's Thermal Energy Requirements at the Thermal Point of Delivery exceed its Contracted Capacity, the State will only serve the City's Thermal Energy Requirements at the Thermal Point of Delivery when the total Capacity of the State Heat Plant exceeds the aggregate Capacity needs of the State, including reasonable reserves and redundancy plus the Contracted Capacity of the City.

If the City's Thermal Energy Requirements at the Thermal Point of Delivery exceed its Contracted Capacity, for any portion of an hour, the City shall rent from the State Reserve Capacity Units to meet the City's Thermal Energy Requirements at the Thermal Point of Delivery. For example, if the City's Thermal Energy Requirements at the Thermal Point of Delivery exceed its Contracted Capacity and continue to exceed its Contracted Capacity for two and a half (2.5) hours with the peak load in the first hour, second hour, and third hour equaling 0.8 Million BTU/Hour, 2.2 Million BTU/Hour, and 1.6 Million BTU/Hour, respectively, in excess of the City's Contracted Capacity then the City must rent one (1), three (3), and two (2) Reserve Capacity Units for the first, second, and third hours, respectively. Therefore, in this example, the total rented Reserve Capacity Units for the two and a half (2.5) hour period equals six (6) Reserve Capacity Units.

(ii) **Reserve Capacity Rate.** The City will pay to the State a rental rate on each Reserve Capacity Unit in accordance with Attachment B (as shall be amended) as an additional monthly payment to be invoiced by the State.

(iii) **Payment for Reserve Capacity Units.** The rental rate for Reserve Capacity Units shall be invoiced for the time period in which the City rented the Reserve Capacity Units. The City shall make payment to the State in accordance with Section 6 of this Agreement.

(iv) **Deemed Notice of Intent to Purchase Additional Capacity.** At such time that the City has rented a cumulative total of 200 Reserve Capacity Units in any one Heating Season, the City shall be deemed to have provided notice to the State of its intent to purchase additional Units of Capacity the following May 1 equal to the number of Reserve Capacity Units rented during such Heating Season divided by the number of hours (or portions thereof) where the City's Thermal Energy Requirements at the Thermal Point of Delivery exceeded its Contracted Capacity during that Heating Season. The State agrees to continue to rent Reserve Capacity Units to the City for the remainder of that Heating Season.

(v) **State's Inability to Rent Reserve Capacity Units.** If the State is unable to meet the City's Thermal Energy Requirements for a particular Heating Season through the rental of Reserve Capacity Units and sale of the associated Energy to the City, in accordance with this Section 3 due to the State's need (i) to service the State's load (estimated or actual) or (ii) for the State to maintain reasonable reserves and system redundancy, then the City may make alternate arrangements from another source, including from City Boilers, to meet the City's Thermal Energy Requirements, but only to the extent the State is unable to meet the City's Thermal Energy Requirements.

If the State is unable to rent Reserve Capacity Units to the City as set forth above, it must notify the City within twenty-four (24) hours of the time at which the metered Energy being delivered to the City exceeds the Contracted Capacity plus any Reserve Capacity Units already rented hereunder, and set forth the reason(s) for its inability to rent Reserve

Capacity Units to the City. Should the excessive actual metered delivery occur on a weekend or a State or Federal Holiday then the State shall have until the end of the next Business Day to respond. If excessive actual metered delivery occurs on the day prior to a weekend or State or Federal Holiday then the State shall have until the end of the next Business Day to provide written notice to the City of its inability to rent additional Reserve Capacity Units to the City.

3.3 **Exclusive Supplier.** The State shall be the City's exclusive supplier of the City's Capacity and City's Thermal Energy Requirements during the Term of this Agreement, except in the following situations:

(i) Where it is in the mutual interest of the Parties due to a significant technological advancement that substantially allows both Parties to realize an economic benefit;

(ii) Outside the Heating Season the City may use its City Boilers;

(iii) During no more than 200 hours in any Heating Season when the City exceeds its Contracted Capacity the City may supplement the City's Thermal Energy Requirements by operating the City Boilers. On a schedule and in a manner consistent with the City Operating Protocol, the City shall provide an accounting to the State indicating the extent of operation, including but not limited to dates and hours, of the City Boilers for the prior month;

(iv) At such times as the State is operating the State Heat Plant using oil as its primary fuel source, the City may supplement the City's Thermal Energy Requirements by operating the City Boilers;

(v) Where permitted in accordance with Section 3.1(iii) **(State's Inability to Sell Additional Capacity) and 3.2(v) (State's Inability to Rent Reserve Capacity Units); and**

(vi) In instances of *force majeure* or interruption required and called for under this Agreement.

SECTION FOUR

4. PURCHASE AND SALE OF ENERGY; ENERGY PAYMENT RATE; FIXED PAYMENT RATE; RECONCILIATION

4.1. **Purchase and Sale of Energy.** The State shall sell and deliver to the City and the City shall purchase, pay for and receive from the State during the Term of this Agreement Energy in amounts not to exceed the Contracted Capacity plus any Reserve Capacity Units rented hereunder, as measured at the Thermal Point of Delivery.

4.2. **Energy Price.**

(i) The Energy Payment Rate shall be the pro rata share of estimated Variable Costs for the upcoming Heating Season based on each Parties' respective share of the total Energy

delivered by the State Heat Plant, subject to any increase or decrease to reflect Reconciliation from the prior year. The Energy Payment Rate shall be billed to the City in accordance with Section 6.

(ii) The Fixed Payment Rate is the pro rata share of estimated Fixed Costs based on each Parties' respective share of the Capacity of the State Boilers, excluding back-up, for the upcoming Heating Season, subject to any increase or decrease to reflect Reconciliation from the prior year. The Fixed Payment Rate shall be billed to the City in accordance with Section 6.

(iii) Not later than June 1 of each year of the Term, the State shall provide the City, in writing, its good faith estimated Production Costs, the Reconciliation of Production Costs for the preceding Heating Season, if applicable, and a proposed rate schedule to establish the Energy Payment Rate and the Fixed Payment Rate for the upcoming Heating Season. In addition the State will prepare estimates for each of the next two (2) subsequent Heating Seasons. The State shall supply the City all pertinent materials supporting the calculations of the Production Costs (including annual maintenance), Reconciliation, Energy Payment Rate, Fixed Payment Rate, and estimates for the following two (2) Heating Seasons. In all cases that the State contends that such costs should be included in the calculation of Production Costs it shall furnish to the City the reason for such inclusion.

(iv) The City shall have until June 30 of each year to review the information supplied in accordance with Subsection (i) above and discuss it with the State.

(v) Not later than July 1 of each year, after taking into account the comments and concerns of the City, the Commissioner shall issue a rate schedule to establish the Energy Payment Rate and Fixed Payment Rate for the upcoming Heating Season.

(vi) During each of the last three (3) years of the Term this Agreement, the same procedure will be followed for each of the last three (3), two (2), and one (1) year periods, respectively. Any amount owed to the City or owed by the City on the expiration or termination of this Agreement shall be paid by the owing Party within thirty (30) days of receiving notice of an accounting prepared to reflect such an amount owed by the owing Party.

(vii) If at any time during a Heating Season the State determines the Energy Payment Rate or the Fixed Payment Rate requires adjustment, the State shall provide the City at least four (4) weeks written notice of any changes (proposed or actual) to a previously provided estimate of the Energy Payment Rate or Fixed Payment Rate.

4.3. <u>Reconciliation Process</u>.

(i) The Parties agree that, since the Energy Payment Rate and the Fixed Payment Rate for any single Heating Season are based on estimated Productions Costs, the Energy Payment Rate and the Fixed Payment Rate for the upcoming Heating Season should be adjusted to account for any over- or under-estimate of Production Costs for the prior Heating Season. A reconciliation of the Energy Payment Rate and the Fixed Payment Rate serves two purposes:

(a) It will correct any over- or under-collection for the prior Heating Season; and

(b) The actual Production Costs shall be the basis for the new Energy Payment Rate and the new Fixed Payment Rate for the upcoming Heating Season, thus reflecting an the most reliable data available.

(ii) Prior to each June 1 of the Term, the State shall compare the actual Production Costs of the prior Heating Season with the estimated Production Costs used to develop the Energy Payment Rate and the Fixed Payment Rate for the prior Heating Season to determine any over- or under-estimate of Production Costs for the prior Heating Season ("Reconciliation").

4.4. **Obligation of City to Provide Thermal Energy.** At such times when the State Heat Plant is unable to meet the Capacity needs of the State and the Contracted Capacity of the City due to a scheduled or unscheduled outage, the City will, if requested by the State, supplement the City's Thermal Energy Requirements by operating the City Boilers.

4.5. **Use of Oil.** The State will use wood or biofuel as primary fuel for the State Heat Plant unless market or other conditions make it less expensive or otherwise necessary to burn oil. In the event the State uses oil as a primary fuel source for the State Heat Plant, it shall notify the City in accordance with Section 18.

4.6. **Facilitating Distribution.** The Parties agree to facilitate Energy distribution as set forth below.

(i) During the period(s) the State is the exclusive supplier to the City pursuant to Section 3.3 of this Agreement, should the City wish to purchase Energy and sell it to an entity or entities not connected to the City Distribution System but which is or are adjacent to the State Distribution System and the State has the distribution system capacity without installing additional distribution system or building additional facilities to deliver Energy to such entity or entities on behalf of the City, the State shall transmit such Energy across the State Distrib-ution System for the City for no fee. All reasonable costs and expenses incurred to connect such entity, including but not limited to metering, steam and condensate piping and energy conversion equipment, including reasonable transmission losses and as may be necessary for proper operation of the State Distribution System to affect the delivery of Energy, shall be the responsibility of the City.

(ii) Should the State wish to deliver Energy to a State owned building(s) (including where the State has a capital or financial lease) located within or adjacent to the City Distribution System and the City has the distribution system capacity without installing additional pipe or building additional facilities to deliver Energy to the State's owned building(s) (including where the State has a capital or financial lease), the City shall transmit such Energy across the City Distribution System for the State for no fee. All reasonable additional costs and expenses incurred to connect such building(s), including but not limited to metering and interconnection equipment, as may be necessary for the proper operation of the City Distribution System to affect delivery of Energy shall be the responsibility of the State, including reasonable transmission losses.

SECTION FIVE

5. PLANNING REQUIREMENTS

5.1. **Exchange of Information.** The City and State agree to exchange information regarding their future Capacity and Energy requirements and estimated costs and expenses of the State Heat Plant operation on an annual basis, as set forth in this Section 5.

5.2. **City's Estimated Monthly Loads.** Not later than May 1 of each year, the City shall provide the State, in writing, its good faith estimated Contracted Capacity requirements, monthly estimates of the City's Thermal Energy Requirements, and its monthly estimated Energy load factors for the upcoming Heating Season, and each of the subsequent two (2) Heating Seasons, and all pertinent materials supporting the calculation of the estimated Contracted Capacity requirements, monthly estimates of the City's Thermal Energy Requirements, and monthly estimated Energy load factors. During each of the last three (3) years of the Term of this Agreement, the City shall provide the State with its good faith estimated Contracted Capacity, City's Thermal Energy Requirements, and Energy load factor requirements for each month of the last three (3), two (2) and one (1) year periods, respectively.

5.3. **State's Estimated Maintenance Schedule**. Not later than June 1 of each year, the State shall provide the City, in writing, its good faith estimated annual maintenance schedule(s) for the period beginning July 1 of each of the subsequent three (3) years. During each of the last three (3) years of the Agreement, as it may be extended, the State shall provide the City with its good faith estimated annual maintenance schedule for each of the last three (3), two (2) and one (1) year periods, respectively. Provided, however, that nothing in this Section 5 shall limit the State's ability to perform the maintenance it deems necessary or advisable, in its sole discretion, to assure that the State Heat Plant and State Distribution System will perform efficiently and reliably and the State Heat Plant will perform consistent with the State Operating Protocol.

5.4. **City's Estimated Maintenance Schedule.** Not later than May 1 of each year, the City shall provide the State, in writing, its good faith estimated annual maintenance schedule(s) for the City Boilers and City Distribution System for the period beginning July 1 of each of the subsequent three (3) years. During each of the last three (3) years of this Agreement, as it may be extended,

the City shall provide the State with its good faith estimated annual maintenance schedule for each of the last three (3), two (2) and one (1) year periods, respectively. Provided, however, that nothing in this Section 5 shall limit the City's ability to perform the maintenance it deems necessary or advisable, in its sole discretion, to assure that the City Boilers and City Distribution System will perform reliably and consistent with the City Operating Protocol.

5.5. **Cooperation Regarding Maintenance.** Each Party will cooperate with the other Party to schedule its maintenance activities (including any changes to any previously provided schedule of such activities) to coincide where necessary or advisable with the maintenance activities of the other Party.

5.6. **Permits**. The Parties shall take all reasonable action necessary to secure all the required governmental Permits required by or for this Agreement in its entirety.

5.7. **Notice.** In the event either Party determines it is necessary to change the planning information it has provided to the other Party as required in this Section Five, it shall give the other Party at least four (4) weeks written advanced notice of any such changes (proposed or actual); *provided, however,* each Party shall give as much notice as reasonably practicable (in light of all the circumstances) of any such changes.

SECTION SIX

6. BILLING AND PAYMENT

6.1. **Format.** The State shall bill the City on a monthly basis.

6.2. **Payment.** The City shall pay the State for Energy delivered under and pursuant to this Agreement at the Energy Payment Rate and any Reserve Capacity Units rented during the month. The City shall also pay the State the Fixed Payment Rate. Payment, except for any amounts disputed in good faith, shall be made to the State by the City within thirty (30) days after receiving such billing for the first year of this Agreement following the Commercial Operation Date. After this first year, payment shall be made to the State within fifteen (15) days after receipt of such billing. All such payments shall be sent to the Commissioner.

6.3. **Billing Error.** Any billing adjustment required as a result of an error in metering shall be made retroactive to the midpoint of the period between the meter calibration test which revealed the error in metering and the next most recent meter calibration test. Should the Parties mutually agree on the time the meter failed to make an accurate measurement, the adjustment for such case will be made retroactive to that time.

6.4. **Late Payment Penalty and Charge.** Any failure by the City to pay its monthly bill in full as required in Section 6.2, except for any amount disputed in good faith, shall result in the imposition of a late payment penalty of two hundred and fifty dollars ($250.00).

Additionally, a late payment charge of 1.5 percent per month, to be first imposed upon the expiration of one month from the date payment is due shall be added to the past due amount if the bill is not paid by the due date.

These rights of a late payment penalty and charge are not in lieu of other rights the State may have existing at law or equity for failure to make timely payments.

6.5. **Good Faith Billing Disputes.** If the City disputes in good faith any monthly billing or adjustments to any billing, then the City shall pay the undisputed amount to the State and pay the disputed amount to a separate interest bearing account of an Account Agent. The disputed funds shall be held in this account during the pendency of the dispute. After resolution of the dispute, both Parties will jointly designate to the Account Agent the proper distribution of all accounts, funds, and accumulated interest. Any expenses by the Account Agent shall be borne in equal parts by the Parties. The State shall not have the right to suspend or terminate deliveries of Energy as a result of any or all good faith disputes.

SECTION SEVEN

7. COOPERATION

7.1. **Information and Time of Performance.**

(i) Each Party shall provide the other Party with any information that the Party may have that is reasonably required by the other Party in planning, designing, constructing, owning, managing, operating, and maintaining its portion of the Project.

(ii) The State and the City shall mutually agree on the final engineering design of the State Heat Plant and the City Distribution System to the extent necessary to ensure compatibility between the State Heat Plant and the City Distribution System and City Boilers and to meet the timing of the initial delivery of Energy to the City, for purposes of start-up, testing or otherwise.

(iii) Each Party will exercise good faith toward the other in connection with the tasks required by each to advance the business relationship contemplated by this Agreement.

(iv) In the event of Termination of this Agreement, each Party shall deliver to the other such engineering designs and drawings, and permit applications and permit approvals as may be required by the other Party. Further, each Party agrees to cooperate with the other to assist with the continuation of the other Party's respective portion of the Project and the recovery of any Department of Energy grant funds. Other than Department of Energy grant funds, each Party agrees to be responsible for its own expenses and costs through the date of termination, as well as any remaining residual costs and expenses to terminate its participation in the Project.

SECTION EIGHT

8. OPERATIONS AND MAINTENANCE

8.1. Operating Protocols.

(i) The State shall be responsible for the operation of the State Heat Plant, including the State Boilers. At least six (6) months prior to the estimated Commercial Operation Date, the State shall select and retain an independent insured engineer who shall prepare the State Operating Protocol appropriate for the Term of this Agreement, which shall take into account the system supplier's recommendations and shall include, if deemed appropriate by the State's independent insured engineer, anticipated changes over time as the associated equipment ages. The State agrees to operate the State Heat Plant in accordance with the State Operating Protocol. Throughout the Term, the State shall retain an independent insured engineer to review the State Operating Protocol at least every five (5) years, or such earlier time as the State Operating Protocol requires, and shall modify or revise the State Operating Protocol as may be required by the State Operating Protocol or as it may be advised by its independent insured engineer.

(ii) The City shall be responsible for the operation of the City Distribution System and the City Boilers. At least six (6) months prior to the estimated Commercial Operation Date, the City shall select and retain an independent insured engineer who shall prepare the City Operating Protocol appropriate for the Term of this Agreement, which shall take into account the system supplier's recommendations and shall include, if deemed appropriate by the City's independent insured engineer, anticipated changes over time as the associated equipment ages. The City agrees to operate the City Distribution System and the City Boilers in accordance with the City Operating Protocol. Throughout the Term, the City shall retain an independent insured engineer to review the City Operating Protocol at least every five (5) years, or such earlier time as the City Operating Protocol requires, and shall modify or revise the City Operating Protocol as may be required by the City Operating Protocol or as it may be advised by its independent insured engineer.

(iii) The Parties shall share equally in the cost of preparing and revising the State Operating Protocol and City Operating Protocol and the costs and expenses of the independent insured engineers throughout the Term.

8.2. State Heat Plant. The State shall operate and maintain the State Heat Plant in accordance with the State Operating Protocol and applicable Legal Requirements in such a manner that the State Heat Plant is capable of delivering Capacity and associated Energy to the City.

8.3. City Boilers and City Distribution System. The City shall operate and maintain the City Boilers and City Distribution System in accordance with the City Operating Protocol and applicable Legal Requirements in such a manner that the City Boilers and City Distribution System are capable of receiving Energy from the State and delivering Energy to the City and that

there will be no adverse impact on the State's ability to operate the State Heat Plant and State Distribution System.

8.4. **Make-Up Water and Electric Service.** The City Distribution System is separate and distinct from the State Heat Plant and State Distribution System. The City shall be solely responsible for the electric and water service needed for the City Distribution System.

8.5. **Maintenance Reserve.** A Maintenance Reserve will be established by the Commissioner sufficient to cover estimated maintenance expenses for the State Heat Plant, based on the most recent State Operating Protocol. The purpose of the Maintenance Reserve is to minimize changes in the year-over-year cost schedule necessary to cover maintenance expenses that are necessary but occur less frequently than yearly. The State will provide the City with information that allows the City to confirm the Maintenance Reserve schedule and cost estimate, to the extent consistent with the length and extent of the City's entitlement to its Contracted Capacity. After consulting with the City, the Commissioner shall establish the Maintenance Reserve schedule and cost estimate.

8.6. **Coordinating Committee.** The Parties shall form a committee (the "Coordinating Committee") approximately three (3) months prior to the estimated Commercial Operation Date. The State shall appoint three (3) representatives and three (3) alternate representatives and the City shall appoint two (2) representatives and two (2) alternate representatives to serve on the Coordinating Committee. Each Party shall notify the other in writing of such appointments and any changes thereto. The Commissioner shall appoint the Chair of the Committee from one of the three (3) State representatives. The Chair of the Committee shall oversee the meetings and provide notices and information prior to the meetings. The Chair shall not vote on any issue or recommendation unless there is a tie vote by the Committee members. The Coordinating Committee shall meet quarterly to conduct performance reviews and otherwise as frequently as the Chair or a majority of the members deems necessary. The Committee members shall cooperate in scheduling meetings.

8.7. **Technical Matters.** The Coordinating Committee shall be a forum for discussing technical matters relating to the operation and maintenance of the State Heat Plant, the City Boilers and City Distribution System, including emergency procedures and operating reliability in the delivery of the Energy as set forth in this Agreement. The Coordinating Committee shall serve solely as a means of cooperation and interchange of information between the Parties in connection with this Agreement. Without limiting the foregoing, the Coordinating Committee may recommend to the Parties (i) an audit or review of the State Operating Protocol, the City Operating Protocol, or both; (ii) maintenance systems and practices; and (iii) incident follow-up procedures. Any recommendation, endorsement, approval, suggestion, advice or other action (hereafter "recommendations") by the Coordinating Committee shall be subordinate to the authority vested in the Commissioner. The Coordinating Committee's recommendations shall be non-binding but the Parties agree that each Party shall reasonably consider all written recommendations by the Coordinating Committee.

8.8. **Compliance.** Neither the Coordinating Committee nor any representative thereto, in its capacity as such, shall have authority to give any consents, approvals or waivers hereunder or to modify or waive compliance with any terms or conditions of any Material Project Document. No action or inaction of the Coordinating Committee or by any representative thereto, in its capacity as such, shall limit, waive, relieve or otherwise affect in any way the rights or obligations of either Party hereto from that set forth in this Agreement, as it may be amended. Nor is the Coordinating Committee to substitute for the person who is identified in Section 18, hereof to receive formal notices hereunder.

SECTION NINE

9. FORCE MAJEURE

9.1. **Invocation and Effect of *Force Majeure*.** Notwithstanding any other Section or provision of this Agreement, the State shall not be liable to the City for its failure to deliver Contracted Capacity and associated Energy, and the City shall not be liable to the State for its failure to receive and pay for Contracted Capacity and associated Energy, when such failure shall be due to a cause or event beyond the reasonable control of the claiming Party and the occurrence and severity of which the claiming Party could not with reasonable diligence and foresight have anticipated and, despite diligent efforts to avoid or overcome, prevents the claiming Party from performing its obligations under this Agreement. Provided these criteria are met, *force majeure* events include, but are not limited to, accident to or breakage of pipelines or equipment, failure of boiler or boiler auxiliary equipment or lines, fires, floods, extreme and unforeseeable weather conditions, strikes, lockouts, riots, acts of war, sabotage, acts of nature or public enemy, shutdowns for unanticipated repairs and maintenance, failure of contractors or suppliers to comply with performance requirements of the contracts, times which, in the opinion of the State, an unsafe condition exists, which may result in possible harm to persons and/or machinery, or will exist if operation were to continue, or, without limitation by enumeration, any other cause beyond the State's or the City's reasonable control provided the State or City shall promptly and diligently take such action as may be necessary and practicable under the then existing circumstances to remove the cause of failure and resume delivery of Contracted Capacity or Reserve Capacity and associated Energy. The Party seeking to invoke this protection shall provide notice to the other Party as soon as practicable, but within no more than twenty-four (24) hours of the event or such other time as is reasonable under the circumstances. The Party shall further notify the other Party as to the time when a *force majeure* condition no longer is in effect.

9.2. **Effect of *Force Majeure*.** If either Party is unable to perform, wholly or in part, any of its obligations under this Agreement because of *force majeure*, such Party will be excused from such performance to the extent such inability is due to *force majeure*, provided that:

(i) The non-performing Party shall notify the other Party as required herein specifying the details of the *force majeure* event and attempts to cure it;

(ii) If the Party's inability to perform this Agreement due to the effects of the *force majeure* event continue for more than thirty (30) days, the non-performing Party shall give the other Party notice every seven (7) days thereafter if the *force majeure* event occurs either within the Heating Season or occurs or is continuing to occur within thirty (30) days prior to the Heating Season. Otherwise, such notice shall be every thirty (30) days;

(iii) The excuse of performance shall be of no greater scope and of no longer duration than reasonably required to remove the cause of failure;

(iv) The non-performing Party proceeds diligently to remedy its inability to perform; and

(v) When the non-performing Party is able to resume performance it gives the other Party notice to that effect as soon as reasonably possible.

SECTION TEN

10. RECORDS AVAILABLE FOR AUDIT

Each Party will maintain all books, documents, payroll papers, accounting records and other evidence pertaining to costs incurred under this Agreement for not less than seven (7) years for inspection by any authorized representatives of the State or Federal Government. Once any litigation, claim, or audit is started, all records shall be retained until all litigation, claims or audit findings involving the records have been resolved. Each Party, by any authorized representative, shall have the right at all reasonable times to inspect or otherwise evaluate the work performed or being performed under this Agreement.

SECTION ELEVEN

11. THERMAL POINT OF DELIVERY

11.1. **Thermal Point of Delivery.** The Thermal Point of Delivery for the Energy sold by the State to the City shall be at the high pressure steam side of the thermal conversion unit where the State Heat Plant interconnects with the City Distribution System.

11.2. **Thermal Conversion Unit.** The State will design and construct the thermal conversion unit as part of the State Heat Plant construction, which shall have an initial capacity of 13.5 Million BTU/Hour. The City will be responsible for providing the State with all design criteria and conversion system functional descriptions, including but not limited to pressure drop and temperature out and in data and/or any other data sufficient to enable the State's engineer to meet the responsibility to design and construct the thermal conversion unit. Upon completion of construction, the State will convey and the City will assume ownership of the thermal conversion unit and all responsibility of operation, maintenance, upgrades, and removal.

SECTION TWELVE

12. METERING

12.1. **Metering Devices.** The State shall be responsible for specifying, installing, calibrating, maintaining, repairing, replacing and operating all Metering Devices on its side of the Thermal Point of Delivery. The State's Metering Devices shall be located on the higher pressure steam side of the thermal conversion unit and on the condensate header from the thermal conversion unit. All Metering Devices used to measure the Energy delivered and the heat content at the condensate at the Thermal Point of Delivery shall be sealed and the seal may be broken only when such Metering Devices are to be inspected, and tested and/or adjusted.

12.2. **Testing the Metering Devices.** The Metering Devices shall be tested at least annually by a qualified independent third party selected by the State. The State shall provide the City with the name and qualifications of the independent third party it selected at least ten (10) days prior to the testing. The City has three (3) Business Days to object to the independent third party selected by the State. If the City objects to the independent third party selected by the State then the State and City shall endeavor to select a third party agreeable to both Parties to test the Metering Device(s) within the next seven (7) days. If the Parties are unable to reach agreement upon the expiration of the seven (7) days, then the Commissioner shall select a qualified independent third party.

12.3. **Access to Metering.** Metering Devices and charts used in the implementation of this Agreement that are located on the State's property shall be accessible at all normal business hours to reading, inspection and examination by the City. City meters and charts used in the implementation of this Agreement that are located on the City's property shall be accessible at all normal business hours to reading, inspection and examination by the State.

12.4. **Metering Calibration.** The State shall coordinate and schedule one calibration each year to calibrate its Metering Devices during normal plant operations. The State shall provide the City advance notice such that the City may have its representatives present for each such calibration. Calibrations shall be performed in a workmanlike manner according to accepted industry standards. The State shall promptly provide the City with copies of calibration results.

12.5. **Metering Errors.** Errors in Metering Devices and any City meters of more than plus or minus three (3) percent shall require prompt correction and an affirmative demonstration that the errors have been eliminated.

12.6. **City's Meters.** The City may install, maintain, and operate meters at the City's expense, provided that any such meters are installed on the City's side of the Thermal Point of Delivery and do not interfere with the operation of the State Heat Plant. The City shall coordinate and schedule one meter calibration each year to calibrate its meters during normal plant operations. The City shall provide the State advance notice such that the State may have its representatives present for each such calibration. Calibrations shall be performed in a workmanlike manner

according to accepted industry standards. The City shall promptly provide the State with copies of calibration results.

SECTION THIRTEEN

13. DISPUTE RESOLUTION

13.1. **Negotiation, Administrative and Judicial Remedies.** In the event of a dispute or disagreement between the Parties arising out of or relating to this Agreement (the "Disputed Matter"), designated representatives for the City and the State shall meet to endeavor to resolve such dispute. If a resolution to such dispute does not occur during such meeting or within three (3) Business Days thereafter, the Parties agree to elevate the dispute to a meeting of the Commissioner and the City Manager. If a resolution of such dispute does not occur during such meeting or within five (5) Business Days thereafter, the Parties agree to elevate the dispute to the State's Secretary of Administration. If the Secretary of Administration concludes, after a good faith attempt to resolve the Disputed Matter, that amicable resolution through continued negotiation does not appear likely, then, the Parties may seek all available legal or equitable remedies.

During the pendency of any Disputed Matter, the City and the State shall continue to perform their respective obligations under this Agreement and act in good faith to mitigate any potential damages or interruption in the performance of the obligations hereunder.

13.2. **Trial by Jury.** The City acknowledges and agrees that the State shall not agree to arbitration and the State is prohibited by policy and shall not waive any right to a trial by jury.

SECTION FOURTEEN

14. EVENTS OF DEFAULT, REMEDIES

14.1. **Events of Default.** There shall have been deemed to have occurred an event of default (an "Event of Default") with respect to a Party (the "Defaulting Party") upon the occurrence and during the continuance of any of the following events:

(i) The Defaulting Party fails to pay any undisputed amount when due pursuant to this Agreement and such failure is not cured within five (5) Business Days after receiving notice of such failure from the non-Defaulting Party;

(ii) The Defaulting Party fails to perform any obligation under this Agreement (other than that specified in Section 14.1.(i) and such failure is material and not cured within twenty (20) days after receiving notice of such failure from the non-Defaulting Party; provided, however, if such default is capable of being cured and the Defaulting Party is diligently seeking to cure such default, then such period of twenty (20) days shall be extended for

such time as is necessary to cure such default up to such additional period of time as the Parties may agree;

(iii) Any representation or warranty made by the Defaulting Party in this Agreement was untrue when made, and such misrepresentation is material and not cured within twenty (20) days after receiving notice of such misrepresentation from the non-Defaulting Party.

14.2. **Remedies.** Notwithstanding any other provision to the contrary, upon the occurrence and during the continuation of any Event of Default, the non-Defaulting Party shall have the right to:

(i) Terminate this Agreement;

(ii) Suspend performance of its obligations hereunder;

(iii) Seek provisional or equitable remedies directly from superior court;

(iv) Seek specific performance of the obligations of the Defaulting Party hereunder from superior court;

(v) Pursue any other legal action including damages.

14.3. **Remedies Cumulative.** Subject to the releases and the waivers, allocations and disclaimers of, and limitations on, liability or remedies or recourse set forth in this Agreement, each right or remedy of the Parties provided for in this Agreement shall be cumulative of and shall be in addition to every other right or remedy provided for in this Agreement, and the exercise, or the beginning of the exercise, by the Party of any one or more of any such rights or remedies shall not preclude the simultaneous or later exercise by such Party of any or all other of such rights or remedies.

14.4. **Performance During Dispute.** The Parties shall continue to perform their respective obligations under this Agreement during the pendency of any unexpired cure period (as set forth above) for an Event of Default of which the non-Defaulting Party has given notice.

SECTION FIFTEEN

15. WARRANTY

Other than as set forth herein, the State makes no warranties, representations or conditions of any kind or nature with respect to this Agreement, express or implied, in fact or by law, including without limiting the generality of the foregoing any warranty of merchantability or fitness for a particular purpose.

SECTION SIXTEEN

16. MODIFICATION OF AGREEMENT

Any modification of this Agreement or additional obligation assumed by either Party in connection with this Agreement shall be binding only if evidenced in writing, signed by each Party after all necessary governmental approvals or authorizations have been obtained.

SECTION SEVENTEEN

17. JURISDICTION

The City and the State each agree that any action or proceeding brought by either the State or the City in connection with this Agreement shall be brought and enforced in the Washington County Superior Court of the State of Vermont. The Parties irrevocably submit to the jurisdiction of such court in respect of any such action or proceeding.

SECTION EIGHTEEN

18. NOTICES

18.1. **Notices.** All notices must be given in accordance with the terms of this Section 18.1 and shall be sent to the addresses set forth below (or such other addresses as may be provided from time to time). A notice, consent or other communication required to be made under this Agreement shall be in writing and shall be sufficient if personally delivered or sent by registered U.S. mail or certified mail, return receipt requested, to either Party at the address specified below. Any notice personally delivered shall be effective on the date of receipt. Further the Parties may deliver notice by electronic mail or facsimile transmission, however each Party agrees that if any notices are sent via electronic mail or facsimile transmission, and such notices require a consent, express or implied, or other affirmative action from the receiving Party (as opposed to notices of events such as meetings, reports and the like), then, in addition, the sending party shall provide a hard copy of such notice, either via hand delivery, certified mail or overnight courier. All notices required by this Agreement shall be directed to:

State of Vermont
Commissioner
Vermont Department of Buildings and General Services
2 Governor Aiken Ave.
Montpelier, Vermont 05633
Fax:
Email:

City of Montpelier
City Manager
City of Montpelier

39 Main Street
Montpelier, Vermont 05602
Fax:
Email:

The designation of such person(s) and/or addresses may be changed at any time by either Party upon written notice given pursuant to the requirements of this Section.

18.2. **Date of Receipt of Personal Delivery.** As proof of personal delivery, it shall be sufficient to produce a receipt showing personal service was made with the transmittal sheet confirming delivery to the proper person, with time and date, signed by the receiving Party.

SECTION NINETEEN

19. MISCELLANEOUS

19.1. **No Presumption of Construction For or Against Any Party.** Any rule of construction or interpretation requiring this Agreement to be construed or interpreted against any Party shall not apply to the construction or interpretation hereof.

19.2. **Titles or Headings; No Effect.** Section titles or headings appearing in this Agreement are inserted only for convenience of reference and are not intended to be part of or to affect the meaning or interpretation of this Agreement.

19.3. **Authority of the Signatory.** Each of the signatories to this Agreement represents and warrants to the other Party that he/she has the authority to bind his/her principal to all of the covenants, promises, warranties, agreements, conditions, understandings and commitments set forth in this Agreement and exhibits/attachments and that all necessary governmental authorizations and approvals to bind the City and State, respectively, have been obtained. The City's signatory to this Agreement represents to the State that a binding resolution has been adopted by the City Council approving this Agreement in all respects prior to the execution of this Agreement, a true and correct copy of which shall be supplied to the State at or before the Effective Date. The State's signatory to this Agreement represents to the City that the State, acting by and through its Department of Buildings and General Services, has the necessary powers and authority to perform all acts to be performed by the State hereunder. To the extent additional permits, approvals or authorizations are required the Parties agree to pursue such permits, approvals, and/or authorizations in a prompt and cooperative manner. This Agreement is subject to approval as to form by the Vermont Attorney General.

19.4. **No Waiver or Release.** No waiver or release of any breach of this Agreement shall constitute a waiver or release of any other breach of the same or other provisions of this Agreement, and no waiver or release shall be effective unless made in writing. In the event that any provision(s) herein shall be illegal or unenforceable, such provision(s) shall be severed and the entire

Agreement shall not fail, but the balance of the Agreement shall continue in full force and effect, unless such provision(s) directly affect the delivery of Capacity and Energy or payment therefore.

STATE OF VERMONT **DEPARTMENT OF BUILDINGS AND GENERAL SERVICES**	**CITY OF MONTPELIER**
_____	_____
NAME **DATE**	**NAME** **DATE**
_____	_____
TITLE	**TITLE**

ATTACHMENT A

SCHEDULE FOR THE PURCHASE OF ADDITIONAL CAPACITY

Capacity Price. The price of each additional Unit of Capacity is determined by dividing the total cost (as finally determined) of placing the State Heat Plant into service (as of the Effective Date estimated to be $15.05 Million) by the Capacity of the State Boilers, excluding backup, in Million BTU/Hour (40.2 Million BTU/Hour) and adding the accumulated interest paid by the State on its general obligations bonds (as determined when the bonds financing the State Heat Plant are issued), in accordance with this Attachment A. This Attachment A shall be amended in accordance with Section 16 to reflect the final cost of constructing and placing into service the State Heat Plant and the actual interest cost to the State.

Schedule for the Purchase of Additional Capacity				
Notice Date*	**For Heating Season Beginning**	**Capacity Component Cost****	**Cost of Money Component****	**Price per Unit of Capacity**
May 1, 2012	October 1, 2012	$374,300	$4,018	$378,318
May 1, 2013	October 1, 2013	$374,300	$12,194	$386,494
May 1, 2014	October 1, 2014	$374,300	$20,656	$394,956
May 1, 2015	October 1, 2015	$374,300	$29,414	$403,714
May 1, 2016	October 1, 2016	$374,300	$38,479	$412,779
May 1, 2017	October 1, 2017	$374,300	$47,861	$422,161
May 1, 2018	October 1, 2018	$374,300	$57,572	$431,872
May 1, 2019	October 1, 2019	$374,300	$67,622	$441,922
May 1, 2020	October 1, 2020	$374,300	$78,025	$452,325
May 1, 2021	October 1, 2021	$374,300	$88,791	$463,091
May 1, 2022	October 1, 2022	$374,300	$99,934	$474,234
May 1, 2023	October 1, 2023	$374,300	$111,467	$485,767
May 1, 2024	October 1, 2024	$374,300	$123,404	$497,704
May 1, 2025	October 1, 2025	$374,300	$135,759	$510,059
May 1, 2026	October 1, 2026	$374,300	$148,545	$522,846
May 1, 2027	October 1, 2027	$374,300	$161,780	$536,080
May 1, 2028	October 1, 2028	$374,300	$175,478	$549,778
May 1, 2029	October 1, 2029	$374,300	$189,655	$563,955
May 1, 2030	October 1, 2030	$374,300	$204,328	$578,628
May 1, 2031	October 1, 2031	$374,300	$219,515	$593,815
May 1, 2032	October 1, 2032	$374,300	$231,359	$605,659
May 1, 2033	October 1, 2033	$374,300	$239,457	$613,757
May 1, 2034	October 1, 2034	$374,300	$247,838	$622,138
May 1, 2035	October 1, 2035	$374,300	$256,512	$630,812
May 1, 2036	October 1, 2036	$374,300	$265,490	$639,790
May 1, 2037	October 1, 2037	$374,300	$274,782	$649,082
May 1, 2038	October 1, 2038	$374,300	$284,399	$658,699
May 1, 2039	October 1, 2039	$374,300	$294,353	$668,653
May 1, 2040	October 1, 2040	$374,300	$304,656	$678,956
May 1, 2041	October 1, 2041	$374,300	$315,319	$689,619
May 1, 2042	October 1, 2042	$374,300	$326,355	$700,655

Note:
*Notice of intent to purchase additional capacity may be given at any time in advance of the notice date.
**Per Unit of Capacity as defined in Section 1.1.

ATTACHMENT B

RATE SCHEDULE FOR THE RENTAL OF RESERVE CAPACITY UNITS

Reserve Capacity Rate. The Reserve Capacity Unit rental rate is calculated as the price per Unit of Capacity for the relevant Heating Season as set forth in Attachment A to this Agreement, as amended (Schedule for the Purchase of Additional Capacity), times 1.1 (110 percent) divided by 5,088 ((the number of days in a typical Heating Season (212) times hours per day (24)).

Rate Schedule for the Rental of Reserve Capacity Units	
For Heating Season Beginning	**Reserve Capacity Unit Rental Rate***
October 1, 2012	$82
October 1, 2013	$84
October 1, 2014	$86
October 1, 2015	$88
October 1, 2016	$90
October 1, 2017	$92
October 1, 2018	$94
October 1, 2019	$96
October 1, 2020	$98
October 1, 2021	$101
October 1, 2022	$103
October 1, 2023	$106
October 1, 2024	$108
October 1, 2025	$111
October 1, 2026	$114
October 1, 2027	$116
October 1, 2028	$119
October 1, 2029	$122
October 1, 2030	$126
October 1, 2031	$129
October 1, 2032	$131
October 1, 2033	$133
October 1, 2034	$135
October 1, 2035	$137
October 1, 2036	$139
October 1, 2037	$141
October 1, 2038	$143
October 1, 2039	$145
October 1, 2040	$147
October 1, 2041	$150
October 1, 2042	$152

Note:
*The amount listed is the rental rate per Reserve Capacity Unit for the given Heating Season in accordance with Section 3.2. This rate is to be billed to the City in accordance with Section 6.

ATTACHMENT C: STANDARD STATE PROVISIONS
FOR CONTRACTS AND GRANTS

1. **Entire Agreement:** This Agreement represents the entire agreement between the State of Vermont and City of Montpelier on the subject matter. All prior agreements, representations, statements, negotiations, and understandings shall have no effect.

2. **Applicable Law:** This Agreement will be governed by the laws of the State of Vermont.

3. **Definitions:** For purposes of this Attachment C, "Party" shall mean the City of Montpelier

4. **Appropriations:** If this Agreement extends into more than one fiscal year of the State (July 1 to June 30), and if appropriations are insufficient to support this Agreement, the State may cancel at the end of the fiscal year, or otherwise upon the expiration of existing appropriation authority. In the case that this Agreement is a Grant that is funded in whole or in part by federal funds, and in the event federal funds become unavailable or reduced, the State may suspend or cancel this Grant immediately, and the State shall have no obligation to pay the Party from State revenues.

5. **No Employee Benefits For Party:** The Party understands that the State will not provide any individual retirement benefits, group life insurance, group health and dental insurance, vacation or sick leave, workers compensation or other benefits or services available to State employees, nor will the State withhold any state or federal taxes except as required under applicable tax laws, which shall be determined in advance of execution of this Agreement. The Party understands that all tax returns required by the Internal Revenue Code and the State of Vermont, including but not limited to income, withholding, sales and use, and rooms and meals, must be filed by the Party, and information as to Agreement income will be provided by the State of Vermont to the Internal Revenue Service and the Vermont Department of Taxes.

6. **Independence, Liability:** The Party will act in an independent capacity and not as officers or employees of the State.

The Party shall defend the State and its officers and employees against all claims or suits arising in whole or in part from any act or omission of the Party or of any agent of the Party. The State shall notify the Party in the event of any such claim or suit, and the Party shall immediately retain counsel and otherwise provide a complete defense against the entire claim or suit.

After a final judgment or settlement the Party may request recoupment of specific defense costs and may file suit in the Superior Court of the State of Vermont, Washington Division, requesting recoupment. The Party shall be entitled to recoup costs only upon a showing that such costs were entirely unrelated to the defense of any claim arising from an act or omission of the Party.

The Party shall indemnify the State and its officers and employees in the event that the State, its officers or employees become legally obligated to pay any damages or losses arising from any act or omission of the Party in the performance of this Agreement.

7. **Insurance**: Before commencing work on this Agreement the Party must provide certificates of insurance to show that the following minimum coverages are in effect. It is the responsibility of the Party to maintain current certificates of insurance on file with the State through the term of the Agreement. No warranty is made that the coverages and limits listed herein are adequate to cover and protect the interests of the Party for the Party's operations. These are solely minimums that have been established to protect the interests of the State.

Workers Compensation: With respect to all operations performed, the Party shall carry workers' compensation insurance in accordance with the laws of the State of Vermont.

General Liability and Property Damage: With respect to all operations performed under the contract, the Party shall carry general liability insurance having all major divisions of coverage including, but not limited to:

Premises - Operations
Products and Completed Operations
Personal Injury Liability
Contractual Liability

The policy shall be on an occurrence form and limits shall not be less than:

$2,000,000.00 Per Occurrence
$2,000,000.00 General Aggregate
$2,000,000.00 Products/Completed Operations Aggregate
$ 1,000,000.00 Fire/ Legal/Liability

Party shall name the State of Vermont and its officers and employees as additional insureds for liability arising out of this Agreement.

Automotive Liability: The Party shall carry automotive liability insurance covering all motor vehicles, including hired and non-owned coverage, used in connection with the Agreement. Limits of coverage shall not be less than: $1,000,000.00 combined single limit.

Party shall name the State of Vermont and its officers and employees as additional insureds for liability arising out of this Agreement.

8. **Requirement to Have a Single Audit:** In the case that this Agreement is a Grant that is funded in whole or in part by federal funds, and if the Party expends $500,000 or more in federal assistance during its fiscal year, the Party is required to have a single audit conducted in accordance with the Single Audit Act, except when it elects to have a program specific audit.

The Partymay elect to have a program specific audit if it expends funds under only one federal program and the federal program's laws, regulating or grant agreements do not require a financial statement audit of the Party.

The Party is exempt if the Party expends less than $500,000 in total federal assistance in one year.

The Party will complete the Certification of Audit Requirement annually within 45 days after its fiscal year end. If a single audit is required, the Party will submit a copy of the audit report to the primary pass-through Party and any other pass-through Party that requests it within 9 months. If a single audit is not required, the Party will submit the Schedule of Federal Expenditures within 45 days. These forms will be mailed to the Party by the Department of Finance and Management near the end of its fiscal year. These forms are also available on the Finance & Management Web page at: http://finance.vermont.gov/forms

9. **Fair Employment Practices and Americans with Disabilities Act**: Party agrees to comply with the requirement of Title 21V.S.A. Chapter 5, Subchapter 6, relating to fair employment practices, to the full extent applicable. Party shall also ensure, to the full extent required by the Americans with Disabilities Act of 1990, as amended, that qualified individuals with disabilities receive equitable access to the services, programs, and activities provided by the Party under this Agreement. Party further agrees to include this provision in all subcontracts.

10. **Set Off**: The State may set off any sums which the Party owes the State against any sums due the Party under this Agreement; provided, however, that any set off of amounts due the State of Vermont as taxes shall be in accordance with the procedures more specifically provided hereinafter.

11. T**axes Due to the State**:

a. Party understands and acknowledges responsibility, if applicable, for compliance with State tax laws, including income tax withholding for employees performing services within the State, payment of use tax on property used within the State, corporate and/or personal income tax on income earned within the State.

b. Party certifies under the pains and penalties of perjury that, as of the date the Agreement is signed, the Party is in good standing with respect to, or in full compliance with, a plan to pay any and all taxes due the State of Vermont.

c. Party understands that payment under the Agreement may be withheld if the Commissioner of Taxes determines that the Party is not in good standing with respect to or in full compliance with a plan to pay any and all taxes due to the State of Vermont.

d. Party also understands the State may set off taxes (and related penalties, interest and fees) due to the State of Vermont, but only if the Party has failed to make an appeal within the time allowed by law, or an appeal has been taken and finally determined and the Party has no further legal recourse to contest the amounts due.

12. **Sub-Agreements**: Party shall not assign, subcontract or subgrant the performance of this Agreement or any portion thereof without the prior written approval of the State. Party also agrees to include in all subcontract or subgrant agreements a certification in accordance with paragraphs 9, 11 and 14.

13. **No Gifts or Gratuities**: Party shall not give title or possession of anything of substantial value (including property, currency, travel and/or education programs) to any officer or employee of the State during the term of this Agreement.

14. **Certification Regarding Debarment:** Party certifies under pains and penalties of perjury that, as of the Effective Date, neither Party nor Party's officers are presently debarred, suspended, proposed for debarment, declared ineligible or excluded from participation in federal programs or programs supported in whole or in part by federal funds.

(End of Standard Provisions)

EXHIBIT C

Annual Operating Budget Projection

			2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35
Bond Payment (2011 Bond)		$2,000,000	$0	$50,920	$64,321	$64,321	$64,321	$180,876	$179,557	$175,970	$173,116	$169,997	$166,613	$162,983	$159,180	$155,255	$151,207	$147,038	$142,751	$138,368	$133,903	$129,355	$124,725	$120,018
State Labor		2.50%	$0	$55,669	$57,061	$58,487	$59,949	$61,448	$62,984	$64,559	$66,173	$67,827	$69,523	$71,261	$73,043	$74,869	$76,740	$78,659	$80,625	$82,641	$84,707	$86,825	$88,995	$91,220
Additional State costs -operating			$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Additional State Costs - capacity bond	0.00		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
State Consumables			$0	$7,435	$7,613	$7,802	$7,994	$8,188	$8,384	$8,580	$8,778	$8,978	$9,178	$9,379	$9,580	$9,783	$9,989	$10,239	$10,495	$10,757	$11,026	$11,302	$11,584	$11,584
State Maint. Reserve			$0	$16,000	$16,000	$16,000	$16,000	$17,000	$17,000	$17,000	$17,000	$17,000	$18,000	$18,000	$18,000	$18,000	$18,000	$19,000	$19,000	$19,000	$19,000	$19,000	$19,000	$19,000
Bond Payment (2009 Bond)			$20,202	$20,376	$20,154	$20,134	$19,720	$19,267	$18,789	$16,994	$16,520	$16,029	$15,522	$15,001	$14,468	$13,923	$13,370	$12,811	$12,240	$0	$0	$0	$0	$0
CEDF Loan Interest			$6,875	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$0
Reserve for late/contingency	5% of revenue		$6,073	$15,150	$15,301	$15,454	$15,609	$17,743	$18,441	$18,626	$20,603	$20,809	$21,017	$21,227	$21,439	$21,653	$21,870	$22,089	$22,310	$22,533	$22,758	$22,986	$23,215	$23,448
Construction costs			$5,491	$5,491	$5,491	$5,491	$5,491	$5,491	$5,491	$5,491	$5,491	$5,491	$5,491	$5,491	$5,491	$5,491	$5,491	$5,491	$5,491	$5,491	$5,491	$5,491	$5,491	$5,491
City Operating Costs	15	15	$35,000	$76,710	$77,860	$79,028	$80,214	$81,417	$82,638	$83,878	$85,136	$86,413	$87,709	$89,025	$90,360	$91,715	$93,091	$94,488	$95,905	$97,343	$98,804	$100,286	$101,790	$101,790
		3.50%																						
TOTAL - ANNUAL EXPENSE BUDGET	**NPV**	**$5,056,777**	**$73,641**	**$255,252**	**$271,301**	**$274,218**	**$276,797**	**$398,931**	**$400,786**	**$398,598**	**$400,317**	**$400,044**	**$400,553**	**$399,866**	**$399,061**	**$398,190**	**$397,259**	**$397,313**	**$396,317**	**$383,633**	**$383,189**	**$382,744**	**$382,301**	**$372,551**

CITY OF MONTPELIER, VERMONT

- THE SMALLEST CAPITAL CITY IN THE UNITED STATES -

Mayor John Hollar

City Council Members:

Dona Bate
Jessica Edgerly Walsh
Tom Golonka
Thierry Guerlain
Justin Turcotte
Anne Watson

William Fraser
City Manager

Jessie Baker
Assistant City Manager

MEMORANDUM

To: Mayor Hollar & City Council Members
From: William Fraser, City Manager
Jessie Baker, Assistant City Manager
Re: Recommended District Heat Montpelier Rates for 2014-2015 Heating Season
Date: July 25, 2014

We recommend that the Council establish the District Heat Montpelier capacity rate at $4.84 per MBTUH and the energy rate at $8.82 per MMBTU for the 2014-2015 heating season. These rates are in-line with the projected rates shared with the customers when they signed on to District Heat Montpelier.

The District Heat Montpelier rate is made up of the capacity charge and the energy charge. The capacity charge includes the City operating, maintenance, and repair costs related to District Heat Montpelier including the City's debt service attributable to the distribution system. The capacity charge is contractually established in the customer agreements – a model of which can be seen here: http://www.montpelier-vt.org/upload/pages/579/files/mastercustomer_agreement_121019.pdf. The energy charge includes costs related to the State of Vermont's consumption of fuels, electricity, and other products required to produce the energy distributed through the system as well as the costs associated with running the State's Heat Plant. The energy charges are established by the Commissioner of Buildings and General Services (BGS) as communicated in the attached memorandum.

For the 2014 to 2015 heating we recommend the following rates:

Capacity Rate:	$4.84 per MBTUH
Energy Rate:	$8.82 per MMBTU

Upon analysis of these rates based on anticipated customer demand, the aggregate average cost per gal of fuel oil equivalent for the 2014-2015 heating season will be $3.65/gal.

In reviewing these rates we met with BGS to gain a full understanding of the State's costs, EverGreen Energy did an independent review of the these rates, and we assessed these rates as compared to the rates projected when customers signed on to the system. Based on these rates established in the customer agreements and by the BGS Commissioner, customers can expected to see charges this heating season in-line with what was projected for their buildings when they signed on to District Heat Montpelier.

Montpelier Alive
• ENRICHING A VIBRANT DOWNTOWN •

To: Montpelier City Council
From: Ashley Witzenberger, Executive Director

39 Main Street
Montpelier, VT 05602
director@montpelieralive.org
(802) 223-9604
www.MontpelierAlive.org

proudly serving downtown Montpelier since 1999
a Vermont Downtown Program accredited by the National Main Street Center ®

July 24, 2014

Dear City Councilors,

Montpelier Alive in partnership with ArtsRiot would like to hold an arts festival downtown on Saturday, October 18. We request the closure of State Street in between Elm Street and Main Street from 6:00 am – 11:00 pm on October 18. The event will take place from 10:00 am – 9:00 pm the remaining time will be for set up and break down of the event.

Most cordially,
Ashley Witzenberger
Montpelier Alive

Montpelier Alive
• ENRICHING A VIBRANT DOWNTOWN •

To: Montpelier City Council
From: Ashley Witzenberger, Executive Director

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a Vermont Downtown Program accredited by the National Main Street Center ®

July 24, 2014

Dear City Councilors,

Montpelier Alive would like to hold a community event downtown celebrating our fifteenth anniversary and the end of a great summer. We request the closure of State Street from Elm Street to Main Street from 11 am – 10 pm on Saturday, September 6. The event will take place from 4:00 pm – 9:00 pm the remaining time will be for set up and break down of the event.

Most cordially,
Ashley Witzenberger
Montpelier Alive

Sandy Pitonyak

From: Jessie C. Baker
Sent: Wednesday, July 23, 2014 8:22 AM
To: Sandy Pitonyak
Subject: FW: Truck Stop Extension 60 Main Street

From: jesse jacobs [mailto:jsbjacobs@gmail.com]
Sent: Tuesday, July 22, 2014 5:36 PM
To: William Fraser
Cc: Jessie C. Baker
Subject: Truck Stop Extension 60 Main Street

Hello Bill and Jessie,

We have had great success and even better public response with our Saturday Truck Stop series in the 60 Main Street parking lot. I am looking to extend the Truck Stop event dates per Council's recommendation upon initial approval of the series. Our hope is that Council will approve and extend our use of the 60 Main Street parking lot beyond Saturday, August 2nd to include the following dates:

Saturday, August 9th, 2014

Saturday, August 16th, 2014

Saturday, August 23rd, 2104

Saturday, August 30th, 2014

The same parameters, previously approved, for use of the lot would remain in place with parking closed to the public beginning at 2pm on each of the aforementioned Saturdays and the actual Truck Stop event running from 5:00pm to 9:30pm. I have spoken with the Mayor about this request already and he is supportive of the extension. If possible, please add this request to the Council's agenda for the July 30th, 2104 meeting.

Many thanks in advance,

Jesse Jacobs