

Montpelier Community Renewable Energy Project

Objectives

Vermont's Capital City, Montpelier, is deeply committed to leading the region and the nation in implementing replicable strategies to deploy renewable energy technologies and reduce its carbon footprint. The City has committed to a goal of reducing greenhouse gas emissions and fossil fuel consumption by the City, its citizens, and its business community by at least 80% by 2030. The energy plan the City has adopted includes residential and commercial energy efficiency improvements, renewable energy generation, transportation alternatives, bicycle and pedestrian improvements, and a new multi-modal transit facility. The City has outlined the following concrete approaches to achieve intended fossil fuel and greenhouse gas reductions:

- To design and construct a state of the art biomass-fueled district energy system that will provide clean, efficient production of renewable, sustainable, biomass energy for heat and electric power for Montpelier's downtown buildings. This system will be:
 - Designed and built in partnership with the State of Vermont, the Biomass Energy Resource Center and Veolia Energy ;
 - Complementary of the existing, but dated, system that currently provides the State Complex with heat;
 - Constructed with state of the art technology and equipment to maximize efficiency, minimize emissions, and ensure long-term system durability;
 - Constructed and implemented in compliance with all permits and with processes and systems that are verified and documented during construction, start-up, and commissioning in order to ensure quality, and allow for ease of replication in other communities.
- To implement a seamless delivery and financing system that encourages property owners to undergo energy retrofits, and install renewable energy technologies where appropriate, so that by 2015:
 - 50% of Montpelier's homes will have implemented deep energy retrofits;
 - 50% of the buildings in the designated downtown will have undergone energy retrofits and be positioned to make maximum use of the district energy system;
 - Property owners seeking to install renewable energy technologies will have access to financing that can be repaid on their property tax bills.
 - State energy legislation in 2009 authorized a minimum of \$100,000 toward district energy system connection fees for businesses and homeowners

Project Description

The Montpelier Community Renewable Energy Project encompasses the design, permitting, construction, installation, financing, commissioning and operation of a state-of-the-art 41 MMBtu (1200

HP) combined heat and power district energy system fueled with primarily locally-sourced renewable and sustainably-harvested wood chips. The project will also identify and implement the optimum ownership and customer marketing and connection strategies. As properties are connected to the system, the project will implement efficiency and conservation measures to reduce overall heat load. Finally, the project includes adoption of financing mechanisms that will enable property owners to implement a variety of efficiency measures and renewable energy strategies.

The renewable energy system will be developed by a unique public-private partnership involving City and State government, local property owners and businesses and the expertise of both a national non-profit specializing in community-scale biomass applications and an international district energy development and management firm. The CHP system will be sized to provide heating to an existing ½ million square feet of state-owned buildings in the Vermont Capitol Complex along with a planned expansion of about 240,000 square feet, City-owned properties including schools and the City Hall Complex, and up to 156 additional buildings in the community's designated downtown district, for a total of 180 buildings heating 1.8 million square feet. By also providing 1.8 million KWh of power to the grid, the system will maximize its operating efficiency and reduce thermal costs for users in the community.

Development of the system will be overseen by the City of Montpelier and its district energy system partners, the State of Vermont and Veolia Energy North America. The Montpelier-based national nonprofit, Biomass Energy Resource Center (BERC) will provide technical support. Creating district energy infrastructure that is designed to replace existing building-based systems is by its very nature an incremental process. Unlike the development of mandatory hook-up utilities such as water and sewer services, the process of obtaining user commitments requires market transformation. The project that is embodied in this application will transform the market in Montpelier from extensive dependence on fossil fuels for its heating needs into adoption of a renewable energy system that is being designed with flexibility and growth in mind. As the system is built-out over the next decade it will reach more customers within the community and produce more thermal and electrical energy. The development and operating processes will be fully documented and widely disseminated through promotion on the City's web site, tourist information displays in the community, and through presentations at sustainability and climate change mitigation strategy conferences and in writings on sustainability.

Project History

The City, State, and BERC, have collaborated for close to a decade on feasibility assessment, planning and building support for Montpelier Community Renewable Energy Project. It is now ready to move to the design phase and implementation.

The project was first imagined in the early 1990's. Biomass heating advocates had seen and hoped to replicate the Charlottetown, PEI district heating system. Preliminary assessment began in 2000-2001 with a study performed by Natural Resources Canada, (*District Energy in Montpelier, Vermont – Concepts & Review*) based on Montpelier building surveys conducted by the partners with GIS mapping by the Montpelier Planning Office. Concurrently, district energy was identified as one of the ten key elements in the legislatively-mandated Montpelier City/State Commission Capital District Master Plan.

From 2002 to 2004, project supporters looked more closely at the capacity, economic and policy barriers associated with integrating this new city-wide CHP system with the existing biomass heating system currently serving the state capitol complex. Studies were carried out that assessed economic viability and market potential, preliminary system capacity and air emissions at various new central boiler plant sites. In addition to informing the community, this phase led to stronger partnerships between the City of Montpelier, State Department of Buildings & General Services (BGS), Vermont Department of Public Service, Vermont Environmental Conservation's Air Pollution Control Division, as well as National Life of Vermont and a number of the city's other large building owners.

Over the past four years, the project has moved forward with a number of design studies that assess specific configurations that can meet the needs of the City, the State Complex or both. Two engineering studies were undertaken by BGS in 2005 and 2006 with \$150,000 in funding from the Vermont Legislature, a \$25,000 Vermont Clean Energy Development Fund study to reconfigure the project for CHP and the engagement in 2009 of Veolia Energy as the City's development partner. This phase will conclude with Veolia Energy's completion of the final pre-design scoping study this fall.

Increased fuel costs, concerns about global climate change and the availability of ARRA funding make this the optimum time to bring this project to fruition. Furthermore, the recently passed Vermont Energy Act of 2009 created the new *Vermont Village Green Renewable Pilot Program* to develop district heating systems or CHP systems to serve a downtown development district or growth centers as defined in the legislation. The City of Montpelier was named as one of two pilot communities established to launch this program. As such, the City is eligible to receive at least \$100,000 in connection incentives to help customers connect to new district energy systems. Qualifying biomass CHP systems must achieve at least a 50% net annual efficiency during the heating season and a minimum conversion efficiency of 70% considering all energy inputs and outputs at a normal load. Eligible projects using woody biomass as fuel must use procurement standards, management practices, and supply chains that are third party certified using a performance-based audit. Vermont Village Green renewable energy projects must also comply with all applicable national air quality standards and air pollution control regulations of the Vermont Agency of Natural resources, including the anticipated new EPA emission standards for wood-fueled boilers, due out towards the end of 2009.

In addition, both the Montpelier Master Plan and the Central Vermont Regional Plan expressly support a district-heat and/or cogeneration plant. The Regional Plan specifically supports the expansion of biomass electrical generation as an alternative to the increasing use of imported fossil fuels. It specifically highlights Vermont's leadership in small-scale biomass use and encourages use of biomass energy in the region. Two of the Regional Plan's goals are to: (1) conserve energy through increased efficiency, and (2) to advocate for increased use of local, renewable energy sources.

The City of Montpelier is working with the State and Veolia Energy to secure final project construction funds and permits so that project construction can begin by the end of 2010. Committed funding toward project development and implementation includes \$100,000 from Vermont's Clean Energy Development Fund, at least \$100,000 from the Village Green Renewable Pilot Program and a \$250,000 bond approved by City voters in 2008 that is to be used for part of the cost of the piping infrastructure

to provide thermal energy to community and downtown buildings. Additional funding is expected from the State's capital construction budget and debt financing issued by the City or State. Energy efficiency funding is in part provided by state utilities through the Vermont Department of Public Service administered by the Vermont Energy Investment Corporation (VEIC) and Efficiency Vermont (EVT).

All of the work will be performed at existing city or state offices or on the proposed facility site.

Merit Review Criterion Discussion

Technical Approach & Work Plan

Technical Approach

District energy systems use one or more central plants to provide thermal energy delivered via underground transmission pipes to multiple buildings. Older district energy systems relied on steam transmission – today's modern systems used smaller, well insulated pipe to distribute "low temperature" (approximately 176-200 degree) hot water. These systems are very efficient (approaching 80% efficiency), relatively low maintenance, and extremely reliable. The proposed system will be fueled with sustainably-harvested wood chips.

District energy systems replace the need for individual, building-based boilers, furnaces, and cooling systems. Individual building owners are able to buy their heat (and in some cases, cooling and electricity) from the energy district instead of operating their own boilers, furnaces or air conditioners. This allows for more rapid and universal conversion to renewable fuels, much greater fuel flexibility, more professional and environmentally-sound energy management and an overall reduction of all of the environmental risks associated with multiple locations for fuel storage, fuel combustion, and less sophisticated approaches to system maintenance. Health risks from Carbon Monoxide exposure and fire associated with individual heating systems are eliminated.

The proposed system includes a new central boiler plant containing two woodchip boilers, sized at 13.71 MMBtu (400 HP) and 27.41 MMBtu (800 HP) respectively, totaling 41.12 MMBtu (1200 HP). The new system will include a hot water heat distribution network of over 8,000 feet of pipe, as well as over 8,500 trench feet of pipe connecting to approximately 180 customer buildings. Heat distribution piping is typically paired thin-wall welded steel pipes with integral foam insulation and plastic jacketing, designed to be direct-buried at a depth of about 3 feet. These integrated pipes provide supply pipes for the hot water from the plant and return pipes for the lower-temperature water being returned to the plant in one integrated unit. Each customer building is served by a pair of lateral pipes from the supply and return mains. Generally these pipes enter the basement to connect to heat exchanger (energy transfer stations), which in turn connects to the heating system of the building. The central plant uses variable speed pump controls to minimize the amount of electricity used in pumping. The boilers would also continue to provide low-pressure steam to most of the buildings in the State's Capitol Complex. As the State's steam distribution network reaches its useful life (by approximately 2018), the State Complex is expected to convert to hot water distribution. As explained above, hot water transmission provides heat that is more efficient, cheaper to maintain, safer and easier to control.

Energy transfer stations are installed in each connected building in order for them to make use of the distributed thermal heat. For a building with existing hot water heat, the energy transfer station typically includes one relatively compact wall-mounted water-to-water heat exchanger for space heat, an even smaller one for domestic hot water (DHW) supply and a heat meter. The larger heat exchanger replaces the building's boiler and the smaller one replaces the water heater. The heat meter measures how much heat is taken out of the system water and transferred to the building. These meters are usually read monthly or quarterly, like water or electric meters, with billing according to consumption. Usually when buildings are connected to district heating, the existing boiler is kept in place for one or two years while the customer gets used to the new service. After that, it is common to remove the building's boiler and water heater and oil tank to free up space for other uses. Measures to reduce the building's need for heat and to install efficiency measures like clock thermostats, attic insulation, lighting efficiency improvements and water conservation will be identified and installed along with the energy transfer station.

Finally 200kW steam turbine will be installed in the boiler plant in order to generate 800kW of electricity. The system's electric power will be sold into the grid using Vermont's new standard offer for renewable power. Sec. 4. 30 V.S.A. §8055 of the Vermont 2009 Energy Act creates a "Standard Offer" for qualifying renewable energy resources with a plant capacity of 2.2 MW or less. These "standard offers" will be available until a cumulative state-wide plant capacity of 50 MW has been provided. The price of the "standard offer" will be determined by the Public Service Board. The terms of the "standard offer" will be 10-20 years, except for solar power plants which shall have a term of 10-25 years.

Responsiveness to Programmatic Goals & Requirements

The creation of Montpelier's district energy system will allow the City to offer downtown property owners and others a renewable heating option and drive broad-scale market transformation away from imported fossil fuel based heating to a locally produced, carbon neutral, renewable fuel source. Space heating and transportation are the community's most fossil-fuel dependent energy requirements, with approximately 80% of current heating needs provided by fossil fuels, notably home heating oil with some propane. The district energy system will replace fossil fuels throughout the community with wood fuel. Woody biomass is considered a near carbon-neutral fuel by both the US Department of Energy and the US Environmental Protection Agency (EPA), even when considering the fossil fuels used in production and transportation of wood fuel. Currently, the target beneficiaries of this project burn approximately 913,694 gallons of oil which emit 22 pounds of atmospheric CO₂ per gallon. Converting these systems to wood, as this project proposes, will reduce net CO₂ emissions in the building heating sector by approximately 90 percent, assuming that all target buildings connect to the new system.

In addition to sustained reductions of the community's carbon footprint, this installation will create jobs, promote economic recovery and provide long-term economic and environmental benefits to the State, the City, downtown property owners and City and State taxpayers and residents. These benefits include long-term fuel security, improved energy price stability for all users of the system, reduced environmental risks (including removal of fuel storage tanks from downtown, which is in large part in a floodplain), and creation of local jobs to source and deliver the wood chip fuel. All of these attributes will help increase the affordability, attractiveness and vibrancy of the downtown district and build the

local economy. Siting the system in the State Capital, which is visited annually by millions of tourists, thousands of school children and hundreds of community leaders will help to promote the potential for replication in small communities throughout the State, across the country (and throughout the world) that have the potential to develop, own and operate community-wide biomass-fueled district CHP systems.

Collaboration Plan

The City of Montpelier, BERC and the State of Vermont have a long history of collaboration on this project. Both the City and the State have relied on BERC's technical expertise as the project has evolved. All three long-time partners are committed to continuing this collaboration to the greatest degree possible and recognize that the project may need to be owned by a newly-created quasi-public entity, a cooperative of users or a third-party private owner. The City's recent engagement of Veolia Energy as its development partner is designed to move the project to implementation. As the owner and operator of the nation's largest portfolio of environmentally responsible district energy systems, Veolia Energy has the expertise, resources and willingness to assess and implement the project in a variety of capacities. Veolia Energy is currently completing a scoping study and preliminary design engineering for the system. Once this is completed, the partners will see the permits and financing required to initiate construction.

Environmental Considerations

The district CHP system will need to obtain a variety of permits in order to begin construction and operate. Any facility in Vermont which generates electricity and is connected to the grid, is required to secure a certificate of public good (CPG), pursuant to 30 V.S.A § 248. The Vermont Public Service Board (PSB) is charged with evaluating ten specific criteria that assess a range of economic, environmental, and other issues to determine whether the proposed facility promotes the public good of the state of Vermont. The CPG is a "contested case" proceeding that requires evidentiary hearings and can take six to twelve months, depending on the complexity and concerns of statutory and other parties. If granted by the PSB, the CPG authorizes and governs construction, siting and operation of the facility under specific terms and conditions. Facilities that are subject to PSB authority under Section 248 review are typically exempt from local zoning ordinances and Vermont's Act 250 land use jurisdiction, even though the CPG incorporates many of the same environmental criteria. Since the boiler plant is sited in the Capitol Complex, the Capitol Complex Commission will perform a thorough review as to aesthetics, parking, access, and general harmony with its historic location. These processes are likely to take one to three months.

The boiler plant will also require both a construction and operating air pollution permit from the State Department of Environmental Conservation (DEC) Air Pollution Control Division. Permits issued by the Division must satisfy state and federal clean air act requirements. While the Division typically recommends that applicants begin the permitting process no later than 250 days before the beginning of the proposed construction date, the Division has been well aware of this project and forthcoming with design guidance for years. The Division also oversees the existing State boiler plant's operating license. The project partners commissioned an air quality feasibility that included air dispersion modeling of the six most likely boiler plant sites in anticipation of this requirement. Adequate control

technology will be incorporated into the design of the boiler plant so that it can meet air permit requirements. Additionally, to take advantage of the Vermont Village Green Renewable Energy Program, the system must meet the newly proposed emission limitations of the EPA for these wood boilers.

In addition to these permits, a Stormwater Notice of Intent must be filed with US EPA and any building in the floodplain will require compliance with the City's floodplain development regulations and must meet FEMA 102 flood proofing standards. The system may, depending on the final siting, require storm water runoff or other environmental permits from DEC. In addition, the construction of the piping system is likely to impact existing roadways, which could have traffic and public safety implications that may require review.

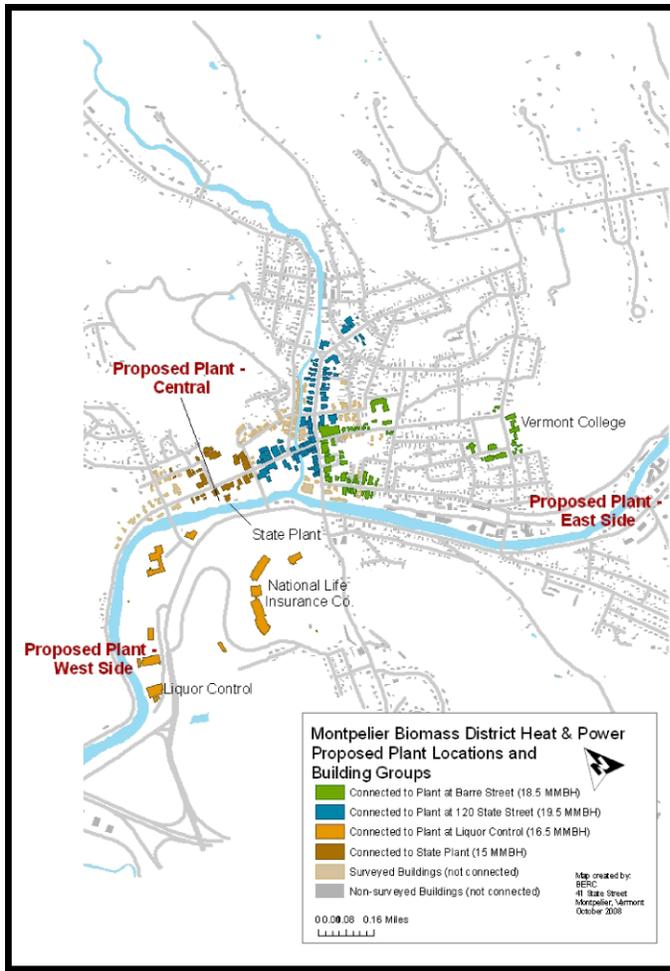
With funding from the federal and state governments, a thorough environmental assessment will be completed, and all environmental and historical assets and impacts will be evaluated. The project will either require a Finding of No Significant Impact (FONSI) or a full Environmental Impact Statement. The property is located within the state's largest National Historic District, although the current plant is listed as non-contributing due to its relatively young age, circa 1960.

Project Description and Implementation Plan

The design of the city-wide district heating system has been through a number of iterations. The most recent building study identified 176 buildings that could be grouped into three distinct areas. Buildings range in size from two or three-unit apartment buildings to the Capitol and National Life complexes of buildings (each ~500,000 sq. ft.). Other significant heat loads include the City's three schools, the Vermont College of the Fine Arts Campus and a downtown hotel. Using a "heat loss factor" of 25.4 Btu/hour/sq. ft. to the heated space of buildings, and a "diversification factor" of 85 percent, planners arrived at an estimate of 44.83 million Btu/hour (MMBH) of connected load or 41.12 MMBH of diversified peak city-wide heat demand for the system, including an estimated 6.10 MMBH of demand from anticipated new state construction.

The three areas delineated for the purpose of preliminary heat distribution layout and analysis are shown :

- **Area 1** - North of the Winooski River, west of the North Branch of the Winooski including the Capitol Complex of state office buildings - 24.9 MMBH
- **Area 2** - North of the Winooski, east of the North Branch including most of Montpelier's downtown and two public schools - 24.4 MMBH
- **Area 3** - South of the Winooski including National Life and Montpelier High School - 14.7 MMBH (as back up for independent system at National Life)



As part of the scoping study underway, Veolia Energy is revisiting the distribution network strategy. While the system is expected to connect to all areas over time, the installation of piping networks will be designed in phases that link with committed customers.

The project also includes adoption and implementation of a Clean Energy Assessment District (CEAD) for all residents of the City. The CEAD will provide the financing that allows downtown property owners to purchase and install energy efficiency improvements and the energy transfer stations. The CEAD will also provide financing to other property owners in the community who want to install efficiency measures or renewables including solar hot water systems, PV systems, solar heating, sustainable biomass, geothermal and wind systems.

Implementation Plan

The City, in collaboration with BERG as its technical adviser, has contracted with Veolia

Energy to complete the following tasks by the end of 2009:

- Collaborate with the State in the development of a partnership agreement defining objectives and responsibilities;
- Finalize central plant location and enter into negotiations for land acquisition, if needed;
- Finalize 30% designs to support a go/no go decision based on economic pro forma;
- Finalize construction budget and economic pro forma;
- Initiate application for permits including the Certificate of Public Good, air emissions and local zoning and site plan review;
- Define and implement ownership structure;
- Secure commitment letters from key building owners for provision of heating service;
- Update and amend Project Management Plan including Project Documentation and Dissemination plan;
- Finalize full commitments, by the State of Vermont and the City Council, to construct the project.

Receipt of this Community Renewable Energy Deployment Grant will allow the City, BGS, BERC and Veolia Energy to build upon this process and implement the following tasks related to the CHP system:

- Complete detailed design process for all buildings, boiler systems and distribution networks;
- Complete detailed design for all mechanical, electrical and plumbing requirements;
- Secure remaining project funding from public and private sector sources;
- Secure Certificate of Public Good from the Public Service Board and all required environmental and land use permits;
- Execute wood fuel supply agreements;
- Secure/acquire the central plant site (if necessary);
- Prepare Construction Manager and General Contractor bid documents and conduct selection process;
- Equipment procurement;
- Upgrade site electrical infrastructure;
- Secure interconnection agreement with Green Mountain Power/ISO New England;
- Site Construction including new boiler plant and heat distribution network;
- Equipment installation and integration;
- System start-up, shake-down and commissioning;
- Operator training;
- Commercial operation;
- Documentation of all processes to encourage replication and knowledge transfer.

Tasks related to adoption of the CEAD include:

- Program design in collaboration with VEIC/EVT
- Ballot initiative – March 2010
- Customer outreach
- Identification of qualifying measures and costs
- Program implementation
- Financing of efficiency and renewable measures

The attached Project Management Plan indicates the process by which the applicant intends to deliver a successful, cost-effective project on time and on budget. The City and State will execute an MOU to define the working parameters for project construction, installation and operation. Construction management services will be provided by Veolia Energy or another construction management firm. The construction manager will work with the partners to oversee all procurement practices including the engagement of a general contractor.

Project Management Practices

The project team is well-skilled in project management. The team will employ all project management best practices including regular communication enabled through a project web site and a variety of project management software tools. The project team will communicate no less than bi-weekly until construction starts. Thereafter, project meetings shall occur no less than weekly. In addition to

maintaining the project management plan, the team will circulate regular activity and financial reports to one another and to key decision makers. Compiled reports will be delivered no less than monthly to project stakeholders including the Montpelier City Council, the BGS Commissioner, the Vermont Secretary of Administration, key legislators and major funders, including DOE, as appropriate. Quarterly progress reports will be filed with DOE reflecting work tasks completed, costs expended, and anticipated work for the upcoming quarter. Any variances from the Project Management Plan will be identified.

Risk Management and Control

The team will manage risk in a variety of ways as the project progresses. During project design, the use simulation and sensitivity analysis will enable the team to determine what risks could affect the construction of the project and project outcomes. The use of a simulation program will allow the team to estimate the risk profiles of various decisions. Throughout the project's duration, the partners and their construction manager will be jointly responsible for risk analysis and response. Regular project meetings and effective project communication strategies will allow for early identification and resolution of errors. Veolia Energy will take the lead on identifying design, construction and technology risk and coordinating the appropriate response. The City will collaborate with the State to take the lead on identifying financial, timing, permitting and market risk. The designated boiler owner will take the lead on commissioning and risks associated therewith. Details on some of the potential risks are outlined in the Project Management Plan.

Other Permits and Compliance Requirements

Green Mountain Power (GMP), the local electrical utility, will undertake the systems feasibility study to determine the systems modifications required to accept power from the CHP component of the project. The identified modifications will be made by the approved contractors under the supervision of GMP. The project will also need to meet the requirements of Public Service Board rule 5,500 governing Generation Interconnection Procedures RE installation and Generation Potential.

Potential Renewable Energy Generation

The Montpelier biomass CHP plant will enable every building in downtown Montpelier to rely on renewable energy for heat and enhance the State's strong concentration of renewable power sources. The system will be designed so that total energy output (thermal and electrical) will be optimized to get the most useable energy out of the input wood fuel. To do this, the plant must be run to meet thermal (heating) loads with the electricity production as a byproduct. The net efficiency of this wood-fired system is about 72%. On a Btu basis, the thermal output is 15 times greater than the electrical output. For every 1000 tons of woodchips burned (valued at \$50,000), 6,616 MMBtu of useful heat (with an oil displacement value of \$191,800) and 128,800 KWH of electricity are produced (valued at \$16,100).

Annual energy production, when all potential heating customers have been connected to the system, will be 94,567 million Btu of heat and 1.84 million kWh of electricity. The CHP system will use 14,292 tons of wood annually and will displace the equivalent of 913,694 gallons of fuel oil use by customers for building space heat and domestic hot water. At full community-wide build-out, the project is targeted to connect 176 buildings. The project's CEAD will assist any City property owner who wishes to install renewables and/or implement energy measures. The \$3 million fund is likely to be evenly divided

between energy efficiency measures and renewables. Approximately 100 properties will be able to install efficiency measures that will average 20% heating fuel savings. This savings will be measured and verified by Efficiency Vermont. The other \$1.5 million will fund the installation of approximately 50 renewable systems targeting displacement of 25% of the energy demanded in the absence of these systems.

Market Transformation & Strengthening Renewable Energy Infrastructure

The Montpelier Renewable Community Energy Project will lead to profound market transformation within the City of Montpelier and serve as a replicable model for communities with biomass resources across the northeast and elsewhere in the country. Across the northeastern US, approximately 80% of space heating needs are currently provided by fossil fuels and 80% of the nation's imported home heating oil is used in this region. Given the availability of sustainably produced woody-biomass across this forested region, replication of community-scaled wood-fired district energy systems has significant potential for transforming the renewable energy infrastructure for this region of the country and beyond.

Property owners in Montpelier have heard about this system for years, and as a result the community has become quite receptive to shifting to a new heating infrastructure. The availability of financial assistance through the new Vermont Village Green Pilot Program will support owners of buildings and public entities to connect to the system as soon as it is available. As fuel prices and volatility increase, we anticipate this interest to expand.

The successful implementation of this system by the City of Montpelier will provide a replicable example for other communities. BERC is currently working with five other Vermont municipalities and many other communities across Northern New England and in other regions of the country to assess the feasibility of installing similar district energy systems. BERC's experience with implementing school and campus wood heat programs in states across the country has led them to believe that there is a tipping point in community adoption of these renewable technologies, which will be realized after the first few model systems are implemented.

Montpelier and the surrounding area is also home to national leaders in energy regulatory policy, energy efficiency and sustainable communities. Staff from these organizations, which include the Regulatory Assistance Project, the Institute for Sustainable Communities, Global Community Initiatives and the Institute for Energy and Environment at the Vermont Law School, are active participants in or significant observers of Montpelier's district energy system. These individuals consult nationally and internationally on matters related to renewable energy policy and climate change mitigation strategies. Their personal knowledge of the existence of this system and their promotion of it will raise awareness of the opportunities associated with biomass district energy.

Team Expertise and Prior Experience

The Team and Its Key Personnel

The Team that will undertake this project includes the City of Montpelier, the State of Vermont's Department of Buildings and General Services, Veolia Energy and the Biomass Energy Resource Center.

VEIC and EVT are partners for the energy efficiency CEAD aspects of the project. As the project moves into construction, the team will be expanded to include a firm to act as construction manager and a general contractor. The project's principal investigator is Gwendolyn Hallsmith, the Director of Planning and Community Development for the City of Montpelier. Other key players include:

- Teigh Southworth, Vermont Buildings and General Services, engineer – lead responsibility for the Montpelier heating facility, and will provide engineering oversight on behalf of the state and oversee all commissioning of any state-owned facility;
- Todd Law, City of Montpelier, Director of Public Works – will represent the City's interests in construction oversight and the commissioning process;
- Gerry Myers, Vermont Buildings and General Services, Commissioner – will coordinate State funding requests;
- Kamalesh Doshi, Biomass Energy Resources Center, Program Director – will provide guidance on biomass technology selection and design feasibility and planning;
- Christopher Recchia, Biomass Energy Resources Center, Executive Director – will provide guidance to the team on air quality, emissions and regulatory issues.
- Brett Jacobson, Veolia Energy, Business Development Manager – will coordinate the Veolia team involved with this project
- David Mirabelli, Veolia Energy, Project Engineer – will oversee engineering design
- Mary Hooper, City of Montpelier, Mayor – will provide project liaison to State Legislature
- David Cowley, COO, Vermont Energy Investment Corporation, will coordinate VEIC/EVT work on the CEAD program

The City of Montpelier is Vermont's state capital. It is the nation's smallest state capital, with 8,000 residents and a daytime population of 20,000. The City has been working to develop the infrastructure needed to connect to the State of Vermont's district heating system for ten years. In 2003, a bond vote for \$250,000 was passed by the voters for the City's share of the development of a city-wide district heating system involving the State of Vermont's central heating plant in the state complex and the installation of hot water transmission mains from the plant to the City of Montpelier's municipal complex in and around City Hall. Since that time, the State has completed engineering and budget preparation for modernization of its plant, but the project has yet to be funded by the State.

Principal Investigator and Project Manager Gwendolyn Hallsmith has over 20 years experience working with municipalities, and over ten years experience in the energy field. She has served as a Senior Planner for the Massachusetts Executive Office of Energy Resources, as a regional planning director in Western Massachusetts, the Town Manager of Randolph, Vermont, the Deputy Secretary of the Vermont Agency of Natural Resources, and as an international consultant on sustainable development. Hallsmith has been responsible for the implementation of several multi-million dollar development projects, including the construction of a state of the art lined landfill, and major utility and streetscape work in Randolph during her tenure there.

As the Project moves into construction, the City's Public Works Department will take an active role in project oversight and implementation. Public Works Director Todd Law is a Professional Engineer with

over 15 years of experience designing and implementing municipal infrastructure projects including Montpelier's current stormwater management system, the City's water and sewer service, and an extensive network of roads and bridges.

The Montpelier Energy Team is a coalition of townspeople, civic leaders, city officials and local organizations, that has been working over the past 20 years to address Montpelier's energy future – the City's first Energy Plan was adopted in 1985. The District Energy subcommittee will play an important role in publicizing the community system concept, building public support for it, providing information and education, learning about similar systems in other locations, and working with city and state leaders to implement the community-wide system.

The **Vermont Department of Buildings and General Services** is responsible for overseeing all State facilities. This includes operation and maintenance of over 4 million square feet as well as oversight for developing and implementing the annual Capital Construction spending legislation. Vermont State Government has long been a leader in renewable energy utilization with over 20% of the State's heating energy demand being satisfied by wood biomass fuel. The State currently oversees a wood-fueled district heating system at its office complexes in the City of Montpelier and in the town of Waterbury and Pittsford Police Academy. The Montpelier office complex system relies on aging coal boilers that were retrofitted in the mid 1980's and are close to operating well beyond their useful life. The system currently uses steam distribution pipes that were installed decades ago. The State Agency Energy Plan produced in July of 2005 committed the State to a comprehensive approach to energy management including a goal of at least 20% energy reduction in all existing building by 2012. The Plan also outlines a process for implementing energy saving measures including conversions to renewable energy.

Teigh Southworth graduated from Norwich University with a Bachelors Degree in Mechanical Engineering and an Air Force Commission as a 2nd Lieutenant. He spent 4 years as a facilities mechanical design engineer stationed at Fairchild AFB in the State of Washington, Fairchild like many Air Force installations has a district steam heating system, with a combination of above and below ground pipe distribution. Teigh has spend the past 23 years in his current job as a designer and project manager for the Vermont Department of Buildings and General Services, during his tenure he has worked on projects in state office buildings which run the gamut from old wood frame Victorian houses with one pipe steam systems to state-of-the-art climate controlled, multilevel office buildings, courthouses, historic buildings, welcome centers, correctional facilities, transportation garages, fish hatcheries, and State College campuses all of which have district heating systems. During the recent reorganization of the Department, Teigh was assigned to the Central District which includes Montpelier and Waterbury because of his knowledge and expertise with steam heat and district heating systems.

Biomass Energy Resource Center (BERC), a national nonprofit organization, based in Montpelier Vermont, is one of the nation's leading organizations involved in the assessment, development, and management of community-scale biomass energy projects. BERC's expertise in institutional and community-scale wood energy systems has been relied upon by municipalities, industries, academic institutions, hospitals, and others seeking to initiate and implement biomass energy projects. BERC's mission is to achieve a healthier environment, strengthen local economies, and increase energy security

across the United States by developing sustainable biomass energy systems at the community level. BERC works with partners and stakeholders across the country to transform the energy economies of communities through development of community district energy systems, heating plants for schools and public institutions, campus energy systems, industrial cogeneration, CHP, and distributed generation systems. BERC's services include: feasibility studies and reports, assessment of biomass fuel availability, investigating site considerations, assistance in project structuring and development, public education, and program development for state and federal agencies.

BERC will serve as a technical resource for the project management team. In this capacity, BERC will provide vendor-neutral oversight of project elements, support development of project financing, provide a technical liaison to state programs, and provide technical coordination for implementation of this DOE grant.

Kamalesh Doshi, BERC's Program Director will be lead staff on this project. He has managed and coordinated a wide range of CHP, heating and cooling projects based on woody biomass during his five years at BERC. Doshi's work in the US and India includes preliminary site assessments, site selection, feasibility studies, environmental impact analysis, waste water, air permitting and other applicable regulatory requirements, evaluation of technologies, preparation of plan design, supervision of commissioning and power generation from plants, system monitoring and evaluation. At BERC, Doshi has been involved in development and implementation of the "Fuels for Schools" program for the states of Vermont, South Dakota, New Mexico, Pennsylvania and Wisconsin. His work in India included administration of major public programs funded by federal agencies in the state of Gujarat.

Christopher Recchia, BERC's Executive Director, will provide guidance to the team on regulatory issues. Before coming to BERC, Recchia served as Executive Director of the Ozone Transport Commission, and before that as Commissioner of the Vermont Department of Environmental Conservation. He has 25 years of experience on energy and environmental policy and applications.

Veolia Energy North America and its affiliates Dalkia and SourceOne are leading international and domestic providers of custom, sustainable energy and facility management solutions. Veolia Energy owns and operates the largest portfolio of environmentally responsible district energy systems in the US including more than 700 cogeneration plants, representing a combined electrical generation capacity of 6,266 MW_e and over 83,000 MW_{th} of thermal energy. Globally, Veolia Energy operates energy assets which provide steam, hot water and/or chilled water to customers in thousands of healthcare institutions, industrial sites, education and research facilities and sports, cultural and leisure facilities. Veolia Energy also operates close to 700 urban and local heating and cooling networks with piping networks of 3,500 miles in combined length.

Brett Jacobson is part of the Veolia Energy business development team with responsibilities in the Northeastern United States. Brett will coordinate the Montpelier team's front end project development and facilitate interaction with Veolia Energy's expertise in engineering, master planning, owner's representation, operational management, distribution system, technical support, safety, environmental, and project development. Throughout his career, Brett has been involved in design, construction and

project management of multimillion dollar energy conservation projects throughout the North Eastern United States. His 10+ years experience in working with critical need customers in the biotech field, manufacturing, health, and industrial facilities gives him experience and understanding of the critical need of reliable energy service. Additionally Brett spent over 5 years in the merchant marines as a licensed engineering officer onboard various merchant vessels. In this role he managed the operations of large industrial boiler, chillers, and diesel engines as well as auxiliary equipment while managing technicians from all over the world. He graduated from Massachusetts Maritime Academy in 1995 with a Bachelors of Science in Marine Engineering.

David Mirabelli is a Project Engineer at Veolia Energy. Mr. Mirabelli will be the main point of contact for the proposed project, and will provide regular project updates to all identified stakeholders. In his position at Veolia Energy, Dave is responsible for providing development engineering for projects from first site visit through construction and overseeing all technical aspects of development and retrofit projects in Veolia Energy Corporate's portfolios. Dave brings more than 15 years of experience in building and maintaining steam, power and chilled water plants. He has a BS in Marine Engineering and received a MS in Facilities Management (With Honors) from the Massachusetts Maritime Academy in 2006.

Vermont Energy Investment Corporation (VEIC) and its subsidiary, Efficiency Vermont (EVT) is a unique statewide organization that increasingly is servicing the national market for energy efficiency assessment and implementation. VEIC, founded in 1986, is a non-profit organization with approximately 100 employees. VEIC's mission is to reduce the economic, social, and environmental costs of energy consumption through the promotion of cost-effective energy efficiency and renewable energy technologies. VEIC provides services for Efficiency Vermont (EVT) - the nation's first statewide 'energy efficiency utility' - as well as Residential Energy Services, Business Energy Services, and Planning and Evaluation Consulting.

Team Success in Similar Projects

Veolia Energy's affiliates Dalkia and SourceOne have extensive experience with similar projects. Dalkia, Europe's leading provider of energy management services, has developed and managed biomass facilities across France and abroad. Nearly 150 of its central heating plants are fueled by biomass, with a total generation capacity of 817 MW. Closer to home, SourceOne acted as project developer and designed, contracted and now manage a cogeneration plant for Biogen Idec's headquarters in Cambridge Massachusetts. This 6MW, \$60 million project includes: a dual fuel Solar Taurus 60 turbine/generator, a 50,000 lb/hr gas fired heat recovery steam boiler with an SCR and CO catalyst, two 50,000 lb/hr package boilers, condensate receiver, deaerator, water treatment system, CEM system, a new electrical distribution system with switchgear, new steam distribution system and control systems.

Vermont Buildings and General Services oversees all state buildings and construction projects. This includes everything from new LEED-certified office buildings to prison construction to renovations of historic properties. Typically, BGS is managing an annual construction budget of \$8 million in major maintenance which represents hundreds of projects. The department currently operates district energy systems in Montpelier, Waterbury and Pittsford.

In 2005, BERC completed a four-volume feasibility study for a biomass district energy system for the Crotched Mountain Rehabilitation Center in Greenfield, NH. The Center includes 400,000 square feet of building area including a children's hospital and a small school. The favorable study estimated that fuel-cost savings would pay for the project within seven years; rising oil prices have since lowered that estimate to five years. Based on BERC's reports, the Crotched Mountain Foundation went forward with an ambitious plan to create a district energy system to connect all the buildings to a new woodchip-fired district energy system, with capacity for future growth of the campus. BERC was engaged to manage the wood heating system specification, selection and installation. This became the nucleus of a \$100 million capital construction project, managed by the MacMillin Company, to position Crotched Mountain for the challenges of the next century.

Letters of support

Please see attached letters of commitment and support from project partners and other relevant parties.

Project Timetable

A detailed Gantt chart for the Project is included in the Project Management Plan. The broad timeline of the project is as follows:

- December 2009 – complete final scoping study;
- March 2010 – City adopts special assessment district to enable financing for building connections by individual property owners;
- By April 2010 – finalize design and ownership structure; City/State MOU executed; Create project development website so public can monitor project developments;
- By May 2010 - secure all construction permits required for the project (local zoning, air emissions, Capitol Complex Commission, etc.);
- By June 2010 – total engineering design completed; Site electrical infrastructure upgrade underway;
- By August 2010 – financing secured; Final Project Go/No Go decision point;
- Fall 2010 - Construction manager selected; GC bid documents received; execute financial agreements, equipment procured, site construction
- Winter 2010 - boiler plant construction
- Spring and summer 2011 – equipment and thermal pipe distribution system installations;
- Summer and fall 2011 – commissioning, shakedown and start-up
- Winter 2011 – Fully operational
- By January 2012 – Project documentation complete; City to prepare ICLEI webinar (and other presentations) on system implementation and lessons learned
- 2012 and beyond – plan for additional users, promote implementation of similar approaches elsewhere.

Relevance and Outcomes/Impacts

The Montpelier Renewable Community Energy Project will make renewable thermal energy available to every building in downtown Montpelier including city buildings, privately-owned properties, and the Vermont State Capitol and other state-owned office buildings. It will improve the environment by converting some of the oldest and least efficient building heating equipment in the City to central heat production from new, state-of-the-art, high-efficiency renewable energy boilers. The project will be implemented by an innovative public-private partnership involving state and local government, local businesses and property owners and the expertise of a nationally recognized community-scale biomass organization, and a sophisticated international district energy firm. The project will enhance the community's energy choices and quality of life. It will dramatically increase energy security, promote the adoption of clean renewable energy, offer fuel price stability, create jobs, promote economic recovery, and improve the environment. The Project will also provide a working model for other communities seeking to implement clean, reliable, and affordable biomass district energy systems.

The project will significantly reduce Montpelier's carbon footprint. The district energy system will replace fossil fuels throughout the community with wood fuel. Woody biomass is considered a near carbon-neutral fuel by both the US Department of Energy and the US Environmental Protection Agency (EPA), even when considering the fossil fuels used in production and transportation of wood fuel. Currently, the target beneficiaries of this project burn approximately 913,694 gallons of oil which emit 22 pounds of atmospheric CO₂ per gallon. Converting these systems to wood, as this project proposes, will reduce net CO₂ emissions in the building heating sector by approximately 90 percent, assuming that all target buildings connect to the new system. Implementation of this project would therefore result in reducing net CO₂ emissions by 10,050 tons per year. As the country and the world move to place a value on carbon reductions, the use of carbon-neutral biomass fuel will have long-term benefits and dollar savings related to energy and environmental considerations.

The Montpelier Community Energy System will create jobs and promote economic recovery. At full build-out the system is anticipated to use approximately 14,292 tons of wood annually. A study funded by the Northeast Regional Biomass Program (NRBP) found significant economic benefits from using wood for energy.¹ Within the City of Montpelier, this installation would stabilize energy costs and create an annual demand for 14,292 tons of wood fuel. This translates to the following economic benefits over and above the job creation.

- Total net income increases by over \$800,000;²
- Over \$20,000 is paid in state and local taxes;

¹ Resource Systems Group, Economic Impact of Wood Energy in the Northeastern States, Vol. I., prepared for the Northeast Regional Biomass Program, CONEG Policy Research Center, Washington, D.C., 1994.

² Net income accounts for the difference between direct payments associated with biomass energy and payments associated with conventional fuels, as well as indirect income from the multiplier effect as primary dollars circulate throughout the local and regional economies.

- Over \$140,000 is paid in federal taxes.
- Economic revitalization of areas in Vermont with wood-based industries that have been in decline.

As oil prices rise dramatically, as they have done since 1994 and are expected to continue to do over the coming decades, the economic stress on communities in rural forested areas, like Montpelier and other Vermont towns, will increase. The cost of biomass fuel is *always* much less than the cost of fossil fuels on a Btu basis (currently 75 percent less) and, based on 25 years of experience, biomass fuels prices have historically escalated at a slower rate than fossil fuel prices.

Because the price of local biomass is only weakly linked to the price per barrel for oil, another major energy benefit of wood-fired district energy is energy security. International financial and geopolitical forces do not impact the availability or price of locally-sourced biomass. A fuel that comes from a radius of less than 100 miles away is part of the local economy, not the global economy. This ability to use local energy resources is expected to be an increasingly important factor in the future economic viability of rural communities.

In addition to the primary benefit of low, stable pricing for wood fuel, district energy systems provide a variety of additional benefits including:

- Direct savings to building owners by avoiding both maintenance and repairs costs and capital equipment expenses for replacement of fuel tanks and boilers;
- Improved efficiency resulting from professional maintenance and operation of a central system rather than the often poorly serviced fossil fuel combustion systems in individual buildings, which in many cases are old and inefficient;
- Simplified building operations and reduced building maintenance costs;
- Freeing up of boiler and furnace room space in buildings for other uses; and
- Reductions in fire insurance and liability premiums if the facility removes its existing combustion equipment and purchases heat solely from the district heating plant. The cost of insurance policies can vary widely among customers depending on the type of business, and their exposure through lost income and property damage.³
- In Montpelier, much of the area to be served by the district energy system is in the floodplain, so removing the fuel storage tanks from this area will reduce or eliminate a significant flood hazard.

A final outcome of the Montpelier Renewable Community Energy Project is that it will provide a unique opportunity to address, at the time a building is connected to the system, the heating and electrical efficiency of the building itself. Measures to reduce the building's need for heat and to install efficiency measures like clock thermostats, attic insulation, lighting efficiency improvements and water conservation will be identified and installed along with the energy transfer station. The new Vermont Village Green Renewable Pilot Program, which identifies Montpelier as one of two target communities,

³ International Energy Agency, IEA, Promotional Manual for DH Systems, 1993. p. 83.

will provide at least \$100,000 to help improve the efficiency of buildings connected to the district energy system.

Multiple PIs – Coordination and Management Plan

The City of Montpelier is the sole applicant. Gwendolyn Hallsmith is the PI.

Promoting ARRA Objectives

The Montpelier Renewable Community Energy Project will create jobs, enhance near-term economic recovery, position the community to better weather future economic challenges and accelerate widespread commercialization of renewable energy technology.

The project will create jobs. Estimates indicate that:

- 20 *net* new construction-related jobs will be directly created in the project's first year;
- 16 *net* new jobs will be indirectly created in the project's first year
- 35 total *net* new jobs directly and indirectly created within the project's first year.

These numbers are based on work conducted by Mark Spurr of FVB Energy using a variety of tools including the Regional Input-Output Modeling System (RIMS II) from the Bureau of Economic Analysis, forest professional's estimates of fuel procurement jobs and estimates of other offset economic activity using a basic analysis approach suggested by John "Skip" Laitner of the American Council for an Energy-Efficient Economy. The process identified the number of total new jobs per million dollars of output and the proportional number of direct jobs in the following industries: construction, fuel oil (foregone) and forestry activities. These multipliers were then applied to the projected spending for the project to arrive at the numbers shown above. This estimate of jobs created is conservative since it nets out foregone spending, excludes induced job creation and ignores the value of any additional jobs created as a result of building the infrastructure, replication of the system as a result of market transformation, or those created by new businesses that are attracted to Montpelier as a result of affordable and stable energy costs.

The specific number of long-term skilled labor jobs created or retained by the facility itself is 18, four of which are directly associated with operating the facility and its infrastructure. Three of these jobs are in operations and maintenance with the remaining one in administration and management. An additional 14 long-term jobs will be created in order to procure the wood fuel. The total number of jobs at the facility is offset by an estimated loss of 5.5 jobs in the fuel oil industry, thereby resulting in 12.5 net new long-term jobs lasting more than five years from the end of the project.

The project will enhance economic recovery. Heating costs, with their uncontrollable, volatile fluctuations and increases, are a significant loss to the economies of towns like Montpelier. In a region that has the nation's highest dependence on home heating oil for the basic necessity of staying warm in winter (the northeast consumes 80% of the nation's demand for home heating oil), payments for fossil fuel come out of everyone's paycheck and every business' bottom line, adding up to a huge drain on the economy. The greatest energy benefit accruing from biomass district energy is in reversing this outflow of dollars and stabilizing the local economy, making it immune to future oil price increases. This project

will result in stopping the loss of \$2.7 million annually from Montpelier's economy – from oil and propane payments – and replacing it with the expenditure of \$715,000 for wood fuel – dollars that circulate and multiply in the local economy. In a 2007 study, the Vermont Council on Rural Economic Development conservatively determined that for every dollar spent on biomass energy, three dollars would be generated. Accordingly, this system can be expected to improve the area's economy by \$6,000,000 annually. The project will promote immediate recovery and lay the groundwork for sustained economic growth by creatively restructuring the heat economy and the infrastructure required to warm the town through Vermont's cold winters.

The project will accelerate widespread commercialization of biomass renewable energy technology by successfully operating to meet the needs of the Montpelier community. The opportunity to have real examples of operating facilities with efficient technology and effective operations is one of the most effective tools to accelerate commercialization. Once informed that biomass district energy is actually possible, most people easily recognize the reliability, affordability and effectiveness of it as a community strategy.

The Montpelier project will be promoted to the millions of visitors and thousands of community leaders and schoolchildren that visit Montpelier annually through public informational displays. The system's development process and operation will be shared through targeted public seminars by the PI, BEREC and other partners. Finally, it is expected that the leaders in energy policy and sustainable communities that call Montpelier home will share the Montpelier system as a source of civic hometown pride – a variation of "we did this, you can too!" These conversations will all help inform policy advocates and community leaders about the sustainability, affordability and economic and environmental benefits of biomass energy.

For example, Global Community Initiatives, a Montpelier organization founded by the PI, Gwendolyn Hallsmith, regularly disseminates best practices and other materials to cities and towns around the world through speaking engagements, training, and resources available on three web sites maintained by the organization. In this capacity, Gwendolyn will be delivering a training to elected officials and local leaders involved in the National League of Cities at their San Antonio Conference in November of 2009 on new approaches to economic development in challenging economic times. Renewable energy and Montpelier's biomass facility are key strategies she highlights in this presentation.

The City of Montpelier is the capital of Vermont, so representatives and leaders from cities and rural towns around the state visit regularly. What the capital city does is a model for other places in Vermont and in other parts of the country. Montpelier is engaged in the Capital City Challenge - a competition with Olympia, the capital city of Washington State, to become the first sustainable state capital, and so there are many peer exchanges and best practices shared between these two cities, along with cities in the Cities PLUS Network, ICLEI, the National League of Cities, the Vermont League of Cities and Towns, and the International City/County Management Association.