

IBM's Smarter Cities Challenge

Burlington

Report





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1. Executive summary

Introduction

The City of Burlington, Vermont, USA was one of 31 cities selected to receive a Smarter Cities Challenge® grant from IBM in 2013, as a part of IBM's citizenship efforts to build a Smarter Planet®. During three weeks in April 2013, a team of six IBM experts worked to deliver recommendations on a key challenge identified by Burlington's Mayor, Miro Weinberger, and his leadership team.

Burlington has made great strides toward sustainability. But some of the City's efforts to move forward, including the increased use of electric vehicles and of solar and wind sources to generate electricity, have created new challenges. Mayor Weinberger and the City council have published greenhouse gas (GHG) reduction targets in Burlington's Climate Action Plan (CAP) and are committed to making them a reality. Burlington Electric Department (BED) is committed to minimizing its environmental footprint in a cost-effective manner and wants to leverage the Smart Grid infrastructure investment it has already made. This is in line with the State of Vermont's GHG reduction objectives and targets.

The challenge

Burlington's challenge is to:

Plan and implement broad-based greenhouse gas (GHG) reductions that take advantage of Smart Grid infrastructure and other investments the City has already made, while strengthening Burlington's economy and financial position.

BED has stated a goal to supply 100% of the city's electrical needs from renewable resources. Today, 80% of BED's supply is from renewable sources, and a key challenge is to maintain competitive rates.

GHG emissions come from a variety of sources. Burlington's largest contributor is transportation, which has shown the largest increase during the period 2007-2010.

The City's current efforts to reduce GHG emissions mostly address each source separately (in "silos"). GHG data is at aggregate levels, and reliable and granular data across all categories is not available. This level of data is a prerequisite to understanding patterns, trends and the impact of initiatives and to optimizing the energy mix to achieve objectives.

Burlington needs to effectively execute GHG initiatives and provide broader environmental benefits for citizens through coordinated investments. It needs a focused approach and plan that will align the capabilities of government, business, education and community; take funding and affordability into account; strengthen the local economy; and improve Burlington's financial position.

Findings and recommendations

The Smarter Cities Challenge team identified the following:

- Many initiatives with strong community involvement
- Separate programs being executed in silos; limited integration and lack of alignment
- City budget constraints
- Mayor Weinberger (in office since April 2012) focused on financial stability and viability of initiatives
- Strong higher education sector with a large number of students
- Young talent with skills in software development, green energy and healthcare
- Entrepreneurial spirit and start-up companies (gaming, web services, renewable energy)
- Aged and limited housing stock, low vacancy rate, 57% rentals

The team made the following four focused (2-5) and two (1 and 6) overarching recommendations:

1. Make Burlington synonymous with green technology

Ensure alignment with and reinforce the key initiatives and entrepreneurial spirit of Burlington by agreeing to and communicating a clear vision that establishes the city as a leader for sustainability, based on distributed GHG emission reduction technologies. This is the overarching recommendation that provides a foundation for all other recommendations.

2. Leverage the Smart Grid

Leverage the city's Smart Grid to inform citizens' options and drive actionable insight toward conservation of all important resources by providing a consolidated resource consumption portal, combined with an event messaging system.

3. Optimize the Joseph C. McNeil Generating Station

Request that the McNeil owners establish a project team, fully empowered and with access to all resources needed, which will provide a firm recommendation within 12 months on how to optimize use of the power plant.

4. Enable electric vehicle (EV) sharing

Spearhead a sizeable EV sharing program and integrate it into the existing public transportation system with links to nearby cities, helping to address traffic, parking and GHG emissions challenges and make Burlington more attractive as a result.

5. Promote energy efficiency execution (E3)

Create an E3 team of trained community and student volunteers who proactively encourage a higher adoption rate of efficiency solutions among property owners, specifically relating to structural energy loss.

6. Create a coordinated communication plan for "Burlington – the green tech city"

Effectively communicate the vision for becoming "Burlington – the green tech city" with effective and consistent messaging and engage the Burlington community in an open dialog.

Conclusion

The team's recommendations focus on harnessing the local talent pool and the abundance of renewable resources to enable Burlington to achieve its GHG emission reduction goals. The overarching recommendation – to establish Burlington as a leading "green tech city" – ensures alignment of all initiatives, energizes the community, retains talent and inspires the development of new technologies and businesses. The result is a strengthened economy, new ways to attract tourists through demonstrations of green technology and a more attractive city.

The ultimate outcome is for Burlington to become an integrated, data aware, thriving city that is recognized as a leader in green technologies.

Highlights

- Capitalize on Smart Grid investment, and expand to include a total energy usage portal
- Make Burlington synonymous with green technology through a strong vision, integrated technologies and effective branding
- Enable EV car sharing, integrated with regional transportation, that provides a positive user experience and supports the "green tech city" brand
- Possible biomass gasification pilot

2. Introduction

A. The Smarter Cities Challenge

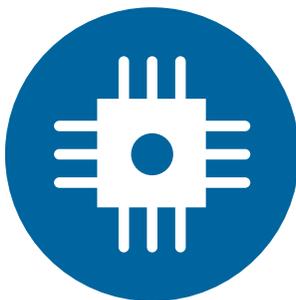
By 2050, cities will be home to more than two thirds of the world's population. They already wield more economic power and have access to more advanced technological capabilities than ever before. Simultaneously, cities are struggling with a wide range of challenges and threats to sustainability in their core support and governance systems, including transport, water, energy, communications, healthcare and social services.

Meanwhile, trillions of digital devices, connected through the Internet, are producing a vast ocean of data. All of this information — from the flow of markets to the pulse of societies — can be turned into knowledge because we now have the computational power and advanced analytics to make sense of it. With this knowledge, cities could reduce costs, cut waste and improve efficiency, productivity and quality of life for their citizens. In the face of the mammoth challenges of economic crisis and increased demand for services, ample opportunities still exist for the development of innovative solutions.

In November 2008, IBM initiated a discussion on how the planet is becoming “smarter.” By this it meant that intelligence is becoming infused into the systems and processes that make the world work — into things no one would recognize as computers: cars, appliances, roadways, power grids, clothes, even natural systems, such as agriculture and waterways. By creating more instrumented, interconnected and intelligent systems, citizens and policymakers can harvest new trends and insights from data, providing the basis for more informed decisions.

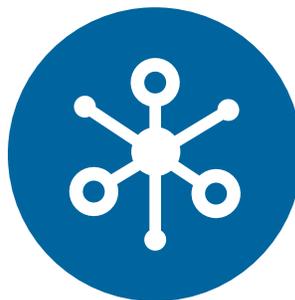
A Smarter City uses technology to transform its core systems and optimize finite resources. Since cities grapple on a daily basis with the interaction of water, transportation, energy, public safety and many other systems, IBM is committed to a vision of Smarter Cities® as a vital component of building a Smarter Planet. At the highest levels of maturity, a Smarter City is a knowledge-based system that provides real-time insights to stakeholders and enables decision makers to manage the city's subsystems proactively. Effective information management is at the heart of this capability, and integration and analytics are the key enablers.

Intelligence is being infused into the way the world works.



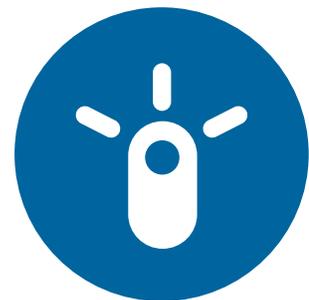
Instrumented

We can measure, sense and see the condition of practically everything.



Interconnected

People, systems and objects can communicate and interact with each other in entirely new ways.



Intelligent

We can analyze and derive insight from large and diverse sources of information to predict and respond better to change.

Figure 1: Instrumented, interconnected, intelligent

As IBM aligns its citizenship efforts with the goal of building a Smarter Planet, we realize that city leaders around the world face increasing economic and societal pressures. Given the increased demand for services, they have to deliver new solutions ever more rapidly.

With this in mind, IBM Corporate Citizenship launched the Smarter Cities Challenge to help 100 cities around the world over a three-year period become smarter through grants of IBM talent. The City of Burlington, Vermont, USA was selected through a competitive process as one of 31 cities to be awarded a Smarter Cities Challenge grant in 2013.

During a three-week period in April 2013, a team of six IBM experts worked in Burlington to deliver recommendations around key issues for Burlington's Mayor, Miro Weinberger.

B. The challenge

Mayor Miro Weinberger introduces the City of Burlington as "... a celebrated, vibrant, small city located on the eastern shoreline of Lake Champlain. Burlingtonians are diverse, forward-thinking citizens, surrounded by scenic beauty and recreational opportunities. We are steeped in arts and culture, and are engaged in the growth of our economy" (Source: www.burlingtonvt.gov April 2013).

Burlington's challenge is to:

Plan and implement broad-based greenhouse gas (GHG) reductions that take advantage of Smart Grid infrastructure and other investments the City has already made, while strengthening Burlington's economy and financial position.

BED has stated a goal of supplying 100% of the city's electricity from renewable resources. Today, BED delivers 80% of its supply from renewable sources. BED also has a challenge to maintain competitive rates.

GHG emissions come from a variety of sources. Burlington's largest contributor is transportation, which has shown the largest increase during the period 2007-2010.

City of Burlington – Community 2010 Emissions by source and increase since 2007		
	2010 GHG Emissions (tCO ₂ e)	% increase 2010/2007
Transportation	51%	22%
Natural gas	29%	-7%
Electricity	19%	-4%
Solid waste	1%	1%
Total	100%	6%

Table 1: 2010 emissions by source and increase since 2007 (City of Burlington 2012 Climate Action Plan, 2012)

Many of the City's GHG reduction efforts are tackled in silos, and reliable data is not available to understand the trends and impacts of separate initiatives.

The challenge for Burlington is how to leverage its investment in the Smart Grid and the myriad other GHG initiatives to provide broader environmental and cost-reduction benefits for citizens. The City needs to reduce its GHG emissions through coordinated investments, in a way that strengthens its economy and financial position. It needs to meet its GHG emission targets, improve energy efficiency and become the recognized leader for effective green technologies.

The Smarter Cities Challenge team spent three weeks in Burlington, using the following methodology:

- **Week 1:** Information gathering
- **Week 2:** Data synthesis and review
- **Week 3:** Final recommendations

The discovery phase revealed that the Burlington community has an impressive understanding of GHG emissions. The 2012 Burlington Climate Action Plan (CAP) documents a number of recommendations made by the City to reduce GHG emissions (see Appendix D for details).

The team began the project with a focus on the Smart Grid and had many interactions with the BED. It learned that the city's Smart Meter rollout was successful, with a high rate of adoption cited at 98% complete as of April 16 2013.

Although the team's initial focus was on GHG reduction and the Smart Grid, a recurring theme of sustainability pervaded the discovery phase. Energy sustainability can be categorized as follows:

1. **Basic conservation:** Reducing energy use
 - Optimized by knowledge/information (usage patterns from data)
 - Augmented by energy efficiency (eliminating waste)
2. **Distributed renewable energy production:** Increasing energy production
 - Mix of renewable energy sources (wind/solar/biomass, geothermal)
 - Intermittent sources (for example, wind and solar are variable)
 - Base load (renewable power plants to maintain stable supply)
 - Storage of energy (capturing energy – battery, thermal)
3. **Understanding the energy system:** Data
 - Patterns and insights (optimizes supply and demand)
 - Expanding consumer insight and options (drive toward 1 and 2)

Throughout the engagement, the team was impressed by the level of information it received and the responsiveness and support of all Burlingtonians. Any request to deepen its understanding was immediately addressed through additional appointments, arranged on short notice.

The team met with representatives from BED and other government departments, community groups, nonprofits, local businesses, healthcare and education institutions (Fletcher Allen Health Care (FAHC), University of Vermont (UVM), Champlain College, Burlington High School) to name just a few, and even enjoyed a site visit to the McNeil Generating Station.

3. Findings, context and roadmap

A. Findings and context

Burlington citizens have a lot of enthusiasm and passion for their city and the environment. This inspires action, discussion and debate. Many green initiatives have been launched and completed in the city.

The Smarter Cities Challenge team framed this report in the context of two themes:

1. GHG reduction
2. Smart Grid

GHG reduction observations

Burlington and Vermont have declared some very specific targets for GHG reduction. See Figure 2.

Significant effort and focus have been invested in addressing GHG emissions. Burlington's CAP was adopted by the City Council in May 2000.

Burlington's 2012 CAP (see Appendix D) is a detailed document that reviews the "impacts of climate change on Vermont and Burlington" and details carbon emissions. Its authors collected more than 200 recommendations and then, through a criterion-based process and with public vetting, published more than 30 recommendations.



Figure 2:
Burlington and Vermont GHG targets

The CAP is a clear statement of Burlington’s desire to reduce GHG emissions and its overall understanding of the effort required to do it. It also brings forth three challenges:

1. How to prioritize the proposed actions across the City of Burlington
2. What the relationship between initiatives is (both direct and indirect; positive and negative)
3. What the potential unintended outcomes of each initiative may be

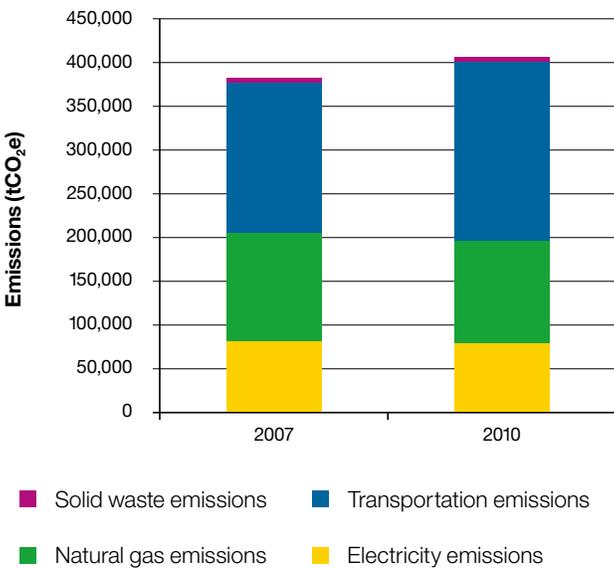


Figure 3:
Burlington carbon emissions
(City of Burlington Climate Action Plan, 2012)

Smart Grid observations

When the American Recovery and Reinvestment Act of 2009 (ARRA) was signed into law, funding was directed into modernizing the nation’s transmission grid, including Smart Grid projects. BED received \$7.15 million of this funding under the statewide federal Smart Grid Investment Grant program.

BED has been working in the Smart Grid space for several years now and is beginning to reap the rewards of its efforts. The Itron Smart Meter and the initial Advanced Meter Infrastructure (AMI) rollouts are now complete in Burlington. Meters are polling every 15 minutes and uploading to the datacenter and Meter Data Management (MDM) system every eight hours.

To complete the first phase of the Smart Grid, BED is preparing for the release of a user portal referred to as “Energy Engage” in June 2013.

This presents BED with a data paradigm shift. In the past, BED did monthly meter readings and aggregated analysis. Now there will be approximately 760,560,000 meter readings per year. Additionally, the number of data points collected will increase to approximately 1.7 million per hour. Despite the useful insight, opportunity and analysis this data will allow, it will place additional pressure on BED IT infrastructure.

Burlington observations

“The whole is greater than the sum of its parts.”

– Aristotle, 384-322bc.

This famous quote applies well to Burlington. The City and the State of Vermont have significant potential and strengths, which include but are not limited to:

- Community awareness and support for the need to reduce GHG emissions
- An innovative, entrepreneurial spirit
- Abundant local sources of renewable energy – biomass, wind, geothermal/hydro, water and solar
- Access to nationally recognized institutions of higher learning and research (including University of Vermont and Champlain College)
- A school district that promotes, develops and encourages talent in environmental science
- Attractiveness for recreation and tourism
- A robust fiber optic network capable of connecting the community
- Visibility and draw of FAHC as an advanced healthcare provider

Burlington faces some challenges, too:

- Execution of separate sustainability programs in silos, with limited integration and lack of alignment
- City budget constraints and liabilities
- Relatively low density and small population multiplier (42,412 – US Census 2010) (Note: This can also be a strength)

Inspired by Burlington's potential, and with appreciation for the complexity and challenges, the Smarter Cities Challenge team created recommendations to leverage Burlington's strengths while complementing citizens' understanding of the Smart Grid and GHG emissions.

B. Roadmap of recommendations

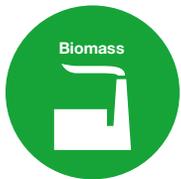
The Smarter Cities Challenge team's recommendations can be summarized as follows:

Focused



Leverage the Smart Grid

Leverage the Smart Grid to inform citizens' options and drive actionable insight toward conservation of all important resources by providing a consolidated resource consumption portal, combined with an event messaging system.



Optimize the Joseph C. McNeil Generating Station

Request that the McNeil owners establish a project team, fully empowered and with access to all resources needed, that will provide a firm recommendation within 12 months on how to optimize the use of the power plant.



Enable electric vehicle (EV) sharing

Spearhead a sizeable EV sharing program and integrate it into the existing public transportation system with links to nearby cities, helping to address traffic, parking and GHG emissions challenges and make Burlington more attractive as a result.



Promote energy efficiency execution (E3)

Create an E3 team of trained community and student volunteers who proactively encourage a higher adoption rate of efficiency solutions among property owners, specifically relating to structural energy loss.

Overarching



Make Burlington synonymous with green technology

Ensure alignment with and reinforce the key initiatives and entrepreneurial spirit of Burlington by agreeing to and communicating a clear vision that establishes the city as the leader for sustainability, based on distributed GHG emission-reduction technologies. This is the overarching recommendation that provides the foundation for all other recommendations.



Create a coordinated communication plan for "Burlington – the green tech city"

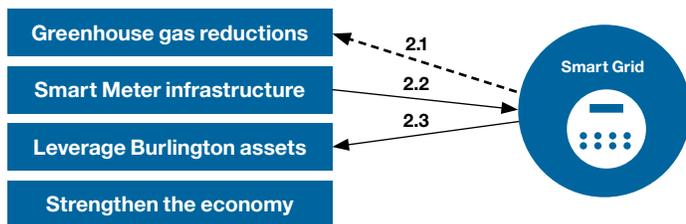
Effectively communicate its vision for becoming "Burlington – the green tech city" with effective and consistent messaging, engaging the Burlington community in an open dialog.

The four focused recommendations align with the following key City objectives:

- Reduce GHG emissions
- Leverage Smart Grid infrastructure
- Leverage existing assets and investment
- Strengthen Burlington's economy

Leverage the Smart Grid

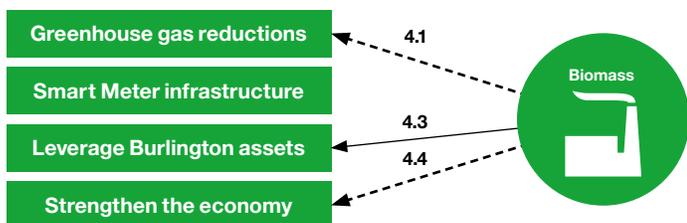
BED is launching Energy Engage, a consumer portal, in June 2013. This will show electricity consumption and cost and provide energy efficiency tips. This recommendation makes a case for future enrichment to include climate data and extension of the portal to natural gas and water. This will enable consumers to actively participate in comprehensive utilities resource conservation, thereby reducing GHG emissions. In the future, the portal should also link with transportation mileage.



ID	Rationale
2.1	The portal will help customers make informed decisions about their energy conservation, thereby reducing GHG emissions
2.2	The portal will leverage the existing Smart Grid
2.3	The portal and the data enriched by the portal will become a city asset

Optimize the Joseph C. McNeil Generating Station

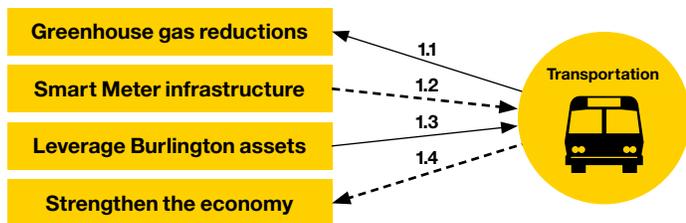
Until a firm decision on how to optimize the McNeil Generating Station is made, the team can only postulate outcomes. The rationale below illustrates a possibility.



ID	Rationale
4.1	Various recommended uses of the power plant would lead to GHG reduction (for example, district heat or biomass gasification could replace natural gas usage in home heating)
4.3	McNeil is a city asset and, depending on the recommendation, could become an even bigger/better asset (for example, it could be used for a biomass gasification pilot)
4.4	Economies run on energy; capturing and using what today is wasted energy benefits the economy

Enable electric vehicle (EV) sharing

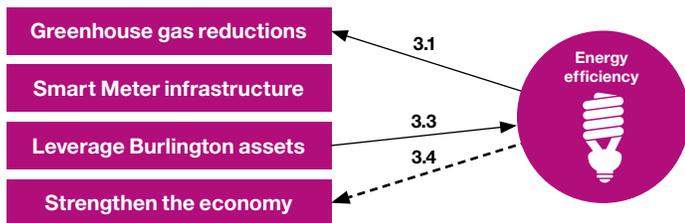
The existing public transportation system needs to be more flexible in time frequency, and it must make use of renewable energy. This recommendation is a first step to tying together transportation, parking and the environment.



ID	Rationale
1.1	Using and sharing EV fuel with electricity coming from renewable sources will reduce GHG emissions
1.2	Linking the EV system to the Smart Grid will enable vehicles to be charged at non-peak times
1.3	Students from the University of Vermont and Champlain College have developed real-time global positioning system (GPS) tracking systems for buses – extending these to the whole public transportation system and CarShare program is a good use of existing assets
1.4	Economy is strengthened as: <ol style="list-style-type: none"> 1. GPS tracking technology solution around EV sharing, busing and parking is packaged and remarketed to other cities 2. EV sharing is promoted as a tourist attraction 3. The entirely new system attracts business opportunities and drives job creation

Promote energy efficiency execution (E3)

By creating an inventory of the structural energy loss of Burlington residences/facilities and establishing a standard baseline and reporting mechanism, property owners will be exposed to the most appropriate programs from the myriad existing energy efficiency programs available to them. Furthermore, the data gathered can be used to evaluate program pervasiveness and measure impact.



ID	Rationale
3.1	This recommendation will have a positive incremental impact on the use of existing energy efficiency programs
3.3	Energy efficiency execution will leverage the many existing programs available; for example: <ul style="list-style-type: none"> • www.burlingtonelectric.com/page.php?pid=62&name=ee_incentives • www.encyvermont.com/Index.aspx • www.vermontgas.com/efficiency_programs/audit.html • http://ecosproject.com/about-project • http://pacenow.org/resources/all-programs/#Vermont • http://vbsr.org/business_energy_action/ • www.cvoeo.org/htm/weatherization/weatherization_home.html • www.encyvermont.com/index.aspx • www.buildingenergyvt.com • http://aceee.org/energy-efficiency-links • www.imt.org
3.4	<ol style="list-style-type: none"> 1. There is a potential to reinject savings into the economy when return on investment (ROI) is reached 2. Weatherization could be performed by local contractors, supporting the economy

In summary, all recommendations rely on existing Burlington assets and successful rollout of Smart Grid infrastructure. The recommendations then drive GHG emission reductions and strengthen the local economy as shown below. Figure 4 highlights the interrelationship between the four recommendations above and the two overarching recommendations.

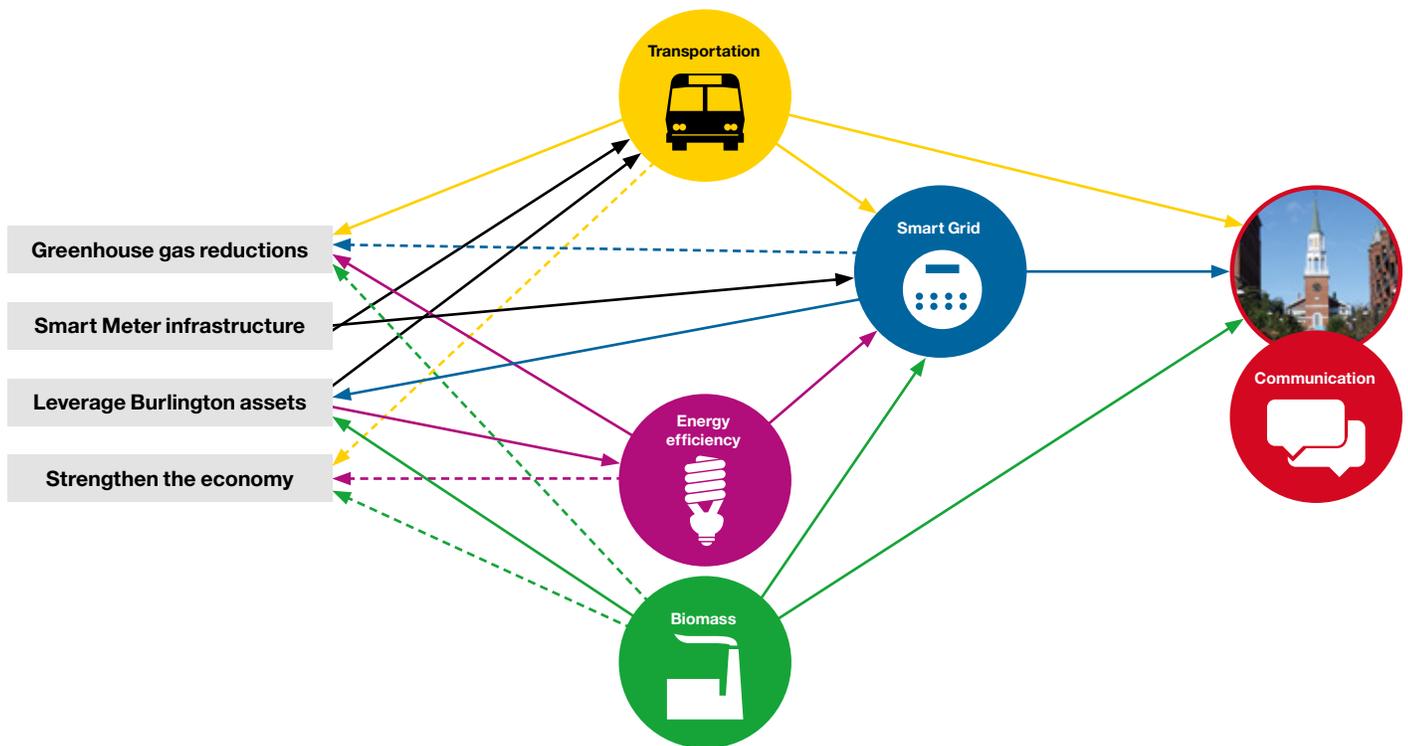


Figure 4: Interrelationship between recommendations

Table 2 represents the four focused recommendations against short-, medium- and long-term timeframes. It is important to consider that this general timeline represents possible and, in some cases, desired achievements. However, it is understood that many things impact a timeline; flexibility and adaptability must be built in via a formal management system interlock and project plans.

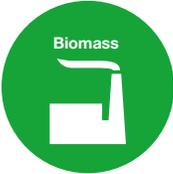
	Short term (< 12 months)	Medium term (12 to 36 months)	Long term (> 36 months)
	<ul style="list-style-type: none"> • Complete Smart Grid rollout • Complete the rollout of user portal (Energy Engage) 	<ul style="list-style-type: none"> • Integrate gas and water • Augment user portal to complete energy picture 	<ul style="list-style-type: none"> • Participate in the citywide operations center • Use analytics with enriched information (weather, humidity, ...)
	<ul style="list-style-type: none"> • Make definitive decision: <ul style="list-style-type: none"> – District heating – Biomass gasification – Other methods to increase efficiency 	<ul style="list-style-type: none"> • Implement the selected solution 	<ul style="list-style-type: none"> • Optimized use
	<ul style="list-style-type: none"> • Develop EV share program value proposition • Identify EV supplier of choice 	<ul style="list-style-type: none"> • Define final business case • Approve and launch program 	<ul style="list-style-type: none"> • EV sharing operation
	<ul style="list-style-type: none"> • Confirm experts to conduct training in efficiency programs • Train teams of volunteers • Launch winter campaign 	<ul style="list-style-type: none"> • Execute summer campaign • Gather data • Establish database 	<ul style="list-style-type: none"> • Analyze data and identify program improvements • Launch adjusted and/or new programs

Table 2:
Timeline for recommendations

C. Other observations

Below is some food for thought based on the team's interview insights, not included in the recommendations.

- Transportation:
 - Evaluate flexible parking rates to encourage people to use public transportation
 - Consider an integrated traffic management system (for example, adaptive signal control)
 - Consider an integrated parking management system
 - Consider shared cab services
- Renewable energy:
 - Further investigate the use of hydropower in energy production
 - Consider using Lake Champlain as a source of energy
 - Extend the use of geothermal technologies
 - Investigate alternative biomass sources (for example, switchgrass)
 - Evaluate further cost-effective optimization of solar and wind energy technologies
- Increase energy efficiency of street lighting (for example, LEDs, motion sensing, dimmers)
- Continue to invest in storm water management and lake protection
- Prioritize the waste management system (for example, waste disposal, compost)
- Consolidate IT datacenters to reduce the energy footprint
- Consider establishing a citywide IT organization
- Figure out how to leverage the fiber-optic network:
 - With healthcare/education/transportation applications
 - Joining the US Ignite initiative for creation of next-generation Internet applications that provide transformative public benefit
- Create a business case for consolidating city-owned facilities under centralized management for optimal portfolio management, including procurement, maintenance and upgrade/replacement practices
- Adapt the energy/housing code to incentivize people to live downtown (currently 50% business, 50% resident for new construction) – revisit urban zoning and planning, as well as permitting
- Create an interrelation/dependency/outcome diagram between all the recommendations in Burlington's CAP

4. Recommendations

Recommendation 1: Make Burlington synonymous with green technology

The City should ensure alignment with and reinforce the key initiatives and entrepreneurial spirit of Burlington by agreeing to and communicating a clear vision that establishes the city as a leader for sustainability, based on distributed green energy production technologies.

Scope and expected outcomes

Scope

The City's vision should leverage the significant potential and strengths of Burlington and the State of Vermont, which are listed on p. 8 of this report.

It should accelerate and support initiatives already underway, including:

- Integrated green technology solutions for distributed sustainable energy, including funding and financing options, as the foundation for job creation and a green economy
- The understanding and the application of best practice technologies
- New ideas and innovation
- New business opportunities and enhanced ecosystem
- A framework that attracts and retains talent
- An energized community with focus on common objectives

This provides a unique opportunity for Burlington to build upon its existing tourism industry by:

- Demonstrating existing and developing green technologies
- Showcasing real examples of best practice implementations
- Allowing visitors to experience these technologies first hand (for example, EV usage)

The vision must be shared with the public explicitly and regularly. In addition to existing exhibits at the ECHO Center, the Moran Power Plant on the lake, for example, could be turned into an attractive site for showcasing distributed green technologies. This would have the additional benefit of revitalizing the waterfront.

In order for this vision to become a reality, a step-by-step approach is required. Green initiatives and actions must be aligned to support the overall vision and objectives. The City should define and implement a process, with clear ownership, to review proposed and existing initiatives and funding as outlined below.

The Office of the Mayor should appoint a dedicated expert resource to lead a team of no more than 12 members, who are empowered to represent key stakeholder organizations:

- City government
 - Energy utilities
 - BED
 - Vermont Gas (VG)
 - Vermont Energy Investment Corporation (VEIC)
 - Education
 - UVM
 - Champlain College
 - Healthcare
 - Fletcher Allen Health Care
 - Transportation
 - Campus Area Transportation Management Association (CATMA)
 - Chittenden County Region Planning Commission (CCRPC)
 - Business
 - Burlington Business Association (BBA)
 - Lake Champlain Regional Chamber of Commerce
-

Recommendation 1: Make Burlington synonymous with green technology (continued)

Scope and expected outcomes (continued)

This team should define projects with measurable business outcomes – prioritized according to GHG emission impact, funding requirements and ROI – and strive to make Burlington’s vision a reality. The City should review project requests and proposals for implementation on a quarterly basis.

The team should agree to a communication plan (see Recommendation 6) with the Office of the Mayor and support its consistent execution.

Expected outcomes:

- Governance and management system for all projects (new and existing), including prioritization and approval
- A foundation to develop and package integrated green technology solutions, combined with funding and financing options
- Scorecard/dashboard with defined metrics and targets (showing planned versus actual)
- Standardized management approach that ensures successful execution of agreed initiatives, programs and projects
- Informed citizens

Cost of inaction

- Critical projects that require cross-functional agreement and execution might not be implemented
- Risk of missing the GHG reduction targets
- Ineffective use of resources and redundant efforts
- Lack of clarity and understanding among the public about the achievement of milestones and successful initiatives, programs and projects
- Missed opportunity to facilitate job creation around a green economy

Proposed owner and stakeholders	Suggested resources needed
<p>Owner: Office of the Mayor</p> <p>Stakeholders: See list in Scope section above</p>	<p>People: One dedicated leader (see Scope section above) with access to existing City infrastructure</p> <p>Cost estimate: Low</p>
Dependencies	Key milestones, activities and timeframe
<ul style="list-style-type: none"> • Funding for the dedicated leader • Buy-in from organizations that need to appoint team members • Funding for related expenses 	<ul style="list-style-type: none"> • Office of the Mayor to secure a funded and qualified resource for this leadership position (2 months) • Assign team lead once funding is secured • Organizations that appoint team members to confirm support and active participation • Organizations to name representative (1 month) • Establish management system <p>Ongoing activities</p> <ul style="list-style-type: none"> • Operate management system as a key tool to ensure target achievement • Adjust management system annually to ensure optimal effectiveness and alignment with all participating entities • Team to report progress against targets to Office of the Mayor • Mayor to report progress made to achieve the long-term vision to the public

Priority

High

Recommendation 2: Leverage the Smart Grid

The City should leverage its Smart Grid to inform citizens of options and drive actionable insight toward conservation of all important resources by providing a consolidated resource consumption portal, combined with an event messaging system.

Scope and expected outcomes

Scope

The City should foster a culture of informed, data-driven decision making regarding conservation and use of renewable energy by providing accurate, timely and salient information to consumers.

It should build a portal that provides a holistic view of resource consumption, building on existing Smart Meter infrastructure and linked to an event messaging system. How and when this data is available will have a major impact on consumer actions.

BED is planning to launch Energy Engage, an electricity consumer portal, in June 2013. This could be extended to provide a more holistic view, becoming the "Burlington Customer Consumption Portal". The portal should display:

Resources, showing:

- Electricity, gas and water consumption, billing and carbon impact
- The mix of renewable and nonrenewable resources consumed
- "What if" scenarios – simulations based on the individual's data (for example, "What if I took time-of-use rate plan B instead of the general residential monthly energy plan?," "What would the impact be if I install solar panels?")
- Insights on energy consumption patterns by connecting consumer data with climate information, such as temperature, humidity, snow and sunlight
- Data in dashboard form, allowing consumers to change/create their own dashboard using data they are most interested in monitoring

Consumer insight and support, enabling:

- Dialog between like-minded customers, incorporating new and creative means, such as conservation-themed social networking and ideas gaming (for example, UVM's "eMinder" research project)
- Consumer profiles for resource consumption patterns (based on location, demographics, housing, infrastructure)
- Resource efficiency recommendations based on user behavior
- Individual consumers to automate usage (demand management within individual premises)
- Individual consumers to share all or part of data to external communities through a standardized Internet interface
- Consumers to actively participate in utilities resource usage management (electricity, gas, water)
- Incentives to customers who actively trend their consumption in a positive direction either by reduction or "flattening" their load

The portal should include a proactive messaging system (texts, tweets, blogs, emails) to alert customers on critical events, such as outages, peak periods and threshold exceptions, enabling individuals to plan and manage their load (washer, dryer, dishwasher, electric hot water), as well as to allow utility providers to take appropriate action.

As well as the portal, BED should pave the way for a Home Area Network (HAN). The HAN is a residential network that interfaces with the Smart Meter to receive data from the utility provider – such as pricing, in order to guide users on less expensive times to run appliances. This could be accomplished by proposing incentive rates or by offering advanced home consumption analytics. With this HAN installed, BED can perform fine-grained analysis on consumption (for example, comparing whether the TV or dryer is consuming more energy at any given time) as well as alert on atypical behavior.

As the technology becomes available and accepted, the consumer portal should also include transportation.

See Appendix C for examples of customer portals and mobile clients around the world.

Recommendation 2: Leverage the Smart Grid (continued)

Scope and expected outcomes (continued)

Additional long-term scope:

This recommendation would set the stage for additional possibilities. With new data sources available, including Smart Grid data, the City would be able to integrate interrelated systems into a single geospatial city operation dashboard to guide departmental activities. This does not relate only to energy; such a dashboard could integrate and correlate information from all relevant sources.

The basic premise of this approach is to offer deep, predictive analytics, integrated data visualization and collaboration that could help Burlington's agencies, departments and businesses prepare for and anticipate problems. Thus problems could be managed as they occur, enhancing the ongoing efficiency of City operations. Executive dashboard capabilities would give decision makers a real-time, unified view of operations so they can see who and what resources are needed and available. Burlington departments could share information and relevant data across organizational lines to accelerate problem response and improve project coordination.

A City operations dashboard would:

- Provide department heads domain Key Performance Indicator (KPI) reports with trends and analysis of event and domain data
- Enable a centralized environment for planning, organizing, monitoring and sharing information continuously in response to changing conditions
- Allow for drill-down capabilities in a geospatial context for situational awareness
- Provide for integrated collaboration
- Allow different data sources to be synergized to provide clear and accurate information on domain operations
- Allow for the connection and expansion of new information sources

Expected outcomes
Qualitative

- Consumers participate and support the optimization of resource usage and planning
- Consumers are aware of their consumption patterns and behaviors and can manage their consumption

Quantitative

- Measurable reduction of resource usage and GHG emissions
- Reduced cost for consumers, both through conservation and greater efficiency
- Financial advantages for utility providers, who can better predict and manage peak load, resulting in smarter power and gas purchasing, and ultimately, pass on a lower cost to consumers
- Better demand management, meaning utility providers can defer capital infrastructure upgrades as a result of equipment loading
- Real-time outage notification so utility providers can improve outage restoration and improve overall consumer satisfaction

Cost of inaction

- The public struggles to understand the benefits and savings of the Smart Meter rollout
 - Future green initiatives may not have the level of support required for significant investment
 - Operational costs and efficiencies of utility providers remain below achievable levels
 - Burlington utility providers risk falling behind providers in Vermont and beyond
 - Ultimately, higher electricity and gas rates for consumers
-

Recommendation 2: Leverage the Smart Grid (continued)

Proposed owner and stakeholders	Suggested resources needed
<p>Owner: BED</p> <p>Stakeholders:</p> <ul style="list-style-type: none"> • City Communications Officer • City planning council • Center for Energy Transformation and Innovation (CETI) • BED Energy Efficiency department • UVM • Champlain College (invite students to participate in portal design and implementation) • Home device appliances supplier(s) 	<p>People: The Energy Engage portal has already been budgeted and is due for release in June 2013. BED has strict budget controls, so the City should take a step-by-step approach to this recommendation. Establish a work breakdown plan to implement functions one at a time and leverage the student population through internships.</p> <p>Cost estimate: Each individual step is low</p> <p>Infrastructure: Leverage BED infrastructure</p>
Dependencies	Key milestones, activities and timeframe
<ul style="list-style-type: none"> • BED ongoing leadership support • Cooperation between BED, VG and Department of Public Works (DPW) • Agreement on the mechanisms for data sharing and systems access • Secure IT infrastructure • Regulatory support 	<ul style="list-style-type: none"> • Roll out BED Energy Engage customer portal (June 2013) • Stabilize usage of Energy Engage and gain preliminary usage feedback (until end of 2013) • BED to define the framework and a joint implementation plan to create the Burlington Customer Consumption Portal (3 months) • Implement the extended portal functionalities and integration with external data (2-3 months for first set of functionalities, then iterate) • Measure portal effectiveness and customer usage (ongoing)
Priority	
<p>Medium</p>	

Recommendation 3: Optimize the Joseph C. McNeil Generating Station

The City should request that the McNeil owners establish a project team, fully empowered and with access to all resources needed, which will provide a firm recommendation within 12 months on how to optimize use of the McNeil Generating Station.

Scope and expected outcomes

Scope

The scope references alternatives described in the May 2011 *Project Final Report: Burlington Pilot District Energy Feasibility Study* by Ever-Green Energy LLC, hereafter referred to as the “Ever-Green study” (Grant Number 02240-ASEP-REN-011 LLC, Saint Paul, MN 55102 www.burlingtonelectric.com/ELBO/assets/Burlington_District_Energy_Final_Report_corrected.pdf)

The City should establish a project team, tasked to:

- Validate whether alternative 1 is feasible, by clarifying if the amount of subsidy needed to offset initial capital cost can be secured to make for an economically viable system.
- Clarify whether alternative 2 achieves 80% of market penetration for the area encompassed, as explained in the report, by establishing a thorough understanding of the level of commitment from future clients of the district heating system (businesses, property owners, governmental institutions). The report indicates that this is a prerequisite to achieving “the economy of scale necessary to be an essentially break-even cost per unit of energy consumed by the customer when compared to natural gas as a natural fuel.” – Ever-Green study.
- Reconfirm with FAHC that the hospital requires steam supply and therefore cannot utilize a hot water district heating system. If confirmed, this means alternative 3 is not feasible. Note: UVM has also stated that its heating system is based on steam and it cannot utilize a hot water district heating system.
- Assess if alternative 2, combined with steam provided by McNeil to healthcare, is a possible solution that should be evaluated for commercial viability.
- Explore alternative solutions to take advantage of waste heat energy (hot water from cooling) near the plant site. Investigate agricultural, recreational/tourist, or industrial usage of this low-cost renewable energy.
- Obtain the current state of successfully applied technologies (US and international) for industrial gasification of biomass. Determine if the existing infrastructure from the 1998-2001 gasification pilot project at McNeil can be reactivated, upgraded and reused.
- Inform the public about the decision process and final outcomes.

Expected outcomes

- A final decision is made about the feasibility of a district heating system in Burlington
- A decision is made around whether past investments into the gasification pilot infrastructure can be put to productive and commercially viable use with the latest technologies and processes available
- Clarity is gained around whether it is economically/politically viable to use waste heat from McNeil, improving overall efficiency of this renewable energy source
- The community is informed about options and decisions

Cost of inaction

- Decision around the district heating system is delayed
 - Potential opportunities to make more efficient use of McNeil (wasted heat energy, new revenue streams, job creation) and existing investments are missed
-

Recommendation 3: Optimize the Joseph C. McNeil Generating Station (continued)

Proposed owner and stakeholders	Suggested resources needed
<p>Owner: McNeil owners</p> <ul style="list-style-type: none"> • BED 50% • Green Mountain Power (GMP) 31% • Vermont Public Power Supply Authority (VPPSA) 19% <p>Stakeholders:</p> <ul style="list-style-type: none"> • BED General Manager • BED leadership team • City of Burlington • GMP • Vermont Public Power Association (VPPA) 	<p>People</p> <ul style="list-style-type: none"> • BED leader • Subject matter expert (SME) on biomass/district heating • SME on biogas generation • Representative from GMP • Representative from VPPA • UVM bioenergy experts <p>Cost estimate: Low – project team staffing and travel (US and international)</p>
Dependencies	Key milestones, activities and timeframe
<ul style="list-style-type: none"> • Regulatory authorities' support and approval • Identification and dedication of expert resources to the project team – assumed – by BED • Ongoing support of all McNeil owners • Legal and regulatory constraints • Support from VG • Access to worldwide gasification technologies and resources • Political will and support (local, state and federal) 	<ul style="list-style-type: none"> • Expert team established (30 days) • Quarterly reports on progress made • Final recommendation to the owners of McNeil (12 months) • Communication of conclusions and decisions to the public
Priority	
<p>Medium</p>	

Recommendation 4: Enable electric vehicle (EV) sharing

The City should spearhead a sizeable EV sharing program and integrate it into the existing public transportation system with connection to nearby cities, helping to address traffic, parking and GHG emissions challenges and make Burlington more attractive as a result.

Scope and expected outcomes

Scope

In 2010, transportation contributed 51% of Burlington's GHG emissions. That was an increase of 16% since 2007 according to the latest data available (source: *Burlington Climate Action Plan, 2012*).

The City should position Burlington as an ideal place to launch and operate a sustainable EV sharing program, attract companies providing innovative technologies and make Burlington a role model for EV sharing. It should pursue a strategic partnership with EV suppliers.

The program should leverage existing local intellectual property and solutions:

- Make use of existing integration with mobile devices (smartphones, tablets) to provide flexible access to EVs, transparent and flexible billing mechanisms and parking management anywhere and anytime
- Expand the existing payment model for bus services, used by UVM and Champlain College students, to provide an effective billing system for EVs
- Extend global positioning system (GPS) bus tracking on mobile devices, used by UVM and Champlain College students, to the EV shared fleet by augmenting functionality to:
 - Locate available EVs
 - Reserve and book an EV
 - Locate charging stations
 - Identify parking lots
 - Locate places of interest
- Since GPS bus tracking has been developed in Burlington, adding new functionality is an opportunity for local job creation
- References: <http://shuttle.champlain.edu> and <http://uvm.blirpit.com>

Building an EV sharing system with technologies developed in Burlington would provide the necessary differentiation to attract EV supplier(s) to invest in a strategic partnership. This partnership should be used by EV supplier(s) to promote fast adoption of integrated new technologies in other cities around the world.

Funding for the EV sharing program should be sourced in innovative ways, such as selling advertising space in/on the cars and the integration of locally developed technologies provided by small and medium businesses and academic institutions.

EV use should be incentivized through exclusive and prioritized parking spaces.

BED should expand its charging stations, and overall transportation planning should be adjusted to reflect the EV sharing program.

The program should define and provide a set of metrics to prove success and acceptance and to further promote and expand the model in other cities.

It is important to mention that the success of the EV sharing program will depend on integration with public transportation offerings, such as Park and Ride and bus services to nearby cities.

The City should invite committees working on similar initiatives, such as the VEIC, to participate in the program.

Recommendation 4: Enable electric vehicle (EV) sharing (continued)

Scope and expected outcomes (continued)

Expected outcomes

- Integrated and enhanced local technologies
- Incorporated and extended local transportation solutions and programs
- Potential to create local jobs and businesses
- Reduced GHG emissions
- Reduced parking constraints
- Less time and fuel wasted looking for parking spaces
- Increased attractiveness of Burlington for tourists and local community
- Showcase of a successful EV sharing solution
- Detailed data created for Burlington's traffic planning (demand, supply, usage patterns, issues)
- Key element of Burlington's branding as a leader in clean energy achieved

Cost of inaction

- Missed opportunity to deploy EVs to reduce GHG emissions
- Missed opportunity to integrate local transportation systems
- Missed opportunities to develop a local ecosystem and jobs around EV solutions
- Ongoing parking space constraints
- High risk of slow EV adoption and not achieving critical mass

Proposed owner and stakeholders	Suggested resources needed
<p>Owner: Consortium (to be established)</p> <p>Initial owner: Office of the Mayor</p> <p>Stakeholders:</p> <ul style="list-style-type: none"> • City of Burlington • EV supplier(s) • CATMA • VEIC/Go Vermont • CarShare Vermont • BED • UVM • Champlain College • FAHC • Chittenden County Transportation Authority (CCTA) • CCRPC 	<p>Potential federal and regional funding and incentives (for example, American Recovery and Reinvestment Act of 2009) should be explored.</p> <p>People:</p> <ul style="list-style-type: none"> • Project lead – low cost • EV fleet management – medium cost • IT management – low cost • Charging station management – low cost <p>IT infrastructure:</p> <ul style="list-style-type: none"> • Implementation – low cost (leverage capabilities of the stakeholders) • Ongoing – low cost <p>Electric infrastructure:</p> <ul style="list-style-type: none"> • Charging station deployment already taking place independently of this project • Implementation – low cost • Ongoing – low cost <p>EVs:</p> <ul style="list-style-type: none"> • Implementation – low cost (if successful partnership with EV supplier(s) established) • Ongoing – low cost

Recommendation 4: Enable electric vehicle (EV) sharing (continued)

Dependencies	Key milestones, activities and timeframe
<ul style="list-style-type: none"> • EV supplier(s) investment • Establishment and buy-in of the consortium • Small and medium businesses and academic institutions to participate and contribute to the program • Sizeable fleet to ensure critical mass and coverage for timely acceptance • Adequate parking space management (Park and Ride, downtown prioritization zoning) • Integration with BED demand management system • Adequate marketing campaign to inform and excite the public (for successful launch and during operation) • Ongoing political support and enablement • Tax and incentive programs for EVs 	<p>City of Burlington:</p> <ul style="list-style-type: none"> • Introduce the concept and the possibility of using Burlington as a successful showcase to leading EV suppliers (2 months) • Win at least one EV supplier to invest in the project (3 months) <p>Owner (consortium leader):</p> <ul style="list-style-type: none"> • Reach agreement with the EV supplier(s) about other critical partners for the consortium (2 months) • Establish the consortium (3 months) • Refine details of the program and create a business case supported by the consortium (3 months) • Establish funding models (TBD) • Sign off for an integrated implementation plan by all consortium members (12 months) • Implement and measure results (TBD)
<p>Priority</p>	
<p>High</p>	

Recommendation 5: Promote energy efficiency execution (E3)

The City should put together an E3 team of trained community and student volunteers who proactively encourage a higher adoption rate of efficiency solutions among property owners, specifically relating to structural energy loss.

Scope and expected outcomes

Scope

The City should initiate a program that mobilizes students and volunteers from the community to achieve a higher adoption rate of energy efficiencies among property owners.

Buildings that are not sufficiently weatherized consume a large amount of energy and have a negative impact on the environment. Burlington's high number (57%) of rental properties (source: VSPC Energy Efficiency and Forecasting Sub-Committee) and its aged housing stock represent a challenge to the City's energy-efficiency programs and incentives.

BED should manage this program on behalf of the City of Burlington, in addition to existing energy-efficiency initiatives, to:

- Define the details of the program with City representatives and promote it to the public in order to raise awareness and prepare for successful volunteer recruitment
- Recruit volunteers from the community, educational institutions (high school, college, university – through community-university partnerships and service-learning programs) and Burlington businesses
- Train volunteers on easy steps to reduce heat loss and to understand and apply all existing programs, including, but not limited to:
 - www.burlingtonelectric.com/page.php?pid=62&name=ee_incentives
 - www.encyvermont.com/Index.aspx
 - www.vermontgas.com/efficiency_programs/audit.html
 - <http://ecosproject.com/about-project>
 - <http://pacenow.org/resources/all-programs/#Vermont>
 - http://vbsr.org/business_energy_action
 - www.cvoeo.org/hm/weatherization/weatherization_home.html
 - www.encyvermont.com/encyvermont.com
 - www.buildingenergyvt.com
 - <http://aceee.org/energy-efficiency-links>
 - www.imt.org
- Equip volunteers with materials and tools (for example, infrared cameras for thermal pictures of buildings, tools for structured data collection and feedback)
- Identify priority areas where the team should start activities and provide contact information for property owners on whom to call to learn more
- Give the team questionnaires to create an inventory of building heat losses and other relevant data

In the future, collected data should then be injected into the Burlington Customer Consumption Portal.

Expected outcomes

- Inventory of building heat losses and other relevant data, including weatherization status
 - A formal reporting scheme that provides standardized and insightful information to property owners and the public, including:
 - Heat loss status of the building surveyed
 - Status of weatherization already installed
 - Level of acceptance of recommended actions
 - Reasons provided (if any) for actions being rejected
 - Other relevant data specified
-

Recommendation 5: Promote energy efficiency execution (E3) (continued)

Scope and expected outcomes (continued)

- A valuable source of data for the City, including:
 - Level of acceptance of recommended actions
 - Level of acceptable weatherization in defined areas and categories of buildings
 - Feedback on why proposed actions are not accepted or cannot be implemented
 - Basis to assess the success of this initiative
 - Data to improve or replace programs for energy savings, including this recommended framework

Cost of inaction

- Limited data about heat loss by area and type of building
- Lack of structured data to understand:
 - Patterns of efficiency gaps
 - Best practices
 - Inhibitors
 - Identification of new solutions
 - Resistance to weatherization
- Property owners may not be aware of their options and that these options are supported by programs and possible funding

Proposed owner and stakeholders	Suggested resources needed
<p>Owner: BED, in possible partnership with educational institutions (for example, Burlington School District (BSD))</p> <p>Stakeholders: All entities providing weatherization incentives and programs</p>	<ul style="list-style-type: none"> • BED to own and lead • Volunteers • BED engineers • VG engineers <p>Cost estimate: Low</p>
Dependencies	Key milestones, activities and timeframe
<ul style="list-style-type: none"> • Recruiting volunteers • Effective training • Central data analysis and management 	<ul style="list-style-type: none"> • Define details of the program (1 month) • Communicate to gain support for the program (2+ weeks) • First wave of recruitment (2+ weeks) • Training – one-day session • Send volunteers out for first round of engagements (2 weeks to occur within appropriate weather conditions/winter/summer) • Feedback/conclusions/adjustments as needed (ongoing)

Priority

High

Recommendation 6: Create a coordinated communication plan for “Burlington – the green tech city”

The City should effectively communicate its vision for becoming “Burlington – the green tech city” with effective and consistent messaging, engaging the Burlington community in an open dialog.

Scope and expected outcomes

Scope

There are many programs and initiatives in Burlington focusing on “green”, sustainability, energy and efficiency.

The City should communicate all of these programs under a common theme to establish a strong recognizable brand and drive consistent and impactful messaging. This branding could be promoted through merchandise with a Burlington theme or logo. The City could develop additional creative ideas through collaboration (for example, social networks and contests) with the community, nonprofit and academic institutions, government and businesses.

The City should perform an inventory of all existing initiatives, materials, content and stakeholders (institutions, programs, forums, websites, TV media). It should integrate messaging around existing initiatives, which should be transitioned into a new integrated communications framework in support of the new Burlington brand.

Meaningful metrics and a progress reporting cadence will be critical to establishing credibility and maintaining focus to successfully proliferate the brand.

In addition, the City should prominently display City- and State-level targets for energy consumption and GHG reduction alongside usage and impact, in order to align the community around brand objectives.

Themes to communicate under the brand include:

- Best practice showcase of green technologies
- Locally developed green tech solutions
 - Integrated EV transportation solution
 - Burlington customer consumption portal
- E3 examples and impact metrics
- Success stories for job creation and ecosystem development

Furthermore, the EV fleet will be highly visible on the streets of Burlington; it alone will significantly contribute to the city’s new branding.

Expected outcomes

Cohesive, branded communications will:

- Advance Burlington around a strong green theme
- Provide purpose and alignment for all related initiatives
- Focus communication efforts and optimize the use of resources
- Create the mindset to achieve GHG emissions reduction
- Differentiate Burlington from other cities
- Provide additional motivation for tourists to visit
- Support entrepreneurial investment and job creation

Cost of inaction

- Lack of alignment of key initiatives and investments in Burlington
 - Missed opportunity to:
 - Unite the community around a strong vision and purpose
 - Accelerate green investments and job creation
 - Further enhance Burlington’s attractiveness as a tourist destination
-

Recommendation 6: Create a coordinated communication plan for “Burlington – the green tech city” (continued)	
Proposed owner and stakeholders	Suggested resources needed
<p>Owner: Office of the Mayor</p> <p>Stakeholders:</p> <ul style="list-style-type: none"> • City department heads • All public and private entities involved in green initiatives 	<p>People skilled in writing, multimedia communications, marketing, public relations, project management and data analysis to define and execute the integrated communications plan and branding – medium cost</p> <p>Suggested approach to accelerate start time and leverage existing resources:</p> <ul style="list-style-type: none"> • Create a virtual project team with communications representatives from all City departments (as stretch /development and/or rotation assignments) • Team to take direction from an assistant to the Office of the Mayor • Supplement required capacity with interns hired on an individual project basis <p>Contribution to funding could come from expanding green initiatives showcasing (for example in ECHO), advertising and sales of merchandise</p> <p>See Appendix H: “Fast-start list for communication and marketing” for affordable program ideas</p>
Dependencies	Key milestones, activities and timeframe
<ul style="list-style-type: none"> • Recommendation 1 • Resources to execute 	<ul style="list-style-type: none"> • Agree to the brand theme, logo, messaging (2 months) • Create a virtual project team (in parallel with above, 2 months) • Supplement required capacity with interns • Inventory available collateral and programs and gather metrics data (2 months) • Define communication plan and calendar (2 months) • Align sustainability initiatives with new brand and update materials accordingly (2 months) <p>Include regular progress reporting in the current community calendar, city website and other relevant forums/events.</p>
Priority	
High	

5. Conclusion

The Smarter Cities Challenge team's recommendations focus on harnessing the local talent pool and the abundance of renewable resources in the area to enable Burlington to achieve its GHG emissions goals. The overarching recommendation – to establish Burlington as a leading green tech city – drives alignment across stakeholders and all initiatives, further energizes the community, retains talent and inspires the development of new technologies and businesses.

It is important that Burlington takes a fact-based, data-driven approach. The City should establish baselines and measurable targets and use data to make effective decisions and build robust business cases.

The ultimate outcome is for Burlington to become an integrated, data aware, thriving city that is recognized as a leader in green technologies.



6. Appendix

A. Acknowledgments

Stakeholder	Name/title
Agilionapps.com	Adam Bouchard, Founder
Burlington District Energy Service (BURDES)	Jan Schultz, BURDES Committee John Irving, Manager of Generation/McNeil Plant Manager Mary Sullivan, Communications Coordinator (BED) Jeffrey Frost, Consultant, Bioenergy Comparators Harry Atkinson, Industry Representative, BURDES Committee Lisa Marchetti, Citizen Representative, BURDES Committee
Burlington Electric Department (BED)	Barbara Grimes, General Manager Ken Nolan, Manager of Power Resources Tom Buckley, Manager of Customer and Energy Services Chris Burns, Director of Energy Services Nick Molander, Assistant Principal BSD
Burlington School District (BSD)	Amy Mellencamp, Principal, Burlington High School (BHS) Jeanne Collins, Superintendent, Burlington Schools Brian Hoffman, Teacher, BHS Environmental Sciences Brian Williams, Principal, Sustainable Academy at Lawrence Barnes
Campus Area Transportation Management Association (CATMA)	Sandy Thibault, Executive Director
Center for Energy Transformation and Innovation (CETI)	Joan Gamble, Strategic Change/Executive Consultant
Champlain College	David Provost, Vice President for Finance and Administration John Caulo, Associate Vice President for Campus Planning
Chittenden County Transportation Authority (CCTA)	Chapin Spencer, Immediate Past Chairman, Board of Commissioners
Chittenden County Regional Planning Commission (CCRPC)	Charlie Baker, Executive Director Michele Boomhower, Assistant/MPO Director Andy Montroll, Attorney and Local Planning Commission Rep Melanie Needle, Senior Planner
City of Burlington “City Green Team”	Jennifer Green, Legacy Project and Sustainability Coordinator David White, Director of Planning and Zoning Ben Pacy, HR Generalist Steve Roy, Project Engineer, Department of Public Works (DPW) Sandrine Thibault, Planning and Zoning Ravi Parikh, Energy Services Specialist (BED) Jon Adams-Kollitz, Parks Ron Redmond, Director, Church Street Marketplace Eugene Bergman, Assistant City Attorney

Stakeholder	Name/title
City of Burlington Office of the Mayor	Miro Weinberger, Mayor Mike Kanarick, Assistant to the Mayor, Operations and Communication Carina Driscoll, Assistant to the Mayor for Innovation and Mayoral Initiatives Jennifer Kaulius, Administrative Assistant Erin Flynn, Mayor's Office Intern
City of Burlington Department Heads	Jesse Bridges, Director, Parks and Recreation Steve Goodkind, Director, Department of Public Works
Fletcher Allen Health Care	Jason Williams, Senior Government Relations Strategist Dawn LeBaron, Vice President for Hospital Services Wes Pooler, Director of Facilities Management
Howard Center	Mary McKearin, Director of Planning Tom Borys, Financial Manager Ed Vizvarie, Director of Facilities
IBM – Burlington at Essex Junction, VT	Janette Bombardier, Director, Burlington Site Operations and Senior Location Executive Stephen R. Blair, Central Utility Plant Manager Gregory L. Rieder, Senior Electrical System Engineer Janet Doyle, Site Operations and Government Programs John Cohn, IBM Fellow, Distinguished Agitator Lindsey M. Sullivan, Potable and Ultrapure Water Engineer Ruma Kohli, Product Stewardship Program Manager Chris Gillman, Senior Manager – 200mm Fab IT and Lean Transformation
IBM – E&U Solution Center LaGaude	Frederic Bauchot, DE Chief Solution Architect Jean-Francois Mermet, Smart Grid Solution Architect
University of Vermont	Richard Cate, Vice President of Finance and Administration Gioia Thompson, Sustainability Director Melody Burkins, Office of the VP for Research and Graduate College Chris Danforth, Assistant Professor, Department of Mathematics and Statistics; Computational Story Lab Austin Troy, Director of Transportation Research Center (TRC) Paul Hines, Assistant Professor, School of Engineering Jeff Marshall, Professor, School of Engineering & Mathematical Sciences Joe Speidel, University Relations Michelle Smith, Green Building Coordinator Sal Chiarelli, Director of Physical Plant
Vermont/Burlington Business Community	Kelly Devine, Executive Director, Burlington Business Association Andrea Cohen, Vermont Businesses for Social Responsibility
Vermont Congressional Delegation	Tom Berry, Field Representative – Office of US Senator Patrick Leahy Jon Copans, Deputy State Director – Office of US Congressman Peter Welch
Vermont Energy Investment Corporation	George Twigg, Director of Public Affairs Erin Carroll, Director, Consulting Division Karen Glitman, Director, Transportation Efficiency Division

Stakeholder	Name/title
Vermont Gas	Don Gilbert, President
Vermont Governor's Office	Elizabeth Miller, Chief of Staff
Vermont Public Service Department	Christopher Recchia, Commissioner Darren Springer, Deputy Commissioner
Vermont Renewable Energy Businesses	Doug Goldsmith, COO, AllEarth Renewables Andrew Savage, Director of Communications and Public Affairs, AllEarth Renewables Chad Farrell, Principal, Encore Redevelopment Nicholas Ponzio, Project Engineer, Building Energy Gabrielle Stebbins, Executive Director, Renewable Energy Vermont Duane Peterson, President, SunCommon
Vermont State Legislature	Tim Jerman, Vermont House of Representatives, Natural Resources Suzi Wizowaty, Vermont House of Representatives, Judiciary
350Vermont.org	Andrew Simon, Campaign Coordinator Bill Scott, Activist

B. Team biographies



Leonard Hand
Executive Information
Technology Architect
Rochester, New York, USA

Hand is an IBM Senior Certified Architect with an infrastructure discipline. He performs many roles beyond IT architect, including instructor, methodologist, mentor, innovator (six US patents) and programmer, to name a few. As an infrastructure architect, Hand understands the importance of looking at the big picture and all possibilities but at the same time has a pragmatic (rubber meets the road) perspective that enables his solutions to work in the real world. Hand is currently engaged as the technical lead on a special assignment called the IBM Asset Factory. Prior to IBM, Hand worked as a software consultant and as an environmental controller programmer. He is a Summa Cum Laude Graduate of SUNY Oswego. Hand has built his own home. He enjoys his family, wrenching classic cars and motorcycles, and managing his farm in central New York.



Robert Laurim
Vertical Industry Expert
Munich, Germany

Laurim pulls together hardware, software and services to support clients. All his career moves have been with leading IT companies in support of business segments, such as automotive, aerospace, manufacturing, broadcasting/media, utilities, public and defense. He is experienced in growing markets, startup situations and turnarounds. His working style is straightforward and customer focused. Prior to joining IBM Germany in 2003, Laurim worked for several other high-tech firms. Laurim holds a degree in industrial engineering from the Munich University of Applied Sciences. His hobbies include a variety of outdoor activities, including scuba diving. He's also very interested in antiques, modern history and literature.



Jorge Luttgardes
CIO Office Leader,
IBM Latin America
Sao Paulo, Brazil

“Lutt” Luttgardes is responsible for the overall IBM IT operations in Latin America, with activities encompassing the management of technical infrastructure and systems applications maintenance and development. His two positions were in the IBM Consulting Division: as the Brazil Operations Executive and as the Brazil Leader of Applications Services Delivery respectively. Before that, Lutt worked in finance, his last position being Latin America CFO for the IBM Consulting Division. During his 19 years in IBM, Lutt has rotated through several areas with experience in application management, planning, pricing, Treasury, accounting, business development, business controls and delivery excellence. In 2012 he was awarded as one of the best 500 IBM employees in world (“Best of IBM” award). Lutt speaks English and Spanish in addition to his native Portuguese. He has an MBA from Fundacao Don Cabral, a post-graduate degree in administrative finance from Fundacao Getulio Vargas, and graduated in data processing technology from Pontificia Universidade Catolica. He was born in Rio de Janeiro and lives in Sao Paulo, Brazil, where he is married and has two daughters. He likes sports and plays soccer and tennis.



Isabelle Murard
Energy and Utility
Technical Consultant
Nice, France

Murard is a senior IBM certified Project Manager and certified Service Oriented Architecture Associate. For the past three years, Murard has led the team in charge of Technical Consulting for IBM Business Solutions serving the energy and utility market at a global level. Murard has spent the majority of her IBM career working with all IBM lines of business, as well as with business partners, independent software vendors, consultants and systems integrators. During her career, she has worked in Europe, the Middle East and Africa for IBM voice products, in software development, system design, end-to-end solution design, project and team management. Living in Vence on the French Riviera, Murard enjoys outdoor sports like hiking, skiing and sailing. On a volunteer basis, she teaches project management at Nice University.



Gabriela Orwick
Executive Consultant,
M&A Integration
Hillsboro, Oregon, USA

Orwick partners with IT business development leaders with focus on acquisition integration strategy, cross-IBM synergies and the optimal approach to mitigate integration risk. Previously, as an M&A integration Project Manager in IBM Software Group, Orwick led diverse global teams to develop comprehensive plans and deliver successful integration of acquired companies. Orwick is a certified project management professional, has extensive experience leading complex projects and has earned the highest level – thought-leader – recognition in IBM's Managing Projects and Programs capability. In May 2011, Orwick had the privilege of serving as an IBM Corporate Services Corps volunteer, consulting with the Cebu City government in the Philippines on organizational design and revamping human resources programs, especially in recruiting and performance management practices. She thrives on applying her energy, focus, ideas and expertise to driving positive change, and making lasting business and community impact.



Christian Raetzsch
Systems and Technology Group
Technical Executive
Prague, Czech Republic

Raetzsch has more than 25 years experience in IT. Prior to joining IBM, Raetzsch worked with Austrian banks to develop and introduce software for personal and mobile computers and to provide advisory services to clients of these Austrian banks. Raetzsch started his career in IBM Austria as a sales representative, working with manufacturing clients, followed by leadership positions in IBM Services and IBM Systems Technology Group. Work assignments with IBM have included several international roles in mature markets like Germany, as well as in growth markets in central and eastern Europe, Russia, the Middle East, Egypt and Pakistan. Raetzsch was born in Austria in a small village in Tirol, an area famous for its beautiful landscape, mountains and skiing. He holds a degree in civil engineering from the Technical University in Graz, Austria, as well as a certificate in management from the Open University Business School, UK.

C. Reference customer portals and mobile clients around the world

- 1 Edelia project for EDF commerce, for both load shedding and consumer awareness and hints.
www.unebretagnedavance.fr/prod.html
- 2 GridPocket project with the involvement of university research department to make it happen.
www.gridpocket.com/Welcome.html
- 3 **Smart Grid initiatives around the world**
Smart Grid initiatives around the world are quite varied in approach, technologies and purpose. The focus of these initiatives differs according to the needs of utility, client and community. Consequently, no two implementations are alike. Furthermore, the roadmap to each individual Smart Grid initiative is also unique as it takes into account individual budget, timelines, systems, resources, and other business priorities.

4 Localization and island markets

From the localization perspective, Burlington can be seen as an (electrical) island. From this viewpoint, it is valuable to consider what other island markets are doing with respect to Smart Grid. Here is one example:

The island of Bornholm, off the coast of Denmark, is conducting a pilot to use renewables to power electric vehicles but is focused on maximizing wind energy. This is known as the EDISON project.
http://ec.europa.eu/enterprise/archives/e-business-watch/studies/case_studies/documents/Case%20Studies%202009/CS09_Energy2_Edison.pdf

D. Burlington, VT Climate Action Plan 2012

www.burlingtonvt.gov/CAP

Implement “PACE” program. The Property Assessed Clean Energy (PACE) program allows property owners to access long term municipal financing to make eligible energy efficiency and renewable energy improvements to their buildings. By opting into a special tax assessment district, property owners pay for these improvements via property taxes over a period up to twenty years.

Require new commercial construction to follow Core Performance guidelines. This proposed action would require new commercial construction to follow Core Performance guidelines, a program offered by BED, Efficiency Vermont, and Vermont Gas. Core Performance is a prescriptive guide to reduce energy use in commercial buildings by 20-30%.

Implement “Solar on Schools.” “Solar on Schools” is a proposal to put solar PV panels on the City of Burlington schools’ roofs. The panels on seven schools will be owned and operated by a private third-party development partner who can take advantage of federal and state tax credits, which the City cannot.

Implement deep energy efficiency program in government buildings. This action proposes to perform deep energy efficiency improvements in all municipal buildings. Deep energy retrofits are extensive renovations to existing structures that use the latest in energy-efficient materials and technologies and result in significant energy reductions.

Implement BED AMI program. BED is planning to install advanced meter infrastructure (AMI), commonly referred to as “Smart Meters.” AMI would replace all existing meters, provide data to BED and its customers in 15-minute intervals, and offer two-way communication. This better data will be combined with incentive(s), probably in the form of new, voluntary electric rates, to reduce peak electricity use, cost, and emissions.

Implement BED “Renewable Resource Rider” program. The proposed Renewable Energy Resource Rider (currently only includes solar) is a program to encourage residents and businesses to install solar PV panels. This is achieved through setting a predictable and stable rate above the retail cost of electricity, and therefore above the rate for standard net metered production.

Replace existing streetlights with LEDs. LED is currently a rapidly emerging technology that is still maturing. There are issues regarding LED light output for higher lumen requirement applications, high first cost and durability issues that need to be considered. This action proposes to replace all existing streetlights (approximately 4,200) in the City of Burlington with LEDs over a 10-year period at a cost estimate of \$1.49 per fixture as funding allows.

Implement McNeil district heating project. This proposed action is to use McNeil as a heat source for a district heating system that would improve McNeil’s efficiency, make use of some of its waste heat, and provide heat to consumers at a relatively low and predictable price.

Require new residential construction to be VESH qualified. This proposed action would require new residential construction to be Vermont Energy Star for Homes (VESH) qualified. Energy Star Homes are designed and built using best practices to save energy by reducing air leaks and thermal bypass, and by requiring high efficiency heating systems and appliances.

Implement a “Solar City” project on municipal buildings.

This action proposes to install solar photovoltaic panels on appropriate city-owned buildings with the goal of providing 1MW aggregate power and helping to minimize the occurrence of peak load.

Revise and implement Time of Sale ordinance. This action proposes to build upon the existing residential rental housing time of sale energy efficiency ordinance by applying it to all residential and commercial buildings. Furthermore, it proposes that, as a condition of sale, all buildings must receive an energy inspection and rating that is available to prospective buyers.

Create and implement Green Roof policy and incentive program. This proposed action would require that all new flat roofs at or under a 30 degree-pitch, both private and public, have to be vegetated. If old roofs have to be retrofitted, the building owner may be able to receive public financial support for a green roof.

Develop methane gas capture and CHP potential at City’s wastewater treatment facilities. This proposed action would fully develop the potential for capturing methane gas and generating electricity and/or heat from the City’s decentralized waste water treatment facilities.

Implement the Environmental Preferable Purchasing (EPP) Policy. The proposed action builds upon the City’s existing environmental purchasing policy, requiring that it be applied to all procurement decisions city-wide.

Increase the UTC. This proposed action would increase the urban tree canopy (UTC) by planting a total of 588 trees per year and by maintaining the existing urban tree canopy. This would be achieved both on public and private property.

Develop public-private partnerships and infrastructure for the processing, preserving, and storage of locally produced foods. This action proposes to develop public-private partnerships and infrastructure for the processing, preserving, and storage of locally produced foods.

Create and implement policy for raising non-domesticated animals in city neighborhoods and agricultural areas. This action proposes to create and implement a clear and consistent policy for raising non-domesticated animals, for egg, meat, and milk production, in city neighborhoods and urban agricultural areas.

Implement a digester for organic waste. The proposed digester system would take community organic waste and manure from local farms to process in a strategically located CHP facility. In addition to generating electricity and heat, this project would create a bi-product to be sold as bulk compost/soil amendment. Moreover, it would reduce GHG emissions by producing cleaner electricity and heat and from avoided landfill emissions.

Implement residential organics collection program. This proposed action would collect residential organic food waste (no yard waste) to be composted and will be modeled after the existing City residential recycling program, thus having a similar infrastructure and cost profile.

Implement residential PAYT program. This proposed action would change the current residential collection payment system to a system in which residents pay per unit of trash collected. Programs like these result in a decrease in solid waste, as well as overall cost savings to participants. The current physical collection system would remain the same.

Require recycling bins at all public facilities and events.

This proposed action would require that recycling bins are available and maintained at all public facilities and events.

Eliminate use of plastic bags in the City of Burlington for purchases. This proposed strategy would eliminate plastic bags by building on existing bring your own bag incentives. The action would require shoppers who don't bring their own totes to a store to pay a fee for plastic bags.

Consolidate trash haulers by neighborhood or district.

This action proposes to consolidate trash haulers by neighborhood or district, thereby limiting the number of trucks driving through the city, reducing vehicle miles and congestion, and improving air quality.

Require all construction and demolition projects to submit a waste management plan. This action proposes to require construction and demolition (C&D) projects to submit a waste management plan. Such a plan would include: waste recycling, salvage or reuse goals; estimated types and quantities of materials or waste generated from the project site; proposed and intended disposal methods for these materials; and detailed instructions for subcontractors and laborers on how to safely separate or collect the materials at the job site.

Reduce community VMT. This proposed action would reduce community VMT by 10% through a combination of travel substitutions (combining trips, telecommuting, walking and biking, ridesharing and carpooling, and using mass transit).

Implement government vehicle retirement and replacement program. This proposed action will result in retiring 5% of the government's vehicle fleet and replacing 25% of the gasoline-powered vehicles with hybrids. This action would retire twelve vehicles and replace 62 gas-powered vehicles with hybrids over a five-year period.

Implement government alternative commuting program.

This proposed action would reduce government employee commuting miles by encouraging employees to commute through emissions-free modes (telecommuting, walking, and biking), as well as less impactful modes (car pooling, ridesharing, and mass transit). It would also include incentives such as a parking cash-out program.

Reduce government VMT. This proposed action would reduce government VMT by 10% through a combination of travel substitutions (combining trips, video conferencing and conference calling, walking and biking, ridesharing and carpooling, and using mass transit).

Improve bicycle and pedestrian infrastructure.

The proposed action will build upon Complete Streets guidance integrating on-street bicycle and pedestrian facilities into all future infrastructure improvements to City streets.

Design and implement a new Citywide Bike/Ped Plan.

This proposed action would build upon the City's North/South Bike Plan by taking a more comprehensive look at the City's existing bike/ped infrastructure and designing and implementing necessary improvements.

Implement integrated transportation system

improvements. Building upon the City's Transportation Plan, this action proposes to implement several improvements of an integrated transportation system including the creation of a downtown transit center, Park and Ride and Auto Intercept lots to capture cars before they enter City neighborhoods, and increased frequency of transit in corridors servicing downtown and auto intercept facilities.

Create a downtown Transportation Management Association (TMA). This proposed action would develop a downtown transportation management association that plans, develops, and manages all employee transportation and parking programs, infrastructure, and related facilities. The goal of the TMA would be to offer and improve cost-effective and convenient alternative transportation services while simultaneously reducing travel demand and traffic congestion and improving air quality.

Implement government vehicle sharing/fleet management program. This proposed fleet (vehicle) management and vehicle sharing program will include vehicle acquisition, assignment and maintenance with a focus on cost-effectiveness and emissions reduction. This program will likely also include other functions, such as vehicle financing, vehicle telematics (tracking and diagnostics), driver management, speed management, fuel management, health and safety management, regulatory compliance, and validating green initiatives.

Develop infrastructure for fuel-efficient vehicles. This proposed action would develop infrastructure and incentives for fuel-efficient vehicles. This might include charging stations for electric and electric-hybrid vehicles and fueling stations for CNG and other alternative fuel vehicles.

Price on-street parking to maintain 85% on-street parking utilization. This transportation demand management action proposes to increase on-street parking rates to market-based rates and to maintain an 85% on-street parking utilization rate. This action will better relate parking supply with demand, increase the likelihood of available spaces, reduce traffic congestion, improve air quality, and increase revenues for the City.

Create a FT city/staff climate action planning position. This action proposes to create a dedicated staff position responsible for overseeing and managing the implementation of the City's climate action plan. This would include the creation of a system for measuring and managing performance and coordinating the involvement of municipal partners and community volunteers.

E. Burlington energy stakeholders

	Burlington, VT, at city level	
	Organization	Program/asset
Government	Office of the Mayor	Communications plan Budget/resources
	City Council	
	Chief Administrative Officer (CAO)	
	Community and Economic Development Office (CEDO)	
	Public Works	
	Parks and Recreation	
	Zoning and Planning	planBTV
	"Green Team"	Climate Action Plan
Utility	Burlington Electric Department (BED)	50% McNeil Generating Station Burlington PACE Program eMeter "Energy Engage" District Energy Study
Nonprofit	Campus Area Transportation Management Association (CATMA)	
	Howard Center	IBM Centennial Grant Recipient
	Greater Burlington Industrial Corporation (GBIC)	
Business	Burlington Business Association (BBA)	
	Church Street Marketplace	
Institutions	Burlington School District (BSD)	
	University of Vermont (UVM)	eMinder, Transportation Research Center (TRC)
	Champlain College	
	Fletcher Allen Health Care (FAHC)	
Community	Burlington District Energy System (BURDES)	
	Neighborhood Planning Assembly (NPA)	Ward Meetings

	Regional/state level	
	Organization	Program/asset
Government	State Legislature	
	Public Service Department	State Energy Plan
	Public Service Board	
	Chittenden County Transportation Authority (CCTA)	
	Center for Entrepreneurial & Technological Innovation (CETI)	Regional Solar Test Center (at IBM)
	Senate/Congress Federal Delegation	
Utility	Vermont Gas	Methane Digestion pilot (at Middlebury)
	Green Mountain Power	31% McNeil
	Vermont Electric Power Company (VELCO)	
	Vermont Public Power Supply Authority (VPPSA)	19% McNeil
Nonprofit	Vermont Energy Investment Corporation (VEIC)	Efficiency Vermont Renewable Energy Resource Center PACE GoVermont BERC DriveElectricVT
	Renewable Energy Vermont (REV)	
	Champlain Valley Office of Economic Opportunity (CVOEO)	
	Local Motion	
	CarShare	
Business	IBM Burlington	
	Lake Champlain Regional Chamber of Commerce	
	Vermont Businesses for Social Responsibility (VBSR)	Business Energy Action (BEA)
Institutions	Vermont Technical College (VTC)	IBM Centennial Grant Recipient
Community	350Vermont.org	

F. Additional resources for consideration

Programs and funding:

American Council for an Energy-Efficient Economy (ACEEE). <http://aceee.org/about>

Executive Summary: Tax Reforms to Advance Energy Efficiency February 2013.
<http://aceee.org/files/pdf/summary/e132-summary.pdf>

Executive Summary: Overcoming Market Barriers and Using Market Forces to Advance Energy Efficiency. March 2013.
<http://aceee.org/files/pdf/summary/e136-summary.pdf>

<http://aceee.org/energy-efficiency-links>

Energy Funding Opportunity.
<http://energy.gov/public-services/funding-opportunities>

Volunteerism:

AmeriCorps. <http://vtcnsc.vermont.gov/ameriCorps>

Community-University Partnerships & Service-Learning (CUPS). www.uvm.edu/~partners

Renewable energy and sustainability

curricula examples:

The Princeton Review's Guide to 322 Green Colleges, April 2011. www.princetonreview.com/green-guide.aspx

www.unr.edu/energy/curriculum/Renewable-Engineering.pdf

<http://civil.colorado.edu/~brandem/pub/ALOFinalReport.pdf>

<http://mwcc.edu/sustain/renewable-energy-curriculum-development>

G. Acronyms and abbreviations

Abbreviation/acronym	Meaning	Reference
AMI	Advanced Meter Infrastructure	
BBA	Burlington Business Association	www.bbavt.org
BEA	Business Energy Action	http://vbsr.org/business_energy_action
BED	Burlington Electric Department	www.burlingtonelectric.com
BERC	Biomass Energy Resource Center	www.biomasscenter.org
BHS	Burlington High School	http://bhs.bsdt.org
BSD	Burlington School District	www.bsdt.org
BTU	British Thermal Unit	
BURDES	Burlington District Energy System	www.burlingtondistrictenergy.org
CAO	Chief Administrative Officer	
CAP	Climate Action Plan	www.burlingtonvt.gov/CAP
CATMA	Campus Area Transportation Management Association	www.catmavt.org
CCRPC	Chittenden County Regional Planning Commission	www.ccrpcvt.org
CCTA	Chittenden County Transportation Authority	www.cctaride.org
GEDO	Community and Economic Development Office	www.burlingtonvt.gov/cedo
CETI	Center for Entrepreneurial & Technological Innovation	
C&D	Construction and Demolition	
CIS	Customer Information System	
CUPS	Community-University Partnerships & Service-Learning	www.uvm.edu/~partners
CVOEO	Champlain Valley Office of Economic Opportunity	www.cvoeo.org
DPW	Department of Public Works	www.burlingtonvt.gov/DPW
DSM	Demand Side Management	
E3	Energy Efficiency Engagement	
ECOS	Environment. Community. Opportunity. Sustainability.	http://ecosproject.com

Abbreviation/acronym	Meaning	Reference
EMS/DMS/GMS	Energy/Distribution/Generation Management System	
EPP	Environmental Preferable Purchasing	
EV	Electrical vehicle	
FAHC	Fletcher Allen Health Care	www.fletcherallen.org
FT or FTE	Full Time or Full Time Equivalent	
GBIC	Greater Burlington Industrial Corporation	www.gbicvt.org
GHG	Green House Gas	
GIS	Geographic Information System	
GMP	Green Mountain Power	www.greenmountainpower.com
GSF	Gross Square Footage	
HAN	Home Area Network	
IHD	In Home Display	
IT	Information Technology	
KPI	Key Performance Indicator	
KWH	Kilowatt Hour	
LCRCC	Lake Champlain Regional Chamber of Commerce	www.vermont.org
LED	Light-Emitting Diode	
NPA	Neighborhood Planning Assembly	www.burlingtonvt.gov/CEDO/Neighborhood-Services/Neighborhood-Planning-Assemblies
OMS	Outage Management System	
PACE	Property Assessed Clean Energy	www.veic.org/resourcelibrary/PACE.aspx
PAYT	Pay As You Throw	
PV	Photovoltaic	
REV	Renewable Energy Vermont	www.revermont.org
ROI	Return On Investment	
SCADA	Supervisory Control and Data Acquisition	

Abbreviation/acronym	Meaning	Reference
SCC	Smarter Cities Challenge	http://smartercitieschallenge.org
SGIG	Smart Grid Investment Grant	
SOV	Single Occupancy Vehicle	
tCO₂e	Tons of carbon dioxide equivalent	
TMA	Transportation Management Association	
TRC	Transportation Research Center	www.uvm.edu/~transctr
UVM	University of Vermont	www.uvm.edu
UTC	Urban Tree Canopy	
VBSR	Vermont Businesses for Social Responsibility	www.vbsr.org
VEE	Validation Estimation and Editing	
VEIC	Vermont Energy Investment Corporation	www.veic.org
VELCO	Vermont Electric Power Company	www.velco.com
VESH	Vermont Energy Star Homes	
VMT	Vehicle miles traveled	
VPPSA	Vermont Public Power Supply Authority	www.vppsa.com
VT	Vermont	
VTC	Vermont Technical College	www.vtc.edu
VtSBDC	Vermont Small Business Development Center	www.vtsbdc.org

H. Fast-start list for communication and marketing

- Set “Burlington – the green tech city” and **energy conservation as the key themes for the upcoming third annual hackathon** (<http://mywebgrocer.com/about/vt-hackathon>) in Burlington. Use anonymized aggregated data from the newly implemented BED Smart Grid.
- Reference 2012 South by Southwest (SXSW) Eco Hackathon <http://energy.gov/articles/open-data-winners-sxsw-eco-hackathon>, which had as its goal to invent usable technology products and mobile applications for smarter energy choices. Because this event had a particular focus on vehicle data, new products also could be used to improve safety and fuel efficiency. The winner developed an application – **HOMEee** – that helps homeowners track regular maintenance and opportunities for energy efficiency in a fun way, treating their home like a digital pet that gets happier as they make smarter energy choices.
- Partner with University of Vermont (UVM) Research to explore effective ways to gain actionable insight around **energy-efficient behavior and choices through social media and crowdsourcing**. Set up Twitter hashtags and start Facebook conversation topics to solicit a broader set of opinions, while ensuring focus and building momentum around the City’s green goals. Inform collateral and programs with insights and ideas from those social media forums to recognize the contribution and increase public buy-in. Host a “Jam” with targeted invitations and advertising at small businesses and community centers to promote wide participation, and publish the results in local media.
- Feature **success stories in energy usage reduction** like the Howard Center, and promote visible, attractive and regularly updated and distributed reports to demonstrate progress and focus on the largest impact actions. Publicly recognize/highlight local businesses or institutions that have taken effective steps to reduce their carbon footprint/GHG emissions and can share best practices.
- Make the **city a recognizable role model in energy efficiency action and impact**:
 - Launch a Mayor’s blog and/or newsletter featuring content around sustainability efforts, programs and progress
 - Conduct a city fleet evaluation and public sharing of decisions to replace sedans with electric and/or hybrid vehicles over x years, and report each time a positive impact change is made
 - Conduct city buildings energy audits (electric, natural gas/oil/propane, water) with a published progress meter for the biggest offender
 - Set up a friendly competition among departments to come up with ideas for using renewable energy solutions to demonstrate commitment to the State Energy Plan’s 2050 goal to source 90% of its energy from renewable sources
 - Incentivize and reward GHG reduction actions by directing savings back into green programs and initiatives
- Set up **challenges among City wards** to draw out the neighborhood’s creative ideas and bring focus on energy efficiency practical actions via a steady drumbeat. Use existing forums like monthly Neighborhood Planning Assembly meetings, Bagel Cafe Friday “Mayor chats,” or monthly Mayor’s 5:25 CCTV show. Select a winner quarterly and reward them with energy efficiency–geared resources, building a rich reference base – hopefully socioeconomically diverse and representing a cross section of Burlington.

- **Promote** BEA's small business challenge (http://vbsr.org/business_energy_action) and similar **state and national programs** to derive benefit for Burlingtonians from existing resources, and continually enforce Burlington's leadership brand and spur entrepreneurial ideas around efficient energy consumption actions and choices.
- Put **advertising on buses and public vehicles** both as an **education and finding source** for green programs. For example, display metrics related to GHG emission impact from single occupancy vehicles and compare with the opportunity to reduce it if using alternative options like public transportation, walking, biking or electric vehicle sharing (when available).
- Leverage and extend **existing discussions and events around Earth Day** in April:
 - Celebration and town meeting to facilitate an open dialog with the community
 - Survey for ideas
 - Waterfront event as a fund raiser and information sharing forum with vendors offering information
 - Declare a car-free day/week at the City, UVM
- Issue a **Mayor's challenge to schools** at all levels (BSD and higher education) to produce **videos, science projects and research papers** that would be featured at an annual event – for example, Earth Day, ECHO event, science fairs.
- Set up a **visible multimedia "green" section in the library** around what it means to be green every day and renewable energy sources. Put posters of Vermont's goal and Burlington's commitment.

Long term

- Design/focus on a **tourism campaign featuring Burlington as a premier "green tech" city destination for all seasons** – getting advertising sponsorship from known attractions (for example, Stowe is recognized as a "Certified Audubon Sustainable Destination" and for its "commitment to environmental stewardship") across Vermont – and staging demonstration sites and educational energy consumption/efficiency/renewables dashboards at popular destinations.
- **Stage exhibits and installations** in, for example, ECHO or City Hall Museum, in midterm, potentially leading to a central demonstration site and/or museum – on the waterfront – on Vermont and Burlington's economic progress and green energy successes in line with the overall "green tech city" brand.
- Research and create incentives to **attract nonprofits with renewable energy agenda, national/international recognition and grant/proposal writing expertise** to Burlington in order to add to the dynamic business and academic community and fortify the city's brand.

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www.buildingenergyvt.com
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<http://aceee.org/energy-efficiency-links>

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MAINE

Gulf
of
Maine

- Bangor
- Skowhegan
- Augusta
- Belfast
- Brunswick
- Portland
- Portsmouth
- Manchester
- Lowell
- Boston

Mount
Washington
1918

Laconia
Concord

Massachusetts Bay
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Saint John
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Grand Manan
Island

Yarm



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