6

Sustainable Renewable Energy: The Case of Burlington, Vermont

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Background

In the United States (US), public discourse supporting energy independence can be traced back to 1949 when for the first time in American history oil imports exceeded oil exports (US IEA 2012). In response, national policy quickly shifted toward increasing domestic oil and gas production (Green and Liu 2015), advancing energy efficiency (Dixon et al. 2010), and transitioning toward alternative and renewable energy sources (El-Ashry 2012). In the 1970s, energy independence rhetoric was reignited during the Organization of the Petroleum Exporting Countries (OPEC) oil embargo (Jacobs 2016). In addition to energy independence, transitioning to renewable energy has been heralded as the solution to avert the negative impacts from climate change since burning fossil fuels is the principal driver of climate change. In the US, burning fossil fuels represented approximately 82 percent of all greenhouse gas emissions (GHGs) in 2016 (US EPA 2017).

Even though the message of energy independency and climate change has been called for over the last 65 years, the shift toward renewable energy has not significantly increased. In 2016, the US still sources 80.7 percent of its energy from fossil fuels (US EIA 2017). Another 8.6 percent of energy is from nuclear, and only 10.4 percent is from renewable energy sources (US EIA

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R. Brinkmann, S. J. Garren (eds.), *The Palgrave Handbook of Sustainability*,
https://doi.org/10.1007/978-3-319-71389-2_6

2017). The reasons behind the ineffectual movement away from fossil fuels and toward renewable energy have been attributed to a number of economic factors, a lack of social acceptance, and a scarcity of political will (Abotah and Daim 2017). To add to these reasons, energy subsidies continue to favor fossil fuels even though "many subsidies serve almost no discernible public good – and in some ways – can do considerable bad" (Sovacool et al. 2014, 151).

The US does not have a far-reaching, comprehensive energy and climate plan but instead has a long history of siloed energy policy that mostly favors the continued use of fossil fuels. It is in this void of national policy that US state and local governments have taken the lead in promoting energy efficiency and renewable energy. State policies that promote renewable energy include providing public benefit funds, developing renewable portfolio standards (RPS), and providing tax incentives (Cheng and Yi 2017). An RPS is a statewide policy that requires a specific percentage of energy to be supplied by renewable resources, and to date, 29 states currently have an RPS (NCSL 2017). According to Vassar (2016), states that are affluent and have a high density of environmental groups and lack fossil fuel production are predictors of strong renewable energy policy. Two states that meet these criteria include California and New York, and it is no surprise that these states lead the country in energy policy. Each of these states has a long history of codified renewable energy and energy efficiency policies. For example, both states have a target to supply half of their electricity from renewable sources by 2030 (California Energy Commission 2017; New York State n.d.).

In addition to state governments, local governments have also become global leaders that have advanced aggressive policies aimed at transitioning municipalities to renewable energy and reduce GHG emissions. As of June 2017, 36 US cities have pledged to source 100 percent of electrical power from renewable energy, and five cities have already achieved this target (i.e., Aspen, Colorado; Burlington, Vermont; Greensburg, Kansas; Kodiak, Alaska; and Rock Port, Missouri) (Sierra Club 2017). With relatively little fanfare, Burlington, Vermont, became the first American city to source 100 percent of its electrical energy from renewable energy (Peters 2015). But it is worth noting that in 2008, Rock Port, Missouri, which had a population at the time of approximately 1000 people, became the first community to be powered 100 percent from wind (Science News 2008). If all 36 cities that have formally pledged to transition toward renewable energy achieve their goal, an additional 15 gigawatts (GWs) of new renewable energy would be added to the grid. In addition to the 36 cities, over 100 mayors have publicly supported the 100 percent goal through the 100+ mayors for clean energy initiative, and 1481 mayors have signed onto the US Conference of Mayors Compact to support reductions in GHG emissions. If all the cities in the compact take action, an additional 422 GWs of new renewable energy would be added to the US energy supply (Sierra Club 2017).

Many may know Burlington as the home of socially conscious Ben & Jerry's ice cream and the gateway to Vermont's expansive outdoor activities which is a 5.5 billion-dollar industry (OIA 2017). However, Burlington, Vermont's achievement as the first city to achieve 100 percent renewable electricity is the topic of this chapter. Along with its renewable energy success, its unique political composition, and a diversified energy portfolio (i.e., biomass, hydroelectricity, wind, and solar), this small city in the Green Mountain state offers many lessons to be learned as well as highlights a number of continued challenges as Burlington works toward its new ten-year goal of becoming a net zero city (BED 2016a). It is for these reasons that Burlington was chosen to be highlighted in this collection of case studies from around the world.

The Case of Burlington, Vermont

About Burlington, Vermont

The City of Burlington, Vermont, is located on the eastern shore of Lake Champlain near the Canadian border (Fig. 6.1). In 2016, Burlington's population was 42,260 (US Census 2016). Even with this relatively low population, Burlington is the most populated city in the state representing approximately seven percent of the state's population. The City of Burlington and neighboring City of South Burlington are the principal cities in the Burlington Metropolitan Area which encompass all of Chittenden, Franklin, and Grand Isle Counties (US Census 2010) (Fig. 6.1). The metropolitan area has a combined population of over 200,000 people which is roughly a third of the state's population of 624,594. The city is primarily Caucasian (i.e., 90 percent) with a population density of 1581.3 people per square kilometer (sqkm) which more closely mimics a suburban region than an urban city. As a comparison, the population density in New York City is 10,890 sqkm (US Census 2010).

Political Context

Burlington is known for its progressive politics with the iconic Bernie Sanders as its champion. Sanders was mayor from 1981 to 1989 and has been credited

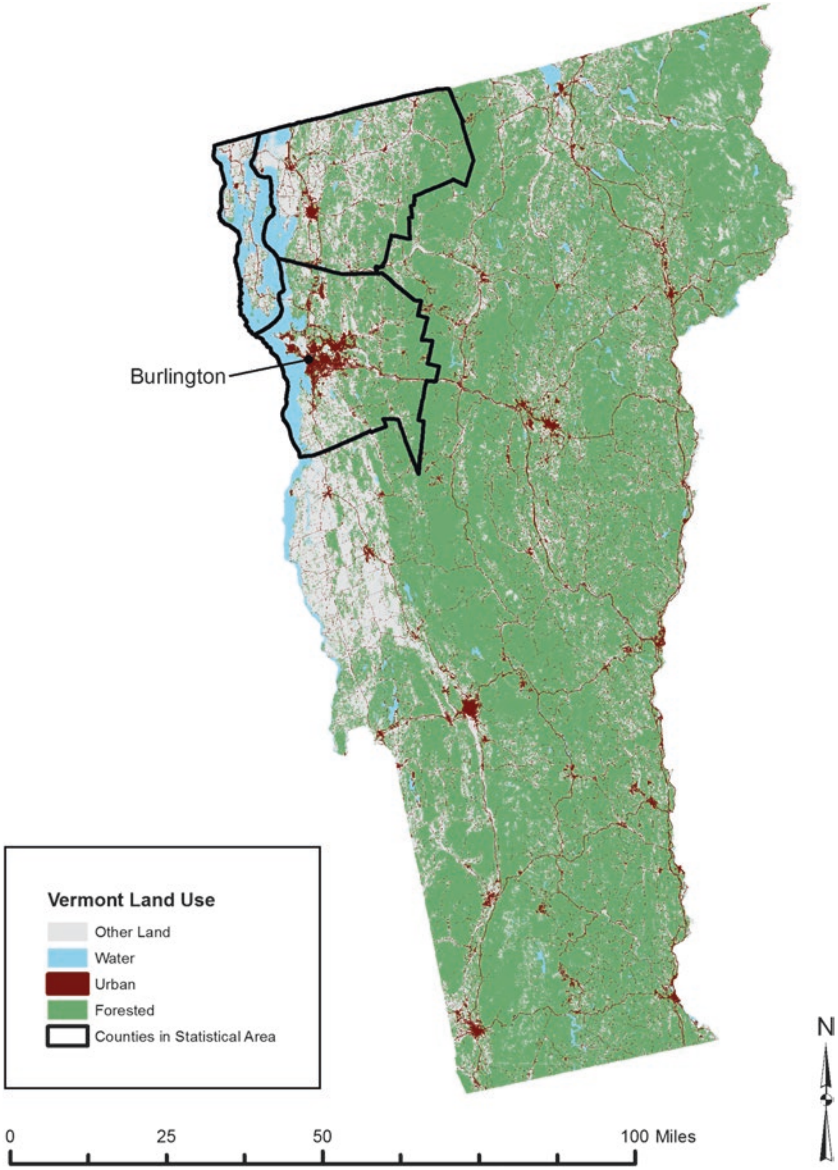

Fig. 6.1 Geographical context of Burlington, Vermont (Source: Land use data were reclassified from NLCD 2011, statistical area was obtained from US Census 2010.)

for turning Burlington into its thriving "hippie counterculture enclave" (Dreier and Clavel 2015, 1). Less mentioned are Sanders' achievements in transforming Burlington's energy system. It was under Mayor Sanders' leadership that led to the closure of Vermont's only coal power plant in 1984. While mayoral leaders after Sanders have been relatively more conservative, his progressive politics set the tone for future action toward the renewable energy transition. For example, it was under the leadership of the current mayor, Miro Weinberger, that Burlington achieved the notable 100 percent renewable electricity achievement. Mayor Weinberger continues to show leadership for energy and climate action and has joined other mayors to support the Paris Agreement after President Donald Trump withdrew from the commitments. He has stated publicly that he supports other state and local governments and organizations to achieve the Paris Agreement's goals and that "together we can and will do our part to save the planet" (Burlington 2017). In addition to the 100 percent achievement, the new ramped up goal of becoming a 100 net zero city within 10 years was advanced under Mayor Weinberger. To achieve this new goal, the following projects have been initiated in the city (from Burlington 2017):

- *Creating a multi-party Memorandum of Understanding for the purposes of exploring the feasibility of a District Energy System. Such as system would reduce the City's total carbon footprint by approximately by 20 percent.*
- *Launching the Energy Champ Challenge in the spring of 2015.*
- *Installing 13 electric vehicle (EV) charging stations, totaling 24 charging ports, in various city locations since 2013.*
- *Completing the first phase of the Waterfront Bike Path rehabilitation in January 2017, and breaking ground for the second phase in June 2017.*
- *Adopting the new Plan BTV Waal/Bike Master Plan in April 2017.*
- *Exploring an E-bus pilot program in April 2017.*
- *Launching a new Electric Vehicle rebate program in May 2017.*

Vermont's Energy Production and Consumption

Before examining how Burlington, Vermont, achieved 100 percent renewable electricity, a snapshot of both Vermont and Burlington's current energy picture is warranted. With a low population and low industrial activity, Vermont has the lowest energy consumption in total and per capita (US EIA 2017). Currently, Vermont does not produce any of its electricity from nuclear or fossil fuels, and production is primarily from renewable resources.

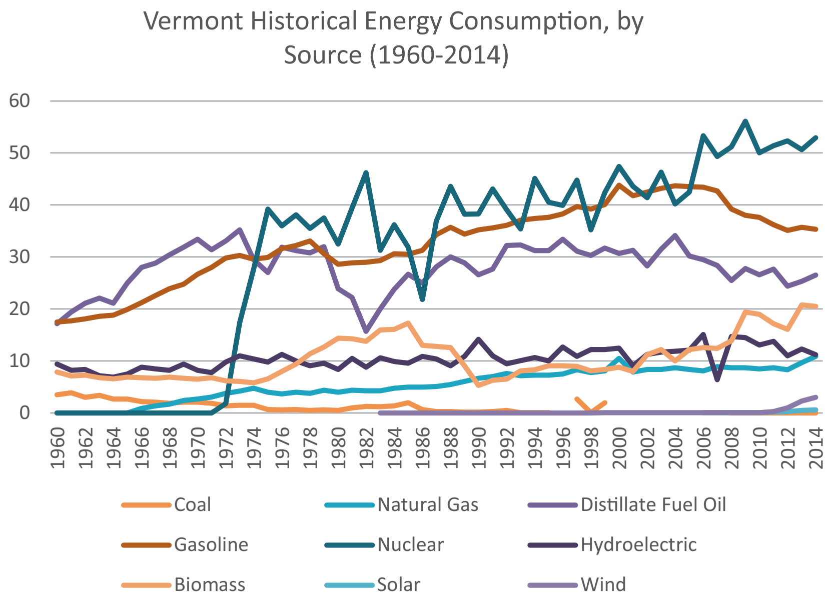

Fig. 6.2 Vermont's historical electricity consumption (1964–2014). Note that nuclear energy is the highest source in 2014. In 2015, this number went to zero. (Data obtained from US EIA 2017)

It is one of only two states that does not have an active coal plant (the other is Rhode Island). The only coal plant that was located in Vermont was in Burlington and operated from 1955 until 1984 when it was closed for good (BED 2016b). Vermont had one prior nuclear plant, Yankee Nuclear, that operated from 1972 until 2014 when it also was closed for good. At its peak, nuclear power supplied roughly one-third of the state's electrical consumption in 2014 (Fig. 6.2) (US EIA 2017). However, Vermont is rich in natural resources. Three-fourths of the state is forested (US EIA 2017), and the mountains and ample water supply make the state ideal for harnessing energy from running water and wind. Hydroelectricity represents approximately 51 percent of the state's electrical needs with most imported from Canada. There are also numerous smaller hydroelectric plants across the state. In 2016, wood and wood waste comprise approximately one-fourth of the state's electrical needs; four utility-scale wind farms make up 15 percent of the net electricity in the state; and, solar energy produced approximately four percent (US EIA 2017).

In contrast, Vermont's largest source of energy consumption is sourced from fossil fuels with 82 trillion British thermal units (TBTU) consumed

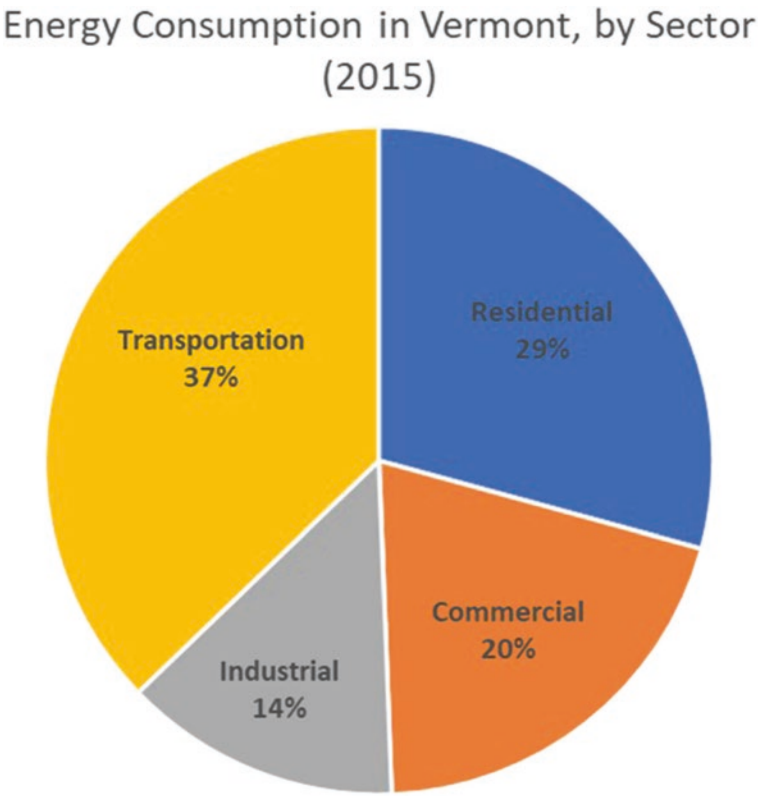

Fig. 6.3 End-use energy consumption in Vermont (Graphed using data obtained from US EIA 2017)

from petroleum and 12.2 TBTU from natural gas in 2015 (US EIA 2017). Renewables accounted for 32.2 TBTU which is roughly one-fifth of total energy consumption (Fig. 6.2). In Vermont, transportation consumes most energy (37 percent) with petroleum products comprising the majority energy source (Fig. 6.3). Residential energy consumption represents another 30 percent. In 2015, residential space heating was provided primarily from fuel oil (51 percent), followed by wood (18 percent), and wood pellets (12 percent) (Frederick and Jaramillo 2016). The use of propane and natural gas for space heating has been on the increase and using electricity for heating has decreased (Frederick and Jaramillo 2016). Natural gas is only provided in the northwestern part of the state through a pipeline from Canada. Very little electricity is used to heat buildings in Vermont. Thus, the transportation system and the heating of buildings remain dependent on fossil fuels.

Burlington, Vermont's Energy Supply

Since 2014, Burlington's energy mix has been comprised of renewable energy through a mix of owned and contracted energy sources presented in Table 6.1 and Fig. 6.4. The largest source of renewable electricity (41 percent in 2015) in Burlington is generated at the McNeil Generating Station which burns woody biomass (BED n.d.). Wood is transported to the facility mostly rail from harvested wood sourced within 60 miles of Burlington. One-third of the total energy source is provided from a number of owned and contracted hydroelectric plants, and approximately one-fifth is from two wind projects (Fig. 6.4). Solar energy is less than one percent, but investments in additional solar have been increasing in Burlington. A small amount (1.5 percent) of renewable energy was obtained through the Vermont Standard Offer which is a statewide mandatory program that requires utilities to purchase energy from small projects (e.g., hydroelectricity, biomass, farm methane, landfill methane, and solar).

Due to shortfalls caused by new renewable energy projects not completed on time, approximately nine percent of electricity was purchased through short-term contracts from ISO New England (ISO). ISO is an organization authorized in 1997 to provide reliable electricity specifically to six states (Connecticut, Rhode Island, Massachusetts, Vermont, New Hampshire, and the majority of Maine) (ISO n.d.). ISO maintains the electric grid in these states and supplies electricity to its member states through contracts. The residual fuel mix varies regularly. For example, at the time of this writing, natural gas comprises the majority of the fuel mix at 51 percent followed by nuclear, renewables, hydroelectricity, and coal (31, 10, 8, and <1 percent, respectively) (ISO n.d.).

How Burlington Achieved 100 Percent Renewable Electricity

The accomplishment of Burlington can be explained through a series of interdependent actions over the last several decades. As outlined in Table 6.2, electricity from biomass began in 1984 along with a number of long-term hydroelectric contracts providing additional supply. The remaining renewable sources were subsequently added to the portfolio with Georgia Mountain Wind in 2012 and Winooski One Hydroelectric Facility in 2014. Table 6.2 provides a chronological listing of key events that led to 100 percent renewable electricity. What follows is a list of key factors that made it possible:

Table 6.1 Burlington Electric Department (BED) electrical energy sources (2015)

Source	Resource (location)	Capacity (megawatts)	Energy (megawatt-hours)	Notes
Wood	McNeil (Burlington, Vermont)	25.0	145,180	BED is 50 percent owner and operator of this biomass plant.
Hydro	Winooski One (Vermont)	7.4	26,785	Winooski is a "run of the river" hydroelectric plant owned and operated by BED.
	NextEra Energy Power Marketing (Maine)	Varies	43,800	Contracted small-scale hydroelectric portfolio from three facilities in Maine through 2017.
	New York Power Authority (NYPA) (New York)	2.6	17,263	Hydroelectricity is contracted from two separate sources (Niagara and St. Lawrence) that expire in 2025 and 2017, respectively.
	Hydro-Quebec (Quebec, Canada)	5/9	4880	Hydroelectricity contract is for 5 MW beginning in 2015 and increasing to 9 MW in 2020. Contract is through 2035.
	VEPP Inc (Vermont)	2.2	7456	Hydroelectric contract that receives energy from Ryegate energy (beginning in 2012) and Bolton Falls and Newport Hydro (beginning in 2015).
Wind	Vermont Wind/Sheffield (Vermont)	16.0	35,006	BED receives 40 percent of the output (40 MW) through 2021.
	Georgia Mountain Community Wind (Vermont)	10.0	33,145	BED has 100 percent entitlement through 2037.
Solar	Burlington Solar (Vermont)	0.9	1117	BED is leasing the space for this fixed array is located at the airport through 2035.
Other	BED Gas Turbine (Oil) (Burlington)	22.0	217	This is a peaking unit owned and operated by BED.
	Vermont Standard Offer (Vermont)	4.4	5543	Through a statewide program, small-scale renewable energy from across the state.
	ISO New England Exchange—Net (New England grid)	n/a	33,337	Short-term purchases to make up for shortfalls. The energy source varies based on the New England residual mix which could contain electricity from natural gas, coal, or nuclear sources.
Total Energy Usage in 2015			**353,730**	

Source: BED website and IRP. https://www.burlingtonelectric.com/our-energy-portfolio

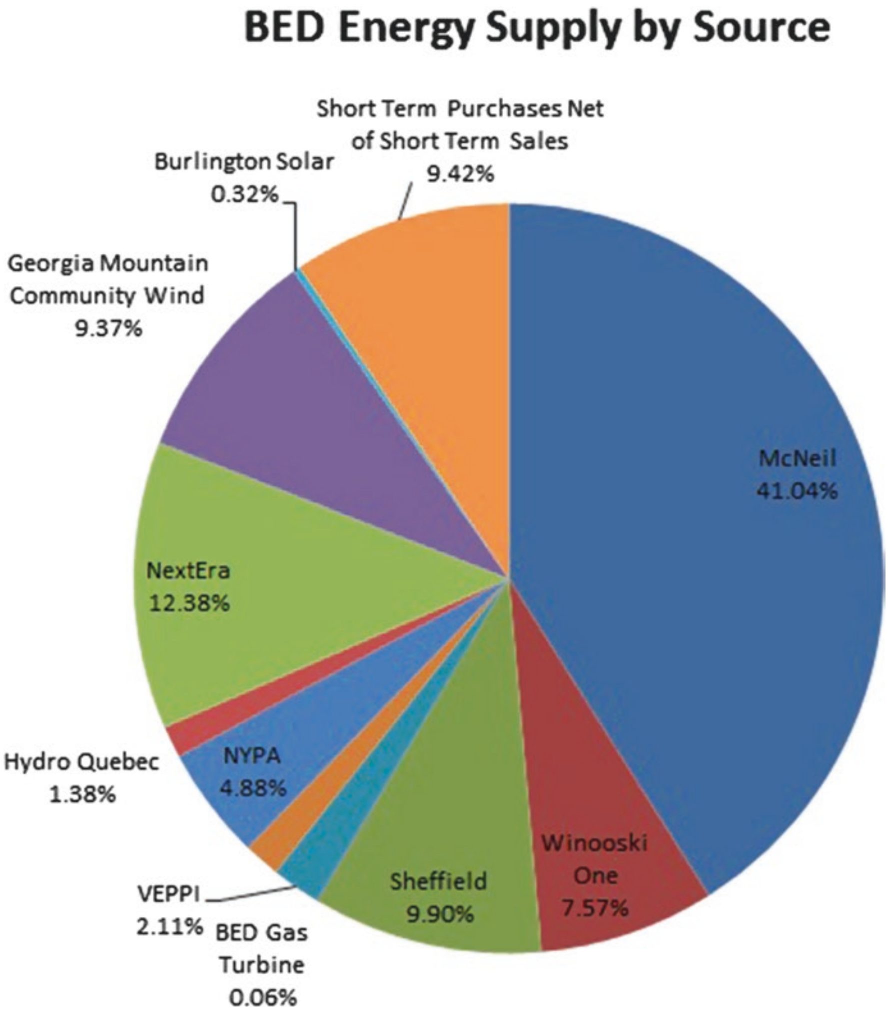

Fig. 6.4 Burlington Electric Department (BED) energy portfolio (Source: https://www.burlingtonelectric.com/our-energy-portfolio)

BED Is a Municipally Owned Utility

The first significant action was the creation of the municipally owned utility, Burlington Electric Department (BED) in 1905. This is significant because municipally operated utilities allow for the decoupling of service from profits which results in reduced rates for its customers. Municipally owned utilities have more flexibility and can be more innovative. In 2015, BED residential rates were lower than in 1990 (when adjusted for inflation) and are 9.4 per-

Table 6.2 Key events that led to 100 percent renewable energy in Burlington, Vermont

Year	Event	Description
1865	Burlington incorporates as a city	Burlington was settled in 1783 and became a town in 1785.
1905	Burlington Electric Department (BED) was established	BED is a municipally owned power which is significant in that electric rates can decouple revenues from sales.
1955	Moran Municipal Generating Station opened	30 MW coal-powered plant was opened to meet the needs of the community.
1970s	Energy Crisis (OPEC Oil Embargo)	The crisis began serious discussion on shifting toward renewable energy in the nation.
1977	Moran Municipal Generating Station retrofits completed	Beginning of renewable energy transition by converting one firing unit to burn wood. This transition was found to be less expensive than burning coal.
1984	McNeil Generating Station opened and the Moran Municipal Generating Station closed	The 30-MW McNeil Generating Station was opened to burn woody biomass and at the time could serve the needs of the community.
1998	Statewide Comprehensive Energy Plan (updated 2011 and 2016)	Among other things, the plan requires that utilities use least cost planning that not only includes financial costs but also environmental costs from energy production.
2000	Burlington Legacy Plan (updated 2013) and Climate Action Plan	The City of Burlington formalized a sustainability plan that was driven by stakeholder engagement.
2000	"Efficiency Vermont" Program Initiation	This statewide program mandates energy efficiency improvements in energy efficiency in all utilities in Vermont.
2005	Vermont joins Regional Greenhouse Gas Initiative (RGGI)	While this is a regional program, RGGI mandates reductions of greenhouse gases from electricity production and provides a market for low-carbon energy sources.
2008	McNeil Generating Plant Pollution Controls	These improvements allowed Class I RECs to be sold (i.e., REC arbitrage) and allowed no new rate hikes for the transition. Allowed quick payback on investment.
2012	Georgia Mountain Wind Farm	Provides 10 MW of energy solely to Burlington (added more to the portfolio).
2014	Vermont Yankee Nuclear Power Plant Closure	Created a need to replace nuclear energy.
2014	Purchase of Winooski Hydro plant	Significant because it brought the totals up to 100 percent renewable energy.
2015	Solar panel array installed at airport	While the capacity is relatively small, the project shows a commitment from the city in transitioning to renewable energy.

(*continued*)

Table 6.2 (continued)

Year	Event	Description
2015	Vermont Renewable Energy Standard (RES)	The RES calls for 55 percent from renewables and electrification of other fossil fuel sources beginning in 2017.
2016	"Net Zero Energy City" ten-year goal	Through the 20-year BED Integrated Resource Plan, this goal requires all of Burlington's energy needs to be met from renewable energy.

cent lower than the statewide average (BED 2016a, b). BED also has been operating its own energy efficiency programs since 1990 which BED boasts that their 20,000 customers use less electricity today per capita than they did in 1989 (BED 2016a, b).

Energy Efficiency in Burlington and Vermont Has Been a Goal Since the 1990s

Burlington has been implementing energy efficiency since its inception with a focus since 1990 (BED 2016a, b). In 1998, the state of Vermont was the first state to develop a statewide ratepayer energy efficiency utility, which is implemented through two utilities. BED is the utility that serves the Burlington area, and Efficiency Vermont serves the remainder of the state (Barbose et al. 2009). The statewide program codified energy efficiency and required utilities to adopt cost-effective programs and strengthen integrated resources plans (IRP) by requiring demand-side management (DSM) planning. In 2015, Efficiency Vermont saved 105,000 MW and $112 billion in total resource benefits (Vermont Public Service Board 2015). Success for energy-efficient utilities is evidenced by the fact that 35 states now have them (Barbose et al. 2009).

Vermont Has a Comprehensive Energy Plan Focused on Renewable Energy

Vermont developed a statewide Comprehensive Energy Plan (CEP) in 1998, which was subsequently updated in 2011 and again in 2016. The most recent CEP expanded on earlier plans and has set the following three overarching statewide goals:

- *Reduce total energy consumption* per capita *by 15 percent by 2025, and by more than one third by 2050.*
- *Meet 25 percent of the remaining energy need from renewable energy from renewable energy sources by 2025, 40 percent by 2035, and 90 percent by 2050.*
- *Three end-use sector goals for 2025: 10 percent renewable transportation, 30 percent renewable buildings, and 67 percent renewable electric power.*

The CEP is significant to utilities across the state since utilities must collectively implement programs to meet these targets. The CEP also requires that least cost planning include not only financial considerations but also the environmental costs of energy usage. In short, decision makers in Vermont utilities cannot legally ignore negative externalities which when considered make renewable energy more favorable to develop. Thus, utilities in the state are mandated to develop renewable resources as well as mitigate against environmental damage from any fuel use.

The State of Vermont Is a Member of the Regional Greenhouse Gas Initiative (RGGI)

The state of Vermont joined RGGI in 2005. RGGI is a regional pact between nine northeast states that have set a cap on carbon emissions from the electric sector. Each state implements the program through reducing GHG emissions and allocating the funds from reductions. Under RGGI, Vermont invests its allowances primarily on energy efficiency with the proceeds funding Efficiency Vermont and BED efficiency programs. Specifically, these funds support Energy Star® and other efficiency programs in businesses and low-income communities. Through participating in RGGI and from statewide energy regulation, Vermont ranked in fourth place according to the American Council for an Energy-Efficient Economy (ACEEE) (ACEEE n.d.).

BED Is Innovative Through the Use of the Renewable Energy Credit (REC) Market

Likely the most controversial of the reasons for Burlington's success is through innovative financial investments through the renewable energy credit (REC) market. An REC represents a megawatt of power generated through renewable energy and includes the "property rights to the environmental, social, and other non-power attributes of renewable electricity generation" (EPA 2017). The REC market is managed through the New England Power Pool Generation Information System (NEPOOL GIS) which regulates the states in the ISO network (NEPOOL GIS n.d.). Each state sets up rules for the management of RECs, and Vermont has rules that allows for unbundling RECs from the electric output which allows RECs to be sold anywhere, and once the REC have been sold, they are considered retired and cannot be sold again (REV 2016).

To explain how RECs helped Burlington reach its 100 percent goal, we need to go back to 1977 when in response to the oil crisis a woody biomass boiler was retrofitted at the Moran Municipal Generating Station. It was found that the operating costs from burning wood were less expensive than burning coal. In 1984, the coal plant was closed and the wood burning McNeil Generating Station was opened to take its place, thereby ending the state's commitment to coal. In 2008, strict pollution controls were installed at the plant which allowed the Class I RECs to be sold from this plant. Here is where the innovation arises. BED then began selling Class I RECs and with the proceeds bought Class II RECs in return. Since Class I RECs are worth more than Class II RECs, this allowed excess funds to be used to repay the upgrades in the plant. After the return on investment was achieved, the excess funds were used to develop additional renewable energy capacity and are one of the reasons that have electric rates remained low. In fact, the rates in BED service area have not been raised since 2009 when this financial investment was implemented.

Burlington Has Engaged Stakeholders

The engaged population of Burlington is another reason for the success. Many of the key events were passed by voters (i.e., purchasing the biomass and hydroelectric plants and investing in pollution controls at McNeil). The city also engaged its stakeholders in the development of its first sustainability plan in 2000, called the Legacy Plan as well as a comprehensive Climate Action Plan in the same year (Burlington 2000a, b).

Burlington and Vermont Geography Are Conducive for Renewable Energy

Another reason can be attributed to geography. Vermont is three-fourths forested and has vast resources of available wood products. The region is also blessed with mountains and water resources that allow for the development of hydroelectricity in the region and through long-term contracts with neighboring Canada and other New England states.

Lessons Learned

Many have questioned whether the success in Burlington, Vermont, could be scaled to larger municipalities given that Vermont has a small population that is rich in wood, wind, and water. From personnel communications, with Mayor Weinberger and the BED employees, the following list provides some key lessons learned and strategies that can be applied at other locations:

- Political will may be the most important factor in attempting to solve a difficult societal problem like addressing climate change. Burlington's political figures, municipal workers, and residents have been leading the way for decades. The Burlington case shows that dedicated and persistent leadership can actually affect change.
- Having a publicly owned utility is instrumental in achieving the target since BED is not beholden to shareholders but rather to its ratepayers. While shifting the ownership of electric companies across the nation may not be feasible, enacting policies that decouple service from profits may result in a faster transition toward renewable energy.
- Energy efficiency needs to be the first line of attack. If it were not for energy efficiency programs, Burlington would not have been able to achieve the 100 percent renewable power target. Thus, the model of a statewide energy efficiency utility and a focus on energy efficiency programs will lessen the need for additional power generation.
- Burlington was able to use innovative policy instruments, namely, RECs, to fund additional renewable energy projects while keeping rates low.

Challenges and Barriers

While the achievements of Burlington should be celebrated, there are some challenges and barriers to consider as Burlington moves to the next challenge of becoming a net zero city. The first is that the majority of energy consumption in the city and state are from transportation and residential heating which relies heavily on fossil fuels. Burlington is addressing this challenge through targeted initiatives such as installing electric vehicle (EV) recharging stations and a rebate program for EVs. For heating, the trend has been to replace fuel oil with wood; however, natural gas and propane have also been on the increase (as discussed above). Fuel oil, natural gas, and propane have long been used for heating, and changing the systems out with renewable resources may take time to transition. For example, the only natural gas utility in the state, Vermont Gas, acknowledges the renewable energy goals of the state and the net zero goal of Burlington in its 2016 IRP but states that changes in expansion have not been considered at this time and is expanding service into five additional communities (Vermont Gas 2017).

Another challenge not specific to Burlington but absolutely applicable is the lack of infrastructure to support distributed renewable energy systems. This challenge includes finding funds to build new transmission lines to connect to the grid. In addition, the development of new permitting systems and standards is in a nascent stage, and workers must be trained to operationalize new renewable energy systems. These challenges are slowly being overcome, and Vermont has been leading the way. For example, Vermont was the first state to establish a feed-in tariff which incentivizes small-scale distributed energy systems by lowering the price of electricity (Sovacool et al. 2014). Green Mountain Power, the state's only investor-owned electric utility, was the first utility to team with Tesla to install 500 Powerwall systems to store the energy generated from solar panels (NBC News 2016).

Lastly and likely the most important challenge to a full transition to renewable energy is the uncertain and ever-changing nature of federal and state energy policy. Some analysts feel that federal preemption of state clean energy policies is on the horizon (Stronberg 2017); however, it is unclear if such an initiative would stand up in court. Federal policies that promote fossil fuels are more likely to thwart progress on developing renewables. The Trump administration's energy policy is devoid of a clear expansion of renewables and is strongly supportive of continued fossil fuel usage. Namely, Trump's policy is to reverse the Clean Power Plan, to clear roadblocks for the Keystone XL Pipeline, and to reduce regulations that harm the coal industry (White House 2017). Based on analysis from the Obama administration, the estimated subsidies allocated to US oil companies add up to over four billion dollars a year (McDonnell 2017). Variability within state energy policies can be uncertain as states and utilities look to add more renewable energy to their portfolio. For example, all states in New England have some form of an RPS; however, the markets are not uniform across each state. For example, RECs from biomass qualify in Maine, but not in Massachusetts, and Vermont allows for large-scale hydroelectricity where other states do not (Gerwatowski 2016). Another clear point is that the markets are complex and not explicitly transparent with concerns over double counting leading the critiques of the REC market. However, state renewable energy policy shows no sign of slowing, and the REC market has been pointed to as a primary driver in advancing renewable energies (Gerwatowski 2016).

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