

Whitepaper: Modernizing Charlotte Energy (Draft Version 6/8/2025)

Transitioning to Clean Energy for a Sustainable Future

This whitepaper provides an overview of Charlotte's efforts to modernize its energy systems, focusing on financial considerations, available incentives, aesthetic planning, regulatory processes, alignment with Town goals, environmental benefits, and potential impacts on the Town's image. The project aims for a fiscally responsible and environmentally friendly approach to lower Charlotte's energy costs and reduce its carbon footprint.

The project strategy modelled was to evaluate the energy mix of all town buildings for which the town pays the energy bills, and determine whether there are savings in either the sourcing of the energy used, and/or creating efficiencies in the equipment being powered by the energy source. This evaluation happened in the context of a moving regulatory and technical environment and is subject to change and limitations. While they are all factored into the financial model, the details of each are beyond the scope of this document.

The resulting solution is comprised of up to four 15KW solar systems placed in the rear of town properties, virtually net metered, to supply the remaining electricity needs of the town not met by the garage. In addition, this project solution will run electric heat pumps as a primary heating and cooling system, similar to what has been done in the library. When applicable, older systems will be left as backup, thus extending their life.

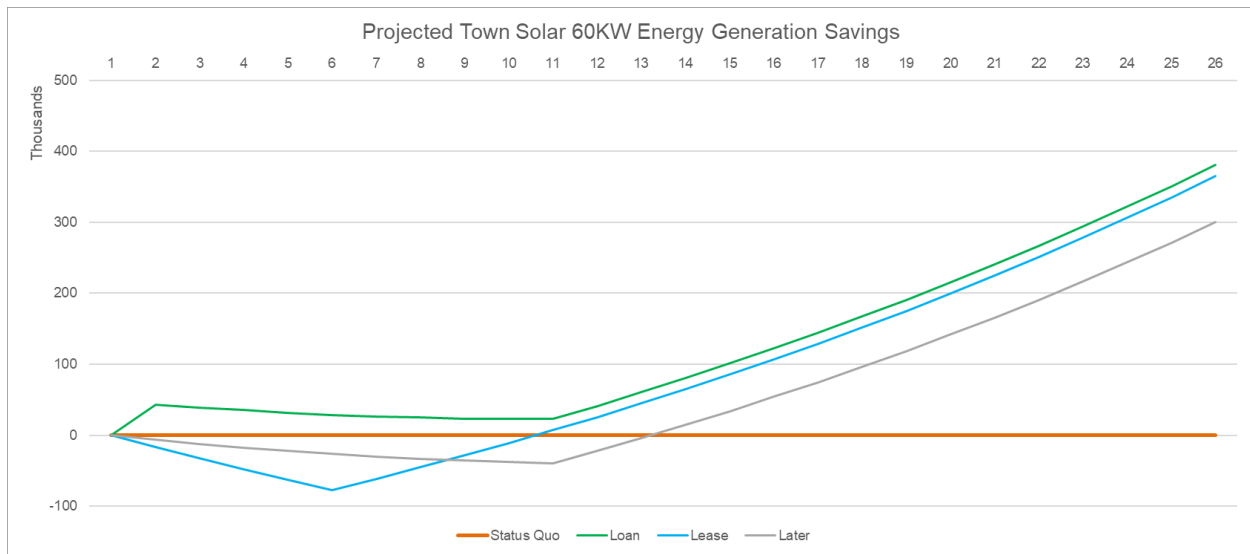
1. Financial Costs, Benefits, and Cash Flow

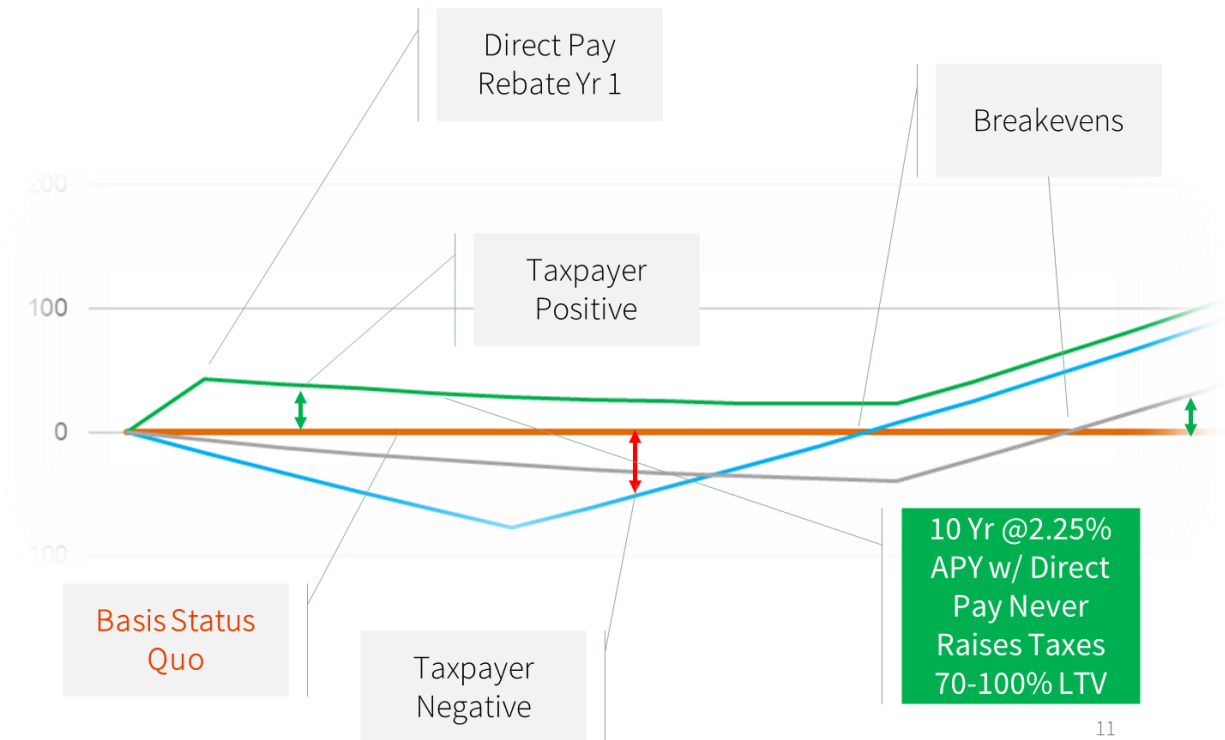
Charlotte's current energy infrastructure is heavily reliant on oil for heating, with fuel and electricity being imported, volatile in cost, and subject to state and federal policies. Over the next 25 years, based on the status quo, Charlotte taxpayers are projected to spend \$631,000 on fossil fuel costs (assuming 4% energy inflation) and \$175,000 on electricity costs (above and beyond the town solar garage). This status quo also results in emitting 2.3 million lbs of carbon and polluting particulate into the immediate environment over 25 years.

The Energy Modernization project aims to stabilize and lower the cost of energy to the Town and source as much of its own energy as possible, using savings for self-sourcing electricity to upgrade equipment. The project modeled 25-year savings compared to the status quo under different scenarios for adopting solar-enabled heating and cooling solutions. These included models of lease to own, direct funding, green loan, and replacing status quo as current infrastructure fails. This paper primarily addresses the Green Loan scenario because of its simplicity, minimal impact to taxpayer, and extremely attractive rates:

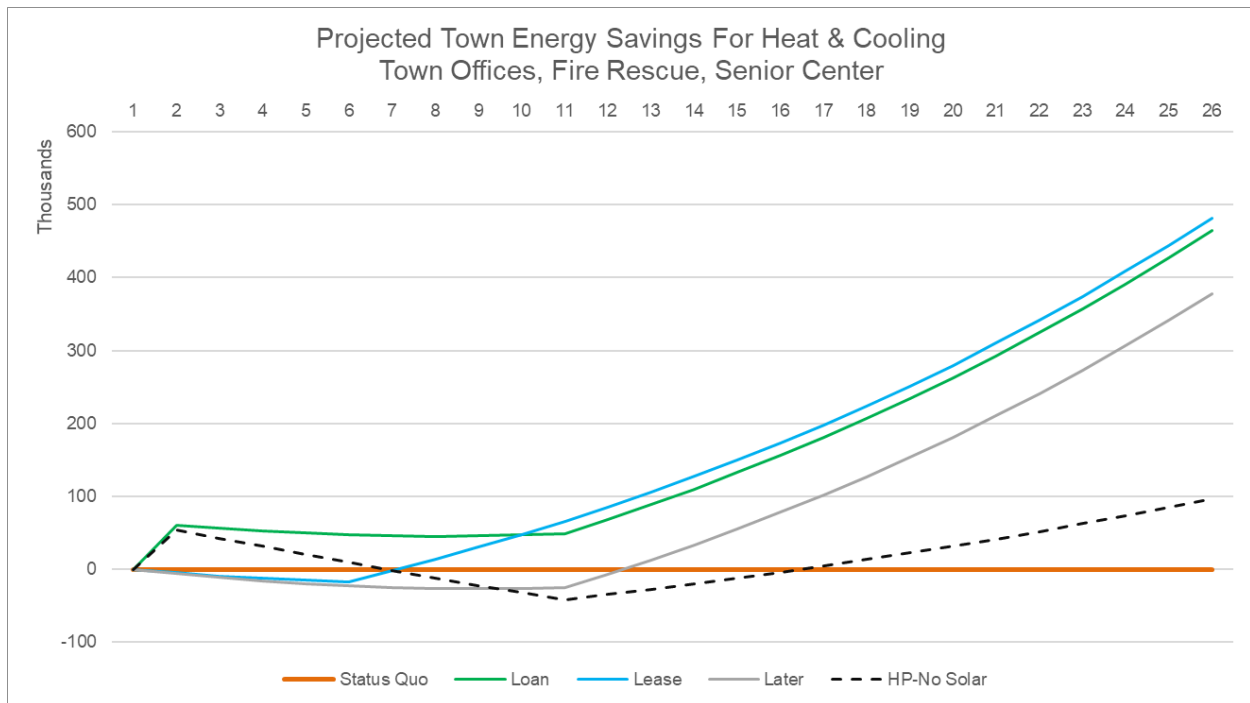
Solar Savings¹: Adding 60 kW of solar capacity is projected to yield 25-year savings compared to the status quo of

- Using a Green Loan at 2.25% APR and federal and state incentives generates \$380,000 savings. The breakeven point happens in the first year if incentives are reimbursed in the same fiscal year and there is no negative taxpayer impact, or
- Using a Green Loan at 2.25% APR with NO federal incentives (implementing after congress repeals Biden Era incentives) \$292,000 savings with a breakeven in year 13, thus requiring a slight near term tax increase to attain long term gain.



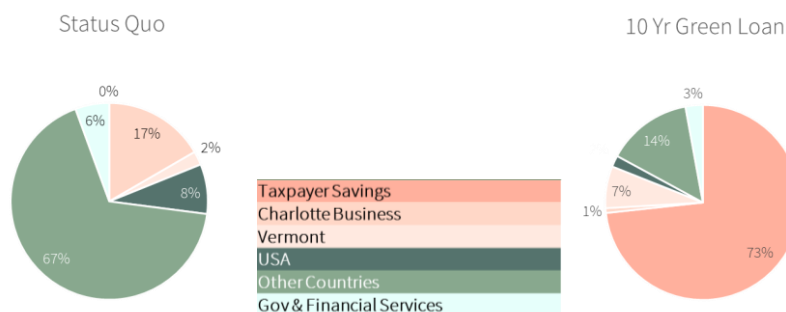


HVAC Savings: Using 44 kW of new capacity to drive HVAC efficiency (likely through heat pumps) is projected to yield 25-year savings of \$378,000 compared to the status quo of heating fuel and inefficient AC. With a Green Loan and incentive, this increases to \$464,000. Similar to Solar investment, the impact to the taxpayer says positive immediately if all incentives are acquired. Otherwise if the project is executed without incentives, the long term still remains positive for the taxpayer, but the short-term requires a slightly negative investment to realize gains starting in year 12.



Combined Savings: The combined 25-year savings of self-sourcing the town’s electrical needs in combination with new HVAC heat pumps instead of furnaces are projected to be to \$563,000 with a Green Loan and incentives. Delaying the project and not taking advantage of incentive yields \$457,000 vs the status quo. Additionally, it is important to consider the town will incur replacement costs not yet in the town budget under the status quo.

These projected savings highlight the potential financial benefits of transitioning to cleaner energy sources and improving energy efficiency. The project aims to minimize taxpayer impact, with scenarios like the 10-Year Green Loan with incentives showing a taxpayer-positive outcome. Transitioning also helps shift where energy money goes, potentially benefiting taxpayers, domestic businesses, and the environment compared to the status quo where more than 67% of Charlotte town energy spend goes to foreign entities.



2. Incentives Available for Equipment and Installation

A key objective of the Energy Modernization project is to take advantage of available incentives. Various federal and state programs offer financial assistance for energy efficiency and renewable energy projects in Vermont.

Federal Incentives: The Inflation Reduction Act (IRA) of 2022 is highlighted as the most significant energy and environmental investment in the country's history, offering incentives such as tax credits and rebates for switching to electric HVAC and installing solar and clean energy systems. There is a 30% credit for solar installation for municipalities using “Elective Pay” or “Direct Pay” which enables the Town to get the credit as if it paid federal taxes. For this project, it is estimated to be \$43,800 that can be used to cushion taxpayer impact on upfront project costs. For heat pump installation, the IRA offers homeowners a tax credit of up to \$2,000 per unit. There is also a federal tax credit of up to \$2,000 for heat pump installation generally.

IRA Elective Pay: Applicable entities, including states and political subdivisions like local governments, can use the IRA's elective pay option to benefit from certain clean energy tax credits. This means a local government making a qualifying clean energy investment can claim the full value of the tax credit as a refund on its annual tax return, even if it doesn't owe other federal income tax. This requires identifying the qualifying project, determining the tax year, and ensuring the applicable property is placed in service before registration.

State & Utility Incentives: Vermont has various statewide and regional programs. For the combined project, these incentives are expected to be \$21,950 in addition to the IRA incentives

Other Timely Financial Factors: The Vermont Public Utility Commission, among other things, determine the credit rate for feeding a surplus energy unit back to the grid, and the rate for drawing electric energy from the grid when the array is not producing. This is called net metering and the rate for the town garage is 0.18398 / kwh, and future rates are 0.16398 / kwh are anticipated to drop further with more adoption throughout the state. This net metering has changed for any new system as of 8/1/2024, unless grandfathered by a certificate of public good (CPG), wherein any new project needs to generate its first kwh to the grid by January 2026. The Charlotte Energy Committee met the deadline for applying under the grandfathered rules which in turn creates an 11% incentive to get the project online before the permit expires and the less favorable rates apply.

3. Aesthetic Considerations for Each Property

Charlotte values its rural character, scenic views, and dark night sky. The Energy Modernization project acknowledges the importance of aesthetic balance and visual impact when siting new energy installations, particularly renewable energy equipment.

Key considerations include:

Town Plan Policies: Development, including energy generation and transmission facilities, should be sited and designed consistent with Charlotte's traditional settlement pattern and avoid undue adverse visual impacts to scenic resources and cultural Areas of High Public Value (AHPVs), such as scenic views and vistas.

Mitigation Strategies: Screening, buffer areas, and/or landscaping may be considered to minimize visual impacts of development. 5 specific Town-owned lands are being analyzed for potential renewable energy generation projects, with factors related to aesthetic concerns included in this analysis. They include:

- Town Hall
- Fire & Rescue
- Senior Center
- Town Garage
- Thompsons Point Wastewater Treatment (Optional)

Siting Preferences: Per the Town Plan, The Town will actively encourage and support renewable energy development that complements the working landscape and avoids undue adverse impacts to viewsheds and AHPVs.

Identified town properties are being evaluated for solar installations, with consideration given to visual impact and best use. Aesthetic choices for array types (Tracking, Ground Mount, Roof Mount) are part of this consideration. While potential locations are being assessed, no final decisions are made, pending cost/performance analysis and aesthetic review. In general however, where possible and functionally feasible, roof mounted is preferred. Both tracking and ground mount pose similar visual drawbacks, and are typically driven by the cost difference vs the use of the adjacent land.

4. CPGs Filed and Associated Constraints

Certificates of Public Good (CPGs) are required for the siting of electric infrastructure, and the Public Utility Commission (PUC) regulates these projects. To minimize costs and utilize virtual net metering, CPGs have been filed for 5 of 7 town properties that have access to the grid.

- 3630 ETHAN ALLEN HIGHWAY, Charlotte, VT - The Town Garage has a 100kW AC rooftop PV system installed in April 2024. It is a Group Net Metered system. CPG: 22-3844-NMR
 - 159 Ferry Rd., Charlotte, VT is currently a member of the above Group Net Metered system.
 - 115 Ferry Rd., Charlotte, VT is currently a member of the above Group Net Metered system.
 - 212 Ferry Rd., Charlotte, VT is currently a member of the above Group Net Metered system.
 - 170 Ferry Rd., Charlotte, VT is currently a member of the above Group Net Metered system.
- Given that the generation from 3630 Ethan Allen Highway facility does not meet the consumption from the members of the net metering group, The Town would like to expand it's generation capability as follows:
 - 1. CPG: 24-XXXX-NMR (Town Hall)- add this installation to the group.
 - 2. CPG: 24-XXXX-NMR (Sr Center)- add this installation to the group.
 - 3. CPG: 24-XXXX-NMR (CFRS) - add this installation to the group.
 - 4. CPG: 24-XXXX-NMR (Town Garage) - add this installation to the group.
 - 5. CPG: 24-XXXX-NMR (Greenbush Rd access)- add this installation to the group.
 - 6. Add the CPG: 24-XXXX-NMR a 2-axis ground mount already deemed approved 22-3844-NMR system behind the meter.

100 Association Way, Charlotte, VT is not a member of the above Group Net Metered system.

Substantial Deference: Under Act 174 of 2016, if a municipal energy plan meets specific standards and receives an affirmative determination of energy compliance, it gains "substantial deference" in PUC proceedings regarding the orderly development criterion. This means a land conservation measure or specific policy in the plan will be applied unless there is a clear and convincing demonstration that other state-wide factors outweigh it. Charlotte intends to seek such certification.

Development Restrictions/Constraints: Energy generation and transmission facilities are considered "Development" and must comply with development restrictions, particularly those related to Areas of High Public Value (AHPVs). Certain AHPVs like conserved land, surface waters, wetlands, and their associated buffers are generally prohibited from development. Other AHPVs and State Known and Possible Constraints (including

agricultural soils, steep slopes, flood hazard areas, wildlife habitat, source protection areas, historic/cultural resources, and scenic views) will be avoided.

Regulatory Process: The Town aims for early involvement in the planning/permitting process for renewable energy projects. The Planning Commission and Selectboard will assess impacts to AHPVs from proposed energy projects and participate in PUC proceedings if warranted. Sites planned for energy development shall be shown on site development.

Specific PUC rate changes and virtual net metering rules are subject to grandfathering provisions that impact the financial timing of projects.

5. Relevant Town Plan Goals Addressed

The Charlotte Town Plan serves as the principal policy statement, guiding decisions and actions to achieve the Town's vision. The Energy Modernization project directly addresses several key goals and objectives outlined in the Plan:

Energy Goals: The Plan explicitly seeks to minimize energy use and greenhouse gas emissions, ensure a secure energy future through conservation, efficiency, and renewable energy, and sets ambitious goals for renewable energy use (25% by 2025, 40% by 2035, 90% by 2050) and reducing consumption per capita. The project supports meeting the municipal renewable energy generation targets (additional 6,731 MWh to 15,214 MWh by 2050).

Fiscal Responsibility: The project aims to plan for and prioritize capital improvements consistent with the Town's fiscal ability by stabilizing and lowering energy costs and using savings for upgrades. Insofar as possible, if the energy modernization project is executed with current incentives, it is fiscally possible to have no negative impact on taxpayers.

Environmental Protection: The project aligns with the goal to maintain and enhance natural features with high public value by reducing carbon emissions and contributing to cleaner air. This project estimated 2.3 million pounds of carbon will not be released if implemented.

Utilities, Facilities, & Services: The project supports planning for and providing necessary public facilities and services efficiently and cost-effectively by modernizing aging heating/cooling equipment in Town buildings and providing energy for municipal facilities.

Economic Development: By reducing energy costs and potentially creating opportunities in the renewable energy sector, the project supports environmentally-sound rural and small business enterprises and seeks to attract working-age residents.

Community Well-being: The project promotes energy efficiency efforts for existing town buildings and create zones of higher air quality and heat and cold relief and resiliency.

6. Environmental Benefit

The primary environmental benefit of the Energy Modernization project is the reduction of fossil fuel use and associated greenhouse gas emissions.

Reducing Carbon Footprint: The project is explicitly aimed at reducing Charlotte's carbon footprint and greenhouse gas emissions. The status quo is estimated to result in 2.3 million lbs of carbon and polluting particulate emissions over 25 years.

Improved Air Quality: Improving air quality in town buildings is an objective, and reducing fossil fuel combustion generally contributes to better air quality. Replacing gas boilers with heat pumps has been shown to reduce air pollution.

Energy Efficiency Impacts: Energy efficiency and conservation efforts, such as weatherization, have a dramatic impact on reducing fuel consumption. Weatherization shall be considered as part of project where applicable.

7. Town Brand Benefits for Forward Thinking

Embracing energy modernization positions Charlotte as a forward-thinking community aligned with state goals and national imperative towards clean energy.

Alignment with Community Values: The project reflects the strong community value placed on the environment, sustainability, and preserving the rural character and quality of life. It supports environmentally-sound enterprises and addresses the challenge of climate change through investments.

Leading By Example: The design choices of this project largely undergo the same considerations a residence may go through. Sharing the approach, benefits, incentive information, and general learnings, may encourage residents to engage on similar projects within their property.

Contributing to State Goals: By working towards the state's ambitious energy goals (e.g., 90% renewable by 2050) Charlotte demonstrates its commitment to broader environmental objectives.

Community Engagement: The planning process has involved citizen volunteers and committees, reflecting a long tradition of active participation in local government and community activities⁹²¹⁰⁸. Continued public education on energy matters⁷¹⁹¹ fosters community pride and cohesion¹⁰³.

By successfully implementing energy modernization, Charlotte reinforces its identity as a community that values its environment, plans responsibly for the future, and actively works towards sustainability goals, potentially enhancing its appeal as a place to live and do business.

i Assumptions

Cost and Credits	Input
Gross System Cost	\$146,000
30% Fed ITC	\$43,800
State Incentive	\$7,500
GMP Rebate	\$14,450
Net System Cost	\$80,250
120 Monthly Payments	(\$1,315.79)
LTV	70.0%
Interest Rate	2.250%
Project Fee	\$10,000
Total Interest	\$ (11,894.78)
Lease Buyout (if appl)	55.00%
NEW kWhs Per Year	-55,348
OLD kWhs Per Year	-11,070
Current Utility Rate	\$0.220
PV Rate	
Electric Rate Inflation	4.00%
OLD Fuel Use per Year	\$15,969
Percentage Fuel Backup Needed	5.00%
NEW Fuel Use per Year \$	\$798
Fuel Rate Inflation	4.0%

* Going Solar freezes Elec. rate at avg kwh over 25 y

