Modernizing Charlotte Energy:
Transitioning to Clean Energy for a Sustainable Future

Charlotte Energy Modernization Project Power Learning Session #1

101 – The Basics

presented by

Charlotte Energy and Climate Action Committee (CECAC)

and

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Fiscally Responsible Approach

"How can the Town reduce energy costs while minimizing taxpayer and environmental impact?"

Why Are We Talking About This Now?

June 2024 legislation changed the economics of solar implementations

Federal incentives are available for now but are being targeted for elimination July 2025

Commitment to town plan energy goals require more immediate action

Lake Champlain is stressed. If not us, then who?

- Now = ~$115K or more savings compared to post tariff / incentives future
- PUC rates changes grandfathered until December 25 (apx 10% per KWH exchanged)
- Federal Incentives under attack (30% on equipment purchases)
- Group Net Metering grandfathered until January
- Vulnerable to Foreign Energy Tariffs or Retaliation

* Depends on financing approach

The Status Quo

With Charlotte's current mix of properties, over the next 25 years, Charlotte taxpayers will spend $631K in fossil fuel costs*, $175K in electricity**, and emit 2.3M lbs of carbon, and polluting particulate into our immediate environment.

One Gallon of fuel produces about 500 balloons worth of CO2

* 4% energy inflation
** Above and beyond the town solar garage

Note: Equipment ($ not incl.) will require replacement as well during this time period

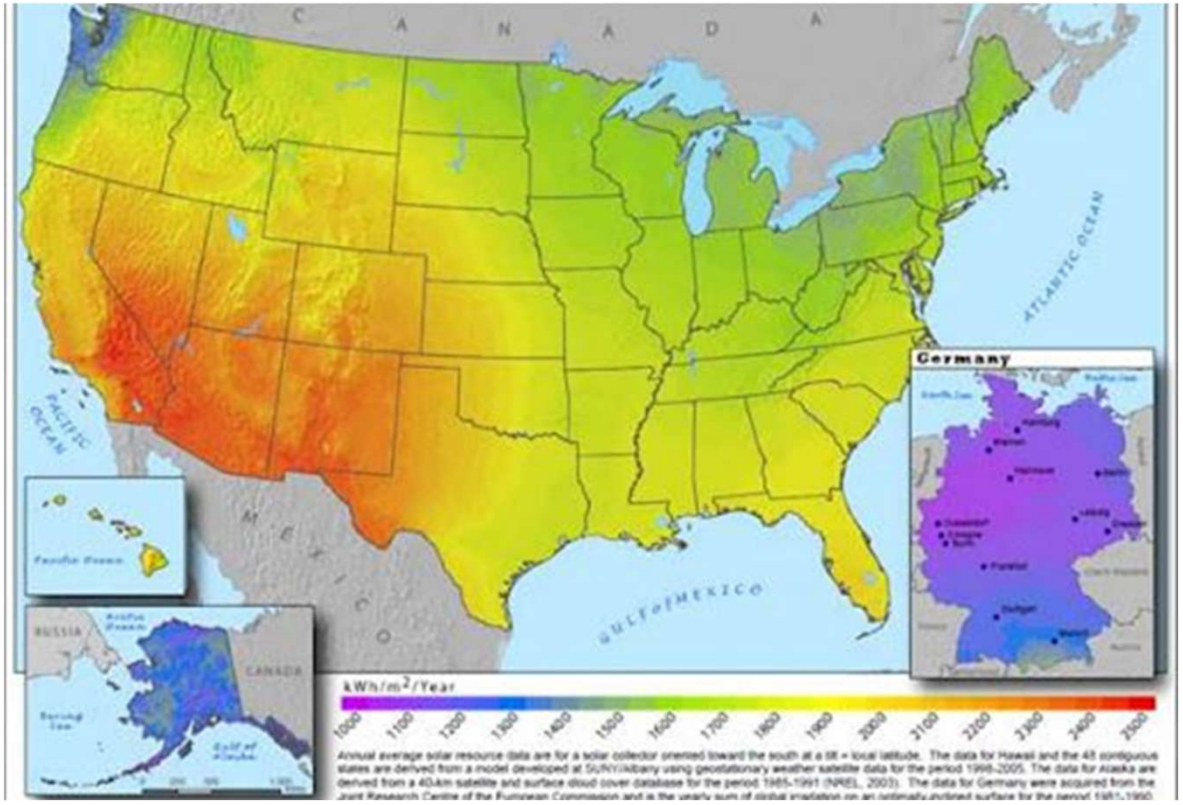
Historic Times for Vermont

- Tax Credits for Solar and Heat Pumps (and more)

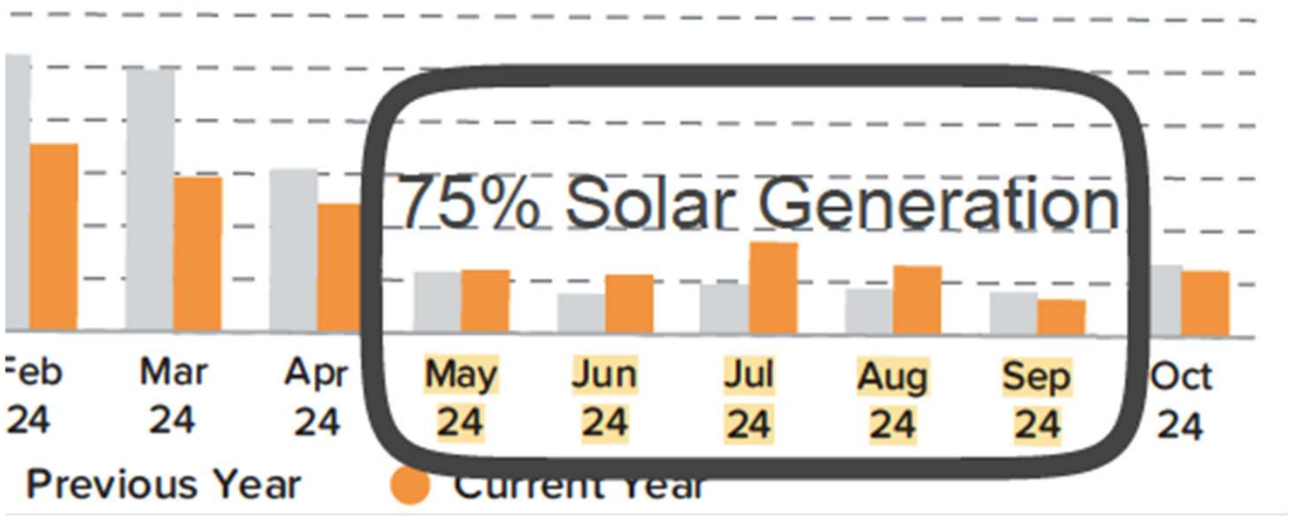
  Inflation Reduction Act,
  State & Utility Incentives

- Net Metering and Group Net Metering
- ROI of 10-18%
- 8-10 Year Payback For Typical Projects

Solar in US


CANADA
ATLANTIC OCEAN
PACIFIC OCEAN
MEXICO
GULF OF MEXICO
Germany
kWh/m²/Year
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
2100
2200
2300
2400
2500

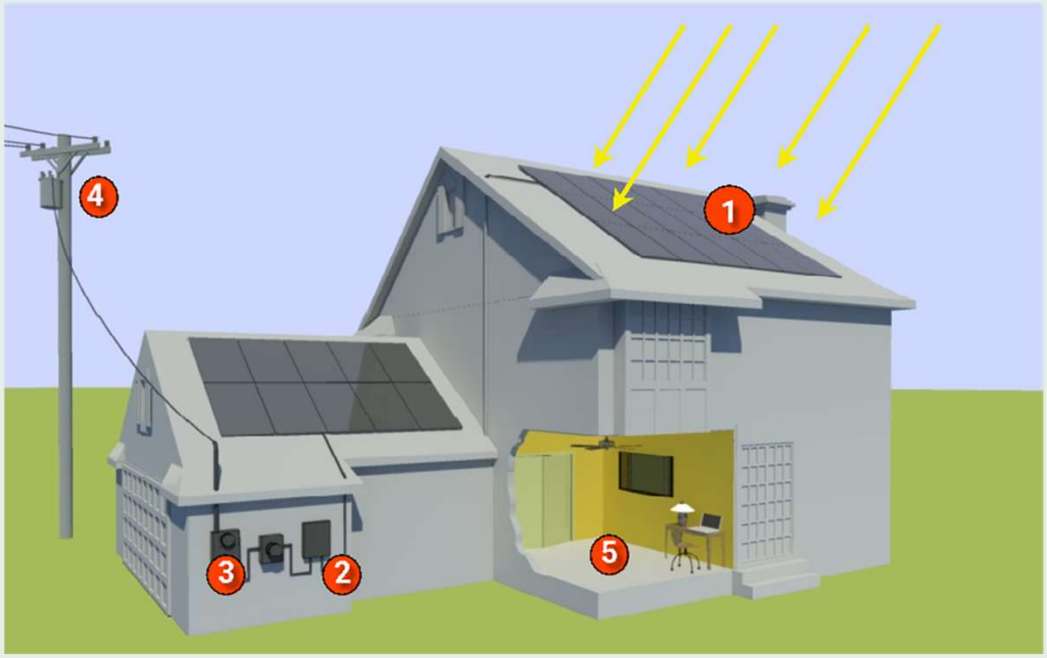
Solar Access In VT (Latitude 44 degrees)



- 75% of Solar generation happens May 1 - Sep 30
  - 5 months = 75%
  - 7 months = 25%

Solar Access

1. Solar Panels
2. Inverter
3. Utility Meter and Panel
4. Current Utility Backup
5. Self Generated Electricity
6. Heat Pumps

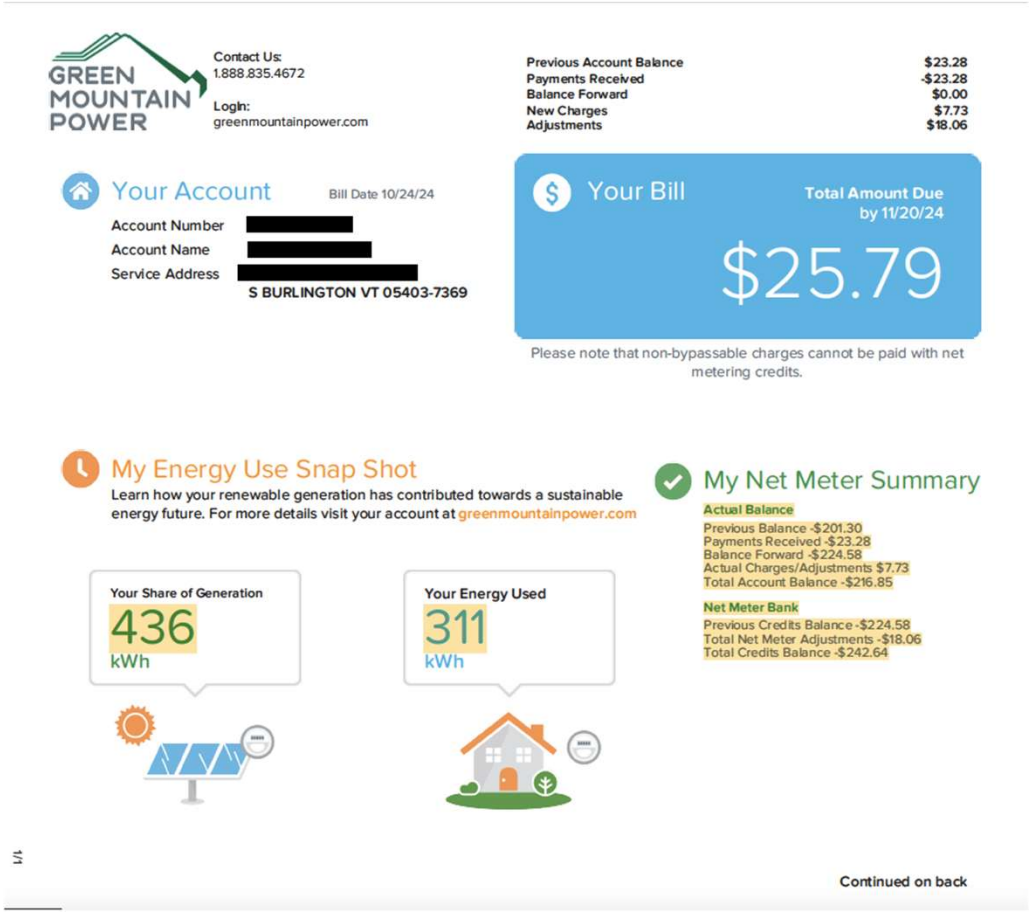


Solar Access

- Vermont has a robust Net Metering Agreement
- It's like a solar bank or battery: carry credits over each month
- Accumulate during the daytime and summer, consume at night and during the winter
- The net amount is tracked and billed
- Possible shared credits for adjacent properties
- 1 Year - use them or lose them

Solar Access

- Does it really work?
  - YES
- Tangible / Measurable results every month



GREEN MOUNTAIN POWER

Contact Us:
1.888.835.4672

Login:
greenmountainpower.com

Previous Account Balance	$23.28
Payments Received	-$23.28
Balance Forward	$0.00
New Charges	$7.73
Adjustments	$18.06

Your Account

Bill Date 10/24/24

Account Number [redacted]
Account Name [redacted]
Service Address [redacted]
S BURLINGTON VT 05403-7369

Your Bill

Total Amount Due by 11/20/24

$25.79

Please note that non-bypassable charges cannot be paid with net metering credits.

My Energy Use Snap Shot

Learn how your renewable generation has contributed towards a sustainable energy future. For more details visit your account at greenmountainpower.com

Your Share of Generation
436 kWh

Your Energy Used
311 kWh

My Net Meter Summary

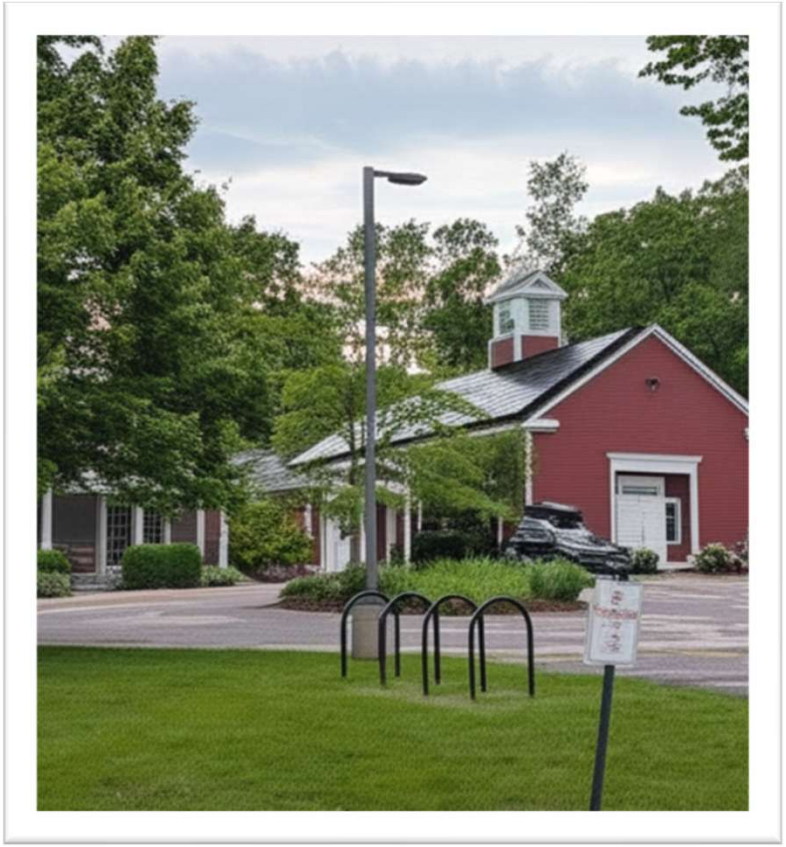
Actual Balance
Previous Balance -$201.30
Payments Received -$23.28
Balance Forward -$224.58
Actual Charges/Adjustments $7.73
Total Account Balance -$216.85

Net Meter Bank
Previous Credits Balance -$224.58
Total Net Meter Adjustments -$18.06
Total Credits Balance -$242.64

1/1

Continued on back

Solar Access



- Rooftop - usually least expensive
  - Limitations on tilt and direction, and others
- Fixed Ground Mount - mid priced
  - Perfect tilt and azimuth, but need land
- Dual Axis Tracker - more expensive
  - Need land
- VT Regulations / Fees:
  - 15.0 kW AC max for Registration $100
  - 15.1 kW - 150.0 kW AC - Application $40-60,000
  - 150.1 kW - 500.0 kW AC Max - (App) $60-300,000

How Long does it Last?

- All panels degrade - usually 0.4-0.5% per year
  - This means at 25 years out they usually have at about 90% capacity remaining
  - At 50 years about 80% capacity remaining
- Panel warranty is usually 85% for 25 years.
- Inverters last longer if protected from weather
- Inverter warranty is usually 10 years (but last ~20)
- Balance of system/workmanship is usually 5-10 years
- Upgrading / repowering arrays is becoming common
- Repurposing / reuse of panels ongoing
- Recycling of defunct panels now catching on

Heat Pump Characteristics

- Converting a property from fossil fuel heating to heat pumps eliminates the oil/gas bill
- Optionally Removes fossil fuel infrastructure (tanks and furnaces) and maintenance
- More electricity is typically required
- Heating with heat pumps is 60-70% more efficient than fossil fuels
- Same Equipment also Cools and is 90% more efficient than in-window or central AC
- Reduces net overall operating costs by 75% per year

Benefits Of Using Both Together

- Does it really work? $169.5 billion industry in 2024
- Heat Pumps: Air to Air, Air to Water, Geothermal are all proven cold weather technologies (Charlotte Library)
- Solar PV is decades of proven technology
- Record deployments last year under the IRA
- Customer-owned Solar contributed more than 239 GWh to the Vermont power grid
- The US and VT are still behind in solar and HP adoption

Electricity in VT

- Vermont currently only produces a small amount of Clean Renewable Energy.
- Clean renewable energy sources are FREE - Sun/Wind
- Whomever owns the generation gets the most financial benefit
- Installation of clean technology freezes rates
- Once amortized, the generation cost of Solar or Wind is near $0 (maintenance & insurance)

Energy in VT

Inflation

- As the prices for fossil fuels and electric generation go up, so do utility bills
- Prices for energy have increased by approximately 119.71%* over last 25 years
- Average annual inflation rate of about 3.20%
- Overall inflation rate of 2.48% for comparison.

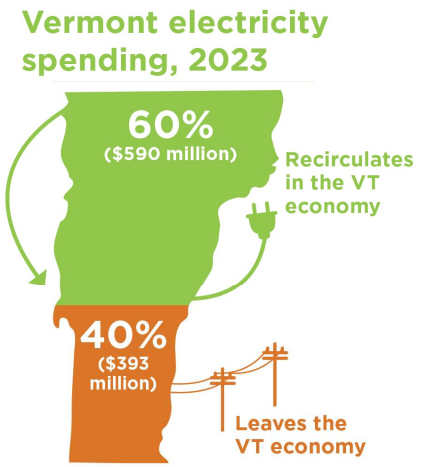
Volatility

Year	Electricity	Natural Gas	Propane	Heating Oil
2020	0.00%	0.00%	0.00%	0.00%
2021	-1.38%	6.06%	8.00%	8.33%
2022	3.48%	10.71%	14.81%	23.08%
2023	4.42%	10.51%	16.13%	31.25%
2024	3.51%	1.17%	6.94%	-8.57%

*According to the U.S. Bureau of Labor Statistics 2000-2025.

Where Charlotte's Electricity Spend Goes

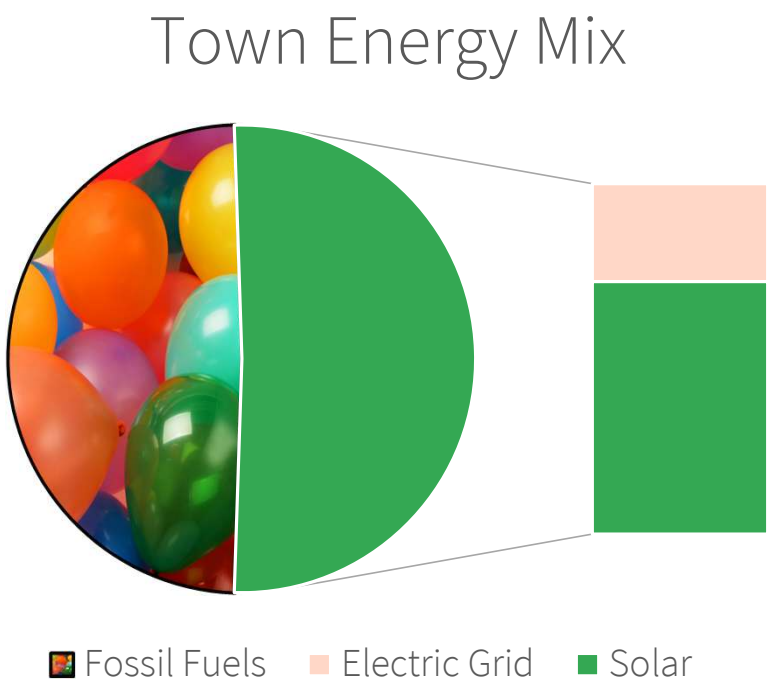
- Currently Vermont only produces a small amount of the electricity it consumes
- The prices of electricity are impacted by distance, time of use, peak times, and more.
- More than 56% of VT electricity comes from Canada



Sources: Electricity spending: Vermont electric utilities. Dollar recirculation share: Ken Jones, Senior Fellow for Economic Analysis, 2024. **Note:** Dollar recirculation share was updated in January 2025 to reflect out-of-state transmission costs.

ENERGY ACTION NETWORK

Current Energy Infrastructure



- Aging Equipment
  - Town Hall, Sr Ctr, and CFRS has aging heating and cooling equipment
  - Charlotte's current energy infrastructure is overly dependent on oil for heating.
- Economic Challenges
  - Fuel and electricity is imported, volatile, and at the mercy of state and federal policy decisions. Costs will rise unless we lock in energy rates.
- Environmental Concerns
  - The environmental impact of oil usage raises concerns regarding pollution and climate change.

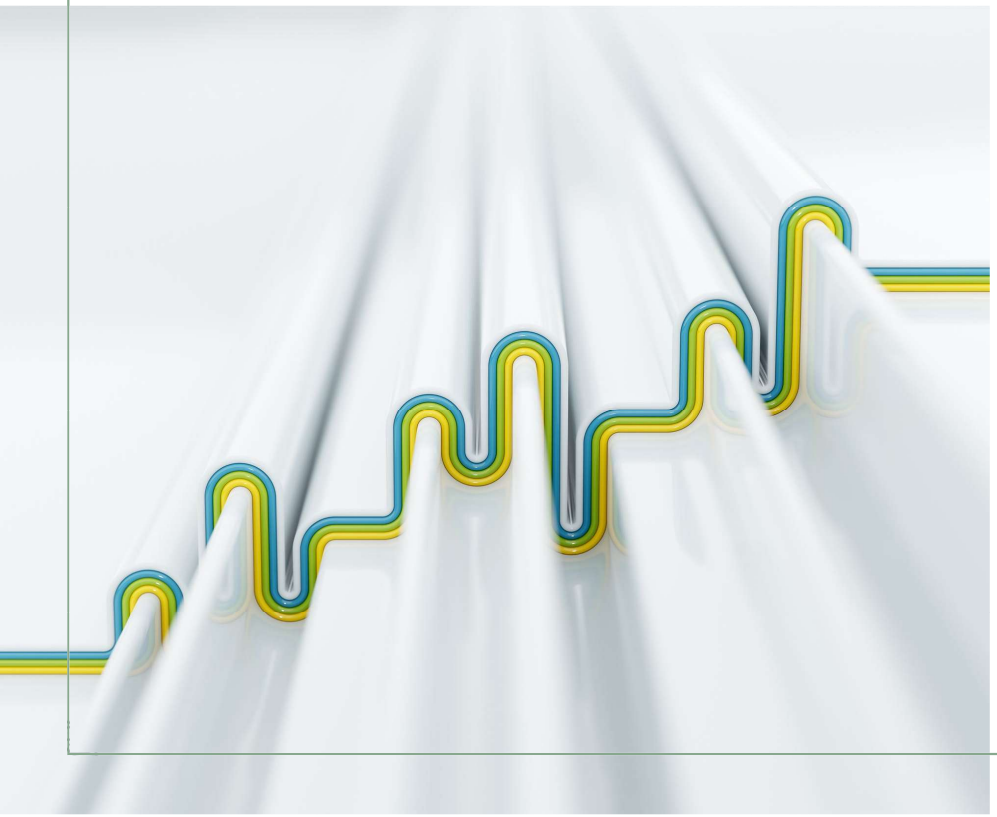
Opportunity for Charlotte

- Best Path To Meet Town Plan Goals
- Lowest Priced Solar (Incentives)
- Lowest Priced Heat Pumps (Incentives)
- Projects Registered In 2024 (Ends In 2025)
- Best ROI
- Shortest Payback
- Lower Your Tax Bill
- Do Our Part For VT And US Goals
- Lead By Example

Project Overview and Objectives

- Transition to Clean Energy
  - More than 80% of voters support the Town transition to sustainable energy usage.
  - Lead VT & encourage other Towns to follow.
  - Improve air quality in town buildings and in town.
- Reduce Costs
  - Stabilize and lower cost of energy to the Town.
  - Source as much of our own energy as possible.
  - Use savings to upgrade equipment.
  - Take advantage of incentives NOW!
- Increase Energy Efficiency
  - Drive energy efficiency through proven technologies and practices to make better use of energy resources.

Charlotte Energy Modernization Proposal



Milestone 1: Analysis

Inventory and Survey the various combinations of solutions and create a financial model based off status quo vs modernized infrastructure approach.

Review with Selectboard

Milestone 2: Request for Proposal(s)

Create RFP(s) for the financially viable solutions. Receive and evaluation technical and financial options

Review with Selectboard & Public Comment

Milestone 3: Implement Project

Go/No-Go Decision

Secure vendor

Secure financing

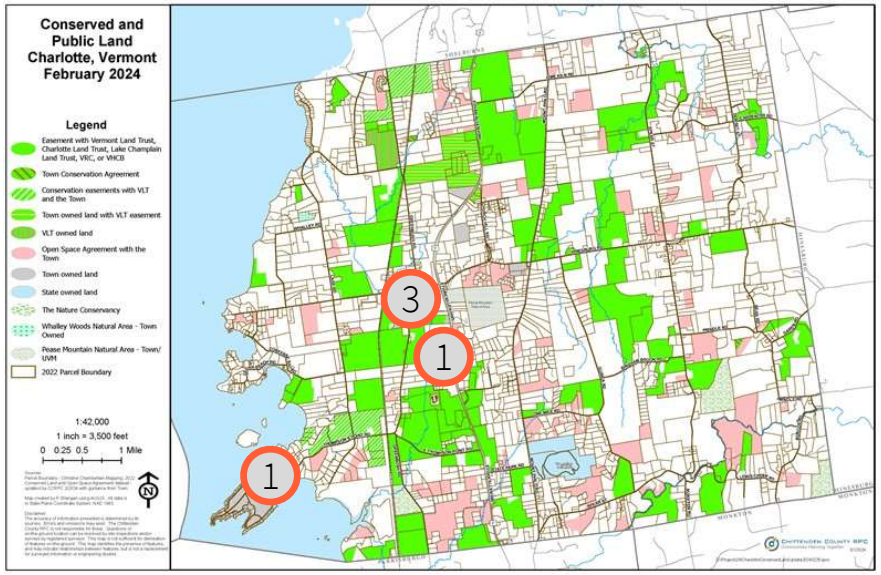
Contract

Build and deploy solution.

Town Building Energy Details

Property	Current	Proposed
Town Hall	Aging Furnaces and Air Conditioners	Leave Furnace In Place as Backup. Add Heat Pump With Splits, Remove Aging AC, dd Ground Mounted Solar Panels
Sr Center	Furnace AC & 1rm Heat Pump	Leave Furnace In Place as Backup. Add Heat Pump With Splits, Remove Aging AC, add Roof Mounted Solar Panels
CFRS	Aging Furnaces and Air Conditioners	Leave Furnace In Place as Backup. Add Heat Pump With Splits, Add Air To Water HP for Floors, Remove Aging AC, add Fixed Ground, or Tracking, or Roof Mounted Solar Panels
Garage	Geothermal and Solar	Add 15KW Ground or Roof Solar
Thompsons Point (Optional)	GMP	Add 15KW Ground or Tracker Solar For Wastewater

Identified 5 Town Properties for Solar Evaluation



Aesthetic & Best Use

Consideration shall be given to visual impact as well as current and future best use of the properties.

Sun Exposure

Identifying town properties for solar installations requires finding unobstructed space for efficient energy generation.

Access To Grid

To minimize cost and use group net metering, CPG's were filed for 5 of 7 town properties that have access to the grid.

Aesthetic Choices

Tracking Array

Ground Mount

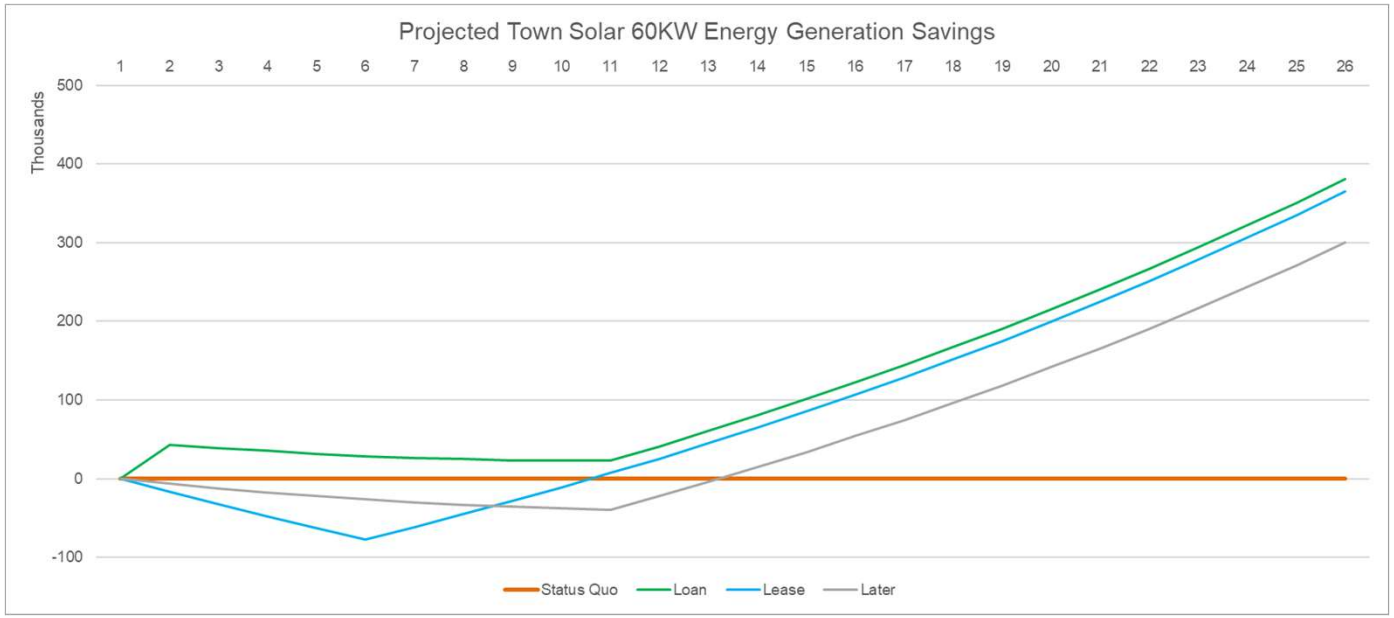
Roof Mount

All locations identified as potentially workable. Not all locations will be necessary. Pending cost/performance analysis and aesthetic review. No decisions have been made.

Possible Rooftop Installations

Adding ~60 KW AC Solar Capacity

25 Yr Solar Savings
$0 Status Quo
$292K* After 2025
$380K* Green Loan
$365K* Lease To Own



*Assumes Electricity is Coming From Solar

Details...

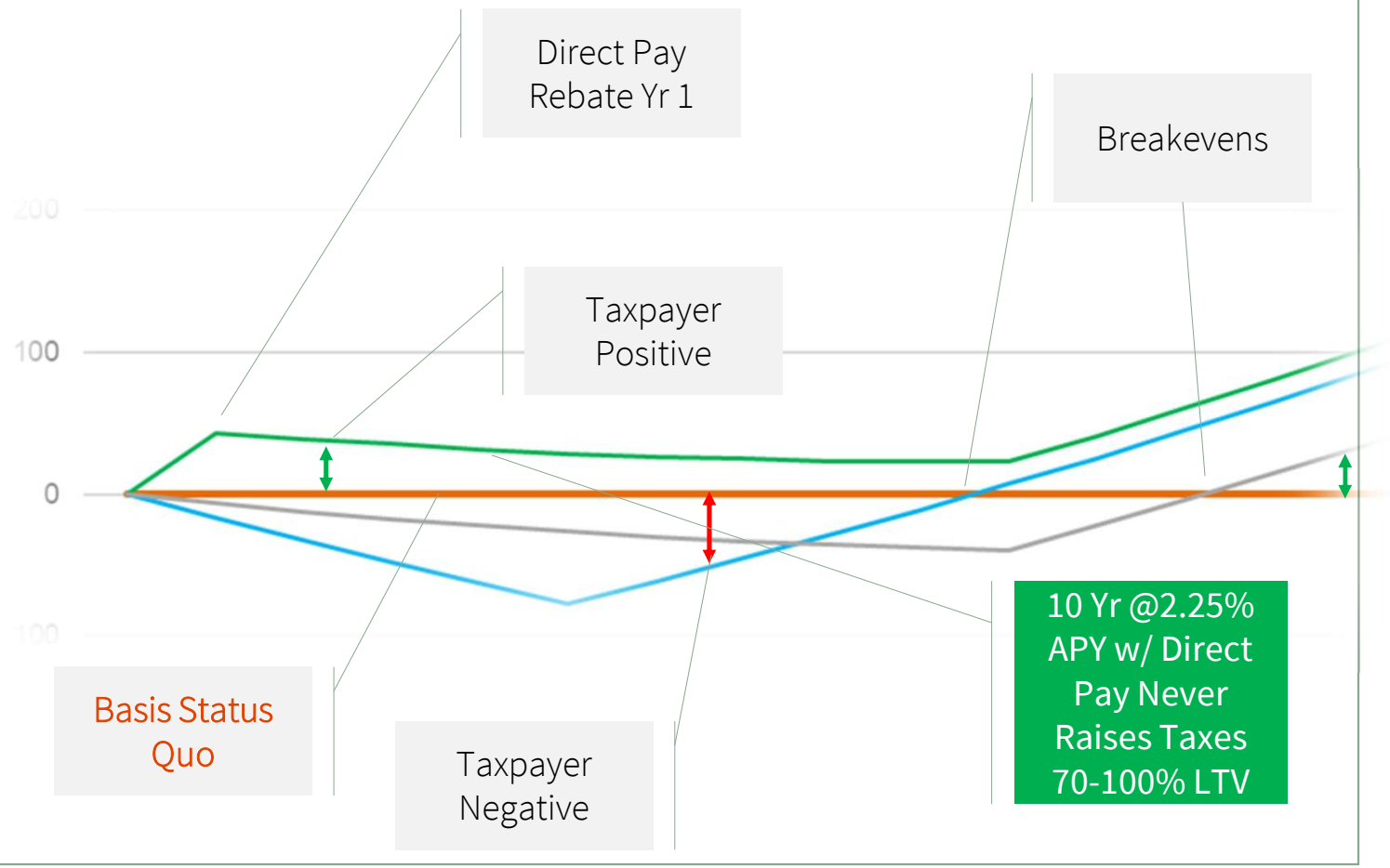
25 Yr Solar Savings

$0
Status Quo

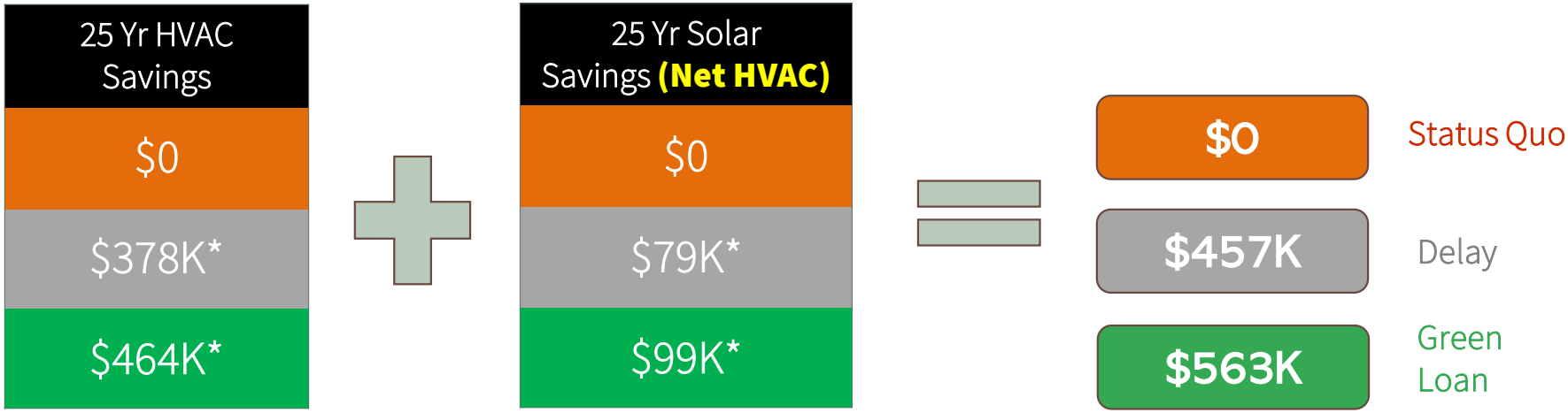
$292K*
After 2025

$380K*
Green Loan

$365K*
Lease to Own



Combined 25 yr Savings



*Assumes Electricity is Coming From Solar

Financing

Purchase / Ownership

- IRA
  - Extends 30% FITC
  - Bonus MACRS (commercial only)
  - Approve location
  - Approve shade mitigation (if any)
  - Check
  - Credit Card
- Clean Energy Loans
  - 12-months, Low interest, no payment loan
  - Low-cost installation loan
  - Flexible payment option

Financing

PPA / TPO

- Power Purchase Agreement / Third Party Owner
  - IRA Benefits to the TPO
  - No money down
  - No out of pocket expenses
  - Land control required
  - You pay for the power - with discount
  - 5 year Buyout Option
- Enables build now / buy later scenario

What this means for the Town…

- Replaces aging heating and cooling infrastructure.
  - Heat Pumps (Air2Air and Air2Water)
  - Heating 65-75% more efficient
  - Cooling 90% more efficient
  - Converts all energy use to Electricity
- Solar Generation covers Town's entire electric bill
  - Freezes electric rates in perpetuity
  - Favorable Loan with Current Incentives Allows For Negligible Upfront Taxpayer Impact
  - Long Term Taxpayer Saving After Loan Period
- Modest investment of <$400,000
- Eliminates >$15,000 in oil bills each year
- Estimated Savings of $563,000 over 25 Years
- Eliminates 2.3 million lbs of CO_2 over 25 Years

Environmental Choices:

35,100,000
CO_2 Balloons Over Charlotte

Questions?

Charlotte Energy and Climate Action Committee

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