Residential Solar Seminar 3/6/2025

Thad Daise, David Goll, Jeff Sira, Jay Watts

Solar System Owners

Disclaimers

- Our views and opinions do not necessarily represent the views and opinions of the Edisto Island Open Land Trust
- We are not licensed and trained experts in solar power, we are just homeowners with solar who want to share their experiences
- We might get something wrong
- We do not represent manufacturers or installers, though we can recommend some if asked
- We are not receiving any compensation for this seminar

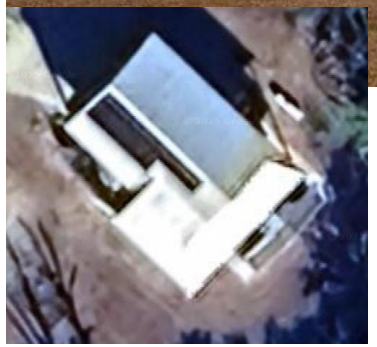
Case Study 1

David Goll

Frampton Inlet Rd, Edisto Island, SC

The System

- Installed 2022
- 1600 ft^2 house w/metal roof
- 6.57 kW system with 18 panels (365W each)
- Time of Use rates with Net Metering
- No battery backup
- Installed by Renu Energy Solutions

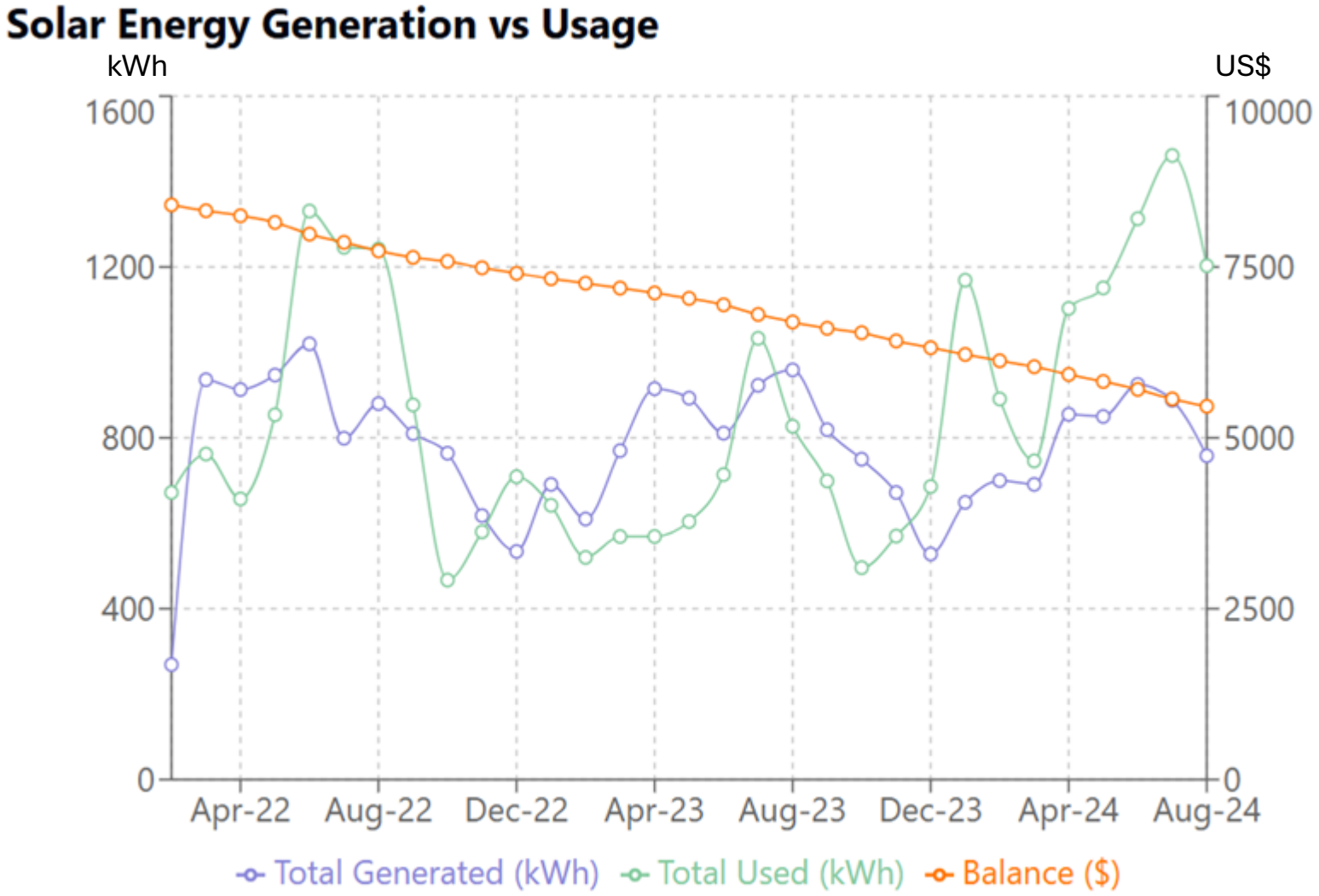


System Cost

2022 prices and credit percentages	
Total system cost	$19,980
Incentive rebate from installer	- 1,000
Manufacturer rebate (through EnergySage.com)	- 250
Net cost for tax credit calculation	$18,730
30% Federal Tax Credit	- 5,619
25% SC Tax Credit	- 4,683
Cost after rebates and tax credits	**$8,429**

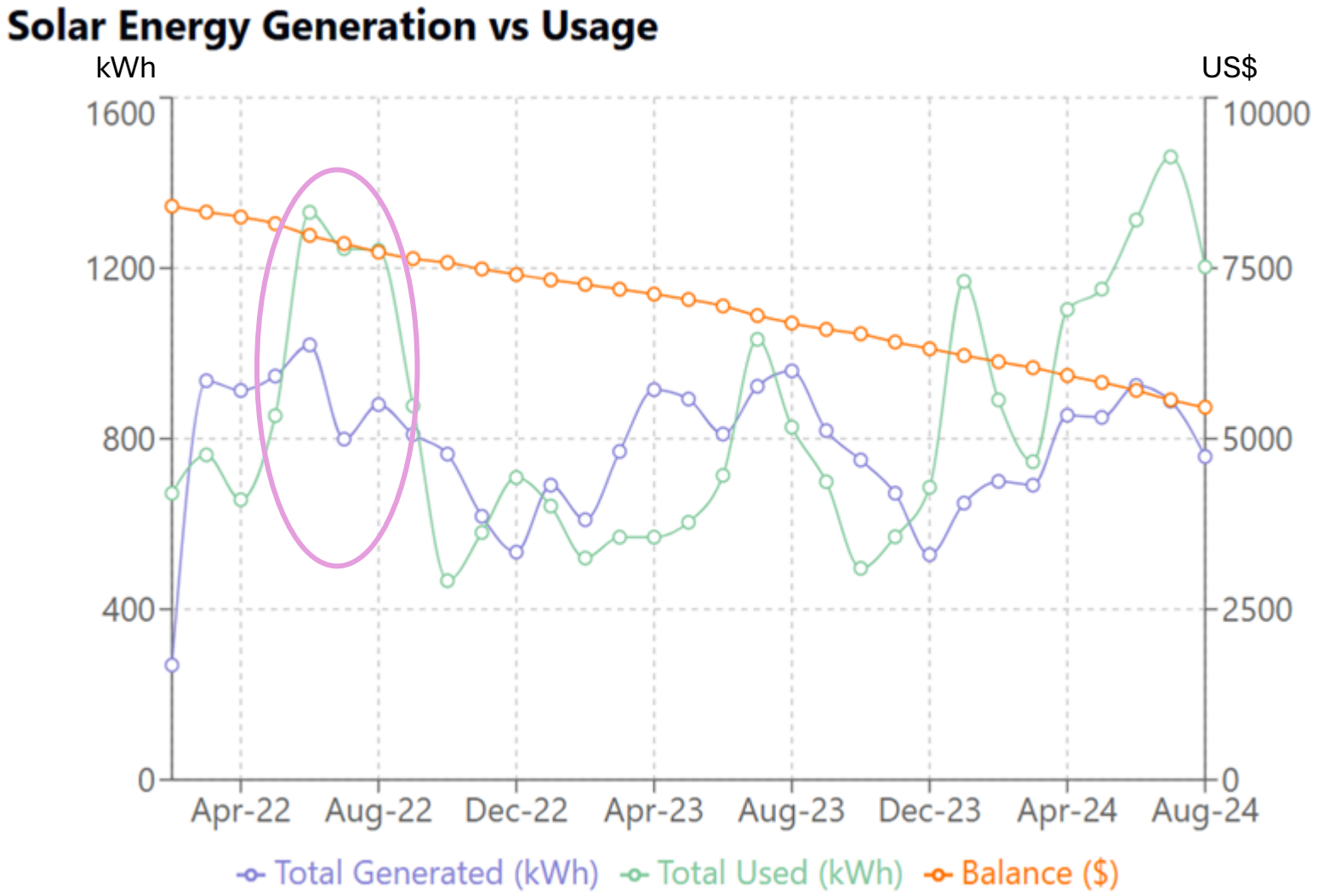
Real-World Numbers

- System went live mid-February 2022
- Trend shows payoff in 2029 (7.6 years from start)
- Net power surplus for all of 2023
- What was going on in 2022 and 2024?



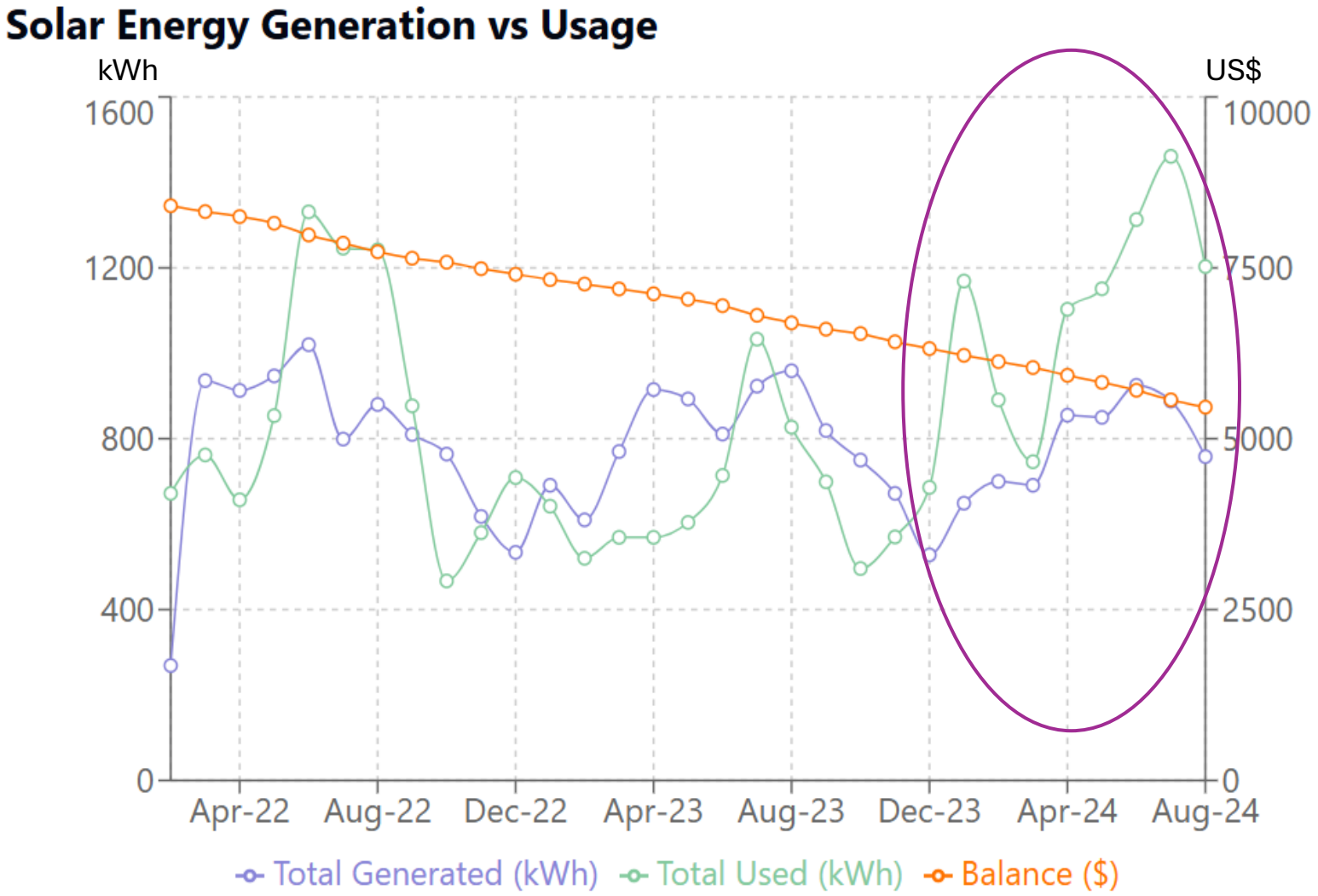
Summer of 2022 (One Simple Trick)

- Our thermostat was set to 77 during the day and 72 at night
- It takes a lot of energy to cool to 72
- Changing the thermostat to 74 at night significantly reduced our usage in 2023
- Did we suffer? No. The trick was to start the cool-down earlier in the evening.
- DON’T GO TO BED HOT!



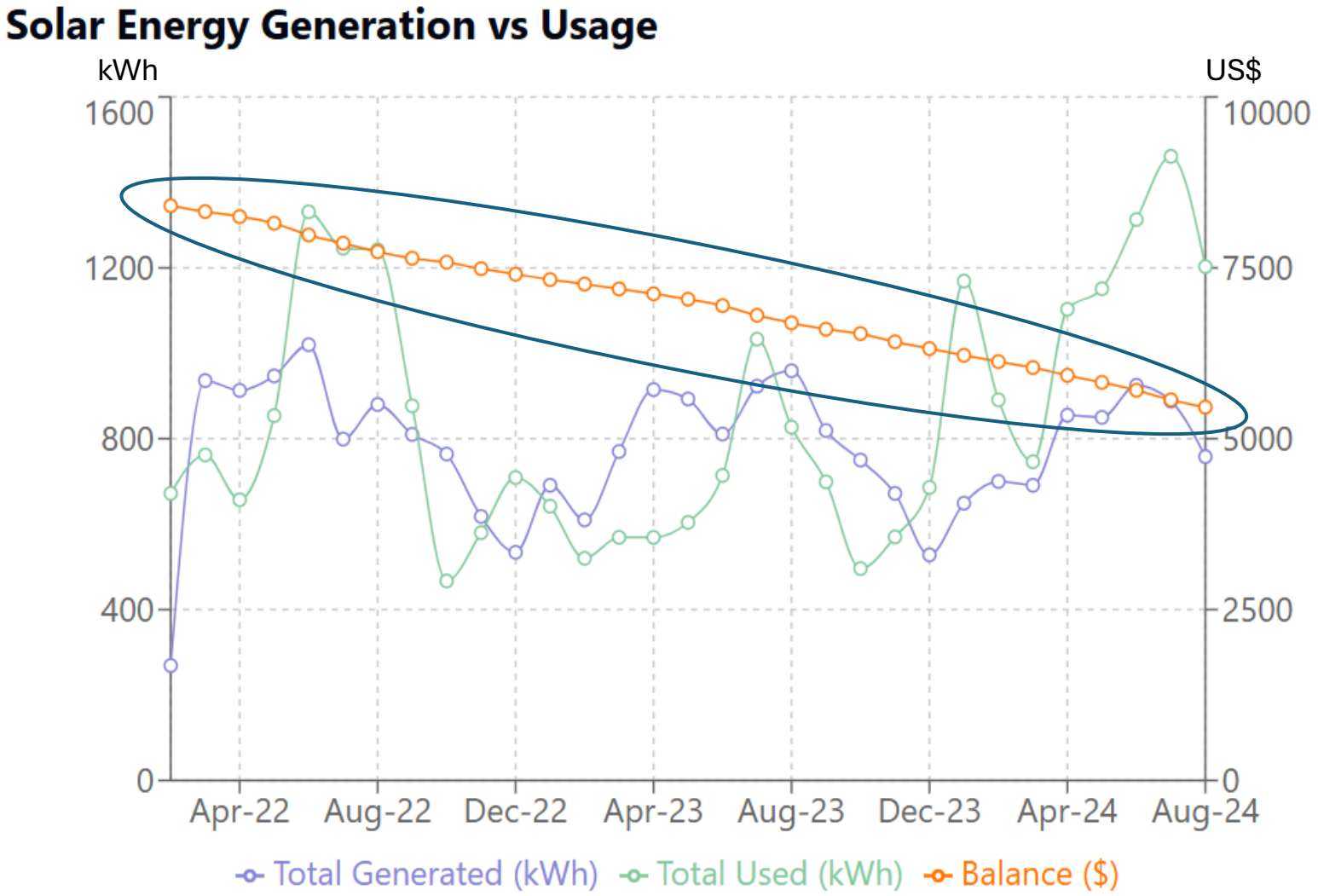
Why did usage go up in 2024?

- Purchased an EV and started charging at home in January of 2024
- Charged the EV only during off-peak hours for the first half of the year
- In July, started charging only during on-peak hours because we had a significant amount of excess energy “banked” on the grid
- Charging the EV from July through November was effectively free using banked hours



Progress to Payoff

- Starting point: system cost minus incentives and tax credits
- Faster payoff in summer months regardless of total energy used
- Strong incentive to match average 12-month generation with average 12-month demand when designing the system
- Diminishing returns when generation exceeds demand over long term (Dominion Energy's buy-back price is very low)



Keys to Success

- Sunny location and acceptable roof orientation (facing SW) was favorable for solar generation
- State and federal energy tax credits for a 55% savings on installation cost
- The Dominion Energy “Solar Choice” plan allows me to use the grid as a battery to even out power generation and consumption
- Understanding and adapting to the Time-of-Use rates inherent in the Solar Choice plan (not an issue if you have battery storage)

Looking ahead

- Dominion Energy recently changed their Time-of-Use (TOU) rates – not enough data yet to determine how this will affect the payoff trajectory, but it seems slightly less favorable.
- Battery storage would mitigate the potential issues with Dominion's new TOU rate plan, but that alone would not fiscally justify an upgrade.

Case Study 2

Thad Daise

Scott Creek Dr, Edisto Beach

The System

- Installed 2021
- 3,081 ft^2 house w/EPDM roof
- 8.71 kW system with 26 LG panels (335W each)
- Time of Use rates with Net Metering
- Battery backup
- Installed by Renu Energy Solutions

System Cost

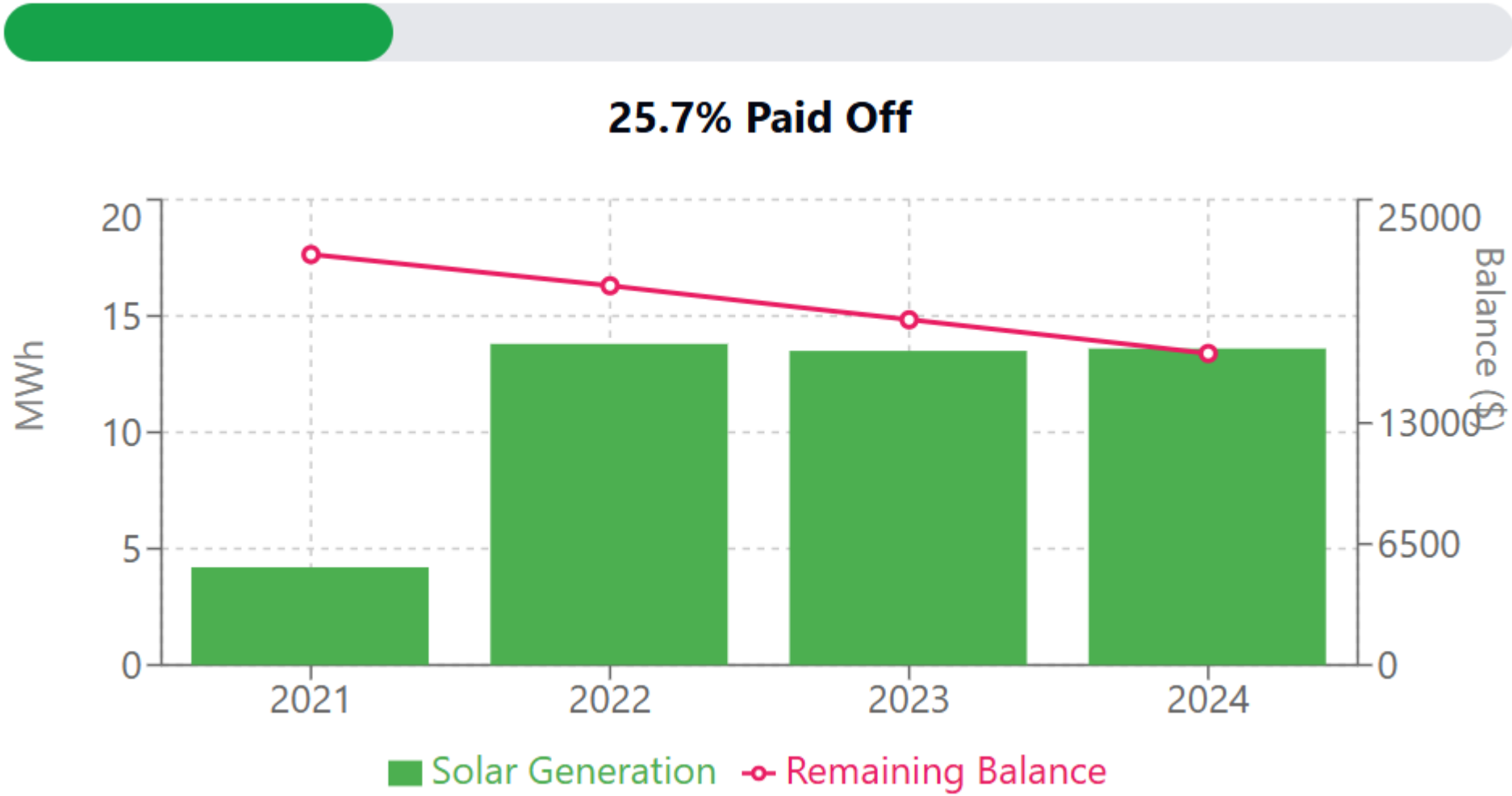
2021 prices and credit percentages	
Total system cost	$46,000
Rebates and incentives	- 0
Net cost for tax credit calculation	$46,000
26% Federal Tax Credit	-11,960
25% SC Tax Credit	-11,500
Cost after rebates and tax credits	**$22,540**

Return on Investment

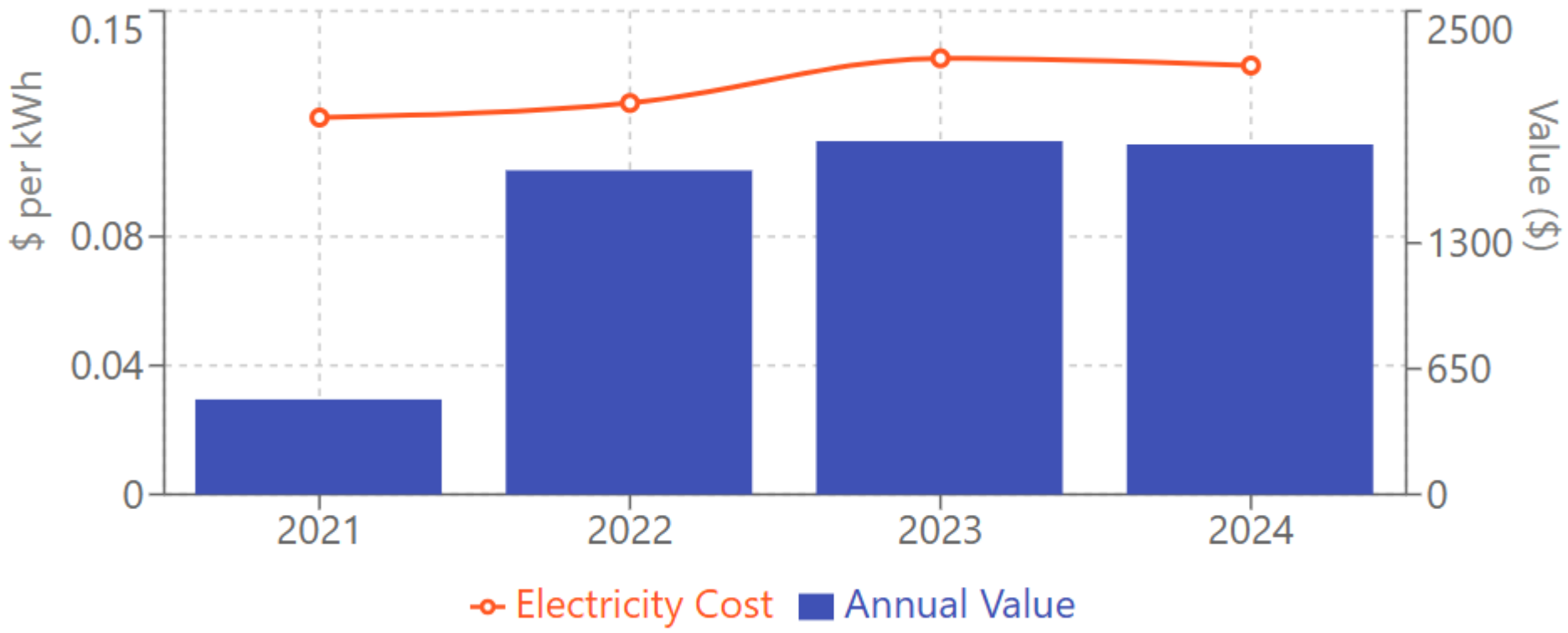
- **Initial Investment:** $22,540.00
- **Total Value Generated to Date:** $5,803.40
- **Remaining Balance:** $16,736.60
- **System Paid Off:** 25.7%
- **Estimated Full Payback:** 11.6 years
- **Projected Payoff Date:** 7/31/2032

Battery backup increases the payoff period compared to panels alone.

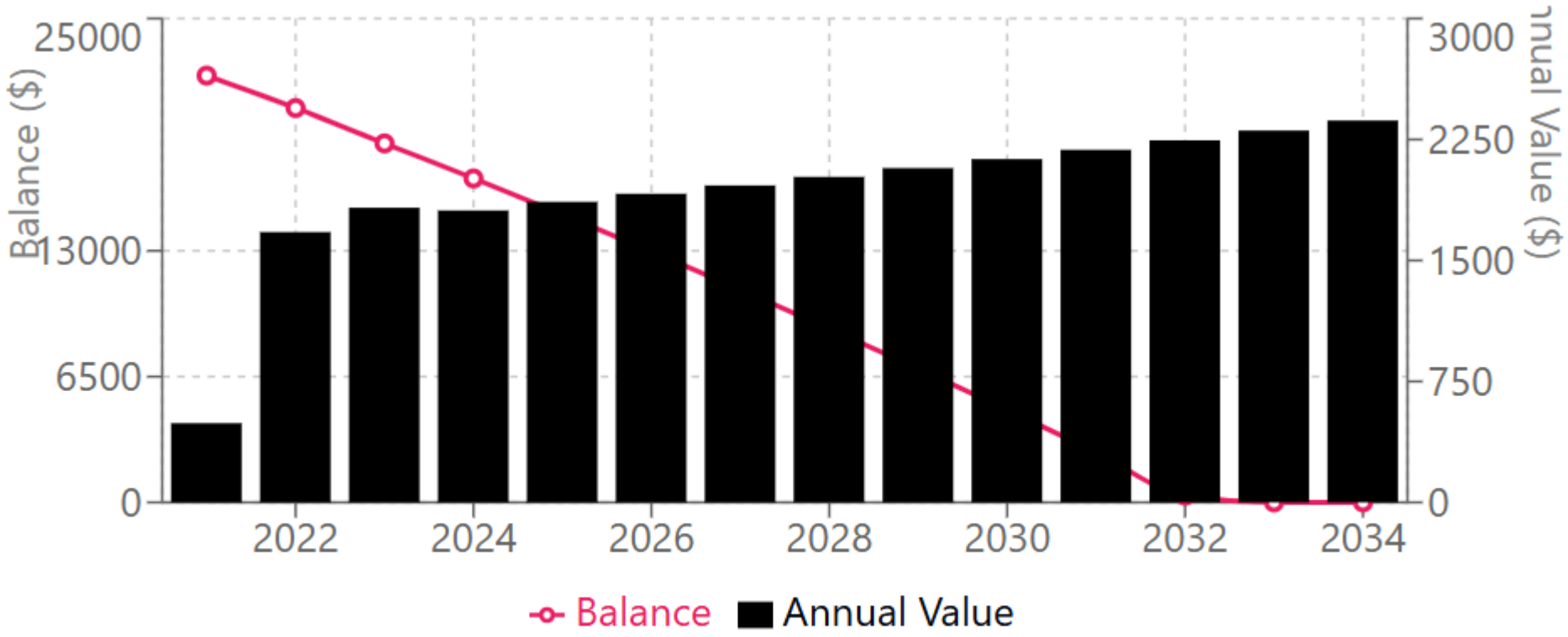
Generation & Payoff Progress



Electricity Cost & Annual Generation Value



Payback Projection



Note: Gray bars represent projected future values based on current trends. Projection shows estimated payoff in approximately 11.6 years.

Conclusions

- Very happy with the system
- Solar generation during power outages has provided uninterrupted battery backup

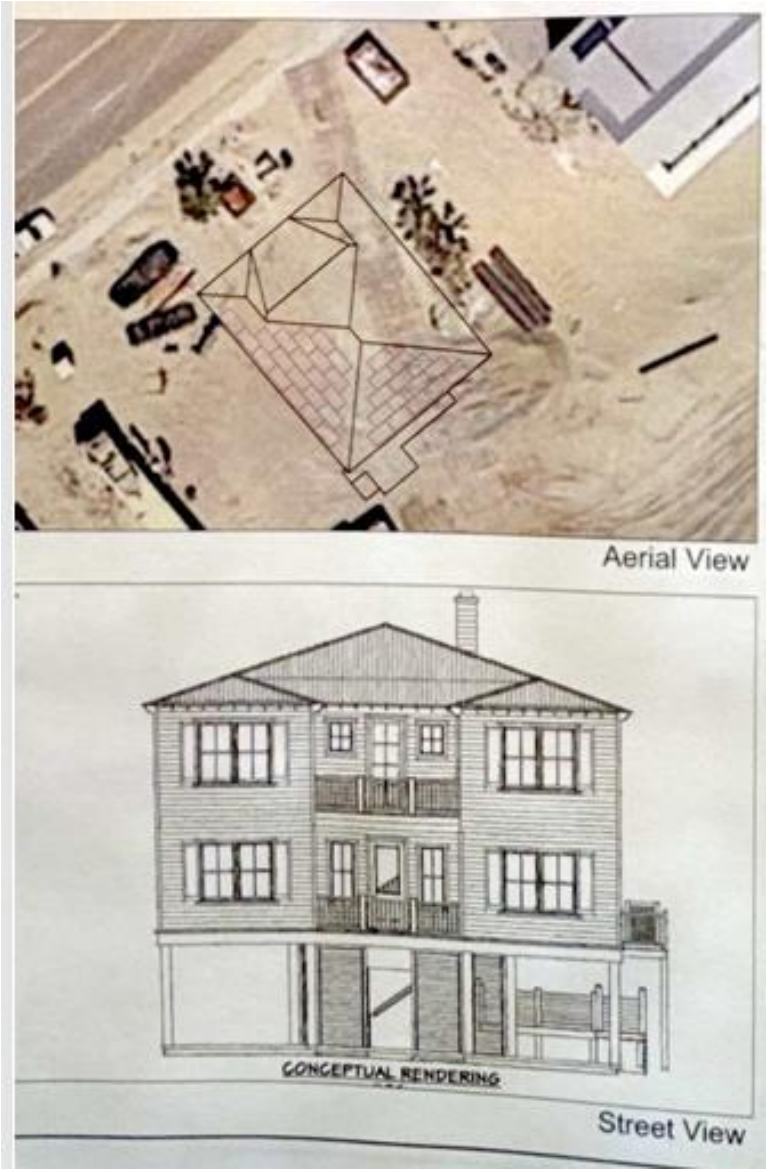
Case Study 3

Jay Watts

Palmetto Blvd, Edisto Beach

The System

- Installed 2018
- 3,098 ft^2 house w/metal roof (new construction)
- 10.8 kW system with 36 panels (300W each)
- No battery backup
- Installed by Southern Current (no longer doing residential)



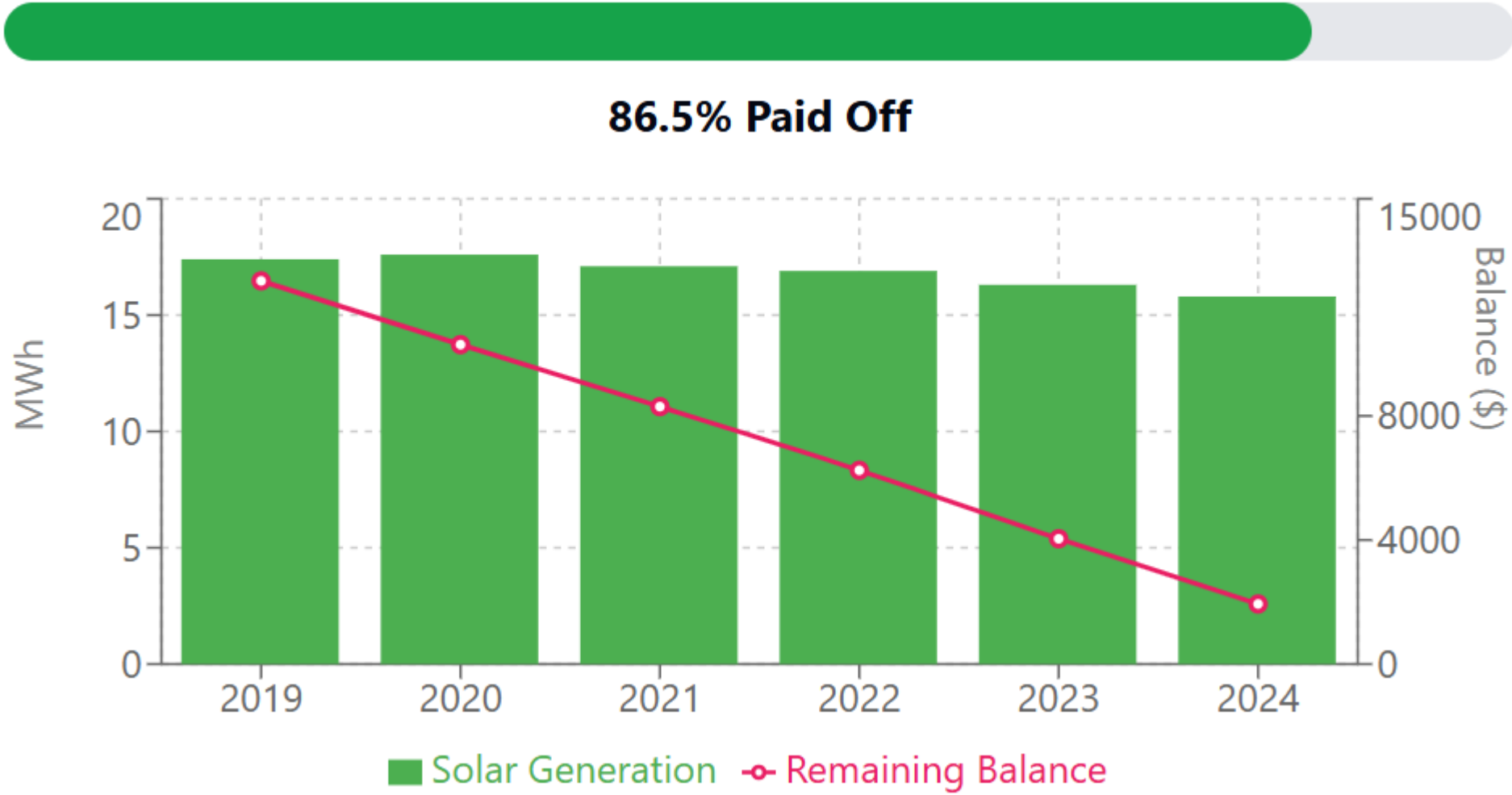
System Cost

2018 prices and credit percentages	
Total system cost	$32,000
Rebates and incentives	- 0
Net cost for tax credit calculation	$32,000
30% Federal Tax Credit	- 9,600
25% SC Tax Credit	- 8,000
Cost after rebates and tax credits	**$14,400**

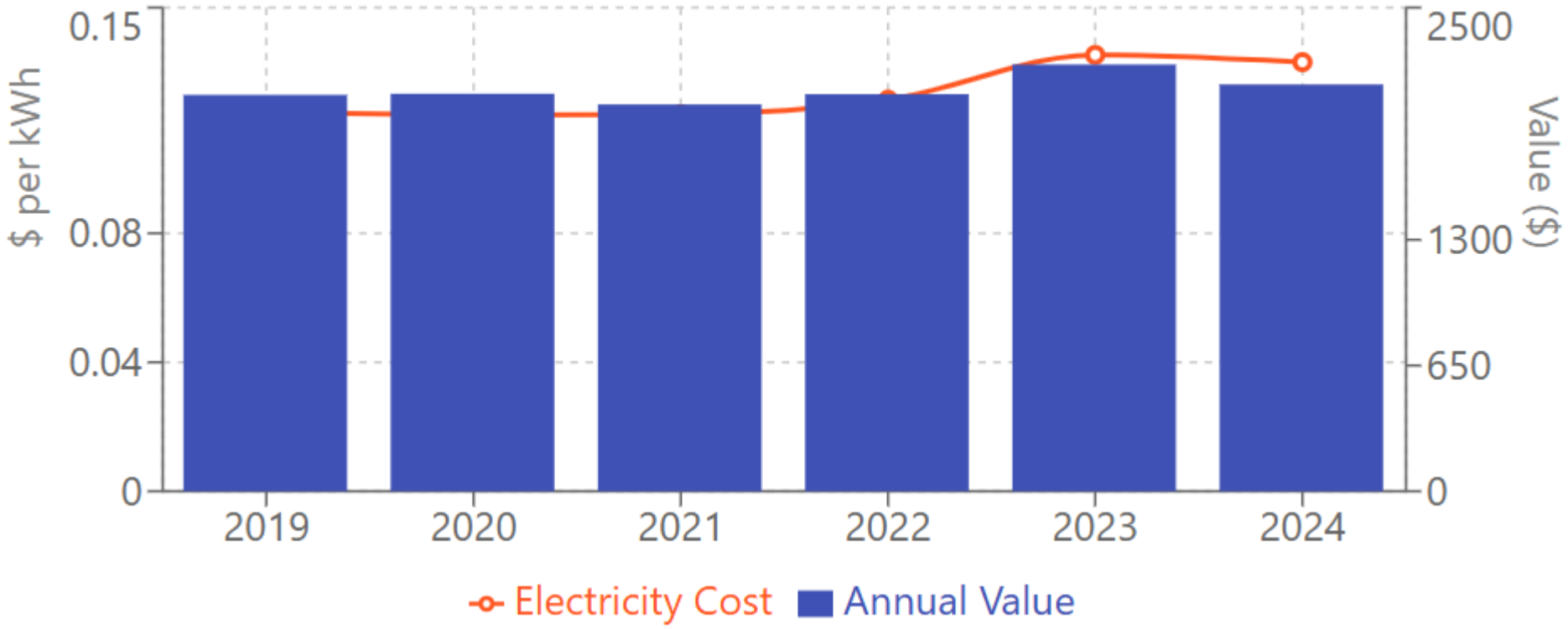
Return on Investment

- Initial Investment: $14,400 (after tax credits)
- Current Status: 86.5% paid off (as of end of 2024)
- Remaining Balance: $1,937.39
- Projected Payoff: Late 2025
- Total Power Generated: 101.1 MWh over 6 years

Generation & Payoff Progress



Electricity Cost & Annual Generation Value



Conclusions

- Very happy with the system
- Solar panel investment is analogous to a single premium annuity… Wrote a big check up front that "pays me dividends" monthly for a couple of decades
- Electricity rate increases are offsetting the greater-than-expected decline in generation
- Would have liked to have included battery backup at time of construction

Case Study 4 (planned)

Jeff Sira

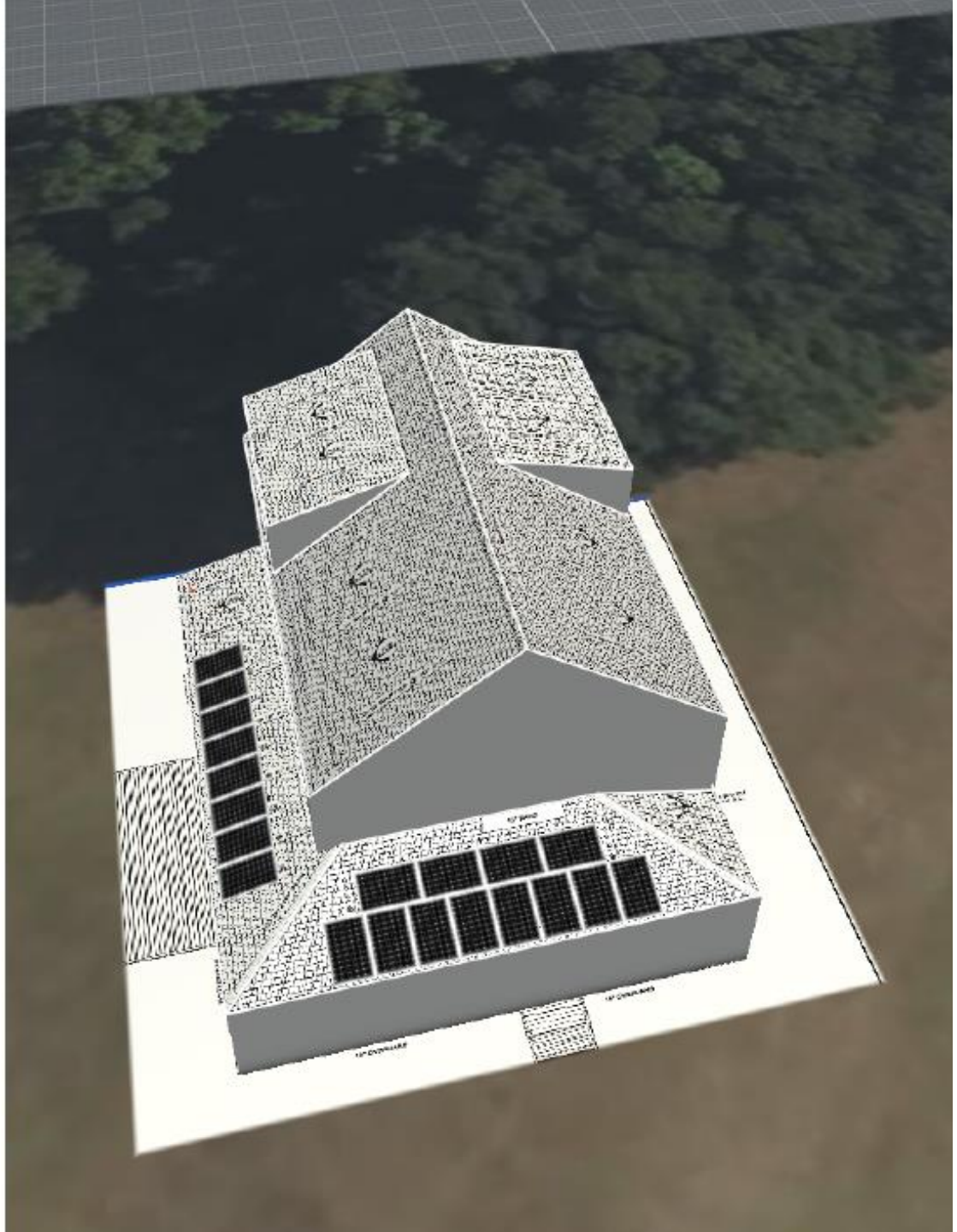
Edisto Oaks, Edisto Island

Your Solar Design Breakdown

System

Q.TRON BLK M-G2+ 430 Qcells	Modules	Qty: 20
Tesla Solar Inverter 7.6 [240V] Tesla	Inverters	Qty: 2

20	11,540 kWh	63%
Solar panels	Yearly energy produced	Energy offset



Your Storage setup

Battery
Powerwall 3

Inverter
—

Operating mode
Energy arbitrage

Capacity	Output	Cost	Backup allocation
13.5 kWh	11.5 kW	$0.00	0%

System Cost

System	Cost
20 Qtron Panels	
1 Tesla Solar Inverters	
1 Tesla Power Wall 3	$43,000.
Federal Residential Renewable Energy Tax Credit 30%	-$12,900
SC Solar Energy Credit 25%	-$10,750
Cost After Tax Incentives	$19,350
Projected system payback	9 years

Your Energy Usage

Dominion Energy (South Carolina)
8 Residential

Average rate	Fixed costs	Escalation
$0.15/kWh	$10.50	5.00%

Average Monthly Utility Bill

Today	In 25 years	Total payments after 25 years
$222.41	$693.93	$124,516.15

Compare pre- and post-solar year 1

Pre solar			Post solar	
Grid use	$211.91		Grid use	$74.95
Fixed costs	$10.50		Fixed costs	$14.00
Avg monthly payment	$222.41		Avg monthly payment	$88.95

The Decision to go Solar

Is it possible and is it worth it?

Is Solar Right for You?

- You need sufficient space for the solar panel array, whether on your roof or on the ground, that receives direct sunlight for most of the day
- You need to be the homeowner (a Dominion Energy requirement)
- Homeowners' associations (HOAs) often restrict placement of solar panels
- Know your goal
- Not mandatory, but…

You should be staying in the house long enough to enjoy the benefits

What if the HOA says no?

- Solar roof tiles
  - A mix of photovoltaic and non-photovoltaic tiles for flexibility in capacity and installation
  - More expensive than traditional solar panels
  - Can be cost effective if you need to replace your roof

Financial Outlay

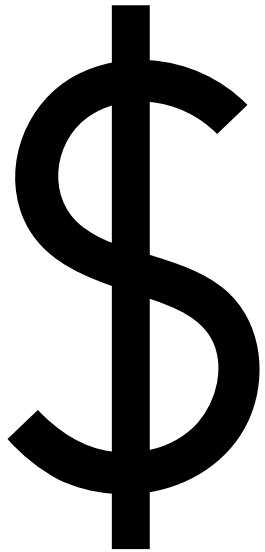
Installation costs start at ~$15,000 for a small system up to ~$50,000 for a large system including battery backup

Federal and SC state tax credits can offset 55% of the cost

You may need to re-roof before solar can be installed

Ground-based solar adds cost

Financing or leasing options are available if you are unable to purchase up-front



Opportunity Cost?

- The Frampton Inlet installation produced an average annualized return of 13.63% through the end of August 2024 (when compared to the same usage without solar).
- For comparison:
  - S&P 500 historical average: ~10% (before inflation)
  - S&P 500 real return: ~7% (after inflation)
- A solar investment has additional benefits:
  - Returns are effectively tax-free (via savings on utility bills)
  - More stable/predictable than stock market returns
  - Protects against rising electricity costs
- The main tradeoff is liquidity - you can't sell solar panels like you can stocks.

If you finance…

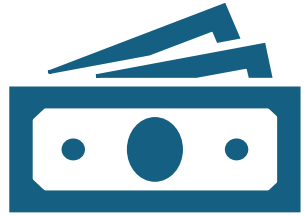
- A home equity loan will often have the best terms
  - https://www.energysage.com/solar/solar-loans/financing-solar-home-equity-loan/
- Make sure your loan allows you to pay additional principal
- Strategies for paying down the principal
  - Rebates often come as gift cards… Use the card(s) and apply the same amount towards paying down your principal (you were going to spend that money anyway)
  - If you get a tax refund in the year(s) you claim a credit, direct all or part of the refund towards paying down your principal
  - Consider directing the savings on your monthly electricity bills towards paying down your principal

Leasing (aka Power Purchase Agreements)

Pros

Zero up-front cost

Leasing company maintains the panels and equipment



Cons

Can negatively impact home resale value

Disqualification from solar tax credits and incentives

Difficult and expensive to end the lease early

Lower long-term savings

Monthly payments can escalate over the life of the lease (20 to 25 years)

Getting Started

Get Educated (but not too educated)

- Don’t obsess… if it all seems too complicated, a reputable installer will offer choices and help you make the right decisions based on your situation
- Resources:
  - This presentation
  - Energy Sage (www.energysage.com)
    - Provides a lot of educational material
    - Also acts as a referral service for installers
    - Offers free consultation to review installer proposals
  - Home Advisor (https://www.homeadvisor.com/cost/energy-efficiency/install-solar-panels/)
  - Dominion Energy SC (www.dominionenergy.com/south-carolina/save-energy)
    - Covers energy efficiency, solar generation, EVs and more
    - Reality check for what you can get in SC
  - Government websites
    - www.energy.gov/topics/solar-energy
    - solar.sc.gov

Check with your insurance agent

- Installation of solar can have insurance implications that will need to be considered
- Some insurance carriers will not issue coverage for systems with “net metering” (Dominion Energy’s “Solar Choice” rate plan, described later)
- You can either choose a different carrier or an alternative rate plan
  - Choosing a different carrier may mean having a higher premium that negates savings
  - The alternative rate plan (Dominion Energy’s “Offset Only”) practically necessitates using battery storage if long-term financial savings is your goal

Choose an Installer

- Finding an installer
  - Use referral services such as EnergySage, HomeAdvisor, etc.
  - Get referrals from people who have solar already
- Look up each installer at the BBB
  - If there are complaints, look to see whether the installer has been responsive to each reported issue. A responsive installer will have an A+ rating
  - Read the reviews
- Get proposals from multiple installers
- Get references from each installer and *talk* to them
- Ask if the installer offers a performance guarantee
- EnergySage offers free consultation to review installer proposals

Decisions you will need to make

- The big ones:
  - Decide which Dominion Energy rate plan you will use
  - Battery backup or not?
  - How will you pay for the system (purchase, finance or lease)?
- Consider replacing your roof if it has less than 10 years of useful life left
  - Panels are typically warranted for 25 years
  - Cheaper to replace now than doing it after panels have been installed
  - Can be even cheaper if your solar installer coordinates the replacement
  - Simply walking on an asphalt shingle roof can damage it and there will be a lot of walking during the installation
- Your installer can help with these decisions

Choosing a Dominion Energy Rate Plan

- “Solar Choice”
  - Tailored for residential solar - offers the most flexibility in system configuration and highest potential return on investment
  - Some insurance carriers will not write policies for Solar Choice due to its implied use of net metering
- “Offset Only”
  - No compensation for excess generation
  - Practically necessitates having battery storage if return on investment is a priority
- “Buy All/Sell All”
  - Not recommended due to its unfavorable financial terms
  - Suffers from the same insurance underwriting issues as Solar Choice

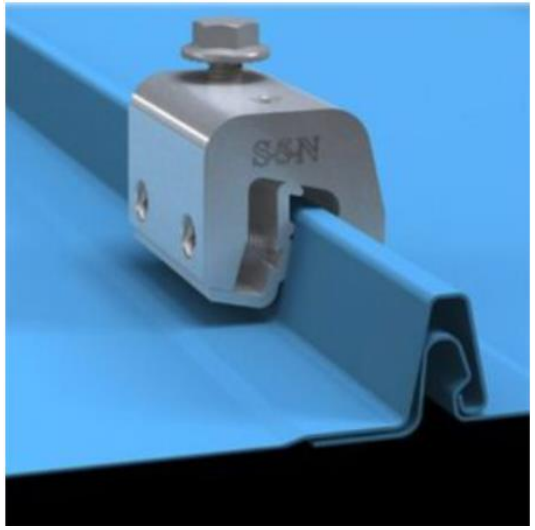
Battery Backup or Not?

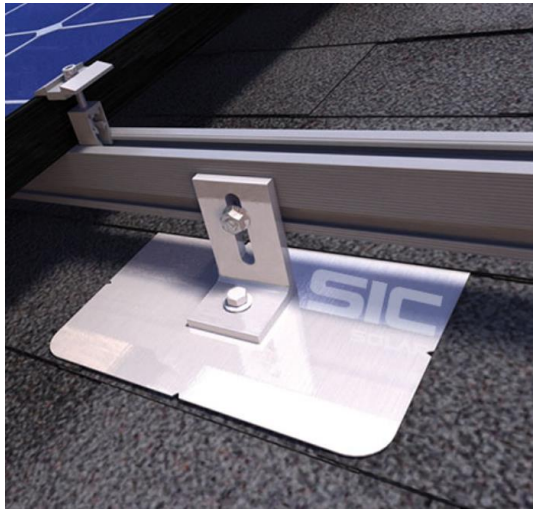
- Makes the most sense if you don’t currently have a backup generator for your home (beyond a using portable generator)
- Can help even out solar generation with demand, especially if using a Dominion rate plan that does not pay for excess generation
- Can coexist with an existing backup generator
- Don’t expect to charge your EV using your backup batteries (an EV car battery has much more capacity than all but the most extreme examples of home battery backup capacities)

Frequently Asked Questions

Will the installers need to pierce the roof sheathing?

- If you have a standing seam metal roof, the answer is “No”
  - Metal clips will be used to attach mounting rails to the metal roof
- If you have a shingle roof, the answer is “Yes”
  - Integrated flashing systems mitigate the risk
- Consult with your installer for other roof types





Will the backup batteries burn my house down?

No

- The predominant battery chemistry for residential use is Lithium Iron Phosphate (LFP)
- LFP batteries will burn if the house burns, but they will not burn your house down by themselves
- LFP batteries can be submerged and not burst into flame (although they will probably stop working)

What is this Community Solar thing I've heard about?

- Community Solar is the general term for shared ownership of solar panels in a utility grade solar farm
- Ideal for people who cannot install residential solar where they live
- Administered via a partnership between the solar farm operator and the utility, where the former installs and maintains the solar farm and the latter manages the billing
- The customer can either purchase or rent solar farm capacity
- Unfortunately, Dominion Energy does not currently have any community solar capacity to offer to the public

Others?

Slides and video are available on-line at
https://edisto.org/solar-power

Financial Details

Federal and State Tax Credits

Federal Residential Clean Energy Credit

Overview

- 30% tax credit through 2032
- Phases out starting in 2033: 26% in 2033, 22% in 2034
- Claim in installation year
- Excess credit carries forward
- No annual or lifetime dollar limit

Federal Residential Clean Energy Credit

Eligible Systems for the Solar Tax Credit

- Solar electric panels
  - New installations only
  - Includes mounting hardware and wiring
  - Includes labor costs for installation
- Battery storage technology
  - New installations only
  - Minimum 3kWh capacity (typical residential battery capacities are 7kWh and higher)
  - Includes labor costs for installation

Federal Residential Clean Energy Credit

Qualification Requirements

- Primary residence in US: Owner or renter may claim*
- Secondary residence in US: Rental properties do not qualify
- Limits for business use of the home:
  - Up to 20% business use: full credit
  - Over 20% business use: reduced proportionally
  - 100%: cannot claim the credit

*Dominion Energy permits only the owner to connect

Federal Residential Clean Energy Credit

Energy Credit Calculation

- Includes*:
  - Equipment costs
  - Installation labor
  - System components
- Subtract:
  - Utility subsidies
  - Manufacturer rebates
  - Installer rebates
- The resulting value is the amount used to calculate the 30% credit

*Roof replacement costs do not qualify

South Carolina Solar Energy Tax Credit

- Similar to the Federal tax credit with the following differences:
  - 25% of total costs
  - $3,500 annual limit per location
  - Limited to 50% of tax liability each year
  - 10-year carry-forward period

Technical Details

Dominion Energy Rate Plans

Dominion Energy Residential Solar Programs

Overview

- Dominion Energy South Carolina (DESC) claims to offer 6 separate rate programs for residential solar, but only three are currently available to new participants:
  - Solar Choice
  - Buy All/Sell All
  - Offset Only
- Available to homeowners only
- These programs are described on the following slides
- Full details at https://www.dominionenergy.com/south-carolina/save-energy/solar-for-your-home

Dominion Energy Residential Solar Programs

Solar Choice

You will move to the Residential Rate 5 – Time of Use Rate. You will consume self-generated power and be credited for excess energy delivered to DESC based upon the on-peak, off-peak and super off-peak periods defined by the Time-of-Use (TOU) Rate.

- Most like classic net metering
- System size limited to 20kW (note that typical system sizes are seldom over 10kW)
- Complicated TOU rates impact the ability to realize full benefit of net metering
- Best plan if you don’t opt for battery storage, but battery storage will help avoid the pitfalls of TOU rates
- Check with your insurance agent to make sure your insurer will cover net metering

Energy Flows: Solar Choice rate plan

Dominion's Solar Choice program has three time-of-use rates in decreasing order of cost: On-Peak ($0.26/kWh), Off-Peak ($0.11/kWh) and Super Off-Peak ($0.08/kWh)

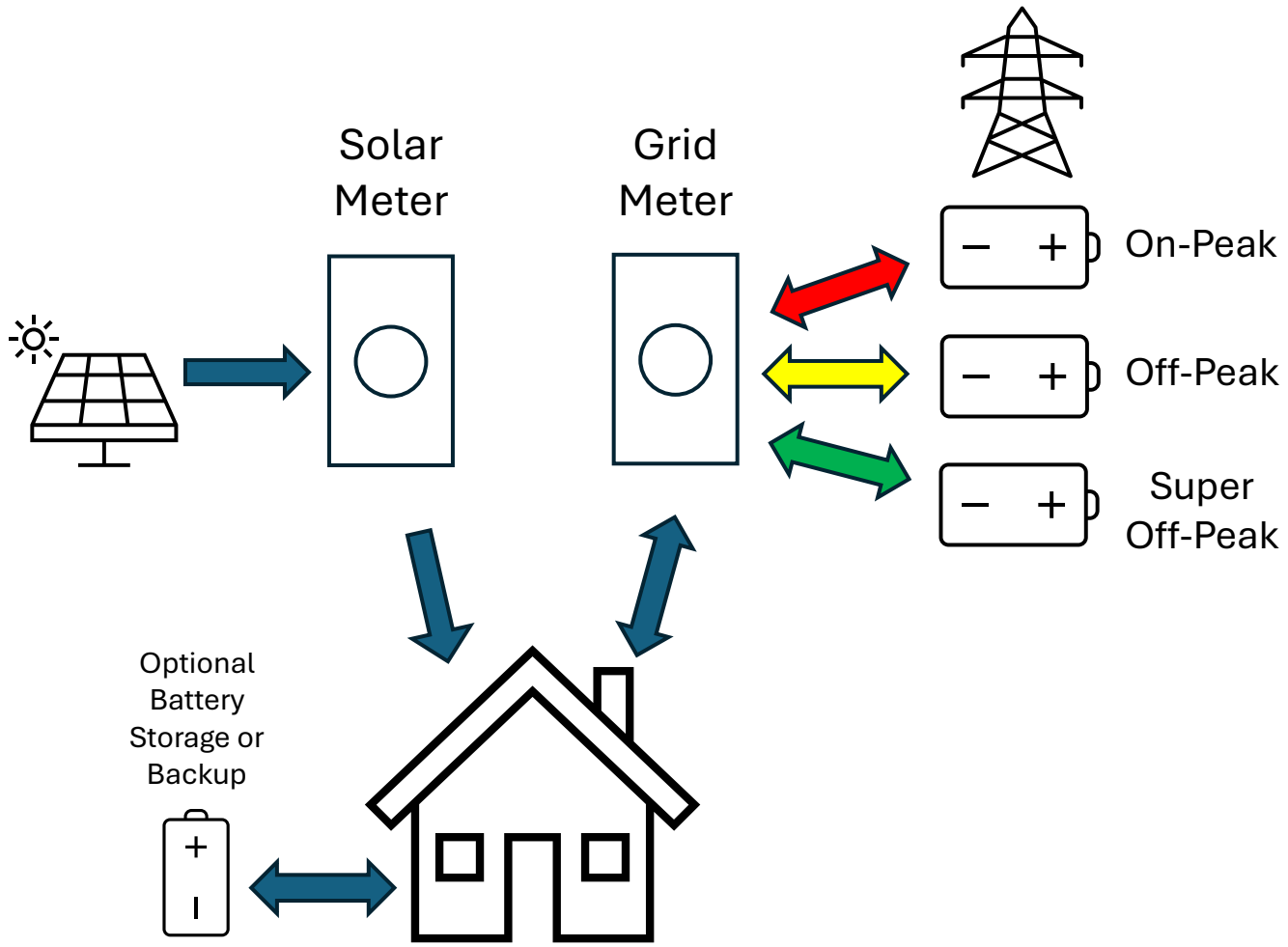
For comparison, the standard residential rate is a tiered rate varying from $0.13 to $0.15 according to the amount of use and time of year

The On-Peak rate is in effect M-F from 6-9am in cooler months (October through April) and 4-8pm in warmer months (May through September)

The Super Off-Peak rate period is 1-5am daily

Off-Peak is any other time

Banked energy is not shared across rates



Simple, right? Let me break it down…

- During On-Peak hours, there is limited ability to offset energy use, particularly in winter, and costs can be high. It's important to monitor your energy consumption during these times.
- Super Off-Peak hours will not benefit from solar energy generation, but they are cost-effective. This time will be ideal for charging your EV until you have accumulated sufficient excess Off-Peak energy.
- Off-Peak hours present the greatest potential for solar generation to offset energy usage and for accumulating surplus energy. If you have accumulated enough excess Off-Peak energy from earlier months, consider charging your EV during this period.
- Dominion’s Solar Choice rate plan dilutes the benefits of net metering, but programmable thermostats and intelligent battery back-up can help

Dominion Energy Residential Solar Programs

OFFSET ONLY

Your home uses self-generated power, as needed. Any self-generated power your home does not use is considered excess energy. DESC will not net, bank, or credit your account for any excess energy. This program is suitable for solar systems that are not expected to send excess energy to the grid.

- Unlimited system size
- Battery storage is a practical necessity to realize financial benefit of solar generation
- Beware the energy needs of EV charging

Energy Flows:
Offset Only rate plan

Blue arrows show AC current flow

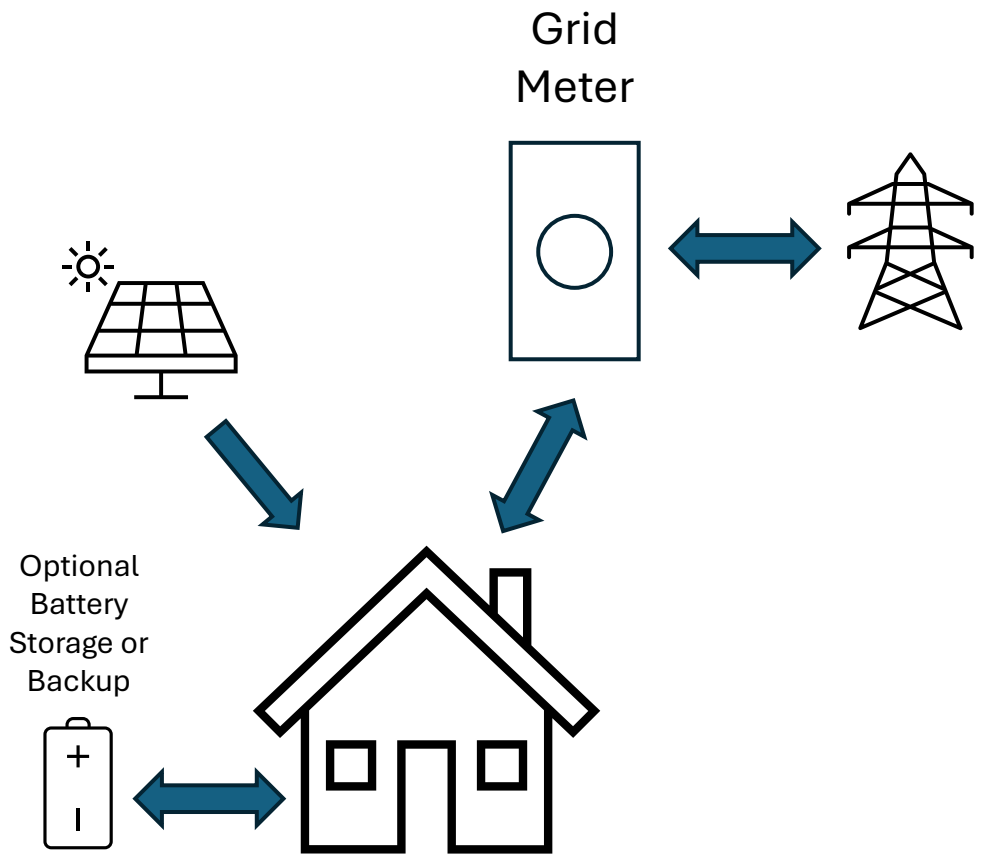
There is one meter for the grid

The Grid Meter does not “run backwards” and the grid does not act like a battery

The meter is used solely to measure energy drawn from the grid

All generated energy is used first to provide household power and recharge batteries

Excess energy is sent to the grid and is available only by re-purchasing at the residential rate



Dominion Energy Residential Solar Programs

Buy All/ Sell All (PR-1)

Buy at the standard residential rate for electric service. Sell *all* renewable energy to DESC at PR-1 Rate.

- Also a form net metering (2 meters)
- Approved for larger system sizes (limited to 100kW)
- Battery capacity cannot be used to even out demand and consumption
- The PR-1 rate you will receive is a fraction of the rate you would pay to purchase the same energy at the standard residential rate*
- This rate plan is effectively a discount on your consumption that will not take full advantage of your solar investment
- Check with your insurance agent to make sure your insurer will cover net metering

*energy generated between 6-9am M-F in winter months has an excellent rate, but will not be enough in practice to make this plan attractive

Energy Flows:
Buy All/Sell All rate plan

Blue arrows show AC current flow

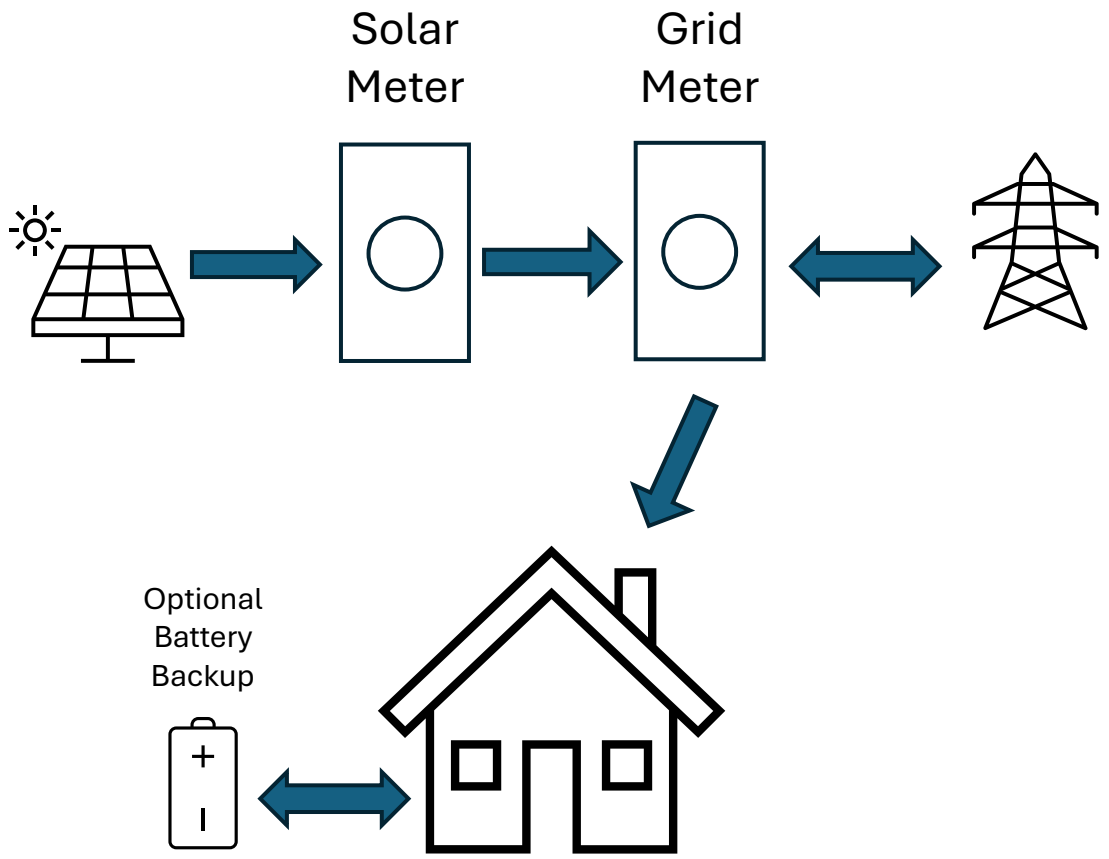
There are two meters: one for the solar panels and one for the grid

The Grid Meter does not “run backwards” and the grid does not act like a battery

The meters are used independently to calculate generated energy and energy drawn from the grid

All generated energy is purchased at the PR-1 rate, regardless of whether it is consumed locally or sent to the grid

Excess energy sent to the grid is available only by re-purchasing at the residential rate



Technical Details

Volts, amps, watts, watt-hours… what does it all mean?

Electric Power vs Electric Energy

POWER (Volts x Amps = Watts) represents what can or will be consumed or generated *at a given point in time*.

A solar panel **can** generate up to 400W (watts) of power when the sun is shining.

A microwave oven **will** draw 1100W of power while it is running.

ENERGY (Power x Time = Watt-Hours) represents how much power was generated or used *over a given period*.

A solar panel array generated 25kWh (kilowatt-hours) of energy on Tuesday.

The same microwave running for 5 minutes will have consumed 1,100 * 5 / 60 watt-hours (92.67Wh) of energy.

Batteries and Energy

Batteries are described by their energy *capacity*

Capacity is another term for energy, represented using the same units (e.g., watt-hours)

- An EV car battery might have a capacity of 135kWh
- A residential backup battery might have a capacity of 11.5kWh
- A pumped storage facility might have a capacity of 10GWh (gigawatt-hours)

Capacity is sometimes given in amp-hours. This is just short-hand when the voltage is known for a particular application (e.g., a power tool battery)

Batteries and Power

The amount of power a battery can produce or consume at a given moment is dependent upon its physical characteristics, NOT on its capacity	A 13.5kWh residential backup battery might offer continuous power of 5.8kW
	The same battery might only recharge at a maximum continuous power of 5kW
	A 135kWh EV battery might sustain a discharge rate of 100kW
	A 135kWh EV battery might recharge at continuous power of 300kW
	A 10GWh pumped storage facility might only offer maximum continuous power of 10MW

Technical Details

Batteries

Battery Chemistries for Residential Backup

One battery chemistry dominates residential battery storage:

Lithium Iron Phosphate (LFP) - ***Offers good safety and cycle life.***

Less common:

Nickel Manganese Cobalt (NMC) – Seen most often in EVs due to higher energy density. ***The solid gold toilet of home battery storage… and it can burn your house down.***

Lead-acid - Used in budget systems. Significantly lower performance and cycle life. ***Don’t even bother.***

Technical Details

Solar Panels

Desirable Solar Panel Characteristics

- Warranted for 25 years
- 92% power output by year 2025 (annual degradation <= 0.25%)
- Heterojunction Cell Technology
- Salt mist certification
- Good performance at high temperatures (P_{max} <= 0.24%/C^0)
- High energy density means fewer panels, but if you have the roof space, not a differentiating factor