

# SOLAR in Concord

This document lays out the benefits of solar (financial, environmental, & energy independence), siting decisions and - if you move ahead - steps in the process, as well as ways to learn, do, give, and ask more on these topics.

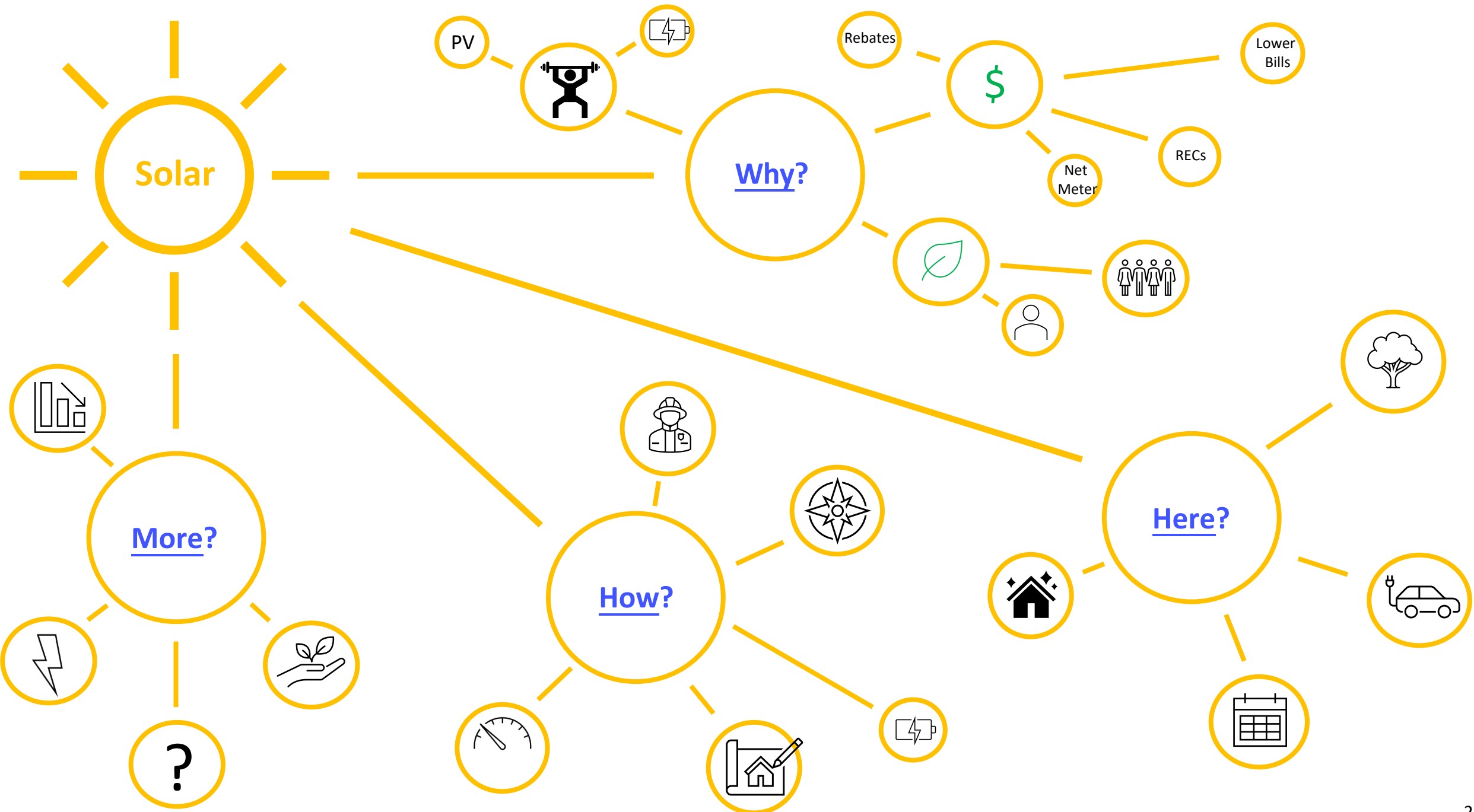
## FIRST THINGS FIRST

Getting a [free home energy assessment](#) can reduce your home's electric needs before you begin, allowing you to save money & right-size your solar array.

The typical home in Concord uses 8,000 kWh per year. Due to CMLP's Net Metering rates, we recommend that you do not install a solar array that will generate more than 80% of your annual electric use unless you have plans underway to increase your needs, such as electrifying your transportation or home. Examples of this would be transitioning from fossil fuels to an electric vehicle or heat pump. This document has some examples for a 5 kW solar array, which maximizes your CMLP solar rebate, but you can put in a system many times larger than this if you'd like.

Average 2023-2024 Installation Costs in Concord (before any financial incentives)	Solar Only		Solar + Storage		
	\$ per kW(DC)	Total for 5 kW Array	\$ per kW(DC)	# Batteries	Total for 5 kW Array
Stand-Alone Project	\$3,670	\$18,350	\$3,625	2	\$18,125
Paired with New Construction or Major Renovation	\$4,030	\$20,150	\$5,675	2	\$28,375

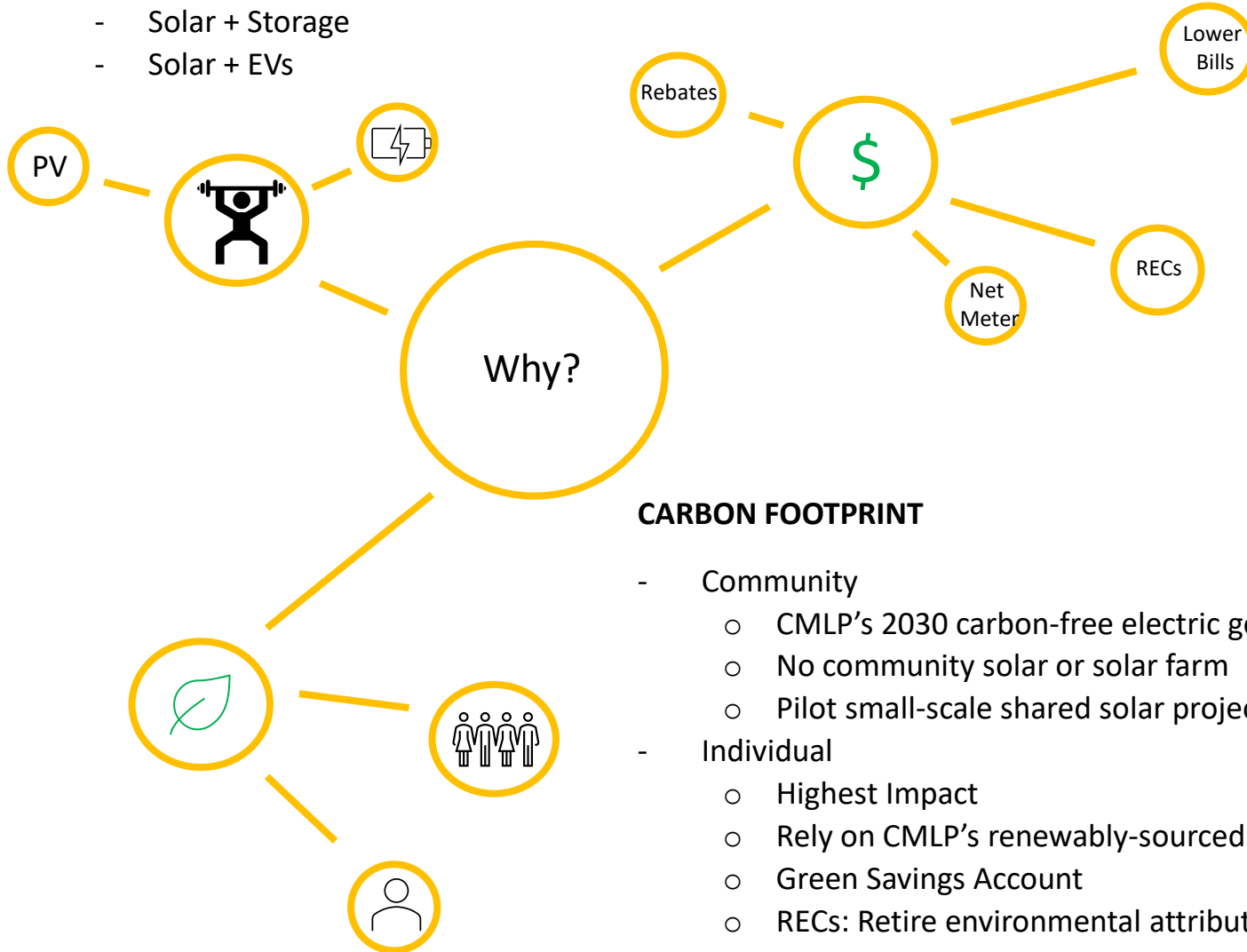
Once you've read this over, you may want to speak with one of our **SOLAR COACHES**. These are your friends and neighbors who've installed solar panels on their homes and volunteered to be available to talk with folks about the process, opinions on installers they worked with, good questions to ask when getting a quote, how to read your CMLP bills once your solar is up and running, and more. See the [last slide](#) for how to sign up for a coach. Let us know if you'd like one experienced in certain scenarios, such as where they live in town, which installers they used, how large their arrays are, whether they live in a historic district, if they also own an electric vehicle, and if they heat their homes with heat pumps or ETS (Electric Thermal Storage) systems.



# Why SOLAR in Concord - Overview

## ENERGY INDEPENDENCE

- Solar Only
- Solar + Storage
- Solar + EVs



## FINANCIAL INCENTIVES

- Rebates & Tax Credits
  - o CMLP: \$3,125 rebate
  - o State: \$1,000 tax credit
  - o Federal: tax credit: 30% of project cost
- Lower Electric Bills from CMLP
- RECs: Trade environmental attributes of your solar power
- Net Metering: Trading kWh back to CMLP

## CARBON FOOTPRINT

- Community
  - o CMLP's 2030 carbon-free electric goal... solar & renewable power both inside and outside of Concord
  - o No community solar or solar farm
  - o Pilot small-scale shared solar project: virtual net metering
- Individual
  - o Highest Impact
  - o Rely on CMLP's renewably-sourced power
  - o Green Savings Account
  - o RECs: Retire environmental attributes of your solar power

## Why SOLAR in Concord - Financial Incentives

### Rebates & Tax Credits

- **CMLP:** [rebate](#) of \$625 per kW(DC) of installed solar capacity, maximum \$3,125 per electric service address
- **State:** [\\$1,000 tax credit](#)
- **Federal:** [tax credit](#): 30% of project cost

### Lower Your Electric Bill

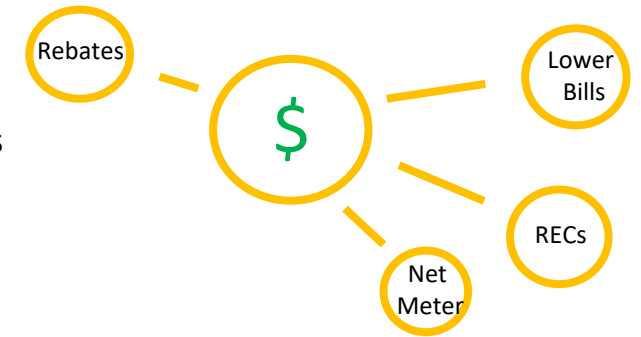
- Installing solar panels could lower your electricity costs by 30% or more
- A solar array will produce power unevenly during the year
  - Springtime: Solar PV works best when its cool, sunny, and trees haven't yet fully leafed out
  - Summer: Do you spend long summer holidays away from town? Will you be at home in Concord to use the solar power your panels produce?
  - Winter: Snow cover, cloudy weather, + lower sun angle = not much production from your solar panels. Can't fully power winter heat needs.

### Renewable Energy Certificates (RECs & SRECs)

- Solar owners have multiple options within this state program that offsets carbon footprint of electric utilities via clean energy aspect of solar power.

### Net Metering

- If, on net, your solar array produces more power than your home uses over the course of a one-month billing cycle, the excess is banked as dollars via wholesale (not the higher value residential) rates. The excess production cannot be stored as kWh on your electric account to trade-in during winter months. This means it's not financially beneficial to you to over-size your array.
- Can't transfer excess power to a different electric account



# Lower Your Electric Bill

If a household used 850 kWh per month, annual costs would be \$2,090 for the electric usage portion of the CMLP bills (before meter charges, etc.). You can expect to save at least 30% after putting solar panels on the roof - \$650 or more each year. Solar arrays should last at least 20 years.

If you follow along with your bill, you can see the breakdown below in usage charges that can be offset by solar:

**Rate Schedule**  
RES

- Service Charge
- Net Metering Distribution
- Underground Surcharge
- Capacity And Transmission Distribution Charge
- Energy Charge
- NYPA Power Cost Adjustment

**Electric Service Subtotal**



CMLP Residential Rate	Charges (in ¢ / kWh) Based on Electric Usage			
	Capacity & Transmission	Distribution	Energy	Total
<b>Tier 1</b> First 657 kWh	5.619	+ 6.561	+ 7.993	= 20.2 ¢ / kWh
<b>Tier 2</b> Next 178 kWh	6.928	+ 6.561	+ 7.993	= 21.5 ¢ / kWh
<b>Tier 3</b> Any use above 835 kWh	9.445	+ 6.561	+ 7.993	= 24.0 ¢ / kWh

Example		Total
850 kWh used in 1 month		
<b>Tier 1</b>	657 kWh x 20.2 ¢ / kWh = \$ 132.71	 <b>\$175</b>
<b>Tier 2</b>	178 kWh x 21.5 ¢ / kWh = \$ 38.27	
<b>Tier 3</b>	15 kWh x 24.0 ¢ / kWh = \$ 3.60	

## Renewable Energy Certificates ([RECs](#))

Your solar panels generate both electricity (kWh) and the fact that this electricity is carbon-free (RECs). RECs are instruments traded on the open market to offset greenhouse gas emissions. When buying RECs, an electric utility is buying the right to claim clean energy so they can abide by government regulations to reduce the carbon footprint of the electricity they purchase. You still use the actual energy generated by your solar array, but the RECs certifying this energy as renewably-sourced are now owned by that utility. This regional cap-and-trade program provides financial incentives to expand solar while also mandating that utilities supply their customers with increasingly clean power over time.

CMLP requires a production meter socket for all solar arrays. Your installer will need to supply either a production meter or jumpers for that socket. A **PRODUCTION METER** enables you to register your RECs, giving you the following options:

- **SELL:** SRECs are valued in hundreds of dollars per MWh rather than tens of dollars for Class 1 RECs. Most solar owners use REC aggregators to watch the market and decide when to sell RECs on the open market for the best price. You could try shopping around for an aggregator or you might want to be hands-on and do the trading yourself. Keep in mind questions such as the number of payments per year, the REC price, and the commission percentage.
- **RETIRE:** On the other hand, you may elect to retire your RECs, meaning you will not gain any financial value from them. In doing so, you will be able to retain the rights to claim that your solar array produces 100% carbon-free energy.

If you choose **JUMPERS** instead of a production meter, the regional renewable energy tracking program cannot tally any production from your solar array so you will not be able to generate any RECs:

- **OPT OUT:** Because you will not produce any RECs, you will not have the option to gain any financial value from them. Just like retiring RECs, you will retain the rights to claim that your solar array produces 100% carbon-free energy.

# Estimate Your Renewable Energy Certificates (RECs)

Different REC classes (SREC I, SREC II, and Class I RECs) have different values on the open market. REC class is dependent on when your solar array started generating power. If CMLP gave your system Approval to Operate before 2019, you qualified for the SREC I or SREC II program. 10 years after your array began operating, your SRECs drop down to the Class I REC value.

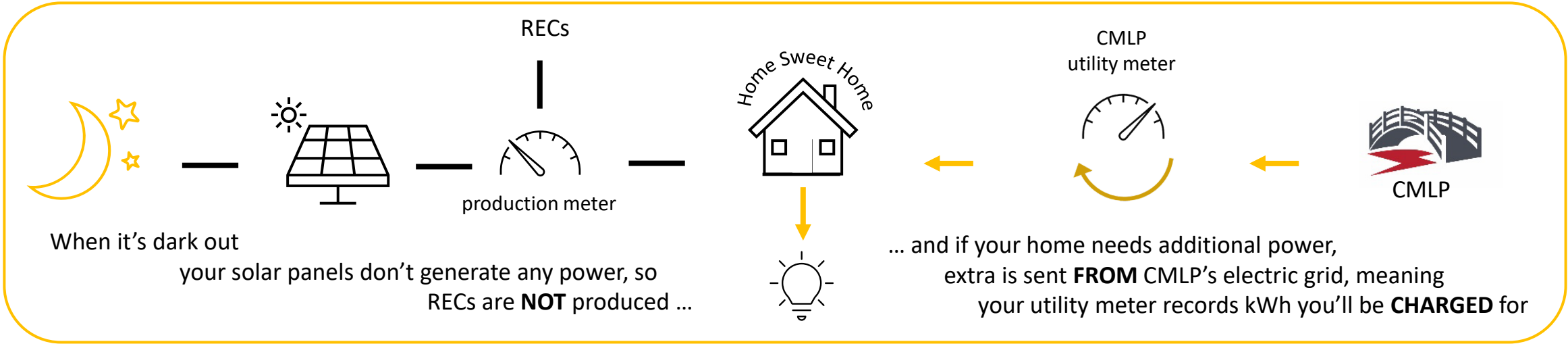
Solar REC Program	First Decade			Second Decade			All 20 Years	Notes
	Initial REC Class based on Approval to Operate		Estimated Annual \$ from 5 kW Array	All are Class 1 RECs based on Transition Date		Estimated Annual \$ from 5 kW Array		
	Earliest	Latest		Earliest	Latest			
SREC I	Jan 1, 2010	Apr 25, 2014	\$ 2,000	Jan 1, 2020	Apr 25, 2024	\$ 250	\$ 22,500	Homeowner owns RECs & may choose to sell or retire them
SREC II	Apr 26, 2014	Nov 26, 2018	\$ 1,500	Apr 26, 2024	Nov 26, 2028	\$ 250	\$ 17,500	Homeowner owns RECs & may choose to sell or retire them
MLP Solar	Nov 27, 2018	Jul 31, 2022	\$ -	Nov 27, 2028	Jul 31, 2032	\$ -	\$ -	CMLP owns RECs & retires them
Class 1 RECs	Aug 1, 2022		\$ 250	Aug 1, 2032		\$ 250	\$ 5,000	Homeowner owns RECs & may choose to sell or retire them

Each MWh (megawatt-hour) of renewable production generates one REC.  
 Approximately  $(1.2) \times (\text{your solar system size}) = 1 \text{ REC}$ .

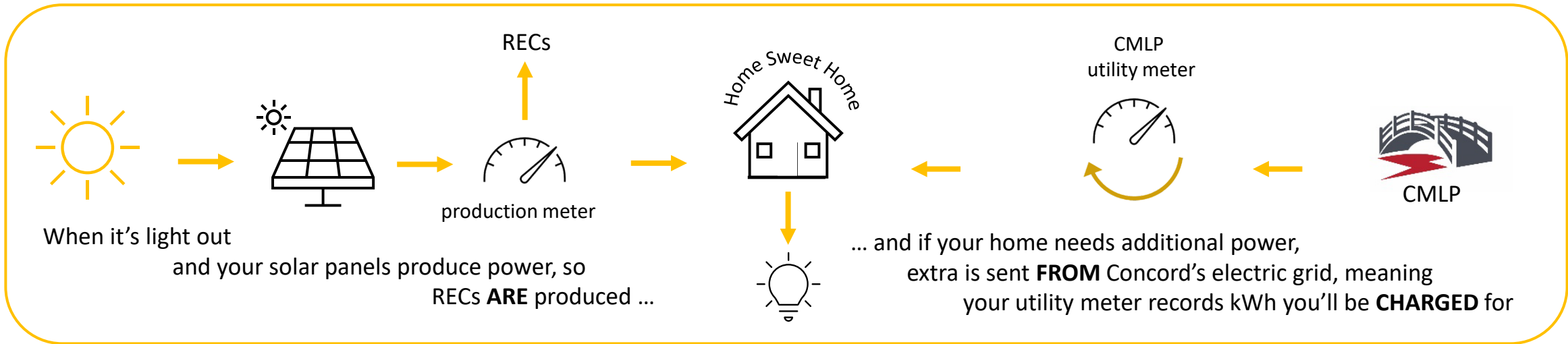
Example:  $(1.2) \text{ times (a 5 kW(DC) system)} = \text{expected to produce 6 RECs per year}$ .

# Net Metering

## Nighttime – No Solar kWh Production

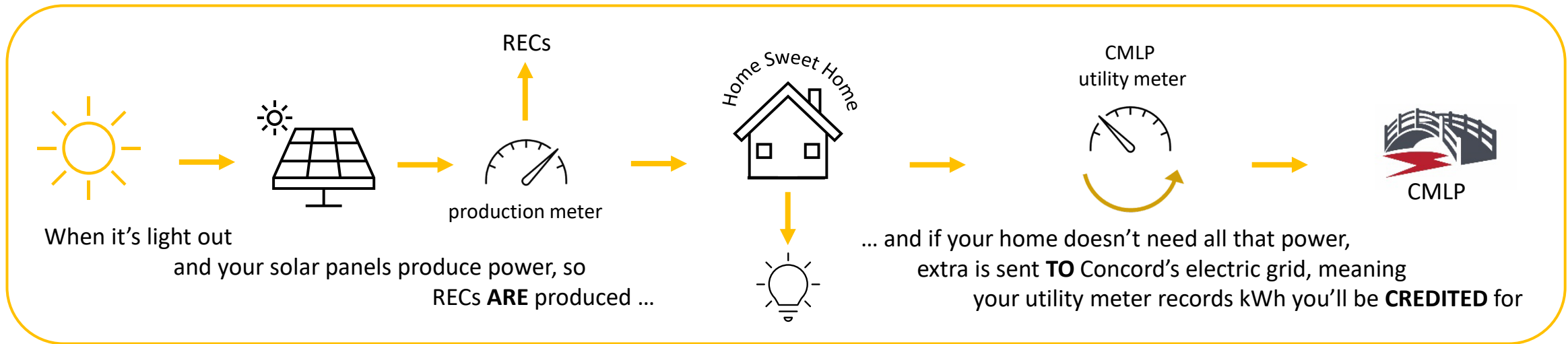


## Daytime – Not Enough Solar kWh Production



# Net Metering, con't

## Daytime – Excess Solar kWh Production



Because CMLP buys excess electricity from you at wholesale rates, but sells energy to you at residential rates, it isn't in your financial best interest to over-size your solar array. The total amount of **SOLAR ENERGY USED AT HOME** over the course of a billing cycle **\*WITHOUT OVER-PRODUCING THAT MONTH\*** (and therefore selling back to CMLP) represents the **HIGHER VALUE** residential rate power. It's more economically efficient for you to right-size or under-size the number of panels on your home. When you do this the avoided cost value of the solar power produced by your panels is the same as the residential rate charged by CMLP (see slide 5). Any excess kWh in a billing cycle generated by an over-sized array, like the 3<sup>rd</sup> scenario in table below, are credited at the wholesale rate on your CMLP bill. Due to this uneven valuation, and because seasonal changes mean your solar array won't always match the exact amount you need (2<sup>nd</sup> scenario), you are better off under-sizing your solar array. We recommend installing a solar system no larger than 80% of your need, unless you have plans in motion to increase your electric demand, such as purchasing an electric car.

Examples over the course of an entire 1-month billing cycle				
Scenario	Your array produces	Your home uses	You send to CMLP (@ wholesale rate)	CMLP sends to you (@ residential rate)
under-size	95 kWh	100 kWh	0 kWh	5 kWh
right-size	100 kWh	100 kWh	0 kWh	0 kWh
over-size	105 kWh	100 kWh	5 kWh	0 kWh

## Why SOLAR in Concord - Carbon Footprint



### ALL of US

- CMLP sources some of our electricity from solar arrays both inside and outside of town borders. Our page [here](#) shows how much of Concord's total electricity use is from renewable & non-renewable sources. CMLP has been increasing our portion of non-carbon emitting power over the past decade. We now purchase less than 50% of our electricity from carbon-emitting power plants. Each year since 2018 we have offset increasing amounts of that carbon-emitting portion of our power via REC purchases, meaning CMLP now provides **100% CARBON-FREE ELECTRICITY**.
- There are **NO SOLAR FARMS** (also called community solar) in Concord that individual residents can buy shares in.

### SOME of US

- CMLP is working with a condominium development on a small-scale **SHARED SOLAR** project. Condo owners pay for and own the solar array. CMLP uses the pilot to field test virtual net metering with our meters and billing system. This allows the solar co-owners to share the benefits by equitably allocating any excess solar electricity to each unit owner's electric bill that month. The solution addresses issues with easements and aesthetics and helps prevent smaller piecemeal arrays that disadvantage unit owners whose roofs are more shaded.

### ONE of US

- Highest Impact – Use of Money:
  - Use \$ for a Different Project: CMLP's electricity is getting greener each year, so you might decide to use your funds on personal actions other than putting solar panels on your roof. With this philosophy, you could **USE THE MONEY YOU WOULD USE FOR SOLAR TO REDUCE YOUR FOSSIL FUEL USE**, such as replacing your car with an electric vehicle. See more [information](#) and read about CMLP's [rebates](#).
  - Grow \$ with a Different Project: You could begin reducing your carbon footprint with the lowest price option, such as [weatherizing](#) your home, and **USE THE MONEY SAVED** via lower home heating and cooling bills for larger ticket items, such as solar panels.
- Highest Impact – Carbon Reduction: Regardless of funds, because the electricity you use from CMLP is already low-impact, you may want to **FOCUS ON THE MOST CARBON-INTENSIVE PART OF YOUR FOOTPRINT**. For instance, you could reduce fossil fuel use by switching to an electric [lawn mower](#), [induction stove](#), or [heat pumps](#) for home heating and cooling.

PV

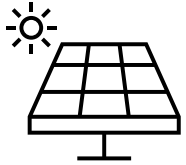


## Why SOLAR in Concord - Energy Independence

**Power Outages:** CMLP has an excellent history of short and infrequent grid outages. But climate change brings more severe weather, increasing the likelihood of power disruptions.

**Home Electric Needs:** It is becoming increasingly popular to work from home, which necessitates more reliable electric supply.

For these reasons, some people want to install solar panels to keep their power running when lines come down.

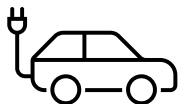


**SOLAR PV Systems:**

**UNFORTUNATELY, SOLAR-ONLY CUSTOMERS WILL NOT HAVE POWER FROM THEIR SOLAR PANELS DURING AN OUTAGE.** Even though the array is always active in daylight, power flow from the panels to the home is stopped by the inverters if they detect no voltage from the grid.

**SOLAR PV + BATTERY Systems: ISLANDING** During Power Outages

Solar + battery customers can use power from their systems during a grid outage. The battery control equipment will isolate the house from the grid. This is called “islanding.” The panels can keep generating power and send it to the battery. The battery will stop providing power if it drains below a particular threshold, such as 20% capacity. The user can configure this setting.



**SOLAR PANELS + EV BATTERIES**

In theory, a homeowner's EV can function like a regular home battery to pair with solar panels.

Currently CMLP's grid, meters, EV technology, and device communication & programming are **NOT YET CAPABLE** of this.

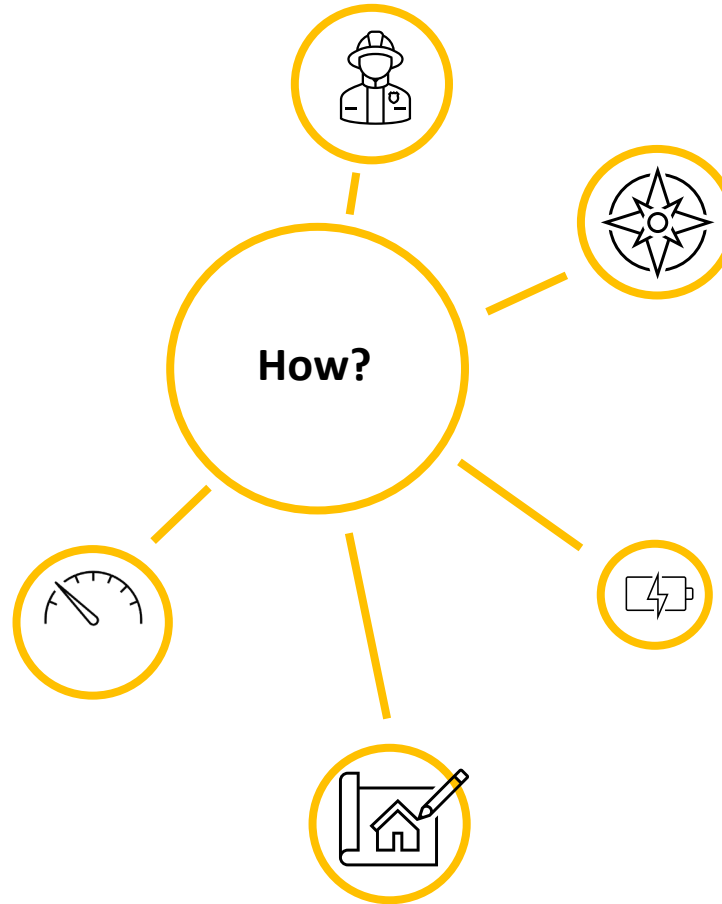
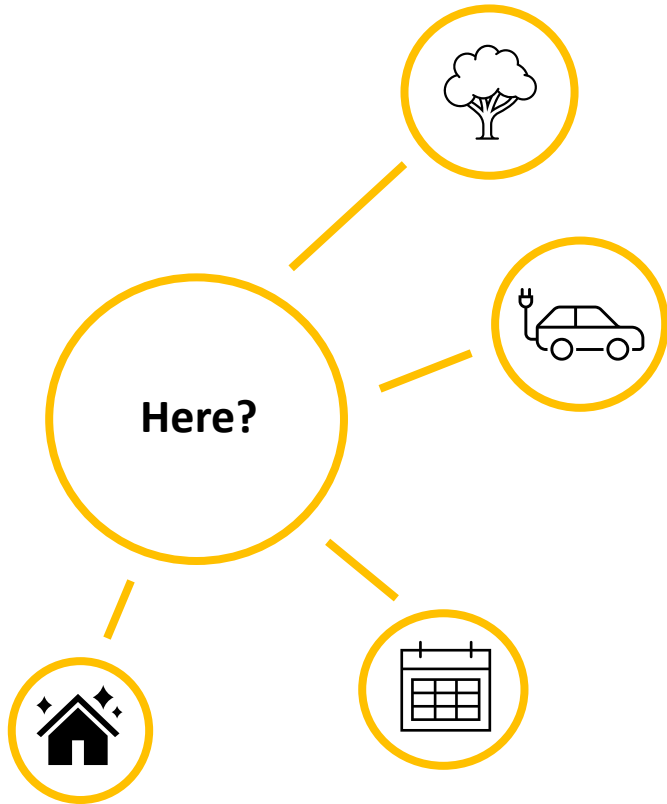
# How to SOLAR Here in Concord – Overview

## SOLAR HERE IN CONCORD

### Location

- Shading & Azimuth
- Historic Districts
- Roof Replacement
- Ground Mounts
- Expected Length of Home Ownership

### Sub-Meters



## HOW TO SOLAR IN CONCORD

### Early Steps

- Research
- Quotes
- Contract
- Documents

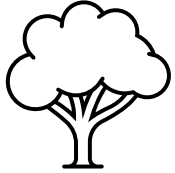
### Middle Steps

- Approval to Install
- Permits & Inspections
- Site Work

### Final Steps

- Batteries
- Meter Swap
- Approval to Operate
- Pay Up
- Go SOLAR!

## SOLAR Here in Concord – Location



**SHADING & AZIMUTH:** CMLP has no mandates regarding the impact of shade or compass orientation (azimuth) on your solar array. But, as food for thought, the state has a solar rebate that doesn't allow panels with more than 20% shading or that face north of due east or due west. Concord residents are no longer eligible for this MLP Solar Program, but it can give you a feel for a 'standard' to keep in mind when comparing your quotes. You can mitigate shade impacts by trimming or cutting down trees, but that added work can increase your costs by thousands of dollars, reduce the natural cooling and wind protection around your house, decrease the carbon sequestration properties of the trees, and affect your curb appeal. If your installer proposes putting panels on roof planes that face northeast or northwest, ask them to provide a solar production estimate comparison with and without using north-sloping parts of your roof.

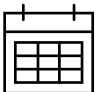
**HISTORIC DISTRICTS:** Another factor to consider when thinking about installing solar is whether you live in one of Concord's [historic districts](#). If you do, you may need to abide by Historic District Commission [regulations](#). Also see [this link](#) plus the bottom of [this page](#) on sustainability tips for historic homes.



**ROOF REPLACEMENT:** If your roof is over 10-15 years old, you may want to include a clause in the contract with your solar installer for removal, storage, and re-installation of the panels. You can also consider replacing the sides of your roof that face the sun with solar shingles instead of asphalt shingles covered by solar panels. You may decide to replace your roof (or the parts where the solar panels will go) before it's truly needed, so you don't need to remove and re-install the solar panels for re-roofing.

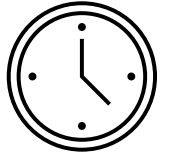
**GROUND MOUNTS:** If various roof complications are too cumbersome, another option is to put a ground-mount array on your property. One benefit of this option is that they can be built to take advantage of the ideal tilt and azimuth for our region, while also avoiding shading.

**EXPECTED LENGTH OF HOME OWNERSHIP:** Many people use a 10-year payback period as a metric to evaluate whether to move forward with a project. If you think you may sell your home before that, you may want to hold off on solar. Multiple studies have found that solar panels increase home [resale value](#), but there are many factors involved.

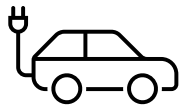


## SOLAR Here in Concord – Sub Meters

If your electric bill includes any special rates (such as Electric Thermal Storage (ETS), Time of Use (TOU), or Electric Heat), each distinct use has its own meter. You must decide if you want your solar array to be wired to that meter or your main house meter. Your solar panels can feed into one or the other meter, but not both at the same time. If you invest in a transfer switch, you can program it or manually switch it between the meters on the different rates. But any given meter can't benefit from multiple rates (such as solar net meter credits + time of use) at the exact same time. See more details on [this page and its sub-pages](#).



Some Specific Examples:



**ELECTRIC VEHICLES:** If your EV is separately metered to take advantage of CMLP's Time of Use rate, you must choose if you want your solar panels to power your home or your car. Your vehicle likely won't need enough electricity to make it worth wiring your solar exclusively to your garage. One solution is to install a transfer switch that you flip each morning to charge the EV from your solar panels during the day and again each evening to benefit from the grid's lower cost off-peak power each night. A simpler work-around is to enroll in CMLP's [EV Miles Program](#) instead. Also see our [decision tree](#).

**CONTROLLED WATER HEATERS** don't have a sub-meter, so they are not impacted by this issue. Electricity from your solar panels will power the water heater along with all your other household power needs.

**ELECTRIC HEAT** (Electric Resistance or Heat Pumps): If you choose the Winter Electric Heating Rate, CMLP installs a second meter and keeps that meter on the Tier 1 rate throughout the winter. All other electricity use in the house is on a different meter that stays at the 3-tier rate throughout the year. Your solar array can feed into one or the other meter, but not both. Homeowner with this rate must choose if they want their solar panels to power their house or their heating system. Another constraint with this scenario is that, although you don't pay for the 2<sup>nd</sup> meter, you do pay for the 2<sup>nd</sup> meter socket, and you may not recoup those costs before CMLP transitions away from the 3-tiered rate system.

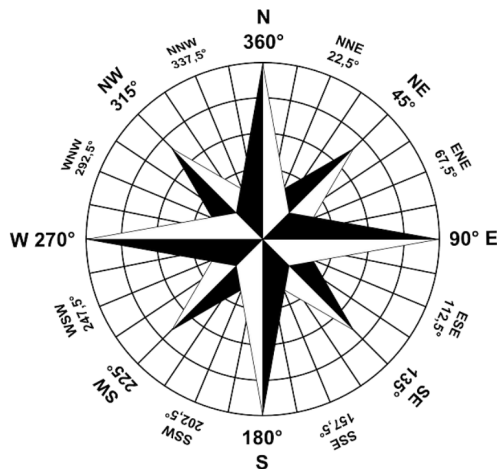
## How to SOLAR in Concord – Early Steps

**RESEARCH** the decision to go solar

Get **QUOTES** from multiple solar installers. CMLP recommends getting 3 quotes from different installers for comparison shopping. We've got a list of [installers](#) who have already worked in town. CMLP does not endorse or pre-qualify these companies in any way. We don't pre-screen any solar contractors, but you can find suggestions for assessing your options on the installer page. Sometimes installers say they won't work in Concord. This may reflect different rebates and net meter rates in other Massachusetts towns, but not CMLP's policies – we welcome projects with any solar installers.

Sign a **CONTRACT** with one.

- Make sure the installer you work with bookmarks our [page](#), reads it and the sub-pages thoroughly, and communicates with CMLP if they have any questions after that.
- Bear in mind that the roof planes you chose to put your panels on will affect the annual electricity production. In Concord, due to how far north we are, and the amount of cloud cover we get each year, you might expect a panel on a roof that faces northeast to produce 75% of the electricity that the same panel could produce if it were installed on the other side of your roof that faces southwest. If you want to put panels on parts of your roof that don't face the sun, ask your installer to run the numbers for your scenario. Factors such as the tilt of the roof slope, tree cover, shading from chimneys or other parts of the structure, or plans to expand your home can affect these discussions.



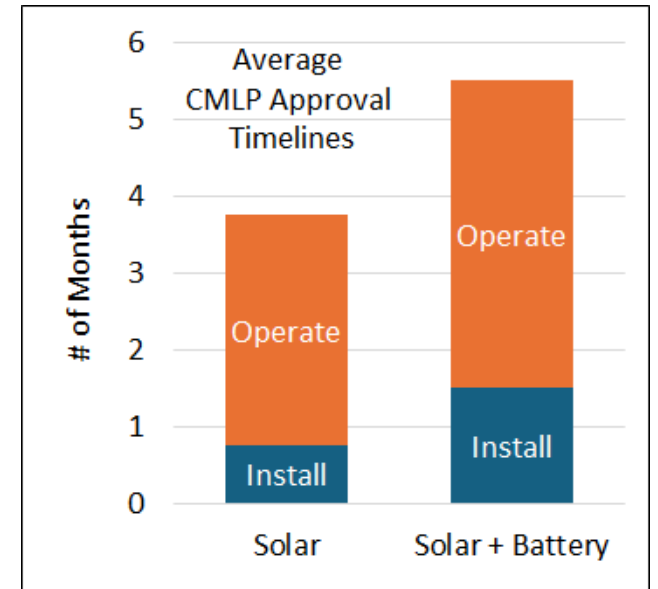
Your installer emails all interconnection **DOCUMENTS** listed [here](#) to CMLP



## How to SOLAR in Concord – Middle Steps

**APPROVAL TO INSTALL:** CMLP Engineering staff review the documents to assure the planned system will be safe for the homeowner and our line crews.

- Sometimes CMLP’s Engineering Division has a packed schedule and needs to prioritize other items over solar reviews. CMLP will notify you and your installer as soon as the project has been approved for installation.
- Occasionally the added excess electricity flowing back to the grid from your solar array means CMLP needs to upgrade equipment in your neighborhood. In those cases CMLP covers the equipment cost but the solar installer and/or homeowner must cover CMLP’s labor costs – usually about \$1,000.
- After CMLP receives the complete document set from your installer, it takes about 4 weeks to reach Approval to Install for solar-only projects. Typically, it’s another 10 weeks for your solar installer’s work, the Concord Building Department’s inspection, and CMLP’s Approval to Operate. Adding batteries to your project significantly impacts the timeline, likely because they are often installed during major renovation or new construction. Solar + storage projects usually take 8 weeks for the first step and another 18 weeks for the next.



Electric **PERMITS** from the [Concord Building Department](#) are required



If **BATTERIES** are included in the project, the plans must be reviewed by the Fire Dept. They do not allow energy storage systems to be sited in basements or attics. They do allow batteries to be installed in garages, sheds, and other easily accessible areas. This is to keep first responders safe in the event of a fire.

Once all the steps above are completed, your installer can schedule the job and do the **WORK ON SITE**.

## How to SOLAR in Concord – Final Steps

After the array is installed, the permits must pass **INSPECTION** by the Concord Building Dept.

If the project includes energy storage, a Battery **WITNESS TEST** must be scheduled. During that on-site visit, your installer demonstrates to CMLP Engineering staff that the system meets our safety requirements, including wiring, equipment, disconnects, labels, battery charge / discharge settings, solar pass through, demand on local transformer following an extended power outage, simulated power outage, & time delay after power is restored.

CMLP writes the **WITNESS TEST LETTER**, which must be counter-signed by your installer and returned to us.

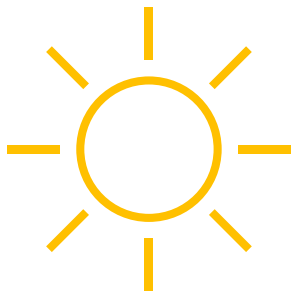


CMLP's Electrician swaps out your old meter for a send-and-receive meter, also called a **NET METER** or smart meter.



CMLP will do a final review before issuing the official **APPROVAL TO OPERATE**. Please do not power up your system until you receive the official Approval to Operate email with the final full set of signed interconnection documents attached. If you turn on your array before we reprogram our billing software, you could be mistakenly charged for electricity your panels generated and sent back to the grid instead of getting a bill credit for that excess power.

We recommend that you do not make your **FINAL PAYMENT** to your installer until this step is completed.



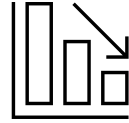
*Congratulations!*

You can turn on your system and **BEGIN GENERATING SOLAR POWER!**

## More SOLAR in Concord

### How to Read Your CMLP Solar Electric Bill

See our [handout](#) for sample bills, explanations of charges, and how to calculate the amount of solar power your home uses each month



Learn More



### Electrify Your Home

Use your solar panels to power [new equipment](#), such as a heat pump water heater, an electric vehicle, or an air- or ground-source heat pump to heat your house

Do More

### More Questions...



Get in touch with Pamela Cady, CMLP's Energy Efficiency & Electrification Specialist at [pcady@concordma.gov](mailto:pcady@concordma.gov) or (978) 318-3149 to ask other questions or talk to a Solar Coach

Ask More

### Want to Be a Solar Coach?

Help others by passing on your knowledge to other Concord residents considering solar. Contact CMLP to be added to the coaching list at [pcady@concordma.gov](mailto:pcady@concordma.gov) or (978) 318-3149

Give More



More?