

Grantham's Going Solar

as a part of



Town of Grantham Energy Committee

<http://www.granthamnh.net/energy>

&

Eastman Energy Committee

<http://www.eastmanenergy.info/>

Grantham Energy Committee:
providing

Education

Guidance

Advice



Are you ready for

Solar ?

☀️ Introduction to residential photovoltaic (PV) solar energy

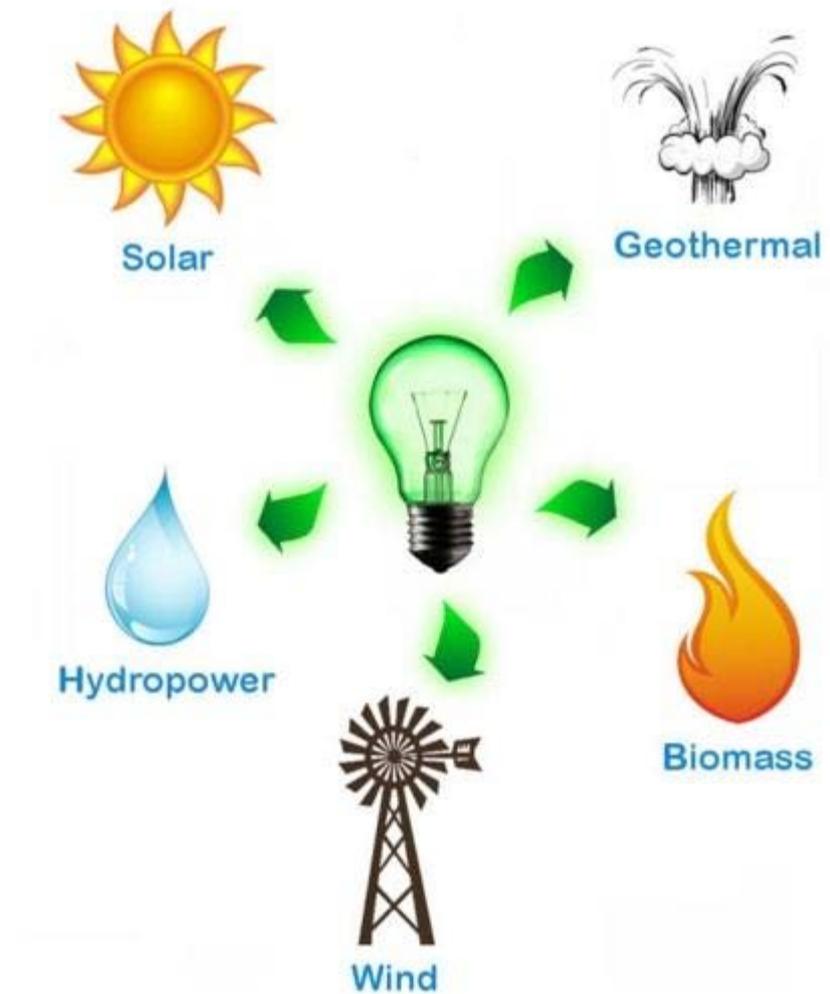
What you need to know to go solar

Q&A with Installers

Meet with Installers



Renewable energy is the power harvested from natural sources which are not in danger of being depleted



What is PV Solar Energy

pho-to-vol-ta-ic: fōtəvōl tāik, fōtōvāl-/adjective, relating to the production of electric current at the junction of two substances exposed to light.



PV is **not** solar thermal energy where a different type of collector is used to heat water or other fluids

Solar Photo Voltaic Systems are:

Cost effective

Efficient

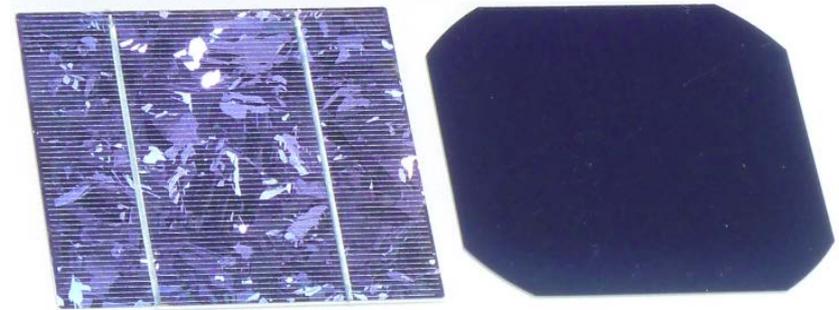
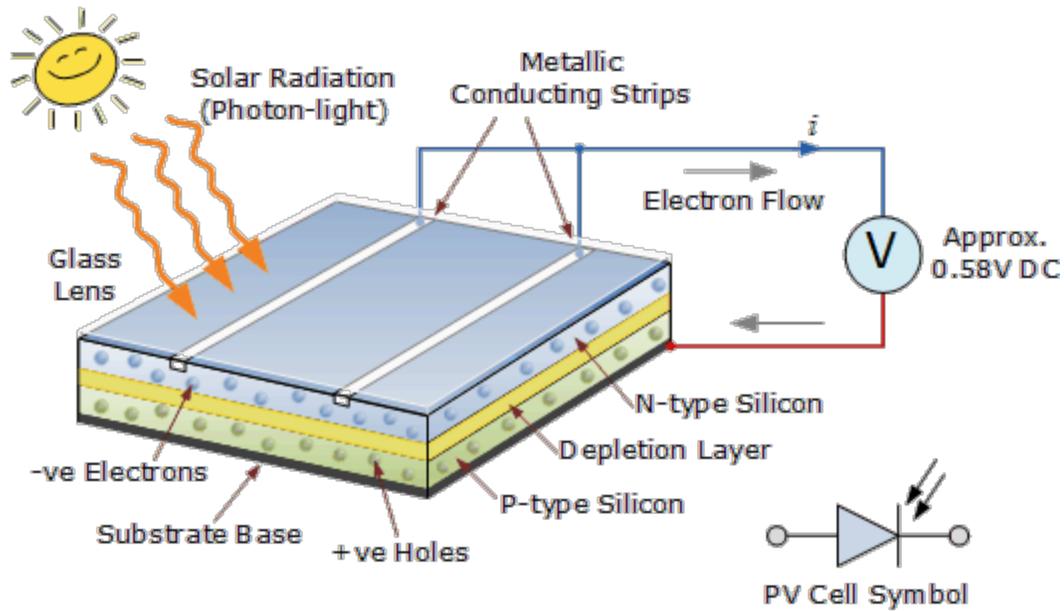
Reliable

Flexible

Green



What is a PV system?



PV cell outside

PV cell inside



PV panels



PV array

20 panels can produce ~5kW of electricity

What is a kW?

- a watt (W) is the unit of measurement for electric power
- a kilowatt (kW) is 1000 watts
- a kilowatt-hour (kWh) is a measure of electric power production or consumption over a period of time



A 100 watt light bulb,
When lit for 10 hours,
uses 1 kilowatt-hour
of electricity

What happens to the power my array makes?

Use it!



OR

Store it :

Battery Backup

for Off-grid and On-grid systems

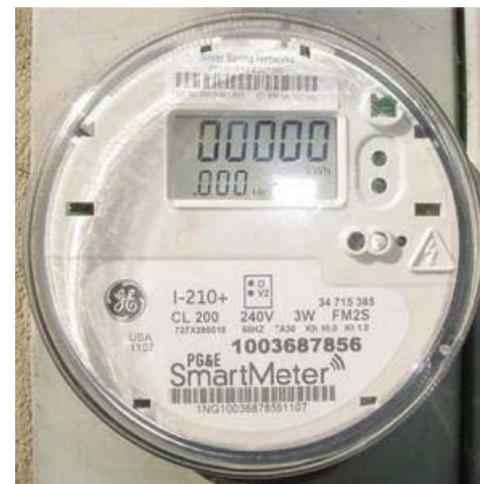


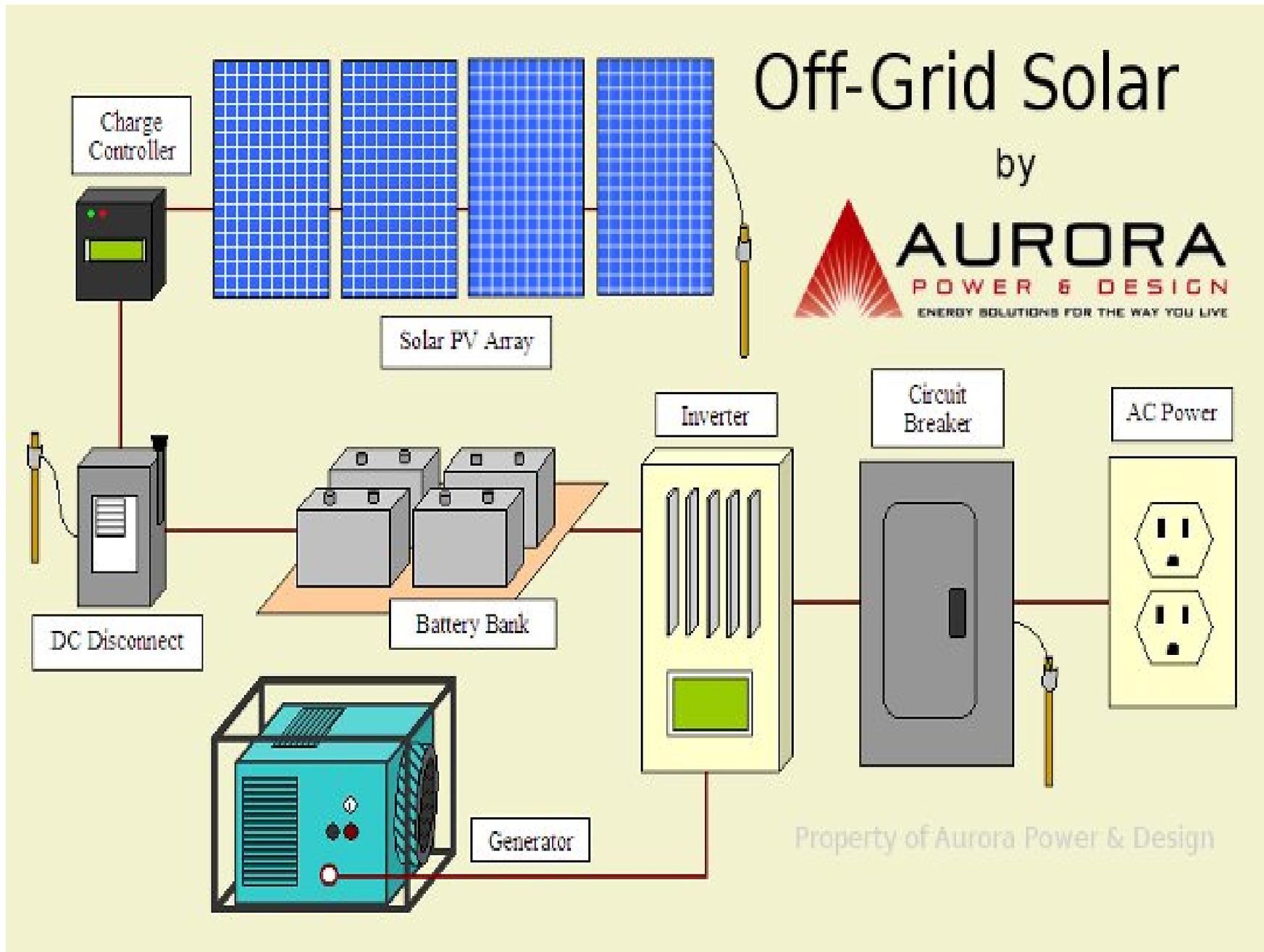
OR

Let EverSource manage it:

Net Metering

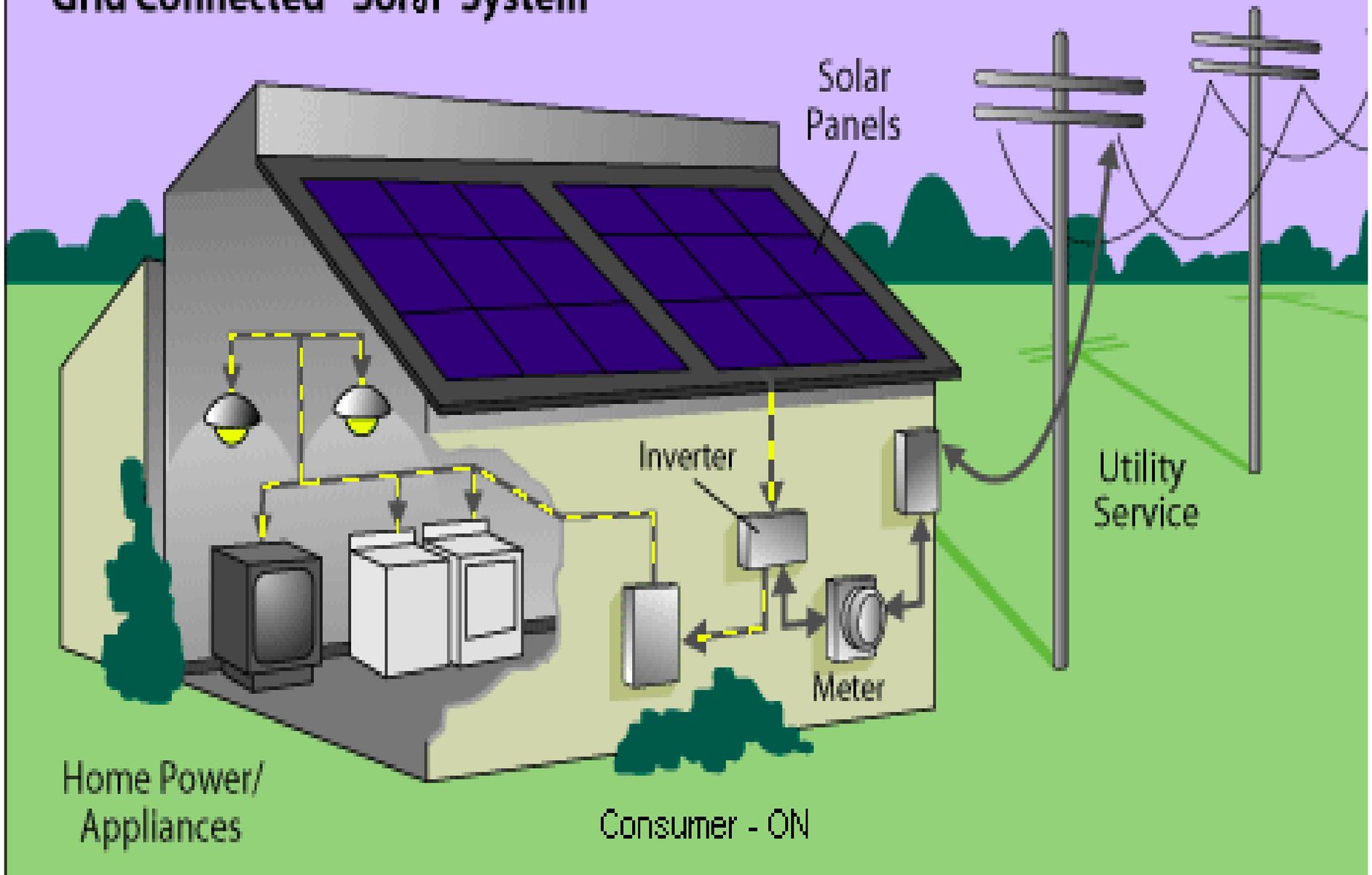
for On-grid systems only





Off-grid system with battery bank and generator

Grid Connected Solar System



Grid-tied system (without battery bank)



What is Net Metering?



Net Metering allows you to use the grid like an electrical bank account. The excess energy you produce, during the days when you don't need it all, you **sell** to the Eversource, and then when your panels aren't producing enough to meet your needs, you **buy** electricity from Eversource.

Under the current 100mW cap, the price for buying and selling is the same (1 to 1 net metering). This relationship is locked in for 25 years. When the PUC finalizes its rates for net metering, perhaps as soon as late autumn, you may have to **buy** electricity **at a higher price** than what you'll **sell** your excess electricity for.

Net Metering is regulated by the NH Public Utilities Commission

The Net Metering Debate

- Utilities contend they should pay residents for their solar power at the same rate they pay Hydro Quebec and coal-fired plants for power, but this ignores the tremendous losses of electricity incurred from long distance transmission lines, and they pay different rates based on demand, not a single rate.
- Your excess solar power helps keep your neighbors' refrigerators running, etc., so it doesn't travel very far, thus it has minimal losses.
- Peak power, which costs the utilities the most to buy, occurs when you are likely to be at work, and your solar array is adding the most power to the grid.
- 1 to 1 net metering is a good incentive for residents to install solar; reducing our dependence on fossil fuel derived power that adds to air and water pollution, and promotes climate change.
- Despite pressures from outside lobbyists, like ALEC, the NH Legislature and Governor had the PUC implement limited net metering. That could change when we hit the new 100mW cap.

The Net Metering Cap

The NH PUC originally required the state's electric utilities to grant 1 to 1 net metering to its customers in order to provide up to 50mW of electricity from renewable resources.

- Senate Bill 333 just increased this cap to **100mW**
- Eversource is now accepting new applications,
- This additional 50mW will be divided proportionately among the state's distribution utilities
- 60% of each utilities' share will be reserved for facilities generating less than 100kW (residential arrays) **but 70mW of this has already been committed**

Apply to Eversource **this summer** to be a part of the last 30mW, or you may not have 1 to 1 net metering extended to you. This is why we urge you to consider going solar **NOW!**

Is solar for me? (it's not for *everyone*)

Do I have enough access to direct sunlight?

(a site evaluation by an installer will help you determine this)

Am I willing to trim or remove some trees, if required?

(Eastman requires a Form 5 submitted to the EEC for approval)

Can I arrange the funding or financing within 12 months?

(5kW systems (20 panels) average about \$20,000, installed)

Will I like how the panels look on my roof, or in my yard?

Will it void my roof warranty or affect my property value?

(the value of the system is **not** added to your appraisal for property taxes)

Does solar even work in New Hampshire?

(as well as it does in Austin, Texas; but not as well as satellites in earth orbit)

Should I wait for the technology to improve? (you'll miss 1 to 1 NM)

Decision 1

What kind of PV System should I invest in?

Grid-tied? (least cost, most ROI)

Grid-tied with a battery back-up? (cost more, but ensures you'll always have power)

Off-grid? (costs the most, but a lot less than running a long power line)

Decision 2

Where should it be installed,
and how complex should it be?

- roof or ground mounted?
- fixed (roof/ground), adjustable (roof/ground), or tracking (ground)?
- Inverters & controllers?

Things to ponder (but not for too long)

Consider being part of the carbon solution by generating electricity.

Aesthetics

Accessibility for maintenance

Cost

Considerations for Roof Mount

- Orientation (south is best), where are the trees?
- Structural integrity of the roof
- Amount of available space

Considerations for Ground Mount

- More flexibility, can be positioned away from trees
- Wind loading, especially with tracking systems.
- Site work: trenching, foundations, ballast systems
- Snow removal

Decision 3

What kind of inverter system?

- **String?**

One large, heavy, wall mounted unit

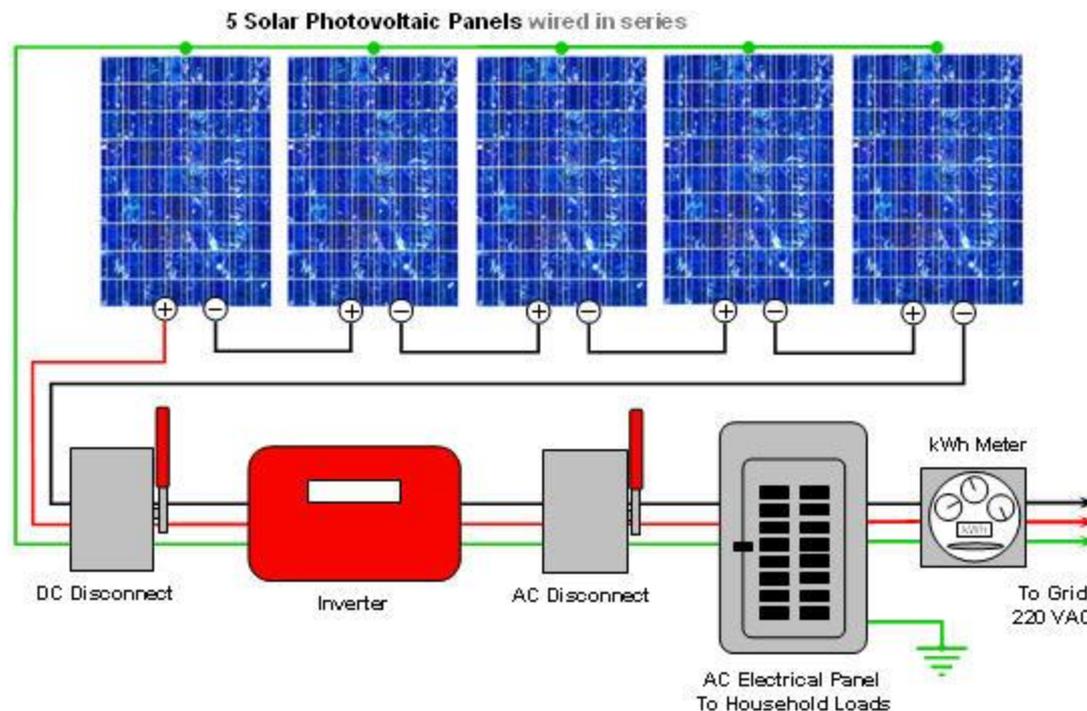
Old technology – converts low voltage DC from all panels to 120/240VAC

Sized to match solar array, so difficult to expand PV array

Lowest cost, but requires long lengths of heavy gage, expensive cabling

If one panel is partially shaded, whole system shuts down

No per panel monitoring



Decision 3

What kind of inverter system?

- **Micro Inverters?**

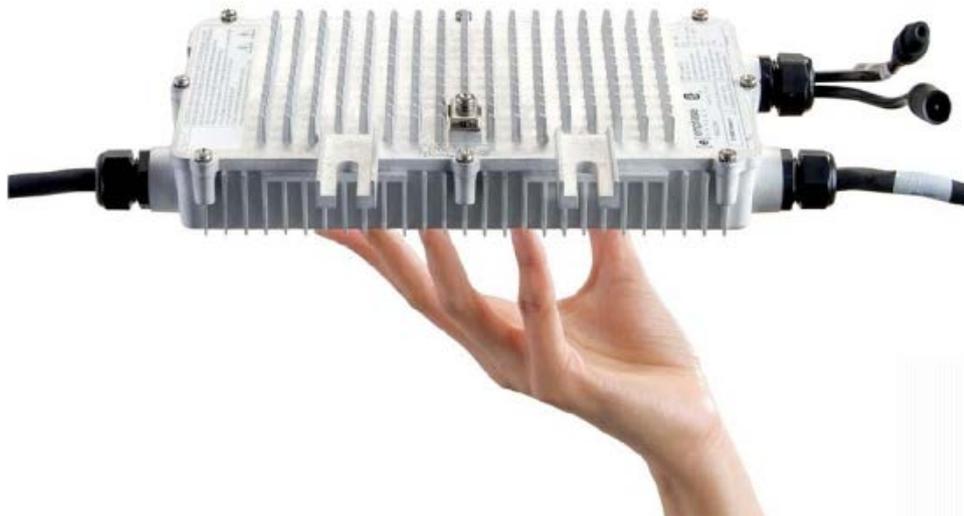
Small electronic inverter on each panel

No high voltage DC – converts DC to AC at the panel, so no heavy cables, easiest to install

Easiest to expand your PV array, each panel separately monitored

Most have same 25-year warranty as panel, reliability has improved

If one panel is partially shaded, only part of the one panel shuts down



Decision 3

What kind of inverter system?

- **Optimizers?**

Similar to microinverters in concept, but still uses a string inverter

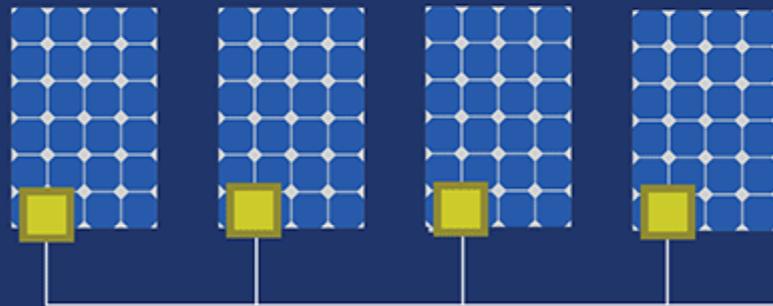
One optimizer per panel for optimization and monitoring

Simpler electrical components, easier to expand PV array

If one panel is partially shaded, only the one panel is shut down

Power Optimizers

- one optimizer per panel, plus central string inverter
- function well on roofs with shade or multiple panel orientations



power optimizers



inverter



Decision 4 Do I need a Battery Backup System?



Lead-acid

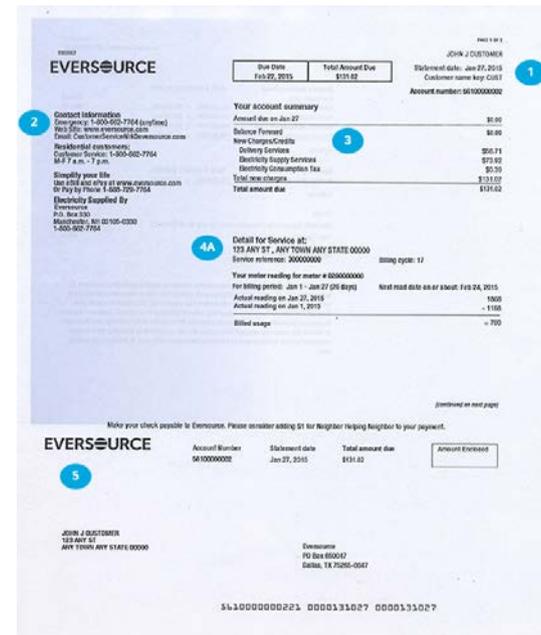
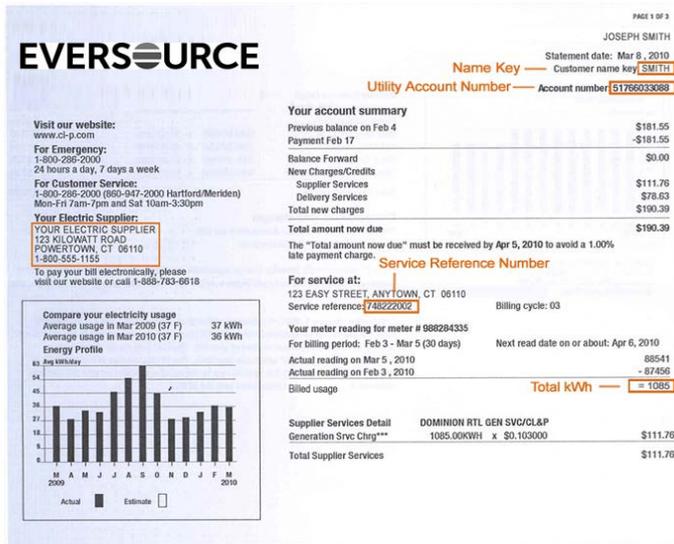


High Tech

Ensures you'll still have power at home when the grid goes down.

Decision 5 What size system do I need?

- What are your energy requirements ?
Electric: Heat? Water Heater? Stove? Clothes Dryer?
- The actual amount of electricity produced is dependent on how much solar energy reaches your site.
- Average size PV system is 5kW
- Determine your power usage from your EverSource bill



More on sizing: Three reasons to potentially “think big” and oversize your system

1) Electric Heat Pump Water Heaters

- Relatively new to the market; very efficient
- Solar water heating from your PV system!

2) Electric Air-Source Heat Pumps

- Becoming more viable in this climate
- Solar space heating from your PV system!

3) Electric Cars

- Even if a Tesla Model S isn't in your future, a Nissan Leaf might be...
- Transportation fueled by your PV system!



Of course,

You can supply all your electricity needs with a smaller PV system, if you improve your energy efficiency:

- Get an energy audit from EverSource
- Seal up and insulate your home
- Trade in your old refrigerators
- If you don't like compact fluorescent lights, try LEDs
- Super-efficient “heat pump” dryers are now available
- Great resources are at energystar.gov



ENERGY
EFFICIENCY

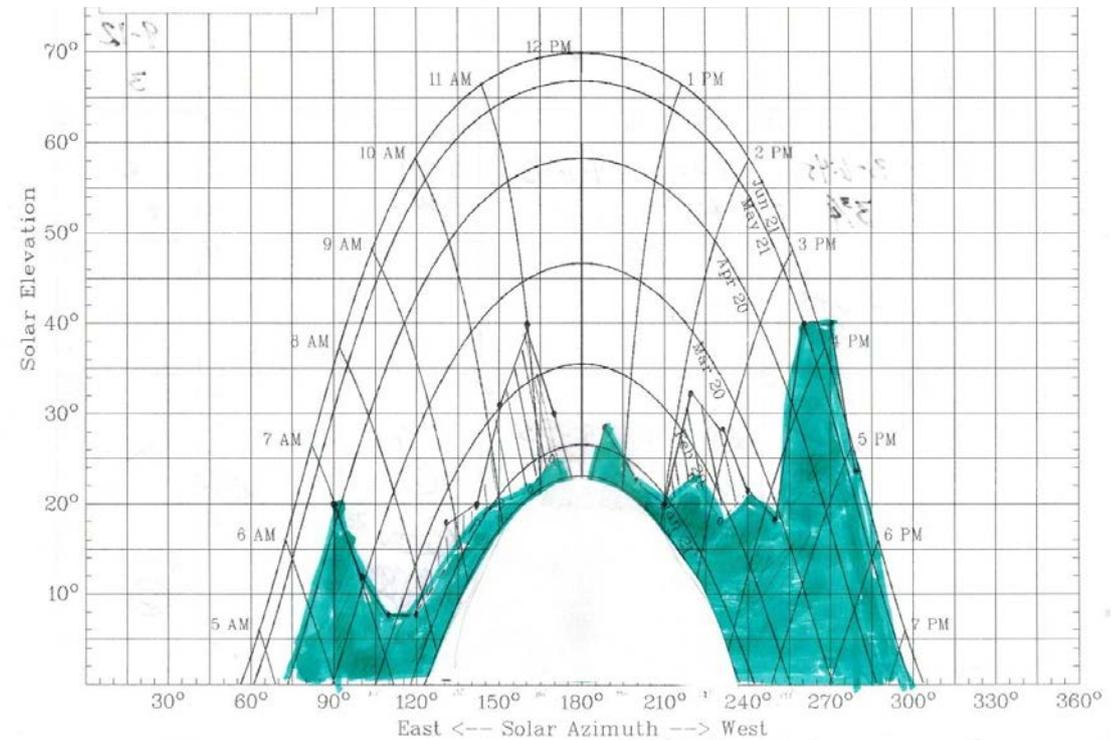
Do I have a good location for solar panels?

(site evaluation/solar survey)

Tilt – The angle of fixed panels should be close to **37** degrees (9:12 roof pitch)

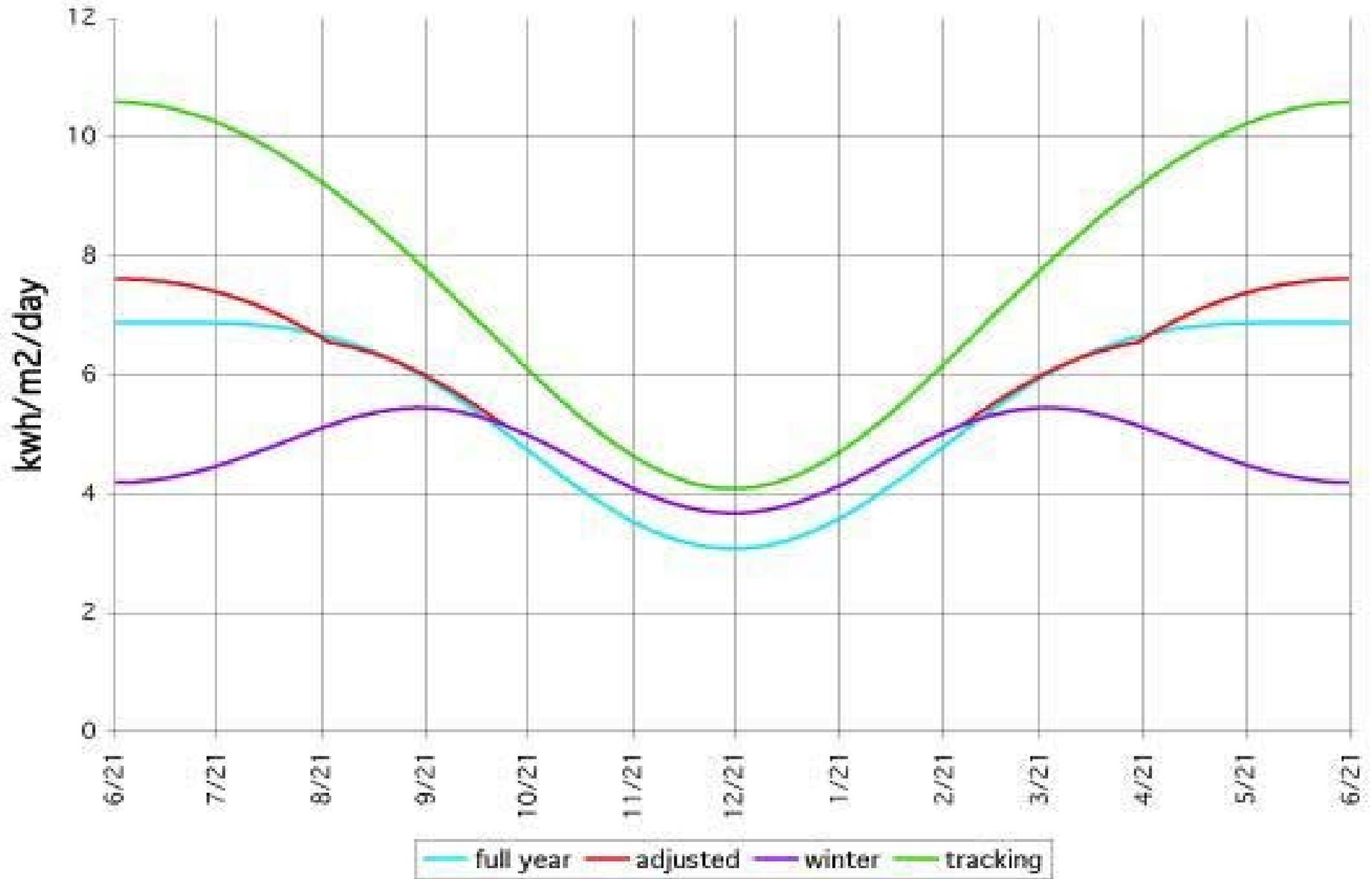


Azimuth -
Pointing true south is best

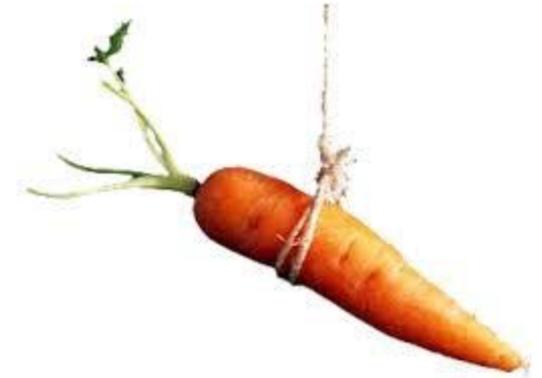


Avoid shading!

Seasonal effects on array tilt



Residential Incentives



Federal: 30% investment tax credit (“30% ITC”)

- Scheduled to decrease to 10% starting in 2019 through 2021
- Credit is claimed on IRS Form 5695: Residential Energy Credits
- Paperwork is simple: enter total system cost and multiply by 30%; copy the result to Line 53 of Form 1040

State (PUC): Cash rebate of 50 cents per watt (on your system wattage rating) up to a maximum of \$2500, or 50% of system costs, whichever is less

- Two-step application process, usually handled primarily by the installer
- Systems as large as 10 kW are eligible, but rebate maximum is still \$2500
- This is a limited fund, so it may not be available in the future

Utility: Class II Renewable Energy Credits (REC's) are worth \$32 per kW

How much does a PV system actually cost?

(an example of a 5kW, 20 panel system at \$4/watt, installed)

Installed price:	\$20,000
Less 30% tax credit:	<\$6,000>
Less 50¢/watt PUC rebate	<\$2,500>
Income tax on rebate	\$625
<u>REC's \$160/yr * 10 years</u>	<u><\$1600></u>

Actual cost: \$10,525 (\$2.10/watt, installed)

Payback / ROI

Given the above established system cost of \$10,525:

If your annual electricity expense is \$1000 at .20/kWh, and your production and consumption are equal at 5000kW/year, your payback period will be ~126 months, and you will get more than 14 years of free electricity worth over \$14000!

That's an annualized Return on Investment (ROI) of 9.3% and a reduction of 89.56 tons of CO2 over the next 25 years! (However, your mileage may vary.)

What if I don't have \$20,000 in cash?

Get a site visit and quote now to get your application in ASAP: you have **12 months** to secure the financing.

Home Equity Loans

Ask your banker

Installer Finance Programs

Ask your installer

www.vitalcommunities.org/energy/solarize-financing/

An excellent resource

Lease to own/Planned Purchasing Agreement's (PPA's)

Usually for municipalities, schools, and non-profits

Offered by some installers and “Angels”

Application, Permitting and Property Taxes

Utility application for Net Metering

If you intend to install a Solar PV system within the next 12 months, get your Net Metering interconnect application into Eversource ASAP, so you'll get 1 to 1 metering. You will need to have a specific system selected, but you can amend the application before you install.

Town Building Permit is Required

Very simple process if PV system will be installed on the roof of an existing structure or on the ground.

Eastman Permitting

With installer, determine required tree work and submit your Form 5 to the ECC right after site visit. Then submit your Form 8 and copy of the Town building permit for adding solar, along with the usual bond that will be returned at project completion.

No property tax impact!

Cost/value of solar systems will not be added to assessed home values for taxation in Grantham.

Six reasons to act **NOW!**

- 1) The 1 to 1 NH PUC Net Metering cap of 100mW is projected to be reached by September.
- 2) The 30% Federal Residential Investment Tax Credit begins to decrease to 10%, starting in 2019.
- 3) State and utility incentives may decrease or disappear if ALEC influenced lawmakers prevail.
- 4) Net Metering regulations may change, but existing 1 to 1 Agreements will be honored for 25 years
- 5) If you are concerned about climate change, CO² reductions today are better than future reductions
- 6) Interest rates are low, which makes financing more viable

What you can do to prepare:

1) Figure out how much electricity you consume in a year.

- Your Eversource bill should tell you this, or they can over the phone.

2) Might your consumption change significantly in the future?

- Sealing and insulating your home, and replacing old windows?
- Electric car? New additions to the family, or kids heading off to college?
- Upgrading to a new efficient refrigerator? Heat pump water heater?

3) Think about viable locations for your PV system

- Roof- vs. ground-mount; consider trimming or thinning trees as necessary

4) Ask questions

- The Energy Committees are your “solar ambassadors”

5) Speak with the Solar Installers tonight

- Learn from the pros. **Schedule a site visit!**

6) Help spread the word!

- If you're not ready, maybe you know someone that is...

How to Select an Installer

What products do they sell, what are the warranty periods and what do they cover?

What services do they provide?

What support do they offer over the warranty period, especially if an equipment manufacturer goes out of business?

Speak with the installers here tonight and go on-line

Talk to your friends and neighbors who have systems

Compare quotes – cost per kW

Or You Can Do It Yourself

Do you have more time and tools, than money?

Its simpler than you think

Kits are available that are eligible for the rebates (requires electrician's sign-off)

Have a Solar Raising

DIY is not for everyone...

- You need confidence in your electrical and mechanical ability
- Are you afraid of heights?
- You wont get the same level of professional support or advice
- You may find that financing (other than a credit card) is not available



When in doubt, get professional help! **Electricity is Dangerous!**

Additional Resources

- A copy of this presentation
- Links to EverSource and Government web pages
- A list of local Solar Installers
- Energy Calculators
- Cost/ROI Calculators
- And much more can be found at www.granthamnh.net/energy

Grantham's going Solar!

Will you join us?



We're here to help you!

Education

Guidance

Advice



It's Q & A time!