Grid-Tied Solar

SAN MIGUEL POWER ASSOCIATION

Touchstone Energy® Cooperatives
The power of human connections®

The following slides offer some information on Net Metering and Grid-Tied Solar at SMPA

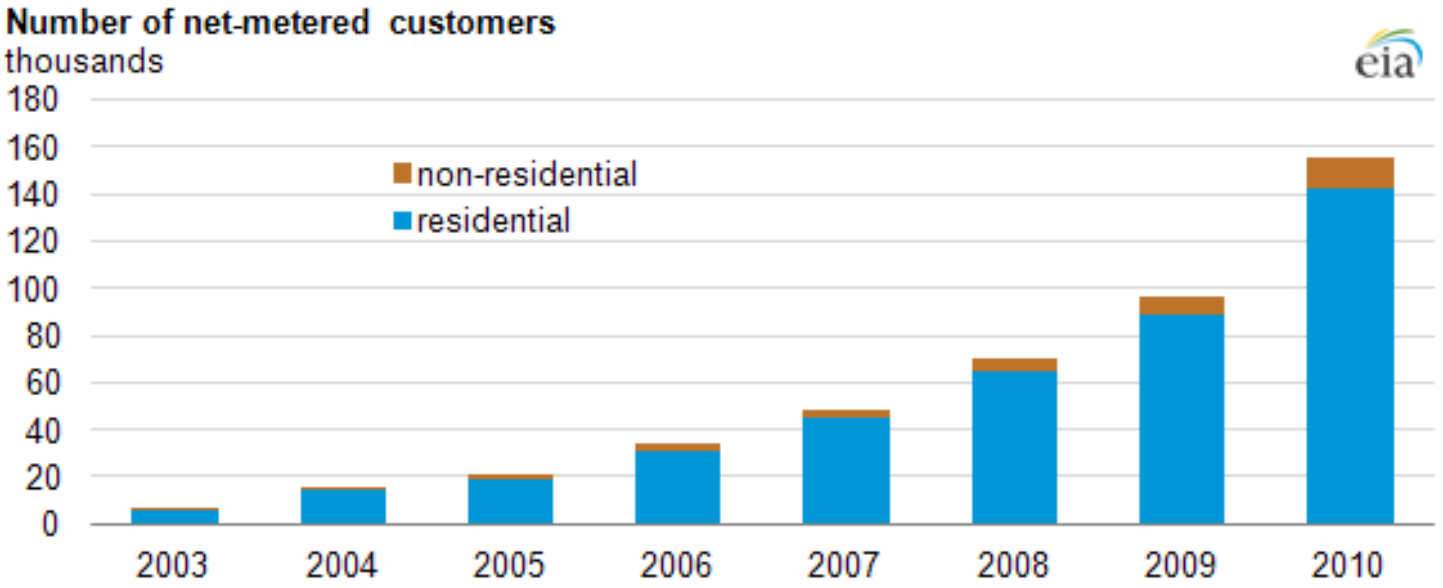
Who is San Miguel Power?

- **SMPA is one of about 900 Rural Electric Cooperatives nationwide.**
- **SMPA is not a Corporation; we are a Cooperative.**
- **SMPA is owned by the members and governed by a 7-member Board of Directors, all of whom are elected by the co-op members.**
- **Each year, profits (called margins) are allocated back to the membership.**

Popularity of Solar

- In 2010 there were 156,000 net meter systems nationwide
- In 2011 this grew to 226,000 (219,000 solar) and 2,700 MW capacity

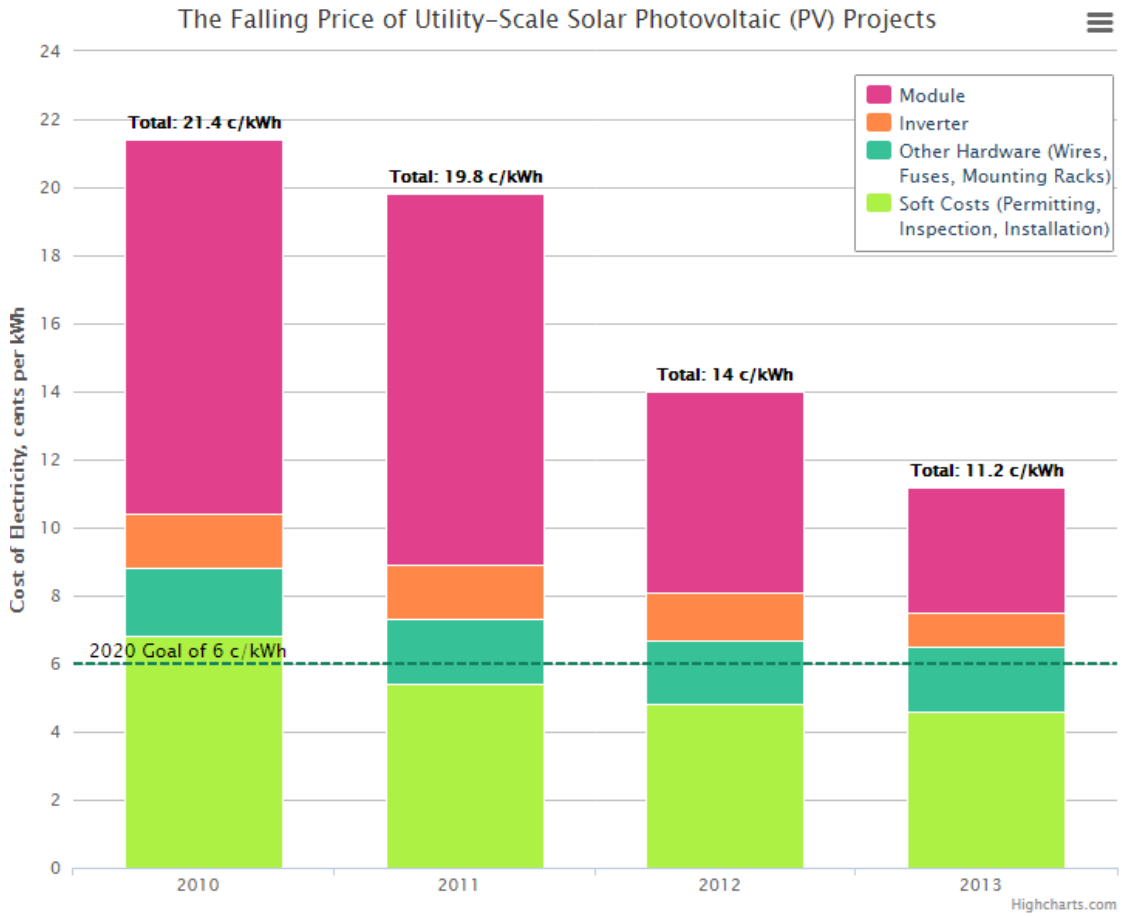
- About 150 million electric customers nationwide
- 0.15% of meters are net metered nationwide
- **As of 2015, SMPA has 174 net meter accounts, or about 1.2% of the total accounts served by SMPA.**



source: Energy Information Administration, http://www.eia.gov/

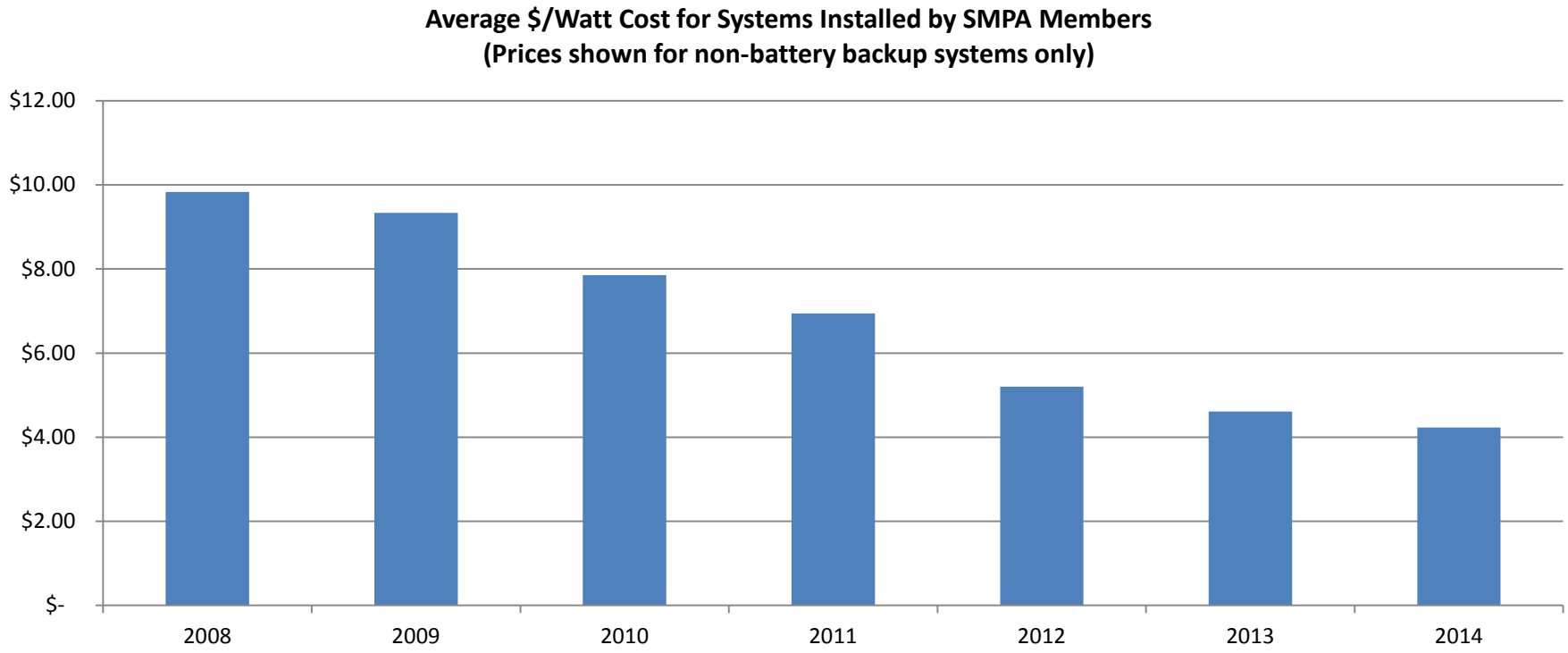
Cost of Solar

The chart below shows price change for solar broken down by component. PV module prices have decreased most dramatically. While this chart shows utility-scale PV pricing, this trend is consistent with residential solar as well.



a courtesy of National Renewable Energy Lab. Chart by Daniel Wood.

Cost of Grid-Tied Solar in SMPA Service Territory



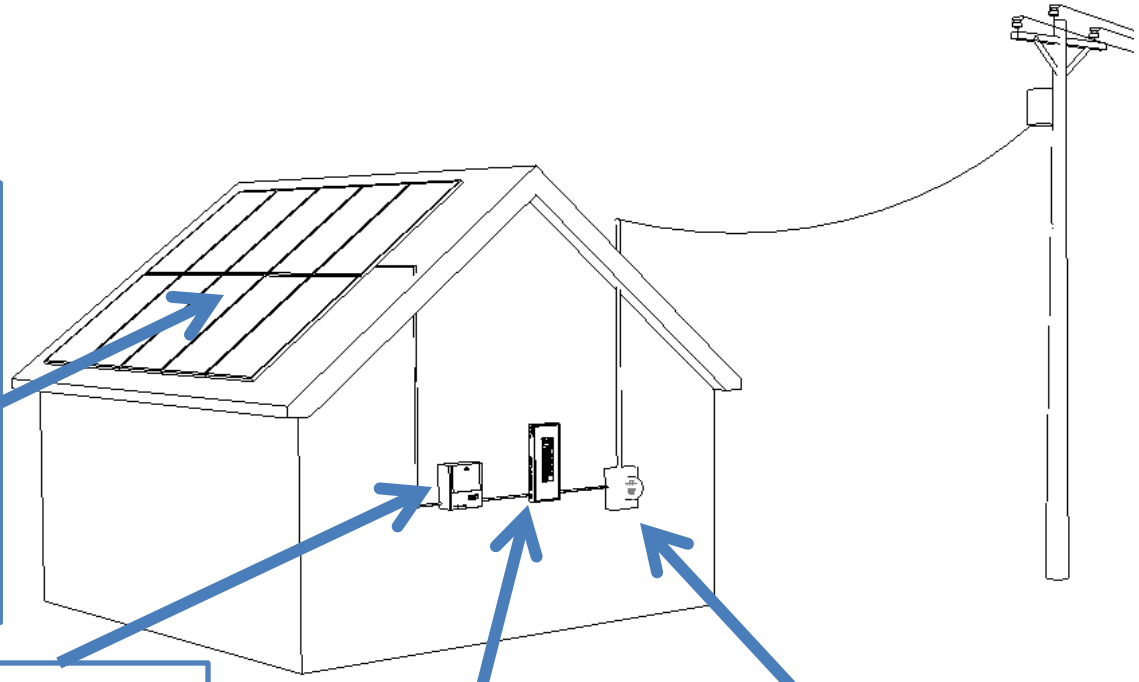
The price drops in this chart are generally a result of the price drops shown in the previous chart. Prices do not include incentives such as Federal tax credit and utility rebates.

What is Grid-tied Solar?

The Basics…

Solar PV Modules

Must be compatible and wired into appropriate strings sizes to work with specified inverter. Many grid-tied inverters operate with string voltages of 200-600 volts DC. Off-grid string voltages range from 12-60 volts. Old solar modules generally can be rewired to work with modern grid-tied inverters, but not always!



Solar Inverter

The grid interactive inverter is a special device that converts the DC electricity from the solar modules to AC electricity that is synchronized with the AC utility grid. Off-grid inverters either cannot sync with the grid or do not offer the safety features required to do so. The overwhelming majority of grid interactive inverters do not require batteries at all. Nearly all non-battery based grid interactive inverters will shut down during a grid power outage. Some inverters have features that integrate a battery bank (big or small) so that the inverter will provide backup power during grid outages.

Breaker Box

The AC output of the inverter connects to a backfeed breaker in the main panel or sub panel for the home. Not all breakers can be used as a backfeed breaker, but most on the market can.

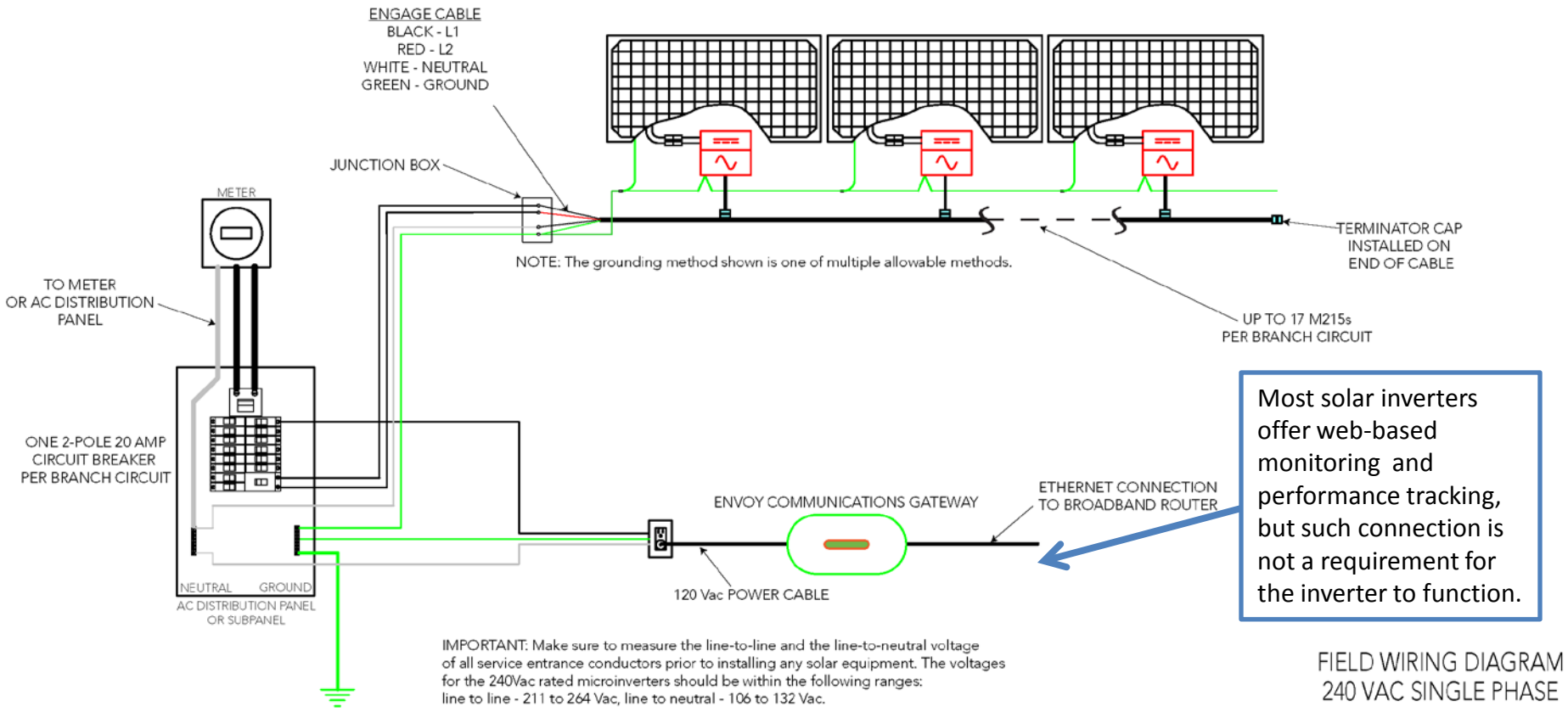
Net Meter

The net meter measures energy pulled from the grid as well as the energy put onto the grid from the solar PV system. More details are discussed on following slides.

Micro-inverters

Micro-inverters do the same thing as a grid interactive inverter only each solar module gets it own individual inverter, or micro-inverter. PV modules on the market have grown in size and output over time. Most modules sold today range from 230-300 watts versus their 80-180 watt predecessors. This is partly why micro-inverters have become very popular.

Actual wiring diagram for micro-inverters

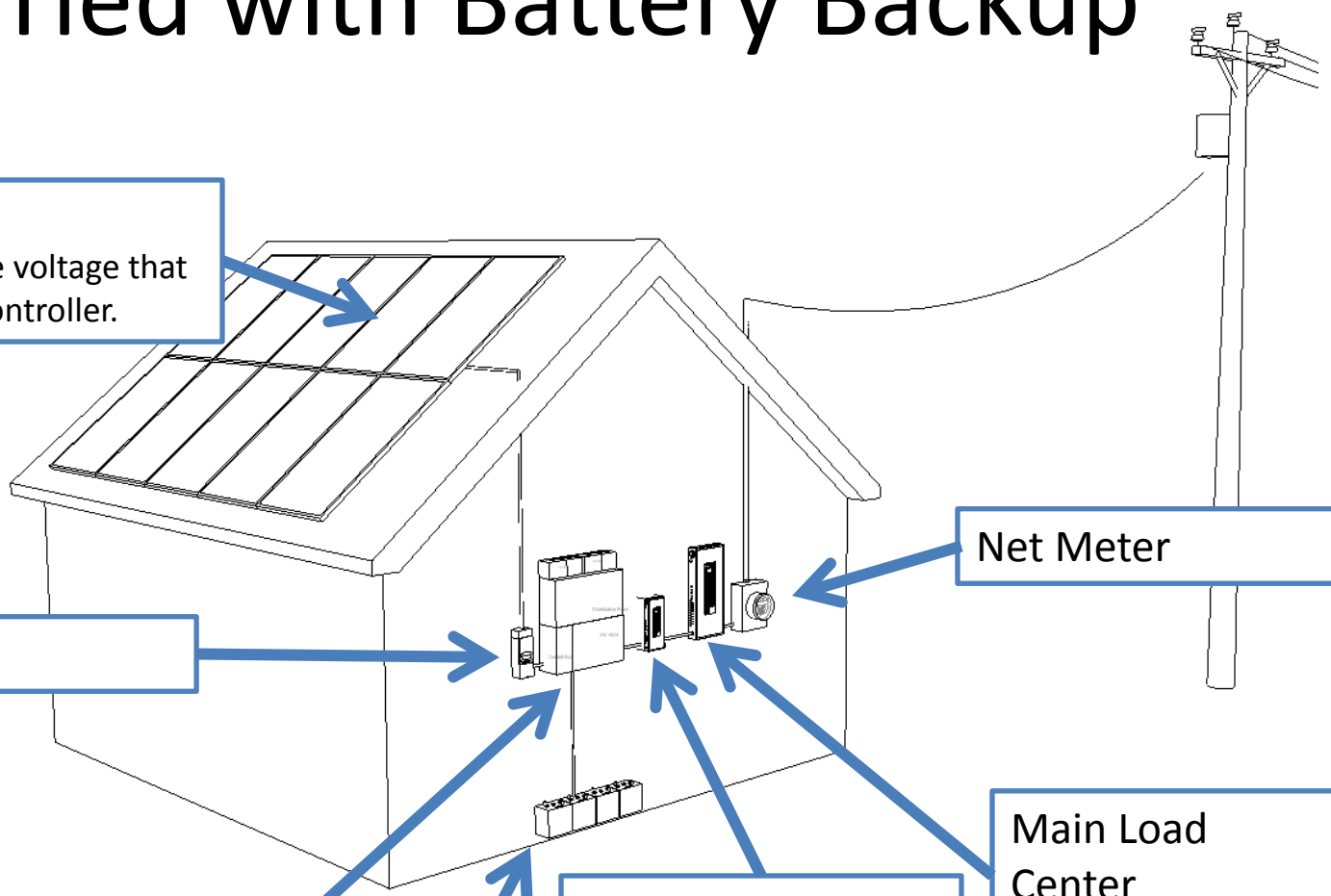


Most solar inverters offer web-based monitoring and performance tracking, but such connection is not a requirement for the inverter to function.

Battery Backup Options for Grid-tied Solar.

- It is possible to install a grid-tied solar PV system that has a battery bank for backup power during grid outages.
- A special battery-based inverter that can interact with the grid and manage power input from both a battery bank and the grid must be used.
- Few, if any, standalone, off-grid solar inverters are capable of being converted to connect to the grid.
- Battery-based grid-tie inverters can operate in standalone mode when the grid is down or disconnected.
- Generally, standalone operation powers only critical loads and not the whole house (see diagram in next slide).

Grid-Tied with Battery Backup



Solar PV Modules
Modules are wired to produce voltage that is acceptable to the Charge Controller.

Charge Controller

Battery-Based, Grid-Tied Inverter

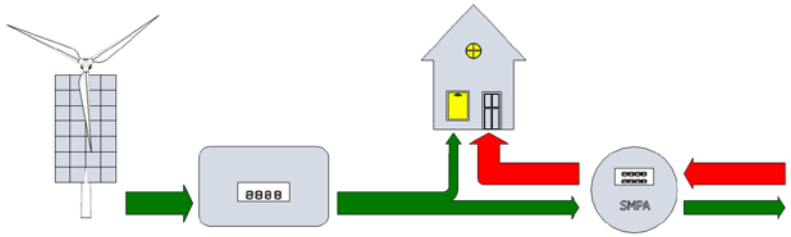
Batteries

Critical Load Center
This AC panel is powered by the inverter/batteries during a grid outage.

Net Meter

Main Load Center
This AC panel is powered only by the grid.

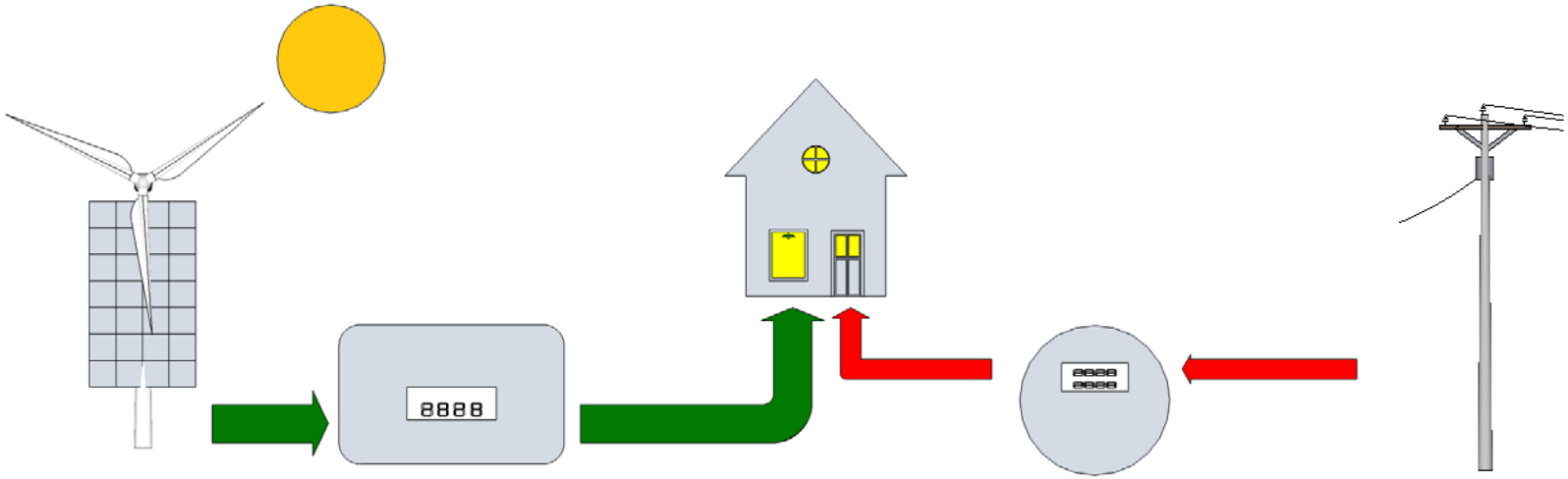
What is Net Metering?



- Colorado law requires electric cooperatives like SMPA to credit customer's excess generation at "nondiscriminatory rates."
- One-for-one crediting.
- Maximum system size is 10kW residential and 25kW commercial.
- Net metering is structured to allow customers to "offset" up to 100% of their electric use.

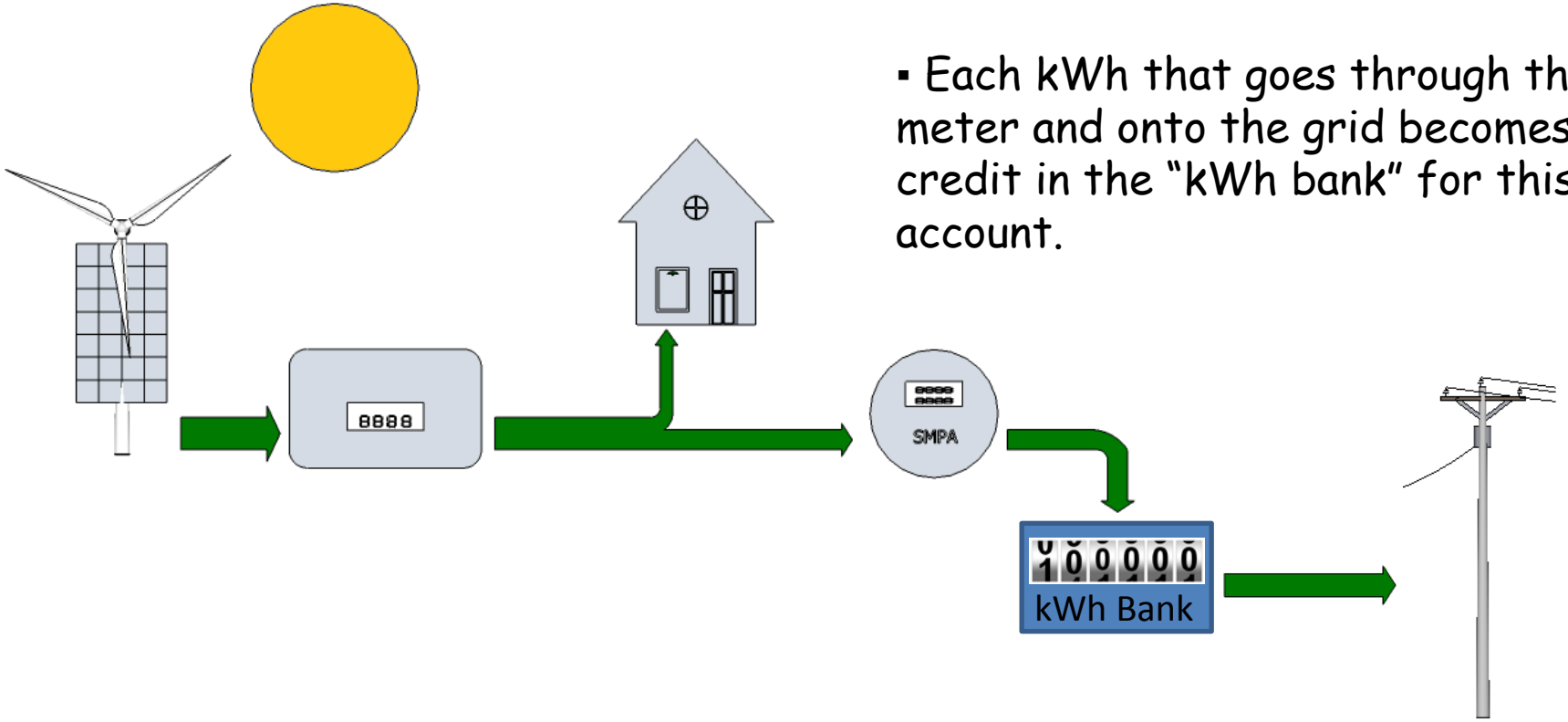
Net meter, Scenario 1.

Loads in the home are being powered by 100% of the inverter output and some additional from SMPA.



Scenario 2.

- Loads in the home require only a portion of the inverter output and the rest is going through the meter and out onto the grid.

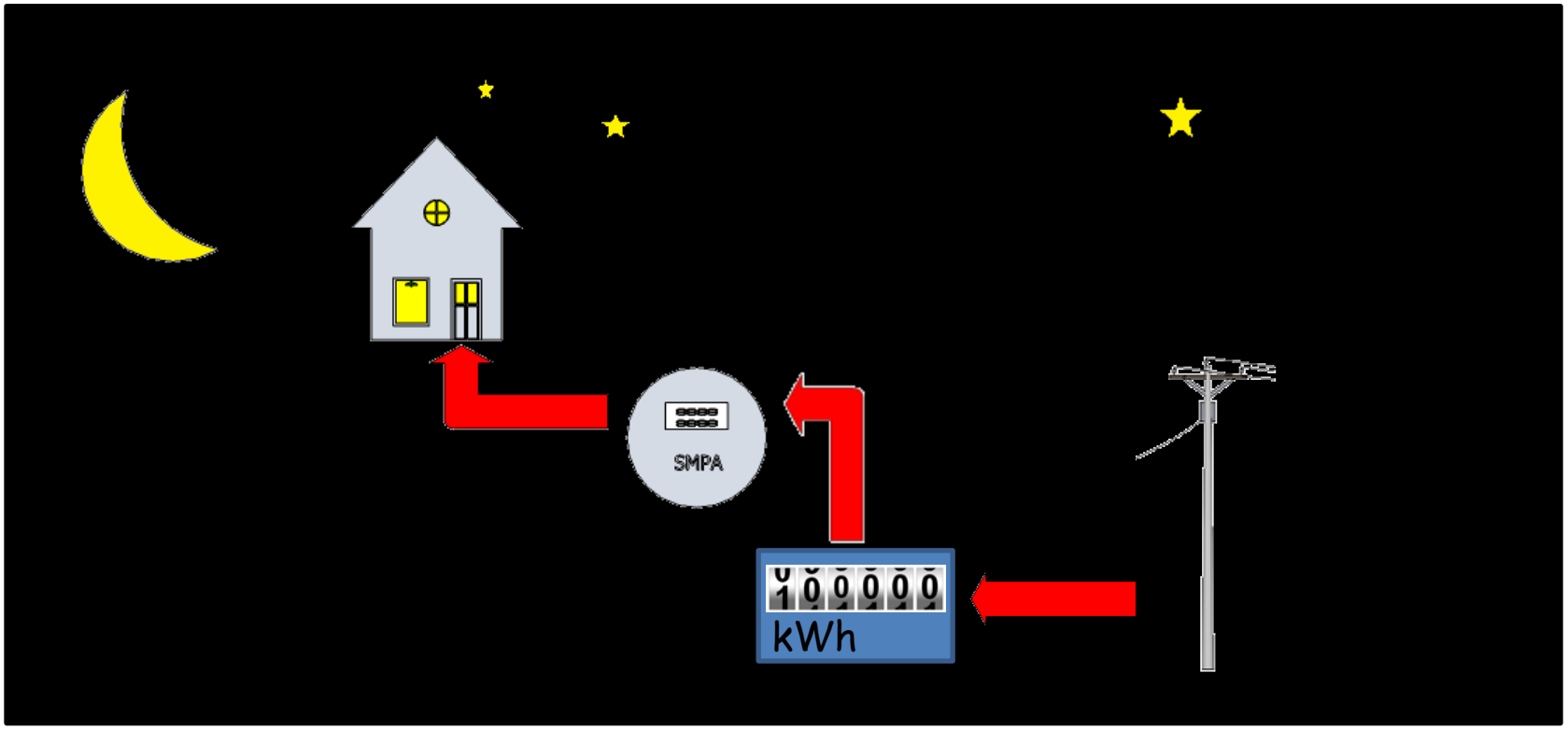


- Each kWh that goes through the meter and onto the grid becomes a credit in the "kWh bank" for this account.

- "kWh bank" credits cannot be shared with another account.

Scenario 3.

The home is being powered by the grid. Credits from the kWh bank (if available) are being used.



Monthly access charge

- SMPA Members pay a monthly access charge on their account to help cover the fixed costs of serving electricity to that meter.
- For residential, single-phase accounts this monthly charge is $16.
- Some electric co-ops charge as mush as $30/month.
- While there are no plans to do so, SMPA could one day elect to raise the access charge.

Many people have asked if off-grid solar is cheaper than grid-tied solar. The answer depends on many factors. One factor, the monthly access charge, is looked at here.

Cost of SMPA monthly access charge over 10-year estimated lifespan of battery bank:

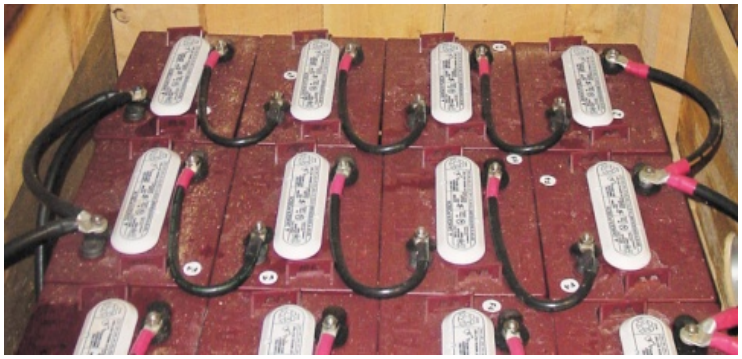
Calculation 1.

- $16 monthly access charge.
- Assume battery bank lasts 10 years.
- $16 x 12 months x 10 years = $1,920

Calculation 2.

- Assume $30 monthly access charge.
- Assume battery bank lasts 10 years.
- $30 x 12 months x 10 years = $3,600

The ongoing expense of the monthly access charge, even the $30 dollar example, is considerably less than current costs for batteries. At some point, better performing and cheaper battery technology may change this equation drastically.



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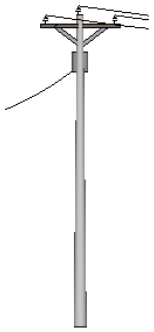

A simple comparison of off-grid and on-grid solar is discussed in HomePower Magazine, Issue #128, December / January 2009. This article is available free online. http://www.homepower.com/articles/solar-electricity/design-installation/or-grid

Many other articles that discuss the pros and cons of off-grid and on-grid solar can be found on the web. Many of these discuss the "greenness" of the grid, battery bank inefficiency, expense, and more.

Thank you for taking time to learn more about Grid-Tied Solar and Net Metering. You may want to read the SMPA Net Meter Agreement and the SMPA Net Meter Policy for further information, both of these can be found at www.smpa.com. Also, many solar installers can provide detailed information about solar for your particular situation, as well as offer free price estimates.

If you have questions or want more information, please visit www.smpa.com or contact:

Wiley Freeman

Energy Services Executive

wiley@smpa.com

(970)-626-5549 ext. 231

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