

# 10<sup>th</sup> Annual DFW Solar Tour!

## Presentation Objectives:

- (1) put solar energy in your vocabulary,**
- (2) to provide the basics of rooftop solar before you contact solar installation companies, and**
- (3) To encourage you to “talk up” solar energy with your family and friends!**

**North Texas Renewable Energy Group**

[www.ntreg.org](http://www.ntreg.org)

*Non-profit chapter of*

**Texas Solar Energy Society**

[www.txses.org](http://www.txses.org)

**Learn more about the DFW Solar Tour**

[www.dfwsolartour.org](http://www.dfwsolartour.org)

# Before we begin, key things to remember

1. Your home's annual electricity consumption in kilowatt-hours (kWh)
2. 1400
3. \$0.05 for 25 years

**Note:** Energy efficiency and conservation are vitally important. Please check for savings suggestions and tips from:

1. your local electricity provider
2. your local city sustainability/recycling department
3. Power to Save - [www.powertosavetexas.org](http://www.powertosavetexas.org)

# Also, Go Beyond Just the \$

## Include emphasis on kWh and GHG reductions

### 1. Annual electricity usage in kWh (lower better)

- **14,900 kWh** per residential meter (we use more in North Texas!)
  - 2016 ERCOT – average for **North Central Texas** Weather Zone Residential
- **13,250 kWh** per residential meter
  - 2016 ERCOT – average across All weather zones

### 2. Annual emissions of pollution and greenhouse gases (lower better)

- In ERCOT, **1.186 lbs** of GHG emissions per kWh (Note 1)
- One mature tree can absorb as much as 48 lbs of CO<sub>2</sub>/year
- 14,900 kWh/year produces **17,671 lbs of CO<sub>2</sub> per year** which requires about **370 mature trees** to absorb this yearly amount

Note 1: <https://www.epa.gov/sites/production/files/2015-01/documents/adiem.pdf>

# Presentation Outline

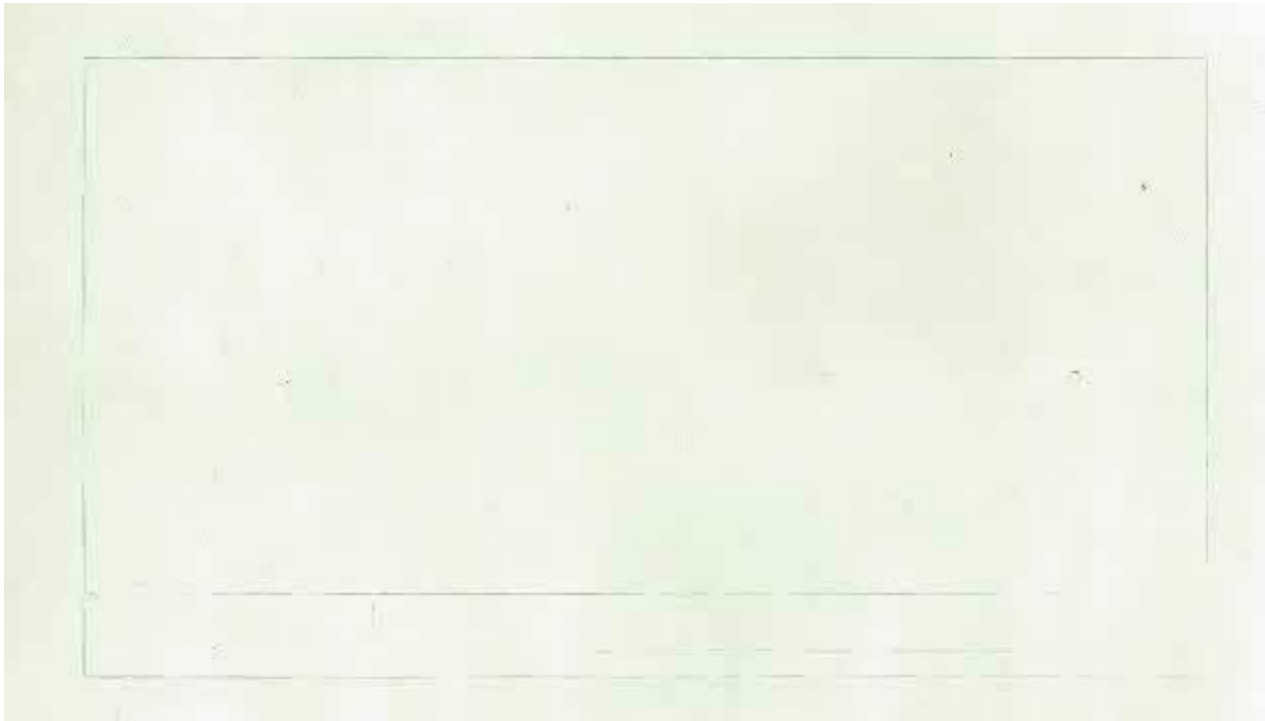
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## **Goal is to address these questions:**

- **What is Solar PV (photovoltaic)?**
- **What are the benefits?**
- **How does it work on my house?**
- **How much do I need and what are the considerations & tradeoffs?**
- **What are the key cost elements & purchase options?**
- **Consumer tips – what are they and where can I find them?**

## Energy 101: Solar PV

<https://youtu.be/0elhlcPVtKE>



# Not a science project anymore

- US installations – 2,100,000 (Q1 2019)  
[tinyurl.com/y4bw9pp7](https://tinyurl.com/y4bw9pp7) 1,000,000+ (1Q 2016)
- Texas installations – 60,000+ (end 2018) 10,000+ (end 2014)
- Texas Solar Electricity Production in 2018
  - 3.9 billion kWh of **zero emissions solar energy**
    - 3.2 billion kWh (ERCOT data) - Utility Scale systems
    - 0.7 billion kWh (EIA data) - behind-the-meter systems, including residential systems
  - Equivalent to CO2 absorption of **96 million trees**

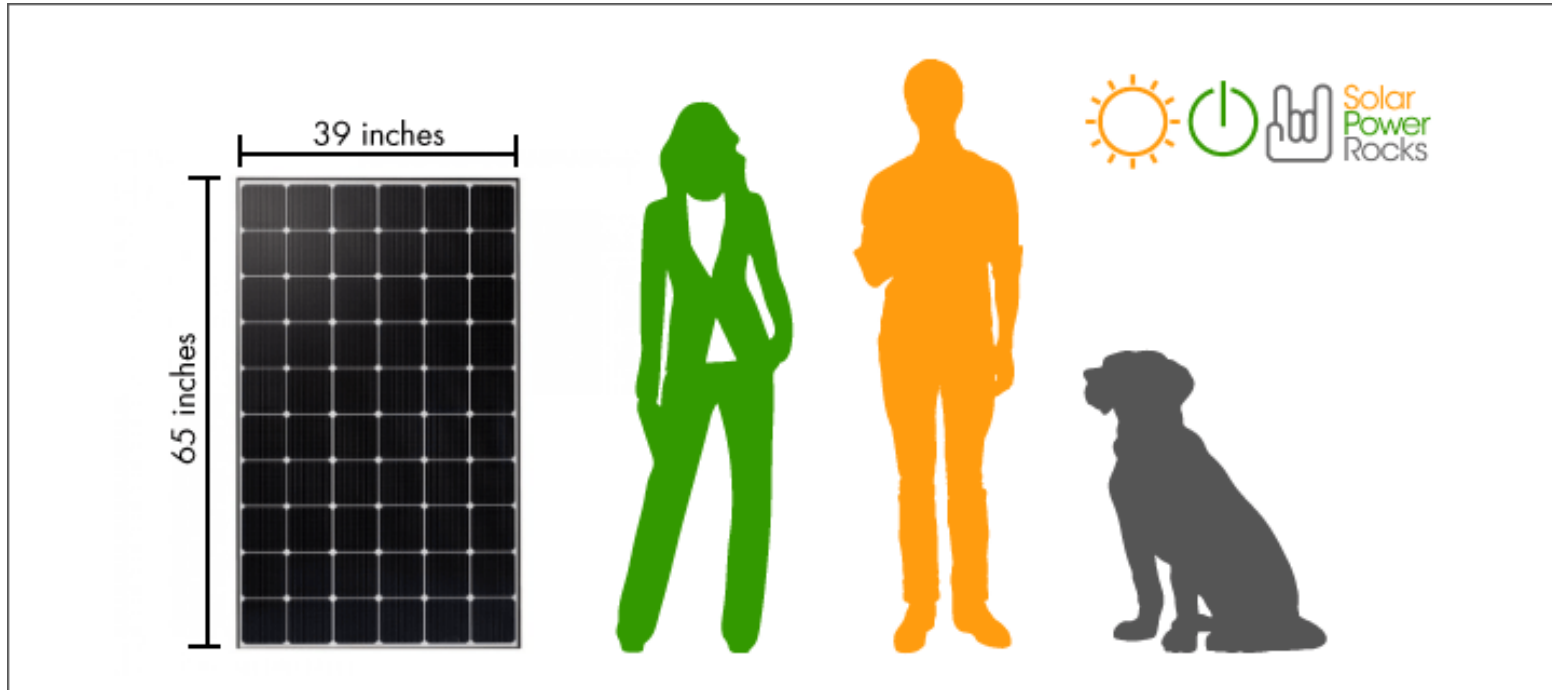
# Rooftop Solar PV Benefits

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- Key Benefits
  - **Abundant & local energy resource**
  - Local electricity generation means less energy waste
  - **Clean Energy** – electricity generation with no air, water, or noise pollution (and *no water required to produce electricity*)
  - No moving parts – low or NO maintenance
- And what else?
  - We use the most electricity **when the sun is shining!**
  - Cost competitive for **rooftop distributed generation**
  - Great **consumer choice** to generate some of your own electricity and hedge your long term electricity costs!
  - Promotes **private investment** in clean energy sources

# Photovoltaic (PV) Solar Panels

## How Big?



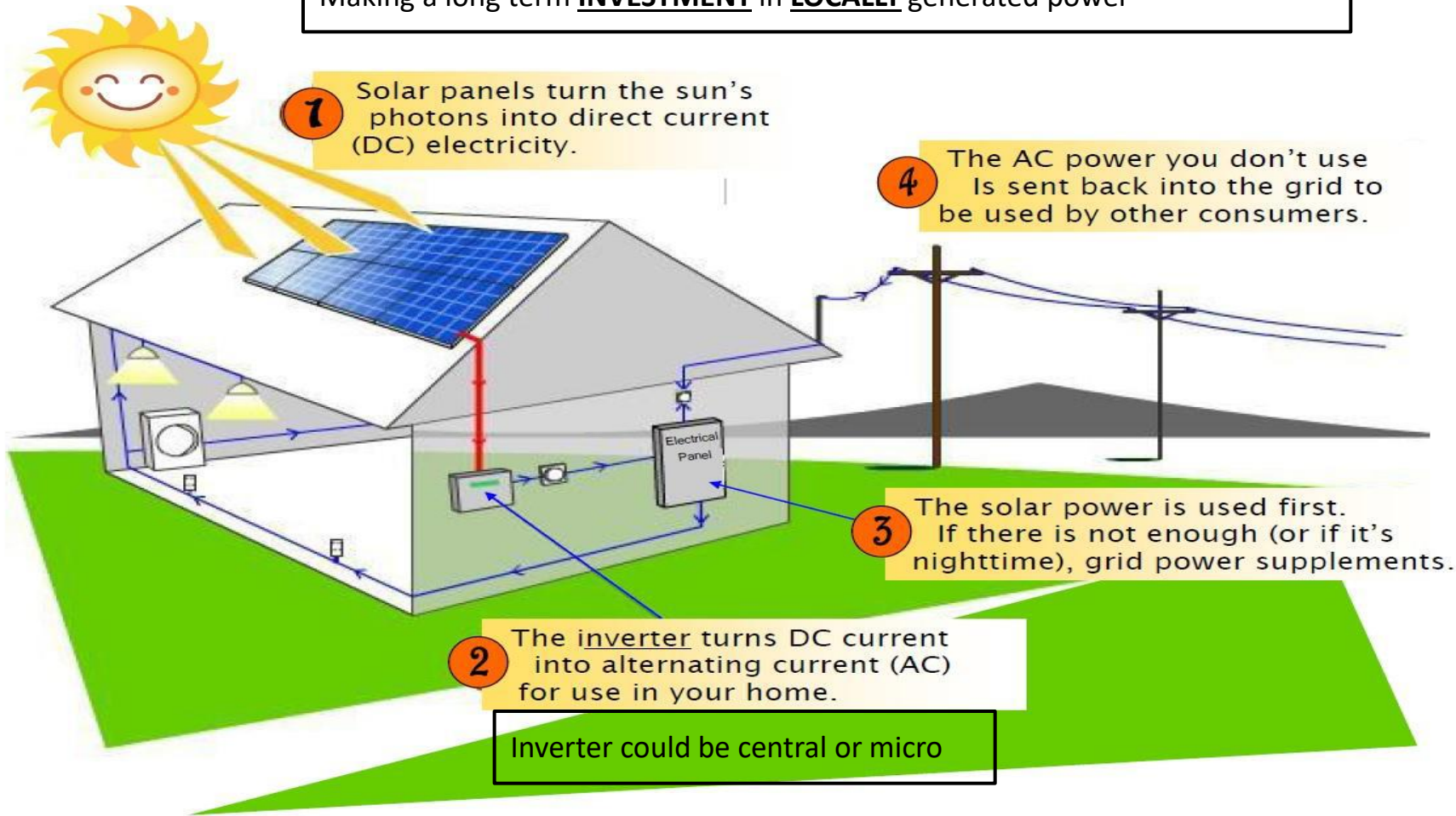
[Solarpowerrocks.com](http://Solarpowerrocks.com)



# Solar PV Electric System

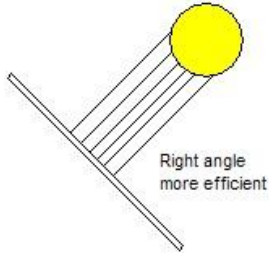
## Example - batteryless grid-tied

Making a long term **INVESTMENT** in **LOCALLY** generated power

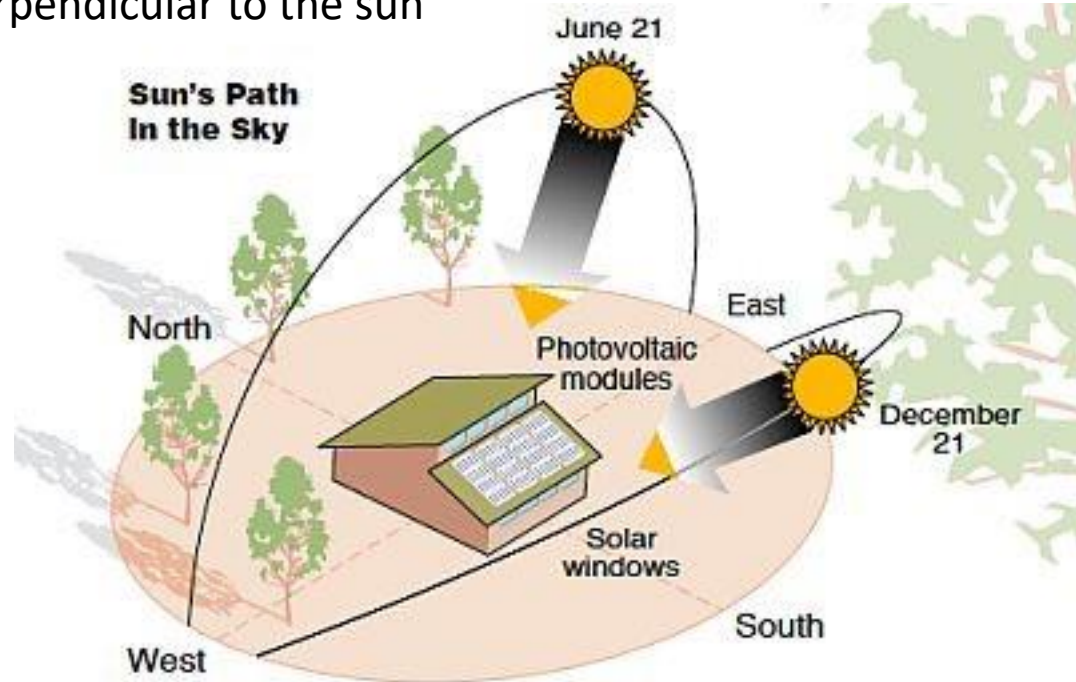


Reference: <http://www.txspc.com/how-solar-power-works.html>

# Solar PV Power Production



- Maximum power output when the PV module is perpendicular to the sun



- Maximum **annual energy production** is achieved from a south facing panel tilted at an angle equal to the home's latitude (*approx 30-35% in North Texas*)

- One kW of installed solar PV (about **3-4 panels**), produces about **1,400 kWh per year**

- 17-20 panels (5 kW) will produce about 5 x 1,400 kWh = **7,000 kWh**

# What size Solar PV system do I need?

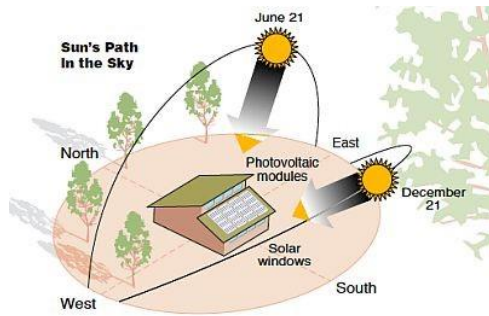
Size of solar PV system determined by:

- Roof space, orientation (*south facing/tilt angle*), & shading
- Percentage of annual energy consumption homeowner wants to offset with on-site electricity generation from PV solar (*also consider summer/winter highs/lows*)
- Cost/Budget

Note: Also need to understand what happens when excess power is sent back to the grid (often referred to as *net-metering* or *buyback plans*)

# What percentage of annual energy consumption do you want to offset with on-site solar electricity?

- For example, assume your annual energy consumption is **14,000 kWh** and your objective is to offset **50%**
- Recall maximum annual energy production is achieved from south facing panels
  - **1,400 kWh** annual production for each kW (about 3-4 panels) of installed solar PV



A 5 KW solar PV system (about 17-20 panels) would generate about **7,000 kWh/year**, enough to offset about **50%** of your annual energy consumption

- Reasons for installing smaller system?
  - Installing PV solar makes you more energy aware and more energy efficient
  - Net metering / less exported energy
- Reasons for installing a larger system?
  - That new Electric Vehicle!



# System Size Examples

Est Annual Usage (kWh)	Generate 50% local clean (kWh)	Solar PV System Size (kW)	Approx # of panels (300W ea)
10,000	5,000	3.6	12
14,000	7,000	5.0	17
20,000	10,000	7.1	24
30,000	15,000	10.7	36

# System Size Examples

Est Annual Usage (kWh)	Equiv # Mature Trees to absorb CO2	Generate 50% local clean (kWh)	Solar PV System Size (kW)	Approx # of panels (300W ea)	Emissions Reductions (lbs/CO2 eq)	Equiv # mature trees
10,000	247	5,000	3.6	12	5,930	124
14,000	346	7,000	5.0	17	8,302	173
20,000	494	10,000	7.1	24	11,860	247
30,000	741	15,000	10.7	36	17,790	371

My Location **75023, USA** [» Change Location](#) **HELP** **FEEDBACK** **ALL NREL SOLAR TOOLS**

RESOURCE DATA **SYSTEM INFO** RESULTS

## SYSTEM INFO

Modify the inputs below to run the simulation.

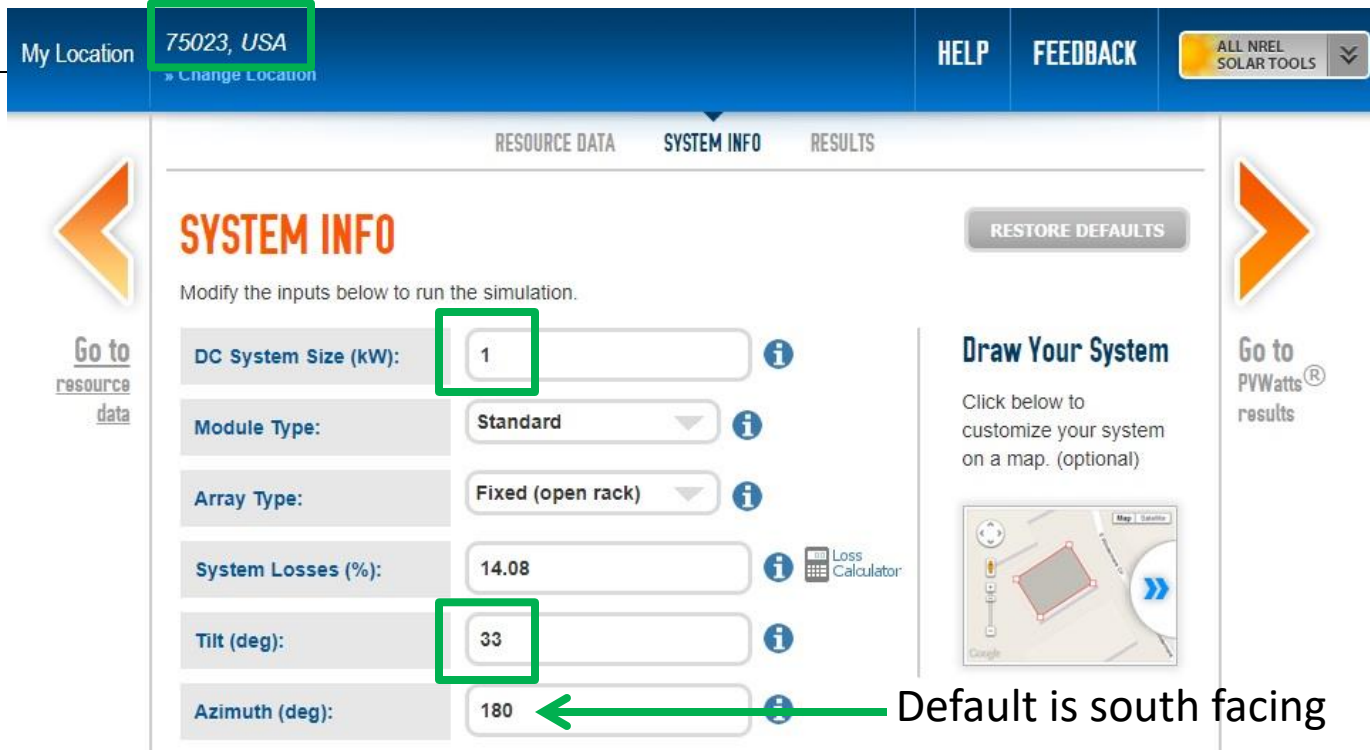
**DC System Size (kW):**  **Module Type:**  **Array Type:**  **System Losses (%):**  **Tilt (deg):**  **Azimuth (deg):**

**Draw Your System**  
Click below to customize your system on a map. (optional)

**RESTORE DEFAULTS**

**Go to resource data** **Go to PVWatts® results**

**Loss Calculator**



Online tool called PVWatts available to calculate an estimate of a systems annual kWh production.

For this example, we are using just 3 unique inputs and defaults for other inputs:

1. Location – 75023 zipcode
2. DC system size – 1 KW (easy to scale to other system sizes)
3. Tilt angle – 33 deg – approximate roof angle

## PVWatts® Calculator



My Location: 75023, USA [» Change Location](#)    [HELP](#)    [FEEDBACK](#)    ALL NREL SOLAR TOOLS [▼](#)

RESOURCE DATA    SYSTEM INFO    **RESULTS**



Go to system info

### RESULTS

Print Results

# 1,556 kWh/Year\*

System output may range from 1,517 to 1,593 kWh per year near this location.  
Click [HERE](#) for more information.

Month	Solar Radiation ( kWh / m <sup>2</sup> / day )	AC Energy ( kWh )	Value ( \$ )
January	4.70	118	13
February	5.39	120	13
March	5.34	129	14
April	5.85	133	15
May	5.69	131	15
June	6.30	137	15
July	6.54	145	16
August	6.70	146	16
September	6.15	133	15
October	5.67	131	15
November	5.00	119	13
December	4.59	114	13
<b>Annual</b>	<b>5.66</b>	<b>1,556</b>	<b>\$ 173</b>

So why 1,556 kWh/KW per year vs 1,400 kWh/KW per year?

1,400 is a more conservative number with higher conversion losses and/or shading impacts



# Five Cost Elements to Know

Example for a 5.0 KW system (~17-20 panels):

- |   |                                   |
|---|-----------------------------------|
| 1. Total Installed Cost (\$3.00/Watt)         | \$15,000                          |
| 2. Utility Incentives ( <i>if available</i> ) | - \$3,500 ( <i>net \$11,500</i> ) |
| 3. <u>Federal Investment Tax Credit(30%)</u>  | - \$3,450 ( <i>30% of net</i> )   |
| 4. Final Net Cost (\$1.61/Watt)               | \$8,050                           |

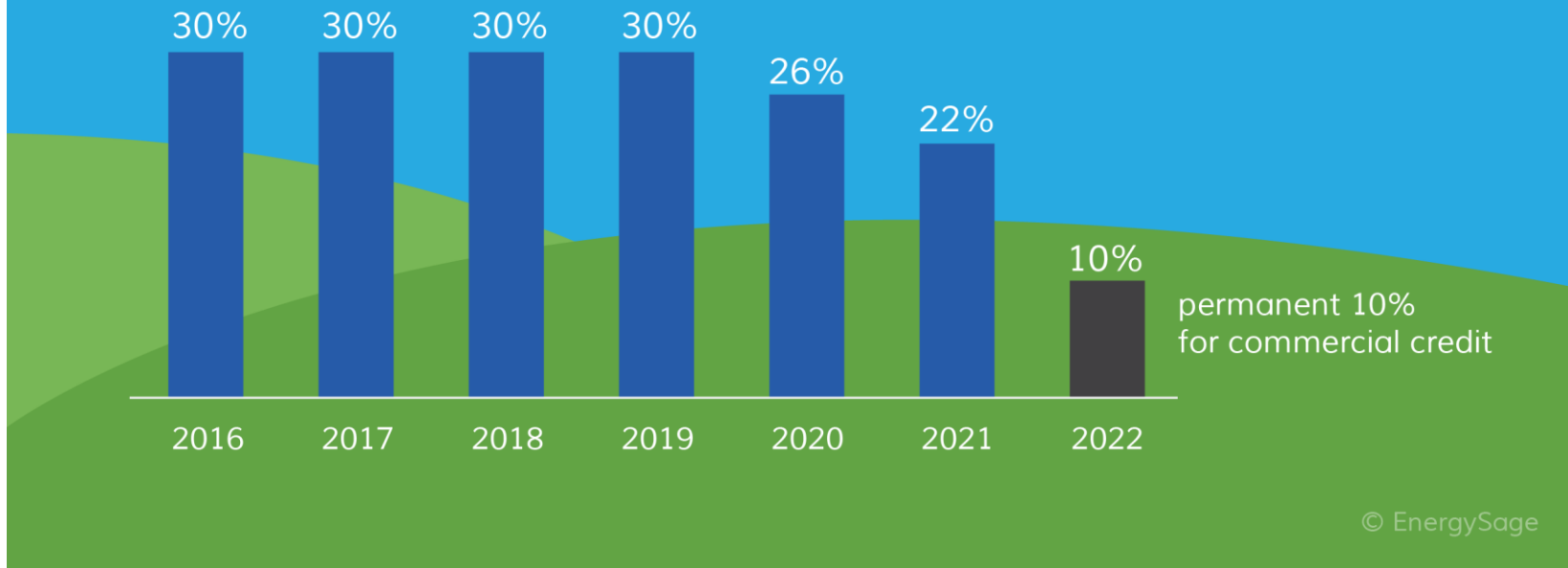
5. Equivalent Cost/kWh

See appendix slide on cost  
for calculation details

\$0.05/kWh

- Federal Investment Tax Credit (30% of *net* cost) extended thru end of 2019, then phasing out over following 3 years

## Everything you need to know about the extension of the ITC



<http://news.energysage.com/congress-extends-the-solar-tax-credit/>

# Buy, Finance, Lease, other?

- Generally available options
  - Purchase installed system
  - Take out a loan to purchase
  - Solar panel system long term leasing options
  - Power Purchase Agreement – long term agreement to buy kWh
- Not all solar installation companies offer all options
- Regardless, the most important things to know
  - *How much electricity do you use on an annual basis*
  - *The net \$/Watt solar installed cost calculations and resulting \$/kWh*
  - Then the purchase, borrow, or lease decision is a personal decision
- Just remember, financing and leasing companies are like any other company, they offer these product options to make money

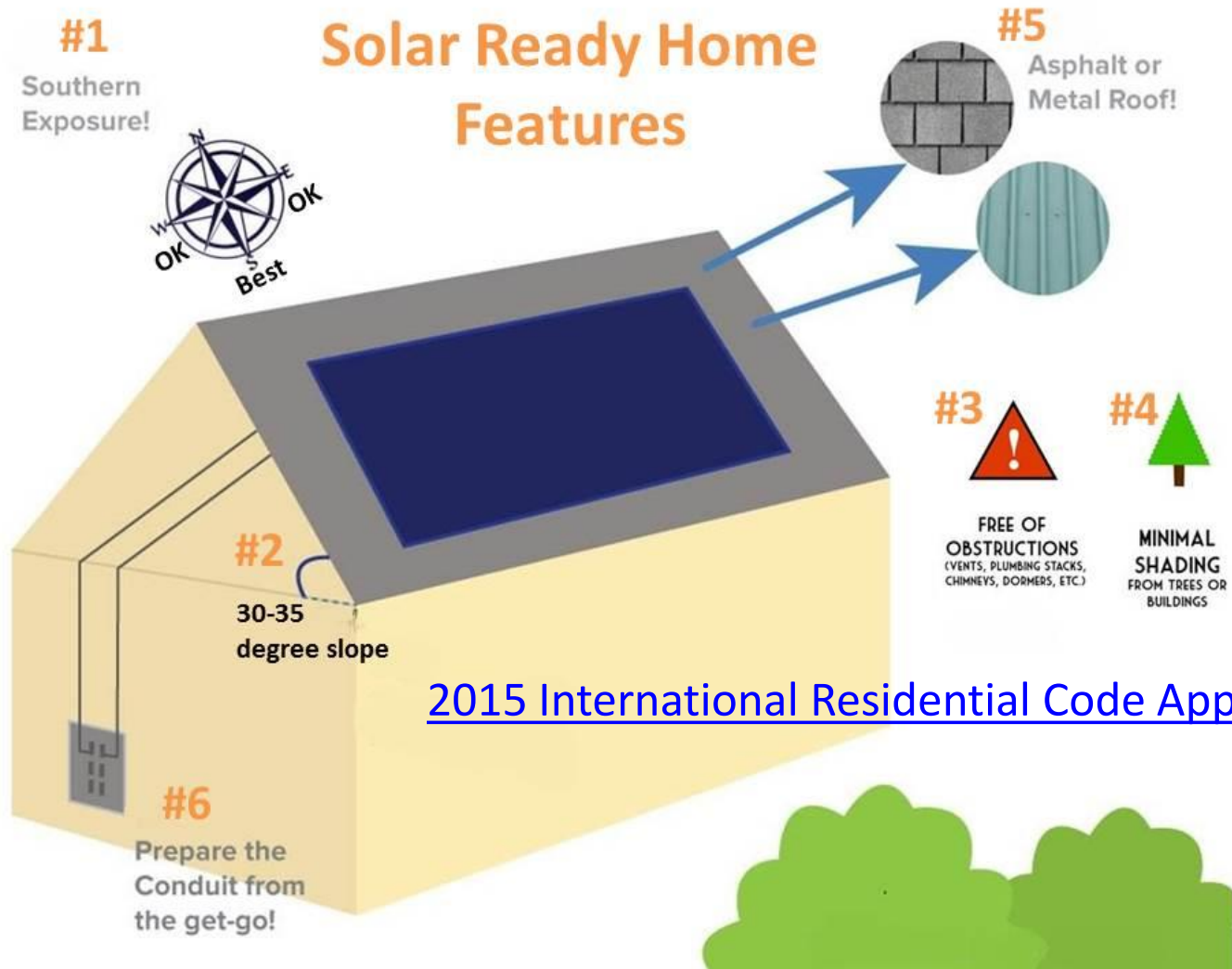
# Other Considerations/Notes

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- Roof condition and structure (age, adequate bracing)
- Electrical panel age and available breaker locations
- AC/DC Inverter types
- Operations & Maintenance – little or none
- Homeowners insurance (& the hail damage question)
- Property tax exemptions
- Home Owners Associations

- **Always good things to do:**
  - Research & compare
  - Obtain multiple bids. If the bid includes a solar PV system installation and energy efficiency upgrades, be sure the costs are separately detailed, for comparison purposes and for tax credit purposes
  - Ask for and check references
  - Learn from friends or neighbors who have had solar PV systems installed
  - Consider using Energy Sage to obtain multiple quotes –  
[www.energysage.com](http://www.energysage.com)
- **Great resources available from the Solar Energy Industries Association**
  - [Residential Consumer Guide to Solar Power](#) - 6 page document
  - [Solar Transaction Disclosure Forms](#) - great templates for purchase, lease, and PPA systems

# Building a New Home ? or know someone who is?



# Go Solar Texas!

[www.gosolartexas.org](http://www.gosolartexas.org)

Launched in 2016 by the State Energy Conservation Office and  
North Central Texas Council of Governments  
Organized by “Audience Type” to help provide the most relevant information



# As we close, key things to remember

1. Your home's annual electricity consumption in kilowatt-hours (kWh)
2. 1400
3. \$0.05 for 25 years

**Go beyond \$ - include emphasis on kWh and GHG reductions**

1. Annual electricity usage in kWh (lower better)
2. Annual emissions of greenhouse gases (lower better)
3. Check into 100% renewable energy plans from Electricity Providers



# Q&A

## Learn more about the DFW Solar Tour

[www.dfwsolartour.org](http://www.dfwsolartour.org)

Rooftop solar education & advocacy groups

To Learn More about the North Texas Renewable Energy Group

[www.ntreg.org](http://www.ntreg.org)

To Learn More about Plano Solar Advocates

[www.planosolar.org](http://www.planosolar.org)

To Learn More about the Texas Solar Energy Society

[www.txses.org](http://www.txses.org)

To Learn More about Solar United Neighbors

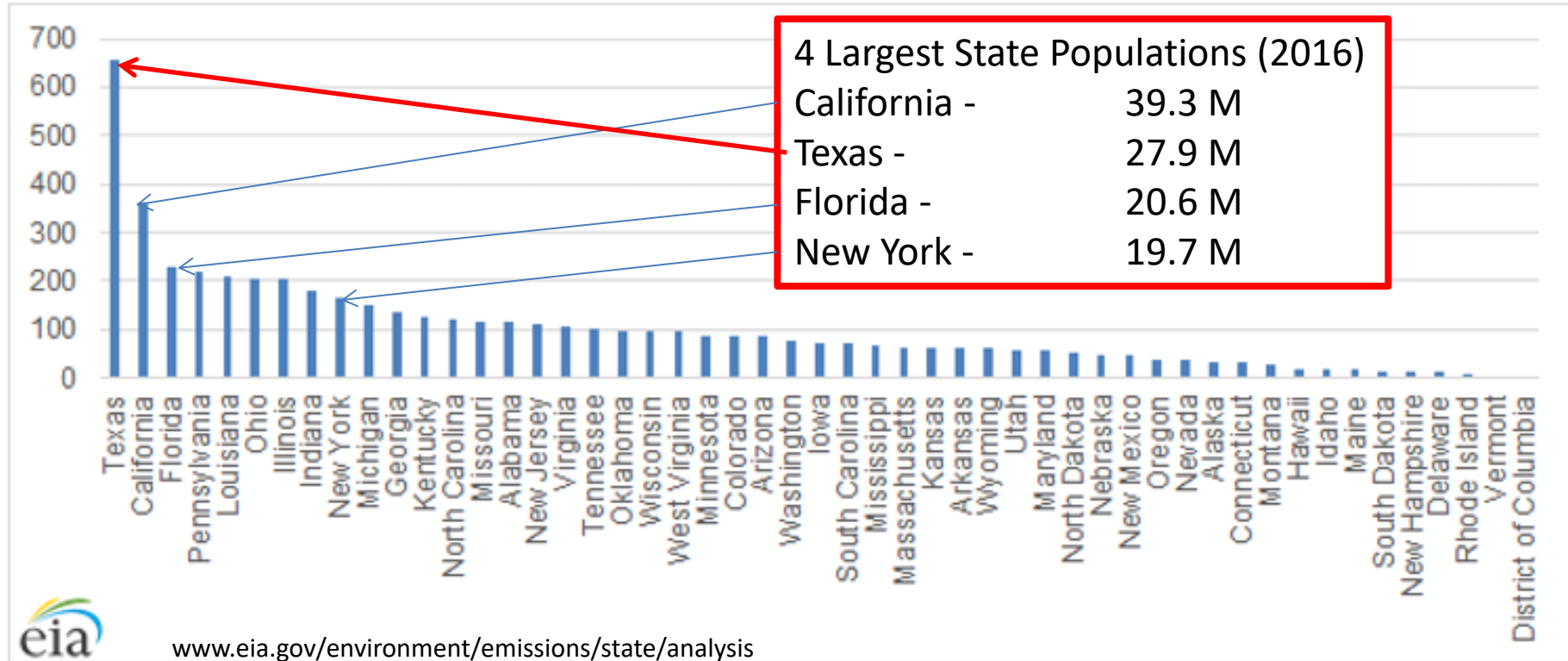
[www.solarunitedneighbors.org](http://www.solarunitedneighbors.org)

- Big Texas Greenhouse Gas Emissions – Go Solar to reduce!
- Example daily solar production, inflow, outflow, and total consumption charts
- Example monthly bills
- What about batteries?
- Where to start to find a solar installation company?
- How to choose a solar installation company?
- What happens to the energy I generate and more on net-metering?
- Retail Electric Providers and the [Power to Choose](#) website
- Example system sizes vs annual energy consumption
- Cost elements and additional cost details
- What makes a solar ready home?
- What if the sun doesn't shine?
- Accessing your “smart” meter’s data using [Smart Meter Texas](#)

# Greenhouse Gas Emissions

Figure 1. Energy-related carbon dioxide emissions by state, 2016

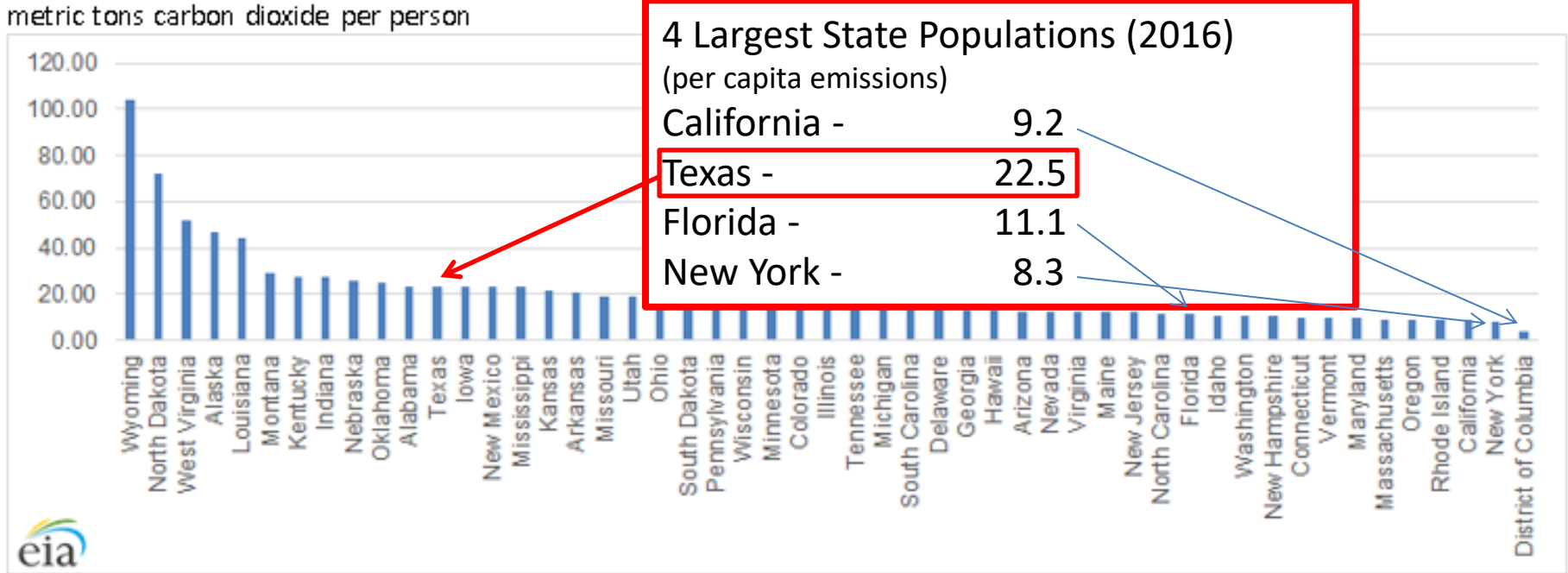
million metric tons of carbon dioxide



Things are always bigger in Texas! However, Biggest in emissions not a good thing!  
 The more greenhouse emissions, the more air pollution, and  
 the more adverse health effects

# Greenhouse Gas Emissions

Figure 2. Per capita energy-related carbon dioxide emissions by state, 2016



Source: EIA, State Energy Data System and EIA calculations made for this analysis.

[www.eia.gov/environment/emissions/state/analysis](http://www.eia.gov/environment/emissions/state/analysis)

Reducing greenhouse gas emissions and associated air pollution reduces adverse health effects!

GO SOLAR!  
Electricity generation with zero greenhouse gas emissions!

Let's talk about reducing greenhouse gas emissions!



# Citizens' Climate Lobby

## Texas Environmental and Economic Stewardship Resolution



Help us pass a bipartisan Texas resolution to enlarge and diversify our economy with the use of sound science to address causes of a changing climate and support innovation for its mitigation



Students and adults (of all ages) needed  
Contact us for more information

[TxEESR@citizensclimatelobby.org](mailto:TxEESR@citizensclimatelobby.org)

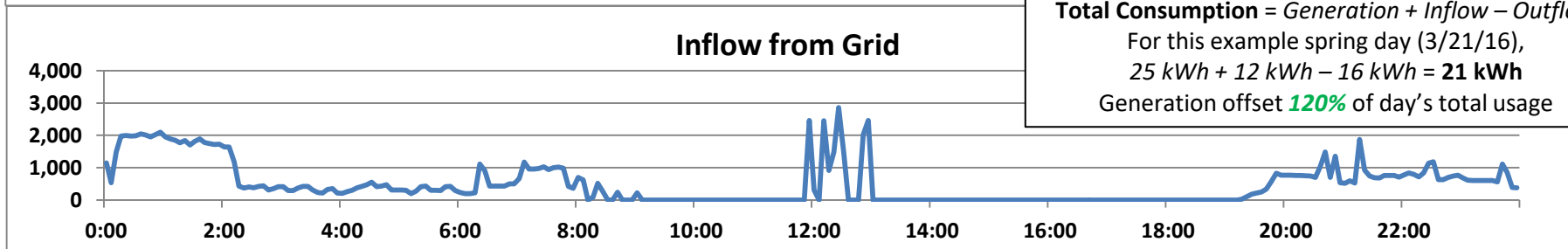
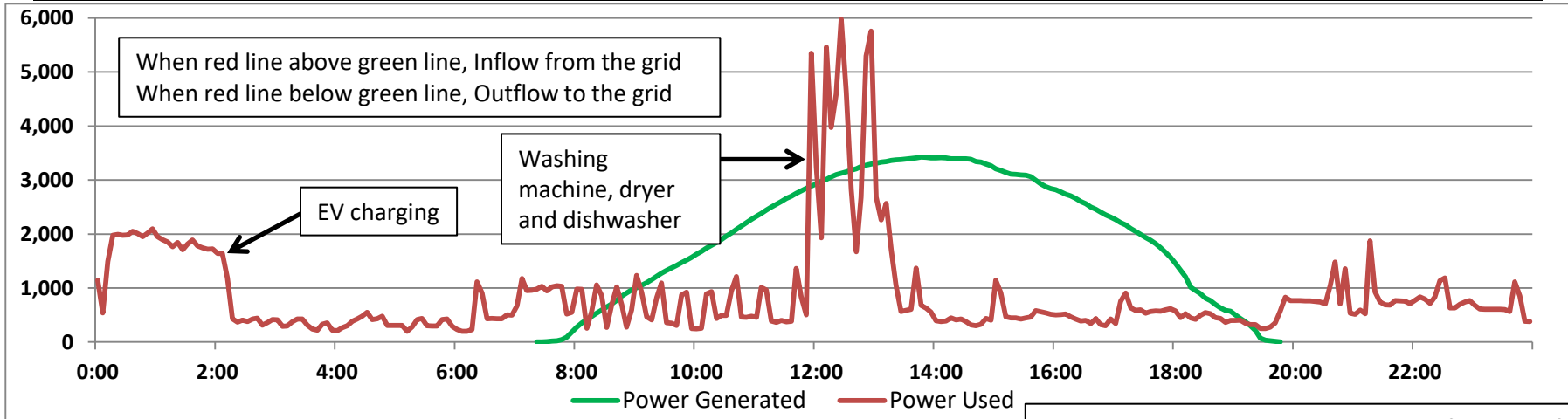
Learn more at:

[www.facebook.com/txeesr](http://www.facebook.com/txeesr)

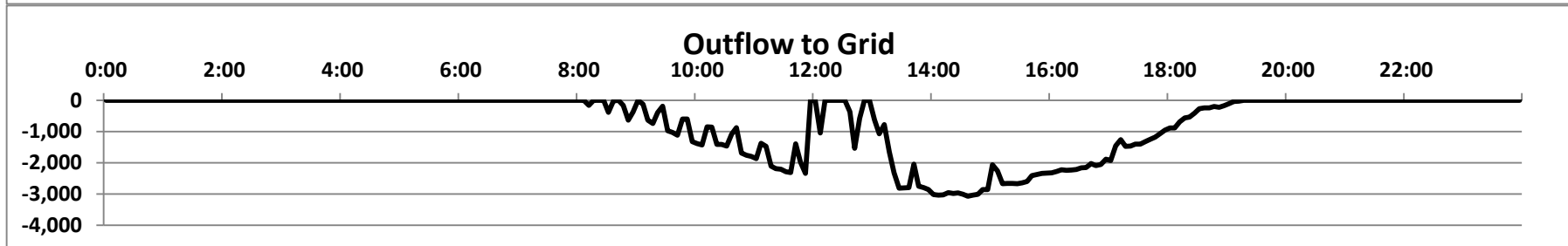
[www.twitter.com/txeesr](http://www.twitter.com/txeesr)

Instagram (txeesr)

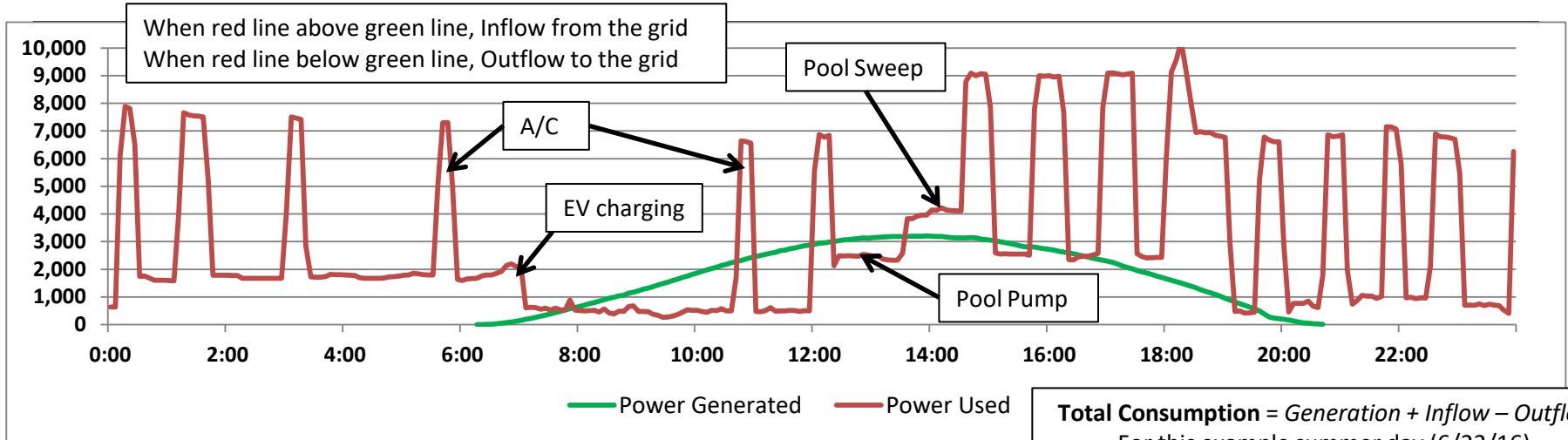
# Example Power and Energy Data (Spring Day Example)



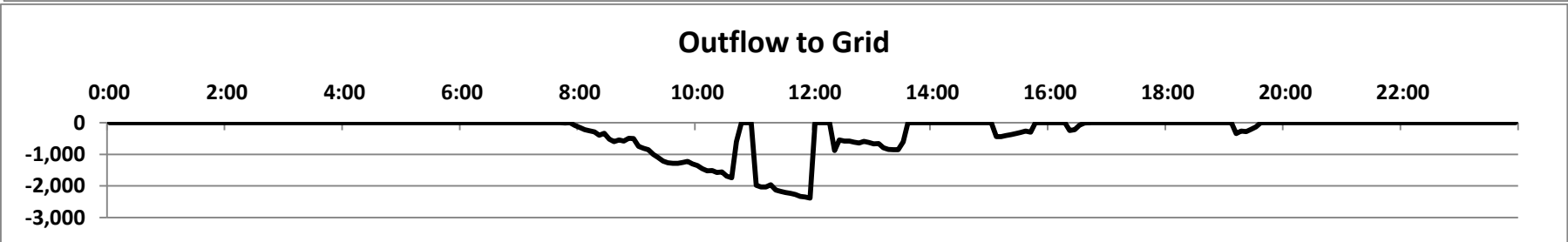
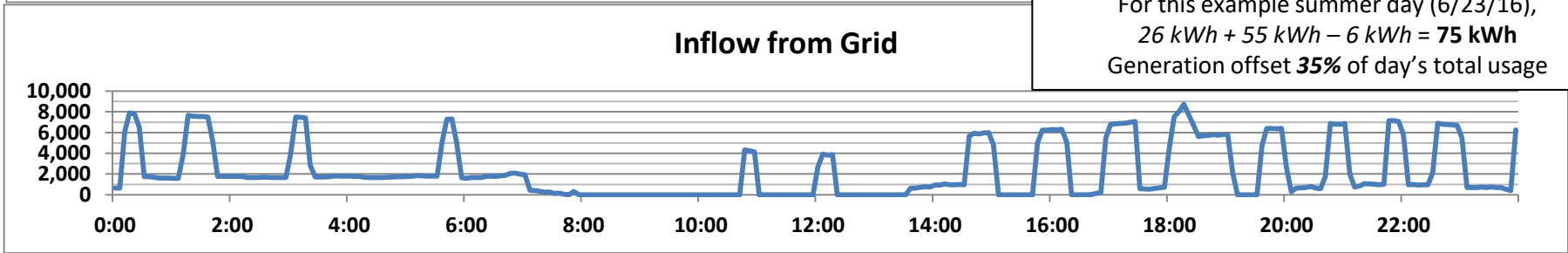
**Total Consumption = Generation + Inflow – Outflow**  
For this example spring day (3/21/16),  
25 kWh + 12 kWh – 16 kWh = **21 kWh**  
Generation offset **120%** of day's total usage



# Example Power and Energy Data (Summer Day Example)



**Total Consumption = Generation + Inflow – Outflow**  
 For this example summer day (6/23/16),  
 26 kWh + 55 kWh – 6 kWh = 75 kWh  
 Generation offset **35%** of day's total usage



# Example Monthly Electric Bill (Spring)

Billing Period From 02/04/2016 To 03/04/2016	
Product:	Renewable Rewards <sup>®</sup>
Meter Number:	[REDACTED]
Current Meter Read 3/4/2016	48127
Previous Meter Read 2/4/2016	47732
<b>kWh Usage</b>	<b>395</b>
Days in Cycle:	29
Energy Charge 395 kWh @ \$0.107259 /kWh	\$42.37
GME Renewable Rewards Credit - 318 kWh	- 34.11
Advanced Metering Charge	2.19
PUC Assessment	0.07
Gross Receipts Tax Reimbursement	0.21
Sales Tax 1.00%	0.11
The average price you paid for electric service this month (per kWh): \$0.113	
<b>Total Current Electricity Charges</b>	<b>10.84</b>

Estimated Savings	Amount
Estimated Bill w/o solar	\$ 60.46
Actual Bill w/solar	\$ 10.84
<b>Estimated Savings</b>	<b>\$ 49.62</b>

Bill Analysis	kWh
Solar Production	458
Inflow from grid	395
Outflow to grid	-318
<b>Total Consumption</b>	<b>535</b>

Not reported on your monthly bill. Solar production available from monitoring system

Generation offset **86%** of month's total usage

**Key points:**

1. The larger the amount of generation that offsets consumption, the larger the savings
2. Obtaining fair credit for excess generation to the grid is very important to achieving the maximum savings
3. Since solar production and total consumption are NOT on your monthly bill, creating a simple monthly tracking spreadsheet is recommended.



# Example Monthly Electric Bill (Summer)

## Billing Period From 06/05/2015 To 07/07/2015

Product:	Renewable Rewards®
Meter Number:	[REDACTED]
Current Meter Read 7/7/2015	40731
Previous Meter Read 6/5/2015	39143

Estimated Savings	Amount
Estimated Bill w/o solar	\$ 231.95
Actual Bill w/solar	\$ 160.87
<b>Estimated Savings</b>	<b>\$ 71.08</b>

kWh Usage	1,588
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Days in Cycle:	32
Energy Charge 1,588 kWh @ \$0.107259 /kWh	\$170.33
GME Renewable Rewards Credit - 155 kWh	- 16.63
Advanced Metering Charge	2.19
PUC Assessment	0.28
Gross Receipts Tax Reimbursement	3.11
Sales Tax 1.00%	1.59
The average price you paid for electric service this month (per kWh):	\$0.109

Bill Analysis	kWh
Solar Production	695
Inflow from grid	1,588
Outflow to grid	-155
<b>Total Consumption</b>	<b>2,128</b>

**Current Charges** \$160.87

Generation offset **33%** of month's total usage

Not reported on your monthly bill. Solar production available from monitoring system

### Key points:

1. The larger the amount of generation that offsets consumption, the larger the savings
2. Obtaining fair credit for excess generation to the grid is very important to achieving the maximum savings
3. Since solar production and total consumption are NOT on your monthly bill, creating a simple monthly tracking spreadsheet is recommended.

# What about batteries?

- ***Grid-tied solar PV systems do not require batteries***
- Off-grid solar PV systems are combined with batteries to provide electric service, *generally for remote locations, cabins, etc.*
- Battery systems can add significant cost to a solar PV investment
  - However, like solar PV systems have declined rapidly over the last number of years, battery systems costs are declining as well due to combined synergies and volumes of electric vehicles and home/business energy systems
- Applications for batteries with grid-tied solar PV systems are starting to grow
  - ***Zero export***, i.e. harness any excess energy generated during the day to use later in the evening. Will become more and more popular if net metering availability declines
  - Complete ***backup systems*** for when electricity grid is not available
  - And longer term, ***utilities in a box***. See example article, [“Utility in a box? Why solar plus batteries equals trouble for utilities”](#)

# Where to start to find a solar installer?

- Finding a list solar installation companies
  - Ask a friend or someone you know that has installed solar PV for some suggestions
  - Check out the business member list of the Texas Solar Energy Society. Contact TXSES and ask them for a few ideas in your particular area of the state.
  - go to the Oncor website - [www.takealoadofftexas.com](http://www.takealoadofftexas.com)
    - select the "Find a Provider" tab on the far right of the upper window area
    - enter your zip code (or the closest zip code to yours that is in an Oncor service area) in the appropriate field
    - in the "Select Program" pull down, select "Solar Photovoltaic Residential" (or "Solar Photovoltaic Commercial" for business installations)
    - in the "Select Service" pull down, select "Solar PV"
    - click on the "Submit" button
  - To obtain quotes from multiple companies, try [www.energysage.com](http://www.energysage.com)
  - To obtain quotes that include options to finance, try [www.sungagefinancial.com](http://www.sungagefinancial.com)
  - Check to see if there are any group purchase projects going on where you live - [www.solarizetexas.org/solarize-programs](http://www.solarizetexas.org/solarize-programs)
- Cautions:
  - See Plano Solar Advocates blog posting - [Considerations When Contemplating Energy Savings "bundles"](#)

# How to choose your installer?

- References
  - Download and review [Residential Consumer Guide to Solar Power](#) from the Solar Energy Industries Association.
  - Review "[How to Choose a Solar Installer](#)" by the Texas Solar Energy Society.
  - See Plano Solar Advocates, [How To & FAQ](#)
- Key points
  - Do your homework, talk to friends and neighbors who have chosen solar, use common sense, and be active and engaged in dealing with solar companies
  - As with any major purchase, make sure to get multiple bids for your solar system.
  - Before entering an agreement with a solar company, do your homework. Ask for references of solar installations in your area and call them.

## Example – No Excess to grid

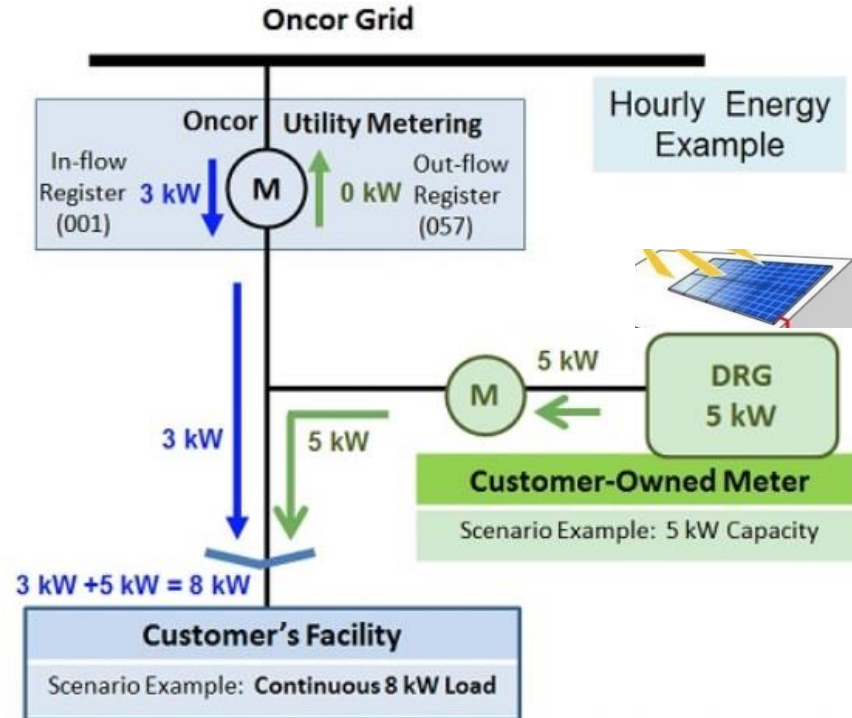
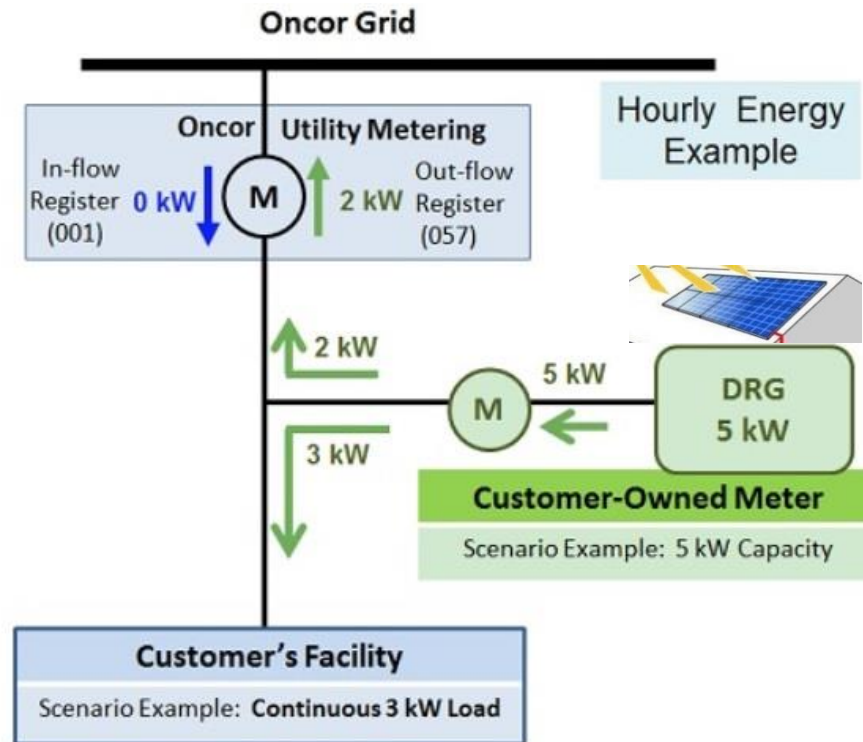


Figure 1 – Illustration of power flow: Customer Load is Greater Than Generation

If this condition existed for one hour:

- Total energy consumed by customer = 8 kWh
- Energy registered by Customer-owned meter = 5 kWh
- In-flow energy (consumption) registered by in-flow (001) Oncor meter = 3 kWh
- Out-flow energy (generation) registered by out-flow (057) Oncor meter = 0 kWh

## Example – Excess to grid



**Figure 2 – Illustration of power flow: Customer Load is Less Than Generation**

**If this condition existed for one hour:**

- Total energy consumed by customer = 3 kWh
- Energy registered by Customer-owned meter = 5 kWh
- In-flow energy (consumption) registered by in-flow (001) Oncor meter = 0 kWh
- Out-flow energy (generation) registered by out-flow (057) Oncor meter = 2 kWh

# Net-metering or Buyback

- We know that if total home consumption < total PV generation at any point in time, then excess power is sent to the grid.
- Over the period of a month, this excess power sent to the grid will vary. Some months as low as 10-20% of monthly generation. Other months, in certain cases, maybe as high as 60-70%. Over the period of a year, maybe averaging about 40-50%.
- ***It is important to obtain fair and reasonable compensation for this excess. E.g. the same is the retail rate paid for electricity from the grid***
- Texas does not have a state mandated net-metering provision in place, but some Retail Electric Providers (REP) will credit you for the outflow/excess per month. (Note: limits may apply.) See PSA blog post for more info – <http://www.planosolar.org/2013/08/the-real-power-to-choose.html?m=1>
- PV system size and energy production should be considered
  - Avoid oversizing
  - Amount of excess generation (outflow) is to be understood and comprehended in the system size tradeoffs

Step 1  
click



POWER2CHOOSE HOME **RENEWABLE POWER** ABOUT SHOPPING ESPAÑOL

**Shop. Compare. Choose.**

Welcome to Power to Choose, the official and unbiased electric choice website of the Public Utility Commission of Texas. This website is available to all electric providers to list their offers for free. Compare offers and choose the electric plan that's right for you.

Step 2  
click



POWER2CHOOSE HOME | RENEWABLE POWER | ABOUT SHOPPING ESPAÑOL

## Buying Renewable Power

**Find Companies Who Will Purchase Your Excess Renewable Energy**

As the population of Texas grows, the demand for electricity also grows. Texas currently produces and consumes more electricity than any other state. Because of its size, diverse climate, and abundance of natural resources, Texas has tremendous potential to generate renewable resources that greatly enhance the diversity of our

Step 3  
Enter  
zipcode



POWER2CHOOSE HOME | RENEWABLE POWER | ABOUT SHOPPING ESPAÑOL

## Available Purchase Offers

Enter your zip code below to find electric companies who will purchase your excess renewable energy.

ENTER YOUR ZIPCODE

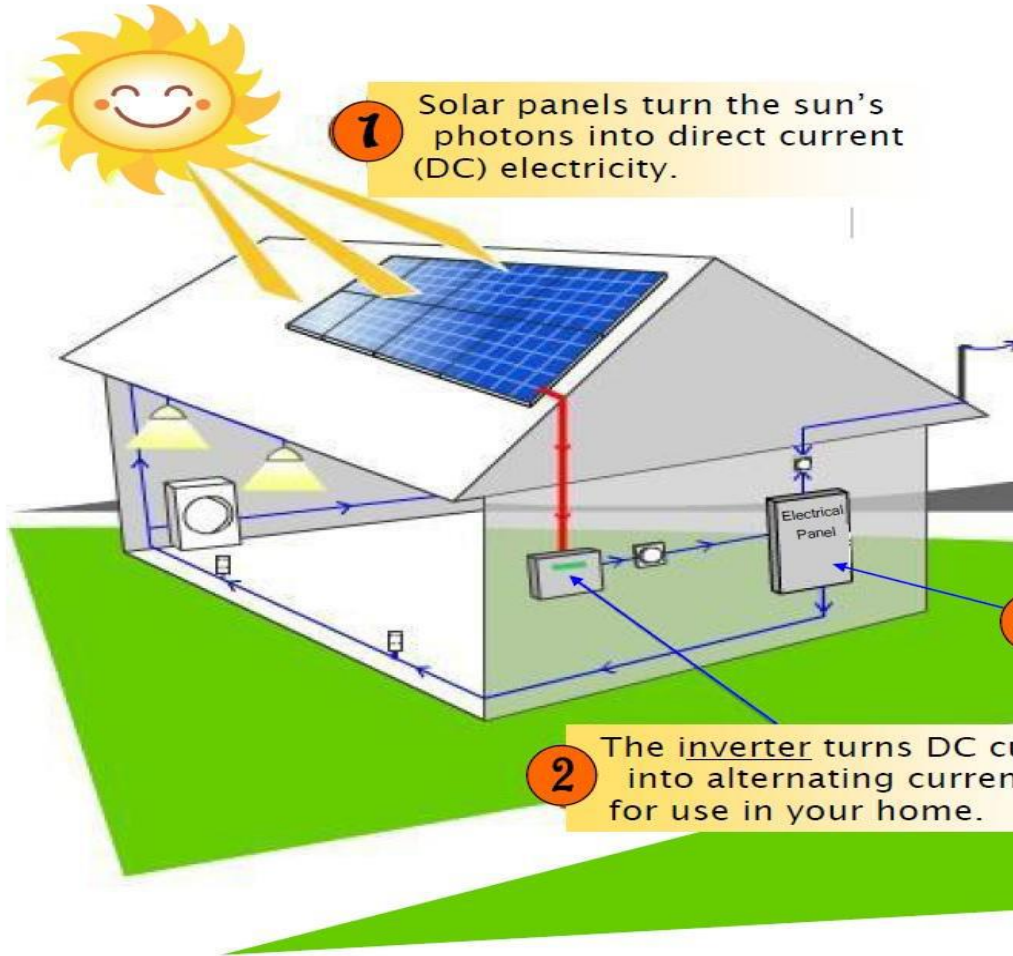


# Other Considerations/Notes

- **Micro-inverters or DC optimizers can reduce effects of partial shading**
- **Roof condition and structure (age, adequate bracing)**
- **Electrical panel age and available breaker locations**
- **Homeowners insurance**
  - PV system (retail value) should be added to homeowners insurance policy
  - Then any hail damage would be covered (less deductibles)
    - *Note – Generally panels will survive hail better than most roof materials.*
- **Property tax exemptions are in place for renewable energy systems**
- **Operations & Maintenance – little or none**
- **HOA**
  - HB-362 passed in the 82nd Legislative session, 2011, updated in 2015
    - [www.capitol.state.tx.us/tlodocs/82R/billtext/html/HB00362F.htm](http://www.capitol.state.tx.us/tlodocs/82R/billtext/html/HB00362F.htm)
    - HOA's can't prohibit homeowners from installing solar
    - Developer loophole reduced 2015-09-01 by recent SB-1626 legislation
  - Review the HOA Checklist on the Solar San Antonio (now Build SA Green) website - [buildsagreen.org/solar-101/hoa-poa-information/](http://buildsagreen.org/solar-101/hoa-poa-information/)
  - Notify your HOA if you plan to install PV solar, then proceed unless the HOA attempts to block. Contact Plano Solar Advocates for assistance!
- See [Solarize Plano FAQ](#) for more details regarding financial considerations, roof condition, hail, maintenance, etc.

# Equipment and Installation Costs Are Upfront NO ONGOING FUEL COSTS

Making a long term **INVESTMENT** in **LOCALLY** generated power



Total PV Solar system costs =  
Equipment costs + Installation  
Related costs

### Equipment related

- **Solar panels**
- **Inverter(s)**
- Mounting hardware
- Wiring, disconnects, junction boxes, monitoring devices, misc items

### Installation related

- Site assessment
- System design for specific installation
- Installation drawings
- Permits, inspections
- **Labor to install and commission system**

Total PV Solar systems are generally priced as

- **\$ per installed Watt**
- **\$ per installed kW (kilowatt)**

# PV Solar Cost Example

•Participants are encouraged to use different price examples e.g. \$3.50, 3.25, 3.00, 2.75, etc

- **Key Assumptions:**

- If installed retail cost of **\$3.20/watt** (example price per watt)
- South facing exposure for solar panels (typical panel (3' x 5') is rated at about 250W dc)
- In North Texas area, **1 kWdc-p** creates about **1,400 kWh** per year
- Annual electricity usage for this example is **15,000 kWh**

- **Example system size/production calculations would be:**

- **20 panels** - approx 5.0kW PV solar, produce 7,000 kWh, approx **47%** of annual usage

- **System Cost Calculations for MEDIUM system (20 panels):**

- 5000 Wdc-p (5.0kWdc-p) installed system at \$3.20/W = \$16,000
- Less \$0.85/W approx Oncor incentive for 2016, then =  $\$0.85 \times 5000 = \$4,250$
- Apply 30% tax credit to total installed cost less incentive,  $\$11,750 \times .3 = \$3,525$
- Net cost to customer =  $\$16,000 - \$4,250 - \$3,525 = \$8,225$ , or **\$1.65/Wdc-p**

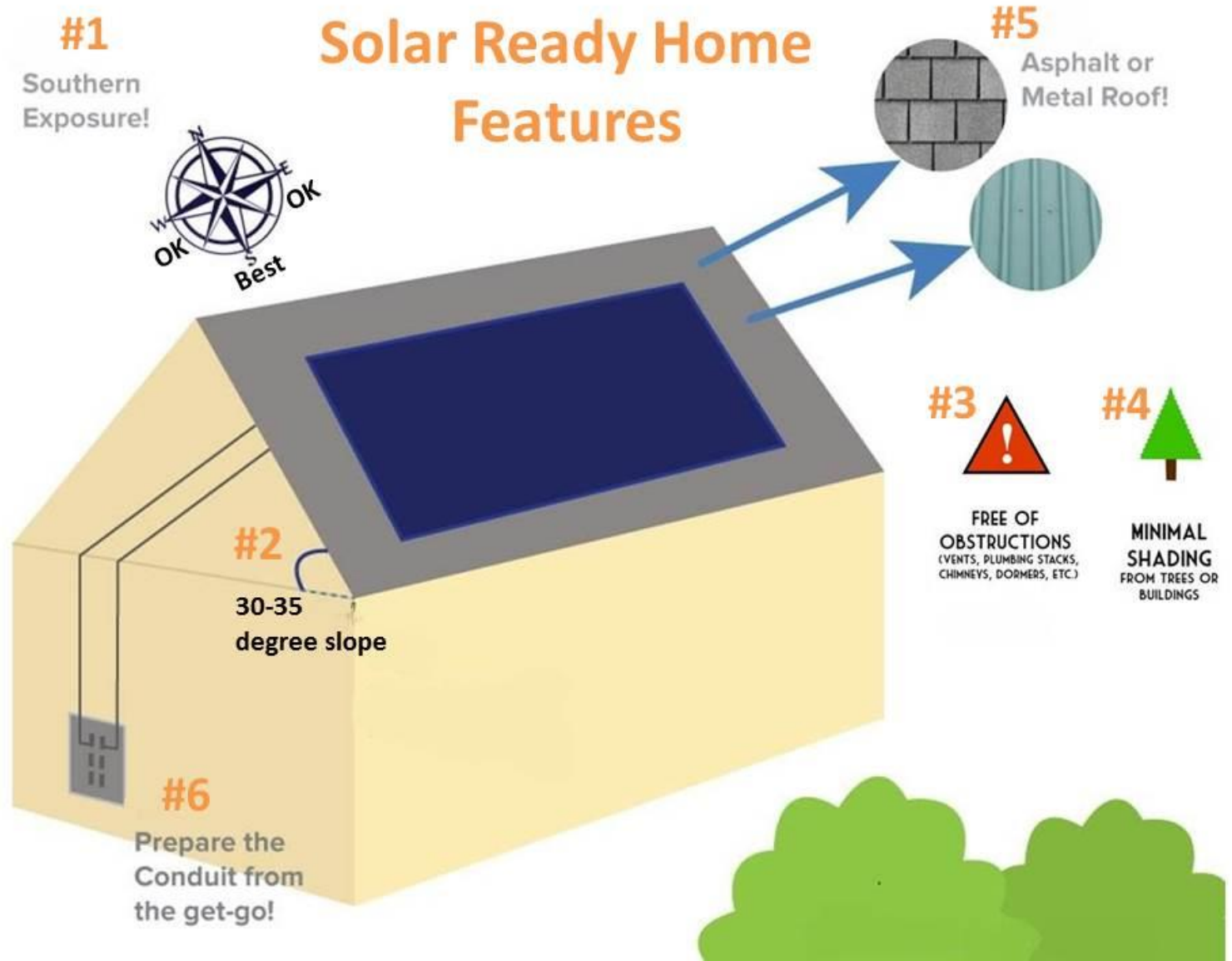
**Sweet Spot?**

- **Using 25 years lifetime, a 5.0kWdc-p system will produce:**

- **25 years x 7,000 kWh = 175,000 kWh**
- Net installed system cost \$8,225 divided by 170,000 kWh = **\$0.047/kWh** (not including O&M or module time degradation, which are really not significant to this cost calculation)
- **Already less than the \$0.08-\$0.13/kWh typical utility cost today, and then FREE!**
- While absolute costs would increase for a larger system (or decrease for a smaller system), **the \$/kWh would remain the same**

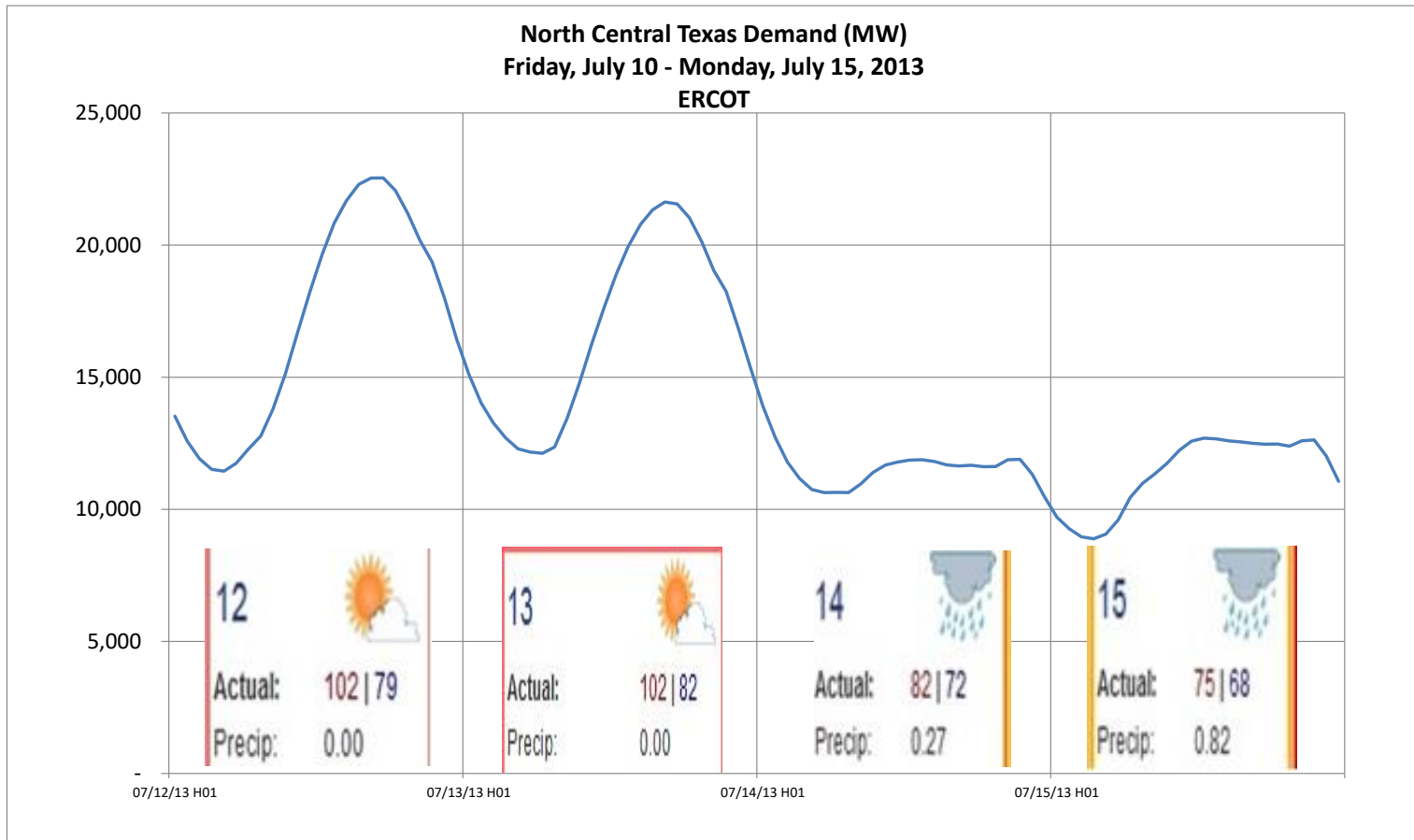
- **Note - PV solar systems produce electricity for a long time – 30-40 years or more**

# Solar Ready Homes



# What if the sun doesn't shine?

Guess what?  
We don't need as much electricity!



# Smart Meter Texas Example

SMART METER TEXAS™
Welcome, Richard Howe [Log Out](#)

Usage
Meters
In-Home Devices
Agreements
Account Profile
Share Feedback
Help

**My Usage**  
[My Friends' Usage](#)  
[Report Request Status](#)

Usage / My Meter - Usage Report

### My Meter - Usage Report ?

---

Description: [REDACTED]

Address: [REDACTED]  
 PLANO, TX

ESIID: [REDACTED]

Meter Number: [REDACTED]

Meter Multiplier: 1

---

**Report Option**

Report Type: Daily Usage (15 min intervals) ▾

Start Date: 01/25/2015 9999 📅

End Date: 01/31/2015 9999 📅 Update Report

**Daily Usage (each 15 minutes) - Kilowatt Hours for 01/25/2015**

Use of Electricity Each 15 Minutes

Print
Export Report in Excel
📄 Green Button Download My Data
< Previous Day
Next Day >
On Demand Read
?

# Measuring Inflow and Outflow to the Grid

- From your electric meter, electric bill, and/or Smart Meter Texas
- Smart Meter Texas Example – Pivot table from SMT csv file

Row Labels	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Grand Total	
<b>Consumption</b>	<b>Inflow</b>	0.959	7.912	7.571	5.9	5.027	5.164	2.079	0.576	0.69	0.491	6.016	6.388	13.497	9.506	8.368	0.213	0.332	0.987	2.626	5.124	7.113	6.493	6.295	124.294	
4/19/2014		1.810	1.711	1.7	1.652	1.727	1.629	1.83	0.459	0.021	0	0.294	0.668	1.791	1.061	1.154	0.001	0.002	0.151	0.319	0.429	0.531	0.409	0.449	19.804	
4/20/2014		0.384	0.325	0.428	0.331	0.397	0.361	0.405	0.301	0.064	0.03	0.001	0.36	0.72	1.794	0.666	1.519	0.12	0.276	0.359	0.402	0.462	0.582	0.482	0.539	11.308
4/21/2014		0.516	0.424	0.324	0.437	0.386	0.266	0.418	0.399	0.286	0.214	0.015	0.604	0.917	2.579	1.521	0.768	0.085	0.025	0.354	0.463	0.538	0.701	0.604	0.58	13.424
4/22/2014		0.4	0.335	0.297	0.334	0.266	0.375	0.306	0.15	0.055	0.094	0	0.313	0.659	1.736	0.552	0.888	0	0.018	0.062	0.325	0.453	0.706	0.623	0.42	9.367
4/23/2014		1.527	1.675	1.71	1.741	0.956	0.388	0.317	0.152	0.036	0.192	0	2.882	0.713	1.655	1.57	1.524	0.007	0.011	0.053	0.371	0.717	1.915	1.876	1.919	23.907
4/24/2014		1.79	1.768	1.717	1.906	1.894	1.615	1.535	0.421	0.11	0.16	0.009	0.423	0.976	1.617	0.513	0.68	0	0	0.001	0.208	0.668	0.923	0.629	0.464	20.027
4/25/2014		1.534	1.721	1.736	1.17	0.274	0.393	0.353	0.197	0.004	0	0.466	1.14	1.735	2.325	3.623	1.835	0	0	0.007	0.538	1.857	1.755	1.87	1.924	26.457
<b>Generation</b>	<b>Outflow</b>	0	0	0	0	0	0	0.002	0.311	1.026	3.241	2.186	0	0	0	0.259	4.657	2.643	0.658	0.012	0	0	0	0	14.995	
4/19/2014		0	0	0	0	0	0	0	0.058	0.241	0.663	0.55	0	0	0	0.044	0.447	0.129	0.021	0	0	0	0	0	2.153	
4/20/2014		0	0	0	0	0	0	0	0.046	0.161	0.677	0.486	0	0	0	0	0	0	0	0	0	0	0	0	0	1.37
4/21/2014		0	0	0	0	0	0	0	0	0.005	0.187	0.111	0	0	0	0.035	0.195	0.529	0.004	0	0	0	0	0	0	1.066
4/22/2014		0	0	0	0	0	0	0.001	0.047	0.123	0.463	0.427	0	0	0	0.048	0.959	0.365	0.074	0	0	0	0	0	0	2.507
4/23/2014		0	0	0	0	0	0	0	0.034	0.127	0.57	0.281	0	0	0	0.031	0.937	0.412	0.095	0	0	0	0	0	0	2.487
4/24/2014		0	0	0	0	0	0	0.001	0.013	0.095	0.525	0.331	0	0	0	0.052	1.025	0.503	0.217	0.012	0	0	0	0	0	2.774
4/25/2014		0	0	0	0	0	0	0	0.113	0.274	0.156	0	0	0	0	0.049	1.094	0.705	0.247	0	0	0	0	0	0	2.638
<b>Grand Total</b>		<b>7.967</b>	<b>7.959</b>	<b>7.912</b>	<b>7.571</b>	<b>5.9</b>	<b>5.027</b>	<b>5.164</b>	<b>2.081</b>	<b>0.887</b>	<b>1.716</b>	<b>3.732</b>	<b>8.202</b>	<b>6.388</b>	<b>13.497</b>	<b>9.506</b>	<b>8.627</b>	<b>4.87</b>	<b>2.975</b>	<b>1.645</b>	<b>2.638</b>	<b>5.124</b>	<b>7.113</b>	<b>6.493</b>	<b>6.295</b>	<b>139.289</b>