State of the market & policy drivers
<table>
<thead>
<tr>
<th>Agenda</th>
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<tbody>
<tr>
<td>1. State of the market</td>
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<tr>
<td>2. Basic current policy regarding solar PV</td>
</tr>
</tbody>
</table>
State of the market

Solar Industry Data: The Solar Industry is Growing at a Record Pace, the following section outlines those trends and trajectories in the solar industry that will demonstrate the diverse and sustained growth across the country.
### Solar as an Economic Engine

Nearly **260,000** American workers in solar – more than double the number in 2012 – at more than 9,000 companies in every U.S. state. By 2020, that number will double to more than 420,000 workers.


<table>
<thead>
<tr>
<th>Year</th>
<th>Installation</th>
<th>Manufacturing</th>
<th>Sales &amp; Distribution</th>
<th>Project Development</th>
<th>Other</th>
</tr>
</thead>
<tbody>
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<td>2010</td>
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<td>2016</td>
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</table>

2016 was the fourth consecutive year in which solar employment grew by approximately 20% or greater; at 24.5% in 2016, it exceeded each of the three previous year's 20% growth. (The National Solar Jobs Census defines solar workers as those who spend at least 50 percent of their time on solar-related work; 90% of the 260,000 jobs spend 100% of their time on solar-related work)

This information is from the Solar Foundation’s National Solar Jobs Census [http://www.thesolarfoundation.org/national/](http://www.thesolarfoundation.org/national/) 2016, which found that the solar industry continues to exceed growth expectations, adding workers at a rate nearly 17 times faster than the overall economy and accounting for 2% (51,000 jobs) of all new jobs created in the U.S.

The number of solar jobs increased in 44 of the 50 states in 2016, showing that solar industry growth is truly a nationwide phenomenon.

Most current data as of 5/31/2017
When it comes to Solar as an Economic Engine, nearly 260,000 Americans work in solar - more than double the number in 2012 – and a 25% increase over 2015 (51,000 workers added). At more than 9,000 companies in every U.S. state. By 2020, that number will double to more than 420,000 workers. 2016 was the fourth consecutive year in which solar employment grew by approximately 20% or greater; at 24.5% in 2016, it exceeded each of the three previous year's 20% growth. (The National Solar Jobs Census defines solar workers as those who spend at least 50 percent of their time on solar-related work; 90% of the 260,000 jobs spend 100% of their time on solar-related work)

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Most current data as of 5/31/2017
NOTES: As prices have fallen, installations have gone up. U.S. Solar Market Through 2016: Key Takeaways

- **14.8 GW installed in 2016**
  - 97% growth in Photovoltaic (PV) market over 2015
  - Largest year on record, surpassing 2015; Q4 2016 largest quarter on record

- **Over 42 GW of total solar capacity now installed**
  - CAGR of 59% since 2010
  - Generates enough electricity to power 8.3 million homes

- **Solar top source of new electric generating capacity installed in 2016**
  - Represented 39% of all new electric capacity added to U.S. grid
  - First time solar ranks first; Natural Gas represented 29% and Wind 26%

- **Solar prices dropped 29% from Q4 2015 to Q4 2016**
  - Price drop is seen across all market segments, led by reduced hardware costs
  - Prices have dropped 67% since 2011
  - Utility-scale PPAs now signed for $0.03 - $0.05/kWh

- **In 2016, a new solar installation was completed every 84 seconds**
  - Now 1.3 million installations in the U.S.

Growth in Solar is led by Falling Prices:
The cost to install solar has dropped by more than 70% over the last 10 years, leading the industry to expand into new markets and deploy thousands of systems nationwide.

In addition, Solar prices dropped 3% in 2015 from 2014, and the Price drop accelerated in Q1 2016, down 12% y/y. 
In total, Prices have dropped over 70% since 2006, and Utility-Scale PPAs are being now signed for around $0.03 - $0.05/kWh

Moving forward, the SunShot initiative is working to decrease the soft costs of solar. ([http://energy.gov/sites/prod/files/2016/09/f33/Revolutiona%CC%82%E2%82%ACNo w%202016%20Report_2.pdf](http://energy.gov/sites/prod/files/2016/09/f33/Revolutiona%CC%82%E2%82%ACNow%202016%20Report_2.pdf))

Although distributed PV technology has been available for years, falling prices over the last decade have unlocked its potential not only for the average homeowner but also for larger consumers like businesses and schools. Many installations are small enough to fit on a roof, but there is nothing tiny about distributed PV’s growth. As of the summer of 2015, there have been nearly 800,000 cumulative distributed PV installations. This represents almost 10,000 MW in capacity, which is nearly equal to the capacity of utility-scale installations. (GTM & SEIA. U.S. Solar Market Insight Report: Q2 2015. September 2015.)

The cost of solar energy system hardware (i.e., panels, inverters, etc.) has dropped significantly, but the non-hardware “soft” costs of solar—such as permitting, installation, interconnection, and maintenance fees—remain a major barrier to greater deployment nationwide and can account for up to 68% of total system costs. (GTM & SEIA. U.S. Solar Market Insight Report: Q3 2014. November 2014.)

Even though module costs have been relatively constant since 2012, distributed PV prices have continued to drop, indicating that soft costs have been the major source of price reductions for the last two years. (Barbose, G.; Darghouth, N. Tracking the Sun VIII: The Installed Price of Residential and Non-Residential Photovoltaic Systems in the United States. LBNL, 2015. [http://go.usa.gov/3SRz3](http://go.usa.gov/3SRz3).)
14.5 GW of solar are expected in 2016, nearly double the 2015 total, and equal to half of the solar capacity online today. Additionally, we expect to continue to see a shift of 2016 utility-scale projects to 2017, 2018.

Solar has reached 1% of total generation, this is up from 0.1% just 5 years ago. Additionally, it is expected to reach 3.5% by 2020.

NOTE: Describe what is meant by “utility scale”.

For STATE-SPECIFIC DATA for each training:


DC: Has 148 solar companies; has 25.6 MW solar installed, including 2,792 homes
FL: Has 451 solar companies in state; has 686 MW solar installed, including 75,000 homes powered by solar: http://www.seia.org/state-solar-policy/florida For a nice handout: http://www.seia.org/sites/default/files/FL%202016Q4.pdf
IA: Has 50 solar companies in state; has 39 MW solar installed, including 5,000 homes powered by solar: http://www.seia.org/state-solar-policy/iowa For a nice handout: http://www.seia.org/sites/default/files/IA%202016Q4.pdf
IN: Has 84 solar companies in state; has 217 MW solar installed, including 25,000 homes powered by solar: http://www.seia.org/state-solar-policy/indiana-solar For a nice handout on IN go to http://www.seia.org/sites/default/files/IN%202016Q4.pdf
MA: Has 433 solar companies in state; has 1,487 MW solar installed, including 244,000 homes powered by solar: http://www.seia.org/state-solar-policy/massachusetts For a nice handout: http://www.seia.org/sites/default/files/MA%202016Q4.pdf
NM: Has 102 solar companies in state; has 634 MW solar installed, including 158,000 homes powered by solar: http://www.seia.org/state-solar-policy/new-mexico For a nice handout: http://www.seia.org/sites/default/files/NM%202016Q4.pdf
OH: Has 244 solar companies in state; has 125 MW solar installed, including 15,000 homes powered by solar: http://www.seia.org/state-solar-policy/ohio For a nice handout: http://www.seia.org/sites/default/files/OH%202016Q4.pdf
SC: Has 56 solar companies in state, has 119.1 MW of solar installed, including 13,000 homes powered by solar: http://www.seia.org/state-solar-policy/south-carolina
TX: Has 467 solar companies in state, has 1,215 MW solar installed, including 136,000 homes powered by solar: http://www.seia.org/state-solar-policy/texas-solar For a nice handout on TX: http://www.seia.org/sites/default/files/TX%202016Q4.pdf
WA: Has 161 solar companies in state; has 90 MW solar installed, including 8,960 homes powered by solar: http://www.seia.org/state-solar-policy/Washington
UPDATE ON 2017 DATA: Nearly 2.4 Gigawatts of Solar Installed in the US During Second Quarter of 2017

The U.S. installed almost 2.4 gigawatts (GW) of solar photovoltaics in the second quarter of 2017, an increase of 8 percent year-on-year, according to a new report from GTM Research and the Solar Energy Industries Association (SEIA). Breaking the figures down, a total of 2,387 megawatts (MW) were installed in the second quarter with total installed capacity in the U.S. hitting 47.1 GW, enough to power just over nine million homes. Looking forward, the U.S. Solar Market Insight report forecast that this year would see the solar industry add 12.4 GW of new capacity, down from GTM Research's prior forecast of 12.6 GW. More
The solar industry is more than 90% of the way to achieving the SunShot Initiative’s 2020 utility-scale cost target. SunShot’s 2030 goal is to cut costs an additional 50% between 2020 and 2030.

When it comes to Solar as an Economic Engine, nearly 209,000 Americans work in solar - more than double the number in 2010 - at more than 8,000 companies in every U.S. state. By 2020, that number will double to more than 420,000 workers.

This information is from the Solar Foundation’s National Solar Jobs Census 2015, which found that the solar industry continues to exceed growth expectations, adding workers at a rate nearly 12 times faster than the overall economy and accounting for 1.2% of all jobs created in the U.S.

And as of November 2015 the solar industry employed 208,859 solar workers, representing a growth rate of 20.2% since November 2014.
According to the National Renewable Energy Laboratory report on U.S. PV system cost benchmarks, from the fourth quarter of 2009 to the first quarter of 2016, the modeled costs to install solar photovoltaic (PV) systems continued to decline in the first quarter of 2016 in the U.S. residential, commercial, and utility-scale sectors. And that the continuing total cost decline of solar PV systems demonstrates the sustained economic competitiveness of solar PV for the industry across all three sectors.

(BOS= Balance of System)


NOTE: GOAL OF CUTTING SOFT COSTS, WHICH INCLUDES DESIGN, DOES NOT MEAN CUTTING FEES. IT MEANS REDUCING LEARNING CURVE SO YOU CAN MAKE A PROFIT.
In just 2016 approximately 14.8 GW of was installed. Solar installed in 2015 -19% growth in Photovoltaic (PV) market over 2014 Compound annual growth rate of 58% since 2010.
1 GW = 1,000 megawatts; 1 GW is about enough energy to power up to 750,000 homes and is equal to about 2 coal-fired power plants.

**Housing Unit source for city-specific data below:**
https://www.census.gov/quickfacts/table/HSG010215/3651000,0952000,2507000,0820000,11

(Washington DC housing units 2015: 309,000+, One gigawatt could power TWO entire cities the size of Washington DC, PLUS surrounding metro areas)

(Denver housing units 2010: 286,000+, so one gigawatt could power TWO cities the size of Denver, PLUS surrounding metro areas)

(Boston housing units 2010: 272,481+, so one gigawatt could power two entire cities the size of Boston and surrounding metro areas). Or 3.8 GW would power the entire state of Massachusetts (2.8 million housing units (2015).)

(New Haven housing units 2010: about 55,000. One GW would provide electricity for all housing units for nearly 14 New Havens. And it would take about 4.5 GW to power NYC (3.3 million housing units)
https://www.census.gov/quickfacts/table/HSG010215/3651000,0952000,2507000,0820000,11
(Orlando housing units 2010: 121,000+, so one gigawatt could power SIX cities the size of Orlando, PLUS surrounding metro areas). Also, it would require a little more than 12 GW to power ALL of Florida’s 9.2 million housing units.

(Jacksonville housing units 2010: 366,000+, so one gigawatt could power TWO cities the size of Jacksonville, PLUS surrounding metro areas). Also, it would require a little more than 12 GW to power ALL of Florida’s 9.2 million housing units.

(Minneapolis housing units 2010: 178,000+, so one gigawatt could power FOUR cities the size of Minneapolis, PLUS surrounding metro areas.)

(Phoenix housing units 2010: 590,000+, so one gigawatt could power the city of Phoenix, plus surrounding metro areas. It would take 3.8 GW to power all of Arizona’s 2.9 million homes.)

(Spokane, WA housing units 2010: 94,000+. One GW could power nearly 8 cities the size of Spokane. Also, it would take about 4 GW to power all housing in the state of WA (2.9 million housing units).

(Columbus housing units 2010: 371,000. One gigawatt could power TWO cities the size of Columbus.) Also, it would take about 6.8 GW to power all housing in the state of Ohio)

(Houston housing units 2010: 893,000. It would take about 1.2 GW to power all housing in Houston.)

(Dallas housing units 2010: 517,000. One GW would power about one and half Dallas-sized cities.)

(Albuquerque housing units 2010: 239,000. One gigawatt could power THREE cities the size of Albuquerque plus surrounding metro areas.) Also, it would take about 1.2 GW to power all housing in the state of NM (915,000 housing units))

(Des Moines, IA housing units 2010: 89,000. One GW would power about EIGHT Des Moines-sized cities.) Also, it would take about 1.8 GW to power all of Iowa’s 1.4 million homes.)

One GW would power about TWO AND A HALF Raleigh-Durham sized cities PLUS surrounding metro areas.) Also, it would take about 6 GW to power all of North Carolina’s 4.5 million homes.)
(Atlanta, GA) housing units 2010: 225,000+. One GW would power about THREE Atlanta-sized cities PLUS surrounding metro areas. Also, it would take about 5.6 GW to power all of Georgia’s 4.2 million homes.

(Charleston, SC) housing units 2010: 60,000. One GW would power about 12 and a half Charleston-sized cities. Also, it would take about 3 GW to power all of SC’s 2.2 million homes.

(Indianapolis, IN) housing units 2010: 380,000. One GW would power about TWO Indianapolis-sized cities.) (Not including Carmel’s 30,738 homes). Also, it would take about 5.6 GW to power all of Indian’s 2.8 million homes.

(AUSTIN: approx 325,000 homes, so this is twice the amount of power needed for all the homes in Austin )

(MISSOURI: approx 2,375,000 homes; 43,000 in Columbia, 142,000 in St. Louis, 192,000 in Kansas City. So, twice the power needed for the homes in ALL THREE CITIES COMBINED)

(PHILADELPHIA: approx 600,000 homes. One gigawatt could power the entire city and some of surrounding metro area)

Source: https://suburbanstats.org/

1 GW is approximately 4.6 million PV panels (based on the average panel size of 295 watts) Source: DOE. https://energy.gov/eere/articles/how-much-power-1-gigawatt
Think about that for a second: 14.8 Gigawatts of power would be equal to approximately the same amount of power produced from 30 coal fired power plants. Enough to power 8.7 million homes!

Keep in mind that a standard coal plant size produces half a GW. (For balance, it is also worth noting that a coal-fired plant can produce energy 24 hours/day, which PV cannot)
Think about that for a second: 14.8 Gigawatts of power was installed in the U.S in JUST 2016. Again, that is equal to approximately the same amount of power produced from 30 coal fired power plants and enough to power 8.7 million homes – installed in just one year.
Source: NREL. *Cost reduction Roadmap for Residential Solar PV*, 2017-2030
https://www.nrel.gov/docs/fy18osti/70748.pdf

This report focuses on the potential for continued PV cost reductions in the residential market. From 2010 to 2017, the levelized cost of energy (LCOE) for residential PV declined .52 cents per KWh, to 15.1 cents/kWh. Two key market segments demonstrate significant opportunities for cost savings and market growth:

1. Installing PV at the time of roof replacement, and
2. Installing PV as part of the new home construction process.

NREL estimates that between 2017 and 2030, an average of 3.3 million homes per year will be built or require roof replacement. If those homes were to have solar PV installed, the potential savings in U.S. electricity consumption is 30 Gigawatts GW)!
In Q1 2016, Solar installation in the United States hit 1 million (CUMILATIVE) solar systems installed, and this is expected to continue with as many as 2 million installs in just 2 more years.
In 2017-2018, 2 millions more installations are expected.
A main point of this slide is that the yellow section (COM buildings) hasn’t shown as much growth as the other market segments – and that’s OUR JOB as designers.

We expect the U.S. solar industry to install 14.5 GW of capacity by the end of 2016, which is nearly double the amount installed in a record-breaking 2015. Through the end of this decade, there will be robust growth across all three market segments, eventually reaching a 20 GW annual solar market.

Because of the extension of the ITC (FEDERAL INVESTMENT TAX CREDIT – more on this in next section), the COM and RES markets will continue to grow. It’s a trend. (NOTE that utility growth is steady despite the fact that utilities do not pay taxes or take tax credit)

The cost to install solar has dropped by more than 70% over the last 10 years, leading the industry to expand into new markets and deploy thousands of systems nationwide. (Source: http://www.seia.org/research-resources/solar-industry-data)

A utility-scale solar facility is one which generates solar power and feeds it into the grid, supplying a utility with energy.

Growth in Solar led by Falling Prices

SOURCE: [http://www.seia.org/research-resources/solar-industry-data](http://www.seia.org/research-resources/solar-industry-data)

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In regards to Solar PV price breakdown: The biggest cost-decline opportunity in the solar industry exists in soft costs, including design, labor, supply chain and overhead considerations. The U.S. Department of Energy is leading the charge on reducing soft costs, and SEIA and The Solar Foundation are working with cities and counties to streamline permitting processes and reduce local barriers to going solar.

Definitions:
BOS=Balance of systems
PII= Professional Indemnity Insurance (for design professionals)
Supply chain=the sequence of processes involved in the production and distribution of a commodity.

Q2 2016 Solar Market Update: Key Takeaways
Over 4 GW installed in 1H 2016
  45% growth in Photovoltaic (PV) market over 1H 2015
  Q2 2016 was largest non Q4 ever
Nearly 32 GW of total solar capacity now installed
  CAGR of 58% since 2010
  Generates enough electricity to power 6.2 million homes
Solar prices dropped 18% from Q2 2015 to Q2 2016
  Price drop is seen across all market segments
  Prices have dropped 63% since 2011
Utility-Scale PPAs now signed for $0.03 - $0.05/kWh
Through Q2 2016, Solar represents 26% of all newly installed electric capacity
With big 2H 2016 expected, could end year ahead of Wind, NG
In Q1 2016, hit 1 million solar installations
Will hit 2 million installs in just 2 years
(SOURCE: http://www.seia.org/research-resources/solar-industry-data)
Residential solar has benefitted from decreasing costs, increased competition, improved consumer awareness, and most importantly an influx of new capital that has allowed companies to offer a variety of financing options.

The commercial market has success with large players like Walmart, Apple and Target, but challenges remain in providing competitive financing for smaller companies without credit ratings.
Solar insolation, or solar resource, maps are available from the National Renewable Energy Laboratory, NREL, at [http://www.nrel.gov/gis/solar.html](http://www.nrel.gov/gis/solar.html)

Solar Insolation is the amount of electromagnetic energy incident on the surface of the earth. Basically that means how much sunlight is shining down on us.
In this map, you can see the areas of the U.S. with the highest solar potential. Although is should be noted that all states in the U.S. are suitable for solar PV.
INSOLATION - THE AMOUNT OF SOLAR RADIATION REACHING A GIVEN AREA

Here’s another way to demonstrate that it’s not the “sun” that determines where solar will be successful – it’s the policies...

Here you can see the solar resource available in all U.S. states, and we can compare that to the solar resource available in Germany.

As a comparison, PV accounted for an estimated 7.4 percent of Germany’s net-electricity generation in 2016 (remember from an earlier slide that the US is at 1%). The US has not even come close to reaching our potential, considering Germany’s annual solar resources are comparable to that of Alaska. Almost every region in the continental United States has greater average solar potential than Germany.

Info on Germany and Spain: http://www.seia.org/research-resources/solar-energy-support-germany-closer-look
Again, here you can see the top five states by percentage growth (compared to previous year) on the insolation map. Again, the states with the strongest solar markets are typically not the sunniest states. (2015 compared to 2014 rate of growth)

**ANIMATION SLIDE**

In order:
1. South Carolina
2. Minnesota
3. Indiana
4. Virginia
5. Michigan
Here you can see the top five states by absolute growth on the insolation map. Here you can see the states with the strongest solar markets are typically not the sunniest states. **They are the states with the best policies – we’ll talk about what those policies are in a moment.** The point is... if these states that aren’t even in the sunbelt can do this well, so can YOUR state. In the CA market, only 25 firms have captured this market; in NJ there are 20 firms that have. This is your opportunity to capture it in your state. Take advantage of the untapped market. Where’s your state’s wedge, who will claim it first? And YOU can capitalize on this opportunity and profit as the market expands – this is YOUR opportunity to create. Someone is going to – will it be you?

**ANIMATION SLIDE**

In order:

1. California
2. New York
3. Massachusetts
4. Maryland
5. Connecticut
Other Issues to Watch

- Access to capital
- State & local goals (40 cities have renewable energy goals!)
- Workforce development
  - Industry to double number of employees over 5 years
  - Committed to hiring 50,000 veterans by 2020
- Technology advances
  - Storage, Electric Vehicles, Continued Price Declines

ACCESS to CAPITAL – the primary reason the residential market has grown faster than the commercial market

WORKFORCE DEVELOPMENT - includes THIS training for design professionals.


Other examples: Denver, CO's goal "to reduce community Greenhouse Gas (GHG) emissions 80 percent below 2005 levels by the year 2050 ("80 by 50")"
Very little of the state’s electricity comes from renewables. Nuclear provides most of the power, followed by coal.
Other Issues to Watch

ILLINOIS “FUTURE ENERGY JOBS ACT”

GOALS:
1. Boost renewable energy production
2. Increase energy efficiency
3. Provide credits for nuclear power plants

EXPECTED RESULTS:
- Boost Illinois solar capacity from 74MW to 3,000MW by 2030
- Add 1,350MW wind power (currently 4,026MW)
- Community solar installations

This chart shows how difficult it is for employers to find workers in the various sectors of the energy market.
ILLINOIS WORKFORCE

Workforce Characteristics

Hiring Difficulty

*Figure 13. Hiring Difficulty by Major Technology*

<table>
<thead>
<tr>
<th>Technology</th>
<th>Very difficult</th>
<th>Somewhat difficult</th>
<th>Not at all difficult</th>
<th>DK/NA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electric Power Generation</td>
<td>25.0%</td>
<td>59.4%</td>
<td>12.5%</td>
<td>3.1%</td>
</tr>
<tr>
<td>Electric Power Transmission, Distribution, and Storage</td>
<td>33.3%</td>
<td>50.0%</td>
<td>16.7%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Energy Efficiency</td>
<td>27.5%</td>
<td>37.7%</td>
<td>31.9%</td>
<td>2.9%</td>
</tr>
<tr>
<td>Fuels</td>
<td>5.0%</td>
<td>40.0%</td>
<td>55.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Transportation, including Motor Vehicles</td>
<td>36.4%</td>
<td>36.4%</td>
<td>27.3%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Component Parts for Transportation Vehicles</td>
<td>23.1%</td>
<td>23.1%</td>
<td>46.2%</td>
<td>7.7%</td>
</tr>
</tbody>
</table>

This chart shows how difficult it is for employers to find workers in the various sectors of the energy market.
Basic policy regarding solar PV

CUSTOMIZE this section for each city / state

Net Metering and tariffs affect the cost structure; policies have changed over the years and fluctuates. The message is “state policy doesn’t stay the same” (this message can be the entry to the Policy section).
Net Energy Metering (NEM) is the most common tool that provides value to the customer via credits received up to the full retail electric rate. Credits are accrued and banked for the purposes of offsetting usage during the evenings and when the sun is not shining and have the ability to be rolled over on a month to month basis for up to a year.

It is important to keep in mind that NEM rules and rate vary by state and sometimes by utility territory.

Who would oppose net metering? (local co-ops?)

1/24/17:
Net-metering policies to give customers financial credit for the solar power they pump into the grid are considered vital incentives for buying and installing solar panels. With some exceptions though, the report notes that Texas as a whole has no traditional net-metering policies. The report does cite the service territory of El Paso Electric for allowing net metering. Texas is one of 10 states with “F” grades on net metering. However, some municipal utilities in the state have adopted net-metering policies. A
handful of individual companies have begun offering net-metering incentives, whether through electricity providers like TXU Energy or solar panel providers like SolarCity.

As for interconnection policies, Texas was chided for requirements for redundant external disconnect switches and for additional insurance that can drive up customer costs.

**COLORADO:** Regulatory policy applicable to all utilities (except municipal utilities with less than 5,000 customers). Net excess generation is credited to customer’s next bill at retail rate. After 12-month cycle, IOU customers may opt to roll over credit indefinitely or to receive payment at IOU’s average hourly incremental cost. Municipality and co-ops provide annual reconciliation at a rate they deem appropriate. Customers own RECs.

**CONNECTICUT:** Regulatory policy required of IOUs. Net excess generation is carried over as a kWh credit for one year; Reimbursed to customer at the avoided cost of wholesale power at the end of the year (March 31). Customer owns RECs. Connecticut’s two investor-owned utilities -- Connecticut Light and Power Company (CL&P) and United Illuminating Company (UI) -- are required to provide net metering to customers that generate electricity using "Class I" renewable-energy resources, which include solar, wind, landfill gas, fuel cells, sustainable biomass, ocean-thermal power, wave or tidal power, low-emission advanced renewable-energy conversion technologies, and hydropower facilities up to two megawatts (MW) in capacity. There is no stated limit on the aggregate capacity of net-metered systems in a utility’s service territory. Any net excess generation (NEG) during a monthly billing period is carried over to the following month as a kilowatt-hour (kWh) credit for one year. At the end of the year (March 31), the utility pays the customer for any remaining NEG at the "avoided cost of wholesale power." (See specific utility rate tariffs for details).

**FLORIDA:** Regulatory policy applicable to all utilities in FL. The Florida Public Service Commission (PSC) adopted rules for net metering and interconnection for renewable-energy systems up to 2 MW in capacity for investor owned utilities and also requires municipal utilities and electric cooperatives to offer net metering without stipulating standards. Net metering is available to customers who generate electricity using solar energy, geothermal energy, wind energy, biomass energy, ocean energy, hydrogen, waste heat or hydroelectric power.

Utilities must file annual reports with the Florida PSC indicating the number of customer-generators and the size, type and location of their renewable energy systems, the aggregate capacity of net-metered generation, the amount of energy delivered to and generated from interconnected customers, and the total energy

**Net Excess Generation:** Customer net excess generation (NEG) is carried forward at the utility's retail rate (i.e., as a kilowatt-hour credit) to a customer's next bill for up to 12 months. At the end of a 12-month billing period, the utility pays the customer for any remaining NEG at the utility's avoided-cost rate.

**Renewable Energy Credit Ownership:** Renewable energy credits (RECs) are the property of the system owner, and customers may sell RECs back to the utility. There is no stated aggregate capacity limit for net-metered systems.

*For example, from the Orlando Utility Commission (OUC’s) website ([http://www.ouc.com/environment-community/solar/solar-programs](http://www.ouc.com/environment-community/solar/solar-programs)): Solar PV Program* - The customer installs a Solar PV system on his or her home or business using a certified solar contractor and submits the required paperwork to OUC. Any excess electricity that is generated by the solar system and not used by the customer is sent back to OUC’s electric grid for which the customer will be credited at the full applicable standard retail rate, this is also known as net metering. HOWEVER THE PROGRAM IS FULLY SUBSCRIBED SO NO NEW CONNECTIONS ARE CURRENTLY ALLOWED. To address this, they’ve created 2 news programs: a "Solar Aggregation" program where the utility buys panels in bulk and sells them at a discount to customers, and the "Community Solar Farm", a new 12 MW farm (on 31 acres) on an old landfill. Customers can add their names to a wait list for these programs.

**GEORGIA:** The Georgia Cogeneration and Distributed Generation Act of 2001 allows but does not require net energy metering to be adopted by utilities. The law requires all utilities -- investor-owned utilities, municipal utilities and electric cooperatives -- to offer bidirectional or single directional metering to customer generators, depending on how the customer's facility is connected to the grid.

Georgia Power does not offer a net energy metering tariff. Net energy metering tariffs filed by cooperatives are recorded in [Docket # 31536](http://www.ouc.com/environment-community/solar/solar-programs) on the Georgia Public Service Commission's website. Customers should contact their utility to see if it offers net metering. SOURCE: [http://programs.dsireusa.org/system/program/detail/574](http://programs.dsireusa.org/system/program/detail/574)

**INDIANA:** The Indiana Utility Regulatory Commission (IURC) adopted rules for net metering in September 2004, requiring the state's investor-owned utilities (IOUs) to offer net metering to all electric customers.

Eligible Resources and System Size: Facilities with a maximum capacity of 1 megawatt
(MW) are eligible for net metering. Eligible net metering energy resources include wind, solar, hydro, fuel cells, hydrogen, organic waste biomass and dedicated crops powered generation.

Aggregate Cap: A utility may limit the aggregate amount of net-metering nameplate capacity to 1% of its most recent summer peak load. Nameplate capacity for inverter-based net metering facilities is defined as "the aggregate output rating of all inverters in the facility, measured in kW." At least 40% of a utility's net metering capacity must be residential customers.

IOUs may choose to offer larger net metering capacity limits.

Net Excess Generation: NEG during a billing period is credited to the customer's next monthly bill in the form of a kilowatt-hour (kWh) credit at the retail rate. NEG credits rollover indefinitely. If a customer elects to cease net metering, any unused credit will revert to the utility.

Interconnection: An interconnection agreement between the utility and the customer must be executed before the facility may be interconnected. Net-metered systems must comply with Indiana's interconnection standards (170 IAC 4-4.3).

SOURCE: http://programs.dsireusa.org/system/program/detail/342

IOWA: Iowa's statutes do not explicitly authorize the Iowa Utilities Board (IUB) to mandate net metering, but this authority is implicit through the board's enforcement of PURPA and Iowa Code § 476.41 et seq. Iowa's net-metering subrule, adopted by the IUB in July 1984, applies to customers that generate electricity using alternate energy production facilities (AEPs). Net metering is available to customers of Iowa's two investor-owned utilities, MidAmerican Energy and Interstate Power and Light (IPL). Note: In January 2014, the Iowa Utilities Board issued an order commencing an inquiry on distributed generation and interconnection issues under Docket No. NOI-2014-0001. Details will be posted here if the inquiry results in any changes to Iowa's net metering policy. SOURCE: http://programs.dsireusa.org/system/program/detail/488

There is no explicit limit on either the size of a net-metered system or on total enrollment in the IUB's subrule. However, separate rule waivers have allowed MidAmerican Energy and IPL to limit individual systems to 500 kilowatts (kW). Customers that have an on-site renewable energy system through an existing third-party power purchase agreement are not eligible for net metering under the existing net metering tariffs of MidAmerican and IPL. IPL also limits net metering to customers on the Residential, Farm, or General Service rate schedules, so customers on the Large General Service rate schedule (i.e., customers using more than 20,000 kWh per month) are ineligible to net meter.

According to the IUB, net metering is available to approximately 89% of residential customers in Iowa (see Docket No. NOI-2014-0001, “Order Soliciting Additional Comments and Scheduling Workshop,” p. 6). The IUB has so far declined to assert
jurisdiction over net metering policies for non-rate-regulated utilities (i.e., electric cooperatives and municipal utilities), but strongly encourages them to adopt net metering policies on a voluntary basis.

**MASSACHUSETTS:** Regulatory policy applicable to Investor Owned Utilities (IOUs). The state's investor-owned utilities are required to offer net metering. Municipal utilities are not obligated to offer net metering, but they may do so voluntarily. (There are no electric cooperatives in Massachusetts.) Massachusetts has three categories of net metering facilities:

- **Class I Facilities:** any type of generating systems up to 60 kilowatts (kW) in capacity.
- **Class II Facilities:** systems greater than 60 kW and up to 1 megawatt (MW) in capacity that generate electricity from agricultural products, solar energy, or wind energy.
- **Class III Facilities:** systems greater than 1 MW and up to 2 MW in capacity that generate electricity from agricultural products, solar energy, or wind energy.

Legislation in 2010 introduced an additional definition for "a net metering facility of a municipality or other governmental entity." This type of net-metered facility must be either Class II or Class III, as defined above, and owned by a municipality or governmental entity or the entity must use all of the facility's output. Facilities owned by a municipality or other governmental entity up to 10 MW are eligible for net metering. **Net Excess Generation:** The treatment of customer net excess generation (NEG) varies by facility class and customer type. In all cases, NEG is monetized and net metering credits are calculated based on the excess kilowatt-hours (kWh) produced. The value of the net metering credits at the end of a billing period is slightly less than the utility's full retail rate for Class I solar and wind facilities, Class II facilities, and Class III facilities used by government customers as they would receive credit for the default service, distribution, transmission, and transition charge. Net metering credits for Class III facilities and neighborhood facilities that are used by customers other than government entities differ only in that they do not receive credit for the distribution component. Any new Class I, Class II, and Class III solar net metering facilities (except those exempt from the state's aggregate capacity limits) submitting an Application for Cap Allocation after September 26, 2016 at 2:00 pm will receive "market net metering credits" for NEG. Market net metering credits are equal to slightly less than the utility's full retail rate for facilities of governmental entities, but are equal to 60% of this rate for all other solar facilities, including neighborhood net metering facilities.

Credits may be carried forward to the next month indefinitely, and credits from net metering facilities may be transferred to another customer of the same utility as long as they are within the same service territory and ISO-NE load zone. If a neighborhood facility has NEG at the end of a billing period, the credits are awarded to designated neighborhood customers. The amount of NEG attributed to each such customer is determined by the allocation provided by the neighborhood net metering facility.

SOURCE: http://programs.dsireusa.org/system/program/detail/281
Also note that: Maryland joined the ranks of early movers in the energy storage market by passing a storage tax credit with strong support in both houses of its state legislature. The measure provides for a 30 percent tax credit on the installed cost of a storage system, capped at $5,000 for residential and $75,000 for commercial projects. The total credits awarded cannot exceed $750,000 in a year, and the program will run from 2018 through 2022. That gives storage providers eight months to get ready for a brand-new market opportunity. The legislation now just needs the signature of Gov. Larry Hogan to become law. It passed unanimously in the Senate and with a 101-11 margin in the House, so a veto seems unlikely.

**MINNESOTA:** Regulatory policy. Minnesota's net metering law, enacted in 1983, applies to all investor-owned utilities, municipal utilities, and electric cooperatives. Minnesota has also finalized a methodology for a value of solar tariff in lieu of a net metering billing mechanism; however, no utility has elected to implement such an alternative tariff as of November 2015.

**System Size:** Customers with "qualifying facilities"* less than 1,000 kilowatts (kW) in capacity at investor-owned utilities and less than 40 kW in capacity at municipal utilities and electric cooperatives are eligible for net metering. Investor-owned utilities may require customers with a net-metered facility of 40 kW or greater to limit total generation capacity to 120% of the customer's on-site annual electric consumption for solar PV and other distributed generation systems, and to 120% of customer's on-site maximum electric demand for wind generation systems.

**Aggregate Cap:** There is no aggregate cap limiting the total amount of systems eligible for net metering. However, an investor-owned utility may request the Minnesota Public Utilities Commission (MPUC) limit net metering once net-metered generation has reached 4% of the utility's annual retail electricity sales. The MPUC has authority to limit the cumulative generation of net metered facilities "only if it determines that additional net metering obligations would cause significant rate impact, require significant measures to address reliability, or raise significant technical issues."

**Additional Fees and Charges:** Investor-owned utilities are not permitted to impose a standby charge on net-metered facilities with a capacity of 100 kW or less. A cooperative electric association or municipal utility may charge an additional fee to recover the fixed costs not already paid for by the customer through the customer's existing billing arrangement.

**Net Excess Generation:** Each utility must compensate customers with systems less than 40 kW in size for net excess generation (NEG) at the "average retail utility energy
rate," defined as "the total annual class revenue from sales of electricity minus the annual revenue resulting from fixed charges, divided by the annual class kilowatt-hour sales." Compensation may take the form of an actual payment (i.e., check for purchase) for NEG or as a credit on the customer's bill.

For systems sized 40 kW or greater but less than 1,000 kW in size, NEG will be credited at the avoided cost rate. Alternatively, a customer may elect to be compensated in the form of a kWh credit.

NEG credits will be reimbursed at the end of the calendar year at the avoided cost rate for customers of investor-owned utilities. NEG credits expire at the end of the year for customers of municipal utilities and electric cooperatives. **Note:** Ongoing issues related to Minnesota's Community Solar Garden rules and program implementation are being considered in Docket No. E002/M-13-867. This entry will be updated as necessary to reflect any final changes arising from this Docket.

Source: http://programs.dsireusa.org/system/program/detail/282

**NEW JERSEY:** Generally credited to customer's next bill at retail rate; excess reconciled annually at avoided-cost rate. System must be sized so that energy production does not exceed customer's annual on-site energy consumption

**NEW MEXICO:** Net metering is available to all "qualifying facilities" (QFs), as defined by the federal Public Utility Regulatory Policies Act of 1978 (PURPA), which pertains to renewable energy systems and combined heat and power systems up to 80 megawatts (MW) in capacity. There is no statewide cap on the aggregate capacity of net-metered systems. All utilities subject to Public Regulation Commission (PRC) jurisdiction must offer net metering. (Municipal utilities, which are not regulated by the PRC, are exempt.) Customers are required to be billed for service in accordance with the rate structure and monthly charges that the customer would be assigned if the customer had not interconnected a QF.

Source: http://programs.dsireusa.org/system/program/detail/284

**NORTH CAROLINA:** The North Carolina Utilities Commission (NCUC) established net metering rules for the state's three investor-owned utilities -- Duke Energy, Progress Energy and Dominion North Carolina Power -- in 2005. The NCUC subsequently amended the rules, most recently in 2009. Customers may net meter under any available rate schedule. However, customers that choose to take service under any tariff other than a time-of-use demand (TOUD) tariff must surrender to the utility all renewable energy credits (RECs) associated with the customer’s generation -- with no compensation for the customer.

The individual system capacity limit is one megawatt (MW). There is no aggregate capacity limit on net-metered systems. For residential systems up to 20 kilowatts (kW) and non-residential systems up to 100 kW in capacity, utilities may not charge any standby charges or any additional metering charges other than those charged to
customers who do not net meter under the applicable rate schedule. For larger systems, utilities are allowed to impose standby charges consistent with approved standby rates applicable to other customer-owned generation.

Net Excess Generation: In general, any customer net excess generation (NEG) during a billing period is carried forward to the following billing period at the utility’s full retail rate, and then surrendered to the utility – with no compensation for the customer – at the beginning of each summer billing season. However, the treatment of generation and NEG for customers on TOU-demand tariffs is more complicated. For these customers, on-peak generation is used to offset on-peak consumption, and off-peak generation is used to offset off-peak consumption. Any remaining on-peak generation is then used to offset off-peak consumption. Off-peak generation may only be used to offset off-peak consumption. SOURCE: http://programs.dsireusa.org/system/program/detail/1246

Blue Ridge Electric Member Corp net metering operates separately: The Blue Ridge Electric Membership Corporation offers net metering to its residential customers with solar photovoltaic, wind, or micro-hydro generators up to 25 kilowatts. There is no aggregate capacity limit. Net excess generation is credited at retail rate. However, net metering customers are not served on the general residential rate tariff; net metering customers have a lower retail energy rate and higher basic facilities charge than general residential customers. Net metering customers also have a higher minimum bill than general residential customers. Excess credit rolls over month-to-month, but is granted to the utility without compensation on May 31 of each year. SOURCE: http://programs.dsireusa.org/system/program/detail/5849

**OHIO:** Note: In December of 2015, the Public Utilities Commission of Ohio (PUCO) proposed new net metering rules in docket (Case 12-2050-EL-ORD). These rules are currently under review.

Ohio’s net-metering law requires electric distribution utilities to offer net metering to customers who generate electricity using wind energy, solar energy, biomass, landfill gas, hydropower, fuel cells, or microturbines. Although there is no stated capacity limit on an individual net-metered energy system in Ohio, the Public Utilities Commission of Ohio (PUCO) has ruled that “an implied limitation” is in effect because, by statute, a net-metered system must be “intended to offset part or all of the customer-generator’s electricity requirements.” Net-metered customers are required to use a single meter capable of recording flow of electricity in each direction. Net-metered customers may request refunds of net excess generation (NEG) credits accumulated over a 12-month period. Source: http://programs.dsireusa.org/system/program/detail/36

**2.23.17 PENNSYLVANIA:** PA has had a net metering law on the books since 2005. Credited to customer’s next bill at full retail rate; reconciled annually at "price-
SOUTH CAROLINA: In April of 2014 the South Carolina legislature unanimously passed S.B. 1189 to create a voluntary Distributed Energy Resource Program. In March 2015 the Public Utilities Commission approved a settlement agreement among solar stakeholders detailing how the new net metering mandates laid out in S.B. 1189 would be fulfilled. The settlement agreement approved by the Public Service Commission stipulates that utilities will offer net energy metering at the full retail rate. Additionally, no new charges or fees distinctly separate from new net metering rates will be imposed upon customer generators until the expiration of the agreement on January 1, 2021. The settlement agreement also stipulates that utility-specific distributed energy resources net metering incentive (DER NEM incentive) will be applied to customer-generators receiving service under new net metering tariffs prior to January 1, 2021. Customer-generators whose net energy metering facilities were operational prior to the availability of net energy metering rates approved by the commission under the terms of the settlement agreement may remain in historic net energy metering programs through December 31, 2020. Eligibility and Availability: Resident net metering customers of independently owned utilities (IOUs) can install renewable systems of 20 kW or less and nonresidential customers can install systems with a cap of the lesser of 100% of demand or 1 MW. Renewable systems are defined as solar photo-voltaic, solar thermal, wind, hydroelectric, geothermal, tidal, wave, recycling, biomass, and combined heat and power and hydrogen fuel derived from renewable sources. These systems must be owned, leased, or operated by the customer-generator and must meet all interconnection, performance, safety, and reliability standards established by relevant authorities. Cooperatives are required by S.B. 1189 to examine net metering policies but are not bound by law to implement new programs. Net Excess Generation: The utility is responsible for maintaining an account of total electricity produced and consumed. When less electricity is produced than consumed in a month, then the customer-generator pays the difference. When more electricity is produced than consumed in a month, excess kilowatt-hour credits roll over to the next month. Utilities must annually pay out for any excess electric production at the avoided cost rate to zero-out electric bills and re-start the monthly carry-over process. Excess generation credits cannot be used to pay for non-volumetric charges. SOURCE: http://programs.dsireusa.org/system/program/detail/3041

TEXAS: Has no statewide net metering law; it’s all voluntary unless a municipality has adopted a net metering policy. These four have:
1. Austin Energy, the municipal utility of Austin Texas, offers net metering to its non-residential retail electricity customers for renewable energy systems up to 20 kilowatts (kW). Austin Energy offers the Value of Solar rate instead of net metering for residential customers with solar photovoltaic (PV) systems no larger than 20 kW. The current Performance Based Incentive Rate being accepted is $0.09/kWh for a ten year term. Net Excess Generation: Customers that generate more electricity than they consume during a monthly billing period will receive a credit for net excess generation (NEG) at the appropriate avoided cost rate. http://programs.dsireusa.org/system/program/detail/327

2. San Antonio CPS Energy customers. There is no aggregate capacity limit or maximum system size. There are also no commissioning fees or facilities charges for customers. CPS Energy offers a rebate incentive to residential and commercial customers who enroll in net metering. Net Excess Generation: At the end of each billing period, CPS Energy pays the customer-generator for net excess generation at its avoided cost rate via a credit to the monthly bill. http://programs.dsireusa.org/system/program/detail/5547

3. El Paso El Paso Electric (EPE) has offered net metering to customer-generators since September 2011. To qualify, distributed renewable generation (DRG) owners must either: interconnect an apartment house occupied by low-income elderly tenants that qualifies for master metering or have a qualifying facility with a design capacity of not more than 50 kilowatts (kW). Additionally, the DRG facility must be rated to produce an amount of electricity less than or equal to the estimated annual electricity consumption (for new apartment house or qualifying facility) or the amount of electricity the owner consumed in the year before installing the DRG facility. EPE will install, at no cost to the customer, a bi-directional meter, although interconnection charges may still apply. Net Excess Generation: At the end of each billing period, El Paso Electric pays the customer-generator for net excess generation at its avoided cost rate via a credit to the monthly bill. If the credits on an account become greater than $50, EPE sends the customer-generator a refund check for the balance. http://programs.dsireusa.org/system/program/detail/5545

4. City of Brenham. Customer generators up to 10 megawatts (MW) are eligible to participate, although customer generators with systems 20 kilowatts (kW) or less are eligible for a separate rider and expedited interconnection. The utility will install and maintain a meter capable of measuring flow of electricity in both directions. Any net excess generation (NEG) is credited on a monthly basis at the utility's avoided cost rate. The ordinance includes a standard form interconnection application and agreement as well as standard riders. Customers must provide all equipment necessary to meet applicable safety, power quality and interconnection requirements established by the National Electric Code (NEC), the National Electrical Safety Code, the Institute of Electrical and Electronics Engineers (IEEE), Underwriters Laboratories (UL), and any applicable local and state agencies.
Net-metered customers with systems greater than 20 kW must maintain general liability insurance for personal injury and property damage of at least $500,000 per occurrence and $1,000,000 aggregate; systems 20 kW or less are exempt from the insurance requirements as long as the system's inverter is UL 1741 listed and meets IEEE 1547 requirements. A disconnect switch that is easily visible and accessible to City of Brenham employees is required for all systems. The customer generator is responsible for paying related interconnection costs (including interconnection studies, if required) and must pass a field inspection prior to generating.
http://programs.dsireusa.org/system/program/detail/4587

WASHINGTON, DC: State regulatory policy: Net excess generation is credited to customer's next bill indefinitely at retail rate (including generation, transmission and distribution) for systems 100 kW or less, and at generation rate for larger systems up to 1MW. For virtual net-metered community solar systems, excess credits carry over to a customer's next bill.

Washington State: Washington's net-metering law applies to systems up to 100 kilowatts (kW) in capacity. All customer classes are eligible, and all utilities -- including municipal utilities and electric cooperatives -- must offer net metering.

Net metering is available on a first-come, first-served basis until the cumulative generating capacity of net-metered systems equals 0.5% of a utility's peak demand during 1996.* At least one-half of the utility's available aggregate net metering capacity is reserved for systems generating electricity using renewable energy. Net excess generation (NEG) is credited to the customer’s next bill at the utility’s retail rate. However, on April 30 of each calendar year, any remaining NEG is surrendered to the utility without compensation to the customer. Meter aggregation, the combination of readings from and billings for all meters on property owned or leased by a customer within a single utility's service territory, is provided at a customer's request. (Meter aggregation is limited to 100 kW per customer.) The electricity produced by a meter-aggregated customer is first used to offset electricity provided by the utility to that customer; any excess kilowatt-hours from a billing period will be credited equally to the customer's remaining meters. Source: http://programs.dsireusa.org/system/program/detail/42
This graph shows a building's consumption and the solar system's production throughout the year. A solar PV system is sized to meet the annual consumption, as the energy use may vary throughout the seasons. When the system produces more energy than the building consumed, the utility account will receive a credit that can be applied to another month in the year. If a system is sized correctly, the total production should not be greater than the consumption.

Without NEM, a battery system would be needed to store the excess energy during the daytime.
SCREC also stands for Solar Renewable Energy **Certificate**.

SRECs: these environmental commodities have the ability to be traded within markets that have predetermined values set for SRECs. The SREC commodity only represents the clean or solar part of the kWh generated from an eligible facility. These markets are typically state driven and are found to be more robust on the East Coast.

SRECs can be claimed by the system owner, which can be the building owner or a lease or power purchase agreement company. SRECs can help shorten the payback period and provide revenue after the system is paid off.

RPS = Renewable Portfolio Standard
SPEAKERS: This slide may generate some debate. Be well prepared to teach the perspective below.

Home Energy Rating System (HERS) added in to residential energy code in 2015 as alternative compliance path called Energy Rating Index.

The Energy Rating Index (ERI) path allows renewable energy to replace insulation. The energy code has historically been designed to maximize the energy efficiency of a structure. Allowing the generation of renewable energy to offset energy consumption means that homes can be code compliant even if they use more energy. While one may think “what does it matter, if the energy is coming from the sun anyway?”, it’s not that simple: (1) solar photovoltaic (PV) panels don’t last as long as wall insulation; (2) solar PV panels can be removed by future owners; (3) solar PV panels are themselves energy-intensive to produce. Overall, the code should focus on assuring energy efficiency rather than allowing PV to offset that basic minimum goal.

Adoption of the 2015 and 2018 IECC may well drive PV deployment in residential construction, but it’s worth keeping an eye out to make sure that it is not happening at the cost of basic EE.
2018 International Building Code

Allows renewable energy to replace insulation, but should it?

• PV panels can be removed by future owners
2018 International Building Code

Allows renewable energy to replace insulation, but should it?

• PV panels can be removed by future owners
• Ceiling and wall insulation last more than 30 years and should not be compromised
2018 International Building Code

Allows renewable energy to replace insulation, but should it?

- PV panels can be removed by future owners
- Ceiling and wall insulation last more than 30 years and should not be compromised
- The greater the energy efficiency in building shells - the fewer PV panels are needed
  (Lowering the cost for adding solar!)

IN SHORT:

The addition of PV panels should not result in lower building efficiency
Local policies include cities mandating rooftop solar on new buildings. So far, the largest city in the country to mandate rooftop solar panels is San Francisco, which began requiring (https://www.greentechmedia.com/articles/read/mandatory-solar-new-roofs-california-san-francisco-wiener-developers) them on most new buildings beginning in January. The city mandates that solar panels, a “living roof,” or a combination of the two occupy between 15 and 30 percent of the surface area of a new rooftop. A “living roof” is covered with grass, trees or other vegetation.

Other California cities that have mandated solar panel installations include Culver City, San Mateo, Lancaster, Sebastopol and Santa Monica. (https://energy.gov/savings/city-sebastopol-mandatory-solar-requirement-residential-and-commercial-buildings)


Other city renewable energy goals: http://www.businessinsider.com/the-greenest-american-cities-renewable-energy-2016-8/#san-jose-california-4
Quiz & Discussion
The number of solar PV installations is expected to increase by what percentage in 2017-2018?

a) 25%

b) 50%

c) 100%

d) 200%

Correct answer b) the solar PV market growth rate in 2016 is expected to be between 25%-50%
The number of solar PV installations is expected to increase by what percentage in 2017-2018?

- a) 25%
- b) 50%
- c) 100%
- d) 200%

Correct answer b) the solar PV market growth rate in 2016 is expected to be between 25%-50%
The fastest growing PV markets are in the sunniest U.S. States.

a) True
b) False
The fastest growing PV markets are in the sunniest U.S. States.

a) True
b) False
Net energy metering offers what opportunity to consumers?

a) Lower conventional energy costs from the utility
b) Ability to balance electricity consumption and production patterns
c) Solar renewable energy credits (SRECs)
d) None of the above
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