Solar Powering Your Community
Addressing Soft Costs and Barriers
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Philip Haddix
The Solar Foundation
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(202) 469-3743
## Agenda

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
</tr>
</thead>
<tbody>
<tr>
<td>10:00–10:30</td>
<td>Introductions and Overview</td>
</tr>
<tr>
<td>11:40–12:15</td>
<td>Planning and Zoning for Solar</td>
</tr>
<tr>
<td>12:15–12:30</td>
<td>Break</td>
</tr>
<tr>
<td>12:30–12:40</td>
<td>Interactive Activity Revisited</td>
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<td>12:40–1:25</td>
<td>Solar Financing Strategies in the Region</td>
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<td>1:25–1:35</td>
<td>Break</td>
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<td>Local Discussion Panel and Audience Discussion</td>
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The SunShot Solar Outreach Partnership (SolarOPs) is a U.S. Department of Energy (DOE) program designed to increase the use and integration of solar energy in communities across the US.
About the SunShot Solar Outreach Partnership

- Increase installed capacity of solar electricity in U.S. communities
- Streamline and standardize permitting and interconnection processes
- Improve planning and zoning codes/regulations for solar electric technologies
- Increase access to solar financing options
About the SunShot Solar Outreach Partnership

Resource Solar Powering Your Community Guide

A comprehensive resource to assist local governments and stakeholders in building local solar markets.

www.solaroutreach.org
Complimentary Services

- Technical Resources
- Regional Workshops
- One to One Assistance
- Strategy Session

Email solar-usa@iclei.org to request a 20 minute consultation
Complimentary Services

Technical Resources

Helping Policymakers Understand Best Practices:
• Case Studies
• Fact Sheets
• How-to Guides
• Toolkits

www.solaroutreach.org

Email solar-usa@iclei.org to request a 20 minute consultation
Complimentary Services

Quickly get up to speed on key solar policy issues:

- Solar 101
- Planning for Solar
- Implementing an Ordinance
- Streamlining Solar Permits
- Growing your Market

Email solar-usa@iclei.org to request a 20 minute consultation
Complimentary Services

Technical Resources

Regional Workshops

Develop an implementation strategy for smart solar policy

Email solar-usa@iclei.org to request a 20 minute consultation
Complimentary Services

Technical Resources

Regional Workshops

One to One Assistance

Receive customized technical support on implementation of smart solar policy

Email solar-usa@iclei.org to request a 20 minute consultation
Poll

Who’s in the room?
Poll
What is your experience with solar?
Explore benefits

and

Overcome barriers
Activity: Identifying Benefits

What is the greatest benefit solar can bring to your community? [Blue Card]

Right Now: Write answer on card
During Session: Compile results
After Break: Group discussion
Activity: Addressing Barriers

What is the greatest barrier to solar adoption in your community? [Green Card]

Right Now
- Write answer on card

During Session
- Compile results

After Break
- Group discussion
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Solar Technologies

Solar Photovoltaic (PV)  Solar Hot Water  Concentrated Solar Power
Solar Technologies

- Solar Photovoltaic (PV)
- Solar Hot Water
- Concentrated Solar Power
Some Basic Terminology

Panel / Module

Cell
Some Basic Terminology
Some Basic Terminology

Capacity / Power
kilowatt (kW)

Production
Kilowatt-hour (kWh)
Some Basic Terminology

- **Residence**: 5 kW
- **Office**: 50 – 500 kW
- **Factory**: 1 MW+
- **Utility**: 2 MW+
Kentucky Solar Market

Cumulative Installed Capacity of Solar PV

U.S. Cumulative Capacity Growth

Solar Development in the US

In 2013, the US solar industry installed 131,000 new solar installations [that’s one every four minutes] of which 94% were residential projects.

Solar Installed Costs

US Average Installed Cost for Behind-the-Meter Residential PV

Solar Installed Costs

US Average Installed Cost for Behind-the-Meter Residential PV

43% drop in price
2009 - 2013

Projected Cost Competitiveness

Source: Bloomberg
Projected Cost Competitiveness

2020

Source: Bloomberg
Solar Job Growth

Solar Economic Growth

http://www.seia.org/research-resources/us-solar-market-insight
Global Installed Capacity

Top 5 Countries Solar Operating Capacity (2012)

- **Germany** 32.0%
- **USA** 7.2%
- Italy
- China
- Japan
- Rest of World

Source: REN 21, Global Status Report 2013
Installed Capacity

Total US cumulative installed solar capacity 13.0 GW

German solar capacity additions (2011-2013) 11.8 GW

The Cost of Solar in the US

Comparison of US and German Solar Costs

The Cost of Solar in the US

Comparison of US and German Solar Costs

The Cost of Solar in the US

Comparison of US and German Solar Costs

The Cost of Solar in the US

Comparison of US and German Solar Costs

The Cost of Solar in the US

Comparison of US and German Solar Costs

Workshop Goal

Enable local governments to replicate successful solar practices to reduce soft costs and expand local adoption of solar energy
Solar Market: Trends

Source: Solar Electric Power Association
Solar Market: Trends

Source: Solar Electric Power Association; U.S. Energy Information Administration (Nov 2013)

Cost of Electricity

<table>
<thead>
<tr>
<th>Stage 1</th>
<th>Stage 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar PV: $0.156 per kWh</td>
<td></td>
</tr>
<tr>
<td>Average KY Retail Rates:</td>
<td></td>
</tr>
<tr>
<td>KU: $0.0716 per kWh</td>
<td></td>
</tr>
<tr>
<td>LG&amp;E: $0.0809 per kWh</td>
<td></td>
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<tr>
<td>Kentucky Power: $0.0752 per kWh</td>
<td></td>
</tr>
<tr>
<td>Duke: $0.0809 per kWh</td>
<td></td>
</tr>
</tbody>
</table>

Source: Solar Electric Power Association; U.S. Energy Information Administration (Nov 2013)
A policy driven market designed to mitigate costs and increase the value of solar production.
# A Policy Driven Market

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<td>Qualified Energy Conservation Bond</td>
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<td></td>
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<tr>
<td>Direct Cash &amp; Performance Incentives</td>
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**Powered by SunShot**

U.S. Department of Energy
# A Policy Driven Market

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<td></td>
<td></td>
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Renewable Portfolio Standard

Retail Electricity Sales

Any electricity source

Renewable Energy
Renewable Portfolio Standard

Retail Electricity Sales

- Any electricity source
- Renewable Energy
- Solar carve-out
29 states, + Washington DC and 2 territories have Renewable Portfolio Standards (8 states and 2 territories have renewable portfolio goals)
# RPS Impacts: Solar Deployment

## RPS and Solar/DG Status of Top Ten Solar States by Cumulative Installed Capacity (as of Q4 2013)

<table>
<thead>
<tr>
<th>Ranks</th>
<th>State</th>
<th>RPS?</th>
<th>Solar/DG Provision?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>California</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>2</td>
<td>Arizona</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>3</td>
<td>New Jersey</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>4</td>
<td>North Carolina</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>5</td>
<td>Nevada</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>6</td>
<td>Massachusetts</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>7</td>
<td>Hawaii</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>8</td>
<td>Colorado</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>9</td>
<td>New York</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>10</td>
<td>New Mexico</td>
<td>Y</td>
<td>Y</td>
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</table>

RPS Impacts: Retail Rates

North Carolina Residential REPS Charges, Monthly Utility Bills and Solar PV Capacity

Sources: EIA, IREC, SEIA/GTM, NC Utilities Commission

Residential Monthly Electricity Cost

<table>
<thead>
<tr>
<th></th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>PV Capacity since 2008</td>
<td>6.6</td>
<td>35.3</td>
<td>80.8</td>
<td>202.8</td>
<td>415.8</td>
</tr>
<tr>
<td>Max Res'l REPS Charge</td>
<td>$0.65</td>
<td>$0.58</td>
<td>$0.56</td>
<td>$0.41</td>
<td>$0.19</td>
</tr>
<tr>
<td>Avg. Remaining Res'l Bill</td>
<td>$111.65</td>
<td>$124.62</td>
<td>$116.89</td>
<td>$117.04</td>
<td>$119.01</td>
</tr>
</tbody>
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# A Policy Driven Market

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Net metering allows customers to export power to the grid during times of excess generation, and receive credits that can be applied to later electricity usage.
Net Metering

Typical Residential Customer With Net Metering (Summer Season)

- Morning
- Afternoon
- Evening
- Night

Peak Customer Demand

Customer Energy Demand
Net Metering

Typical Residential Customer With Net Metering (Summer Season)

- Peak Solar Output
- Peak Customer Demand
- Solar PV Output
- Customer Energy Demand

Morning - Afternoon - Evening - Night

Powered by SunShot
U.S. Department of Energy
Net Metering

“Net Metered” Power Sold back to the Grid/Utility

Savings from Reduced Consumption

Remaining Customer Energy Demand

Morning  Afternoon  Evening  Night

The Result: Solar covers most (or all) of a customer’s bill, even at night!
Net Metering: Market Share

More than 93% of distributed PV Installations are net-metered

Net Metering

43 states, + Washington DC and 4 territories have Net Metering Policies

Source: DSIRE (July 2013)
Net Metering: Kentucky

Kentucky Net Metering Policy:

- **Credit Value**: Retail Rate
- **Credit Rollover**: Unlimited
- **System Capacity Limit**: 30 kW
- **Aggregate Limit**: 1% of previous year utility peak load (kW)

Source: Freeing the Grid
Net Metering: Current Status in Kentucky

### Kentucky Actual and Allowed Remaining Net Metered PV Capacity

**Source:** U.S. Energy Information Administration

<table>
<thead>
<tr>
<th></th>
<th>Kentucky Utilities Co</th>
<th>Louisville Gas &amp; Electric Co</th>
<th>Duke Energy Kentucky</th>
<th>Kenergy Corp</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Net Metered PV Capacity/Allowable Remainder (MW)</strong></td>
<td>41.17</td>
<td>26.83</td>
<td>8.29</td>
<td>12.84</td>
</tr>
<tr>
<td><strong>Potential NM Under Cap</strong></td>
<td>41.17</td>
<td>26.83</td>
<td>8.29</td>
<td>12.84</td>
</tr>
<tr>
<td><strong>Total Installed NM PV</strong></td>
<td>0.21</td>
<td>0.48</td>
<td>0.56</td>
<td>0.01</td>
</tr>
</tbody>
</table>

**Source:** EIA Forms 826 and 861
# Net Metering: Current Status in Kentucky

## Kentucky Net Metering Capacity vs. Capacity Cap

**Source:** U.S. Energy Information Administration

<table>
<thead>
<tr>
<th></th>
<th>Percentage of 2012 Peak Hour Demand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kentucky Utilities Co</td>
<td>0.005%</td>
</tr>
<tr>
<td>Louisville Gas &amp; Electric Co</td>
<td>0.018%</td>
</tr>
<tr>
<td>Duke Energy Kentucky</td>
<td>0.063%</td>
</tr>
<tr>
<td>Kenergy Corp</td>
<td>0.001%</td>
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<thead>
<tr>
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<th>Total Installed NM PV</th>
<th>2013 NM Capacity Cap (1% of Peak Hour Demand)</th>
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<tbody>
<tr>
<td>Kentucky Utilities Co</td>
<td>0.01%</td>
<td>1.00%</td>
</tr>
<tr>
<td>Louisville Gas &amp; Electric Co</td>
<td>0.02%</td>
<td>1.00%</td>
</tr>
<tr>
<td>Duke Energy Kentucky</td>
<td>0.06%</td>
<td>1.00%</td>
</tr>
<tr>
<td>Kenergy Corp</td>
<td>0.00%</td>
<td>1.00%</td>
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Source: EIA Forms 826 and 861
Net Metering: Resources

Resource: Freeing the Grid

Provides a “report card” for state policy on net metering and interconnection

http://freeingthegrid.org/
Standardized interconnection rules require utilities to provide a fair and transparent pathway for customer-generators and other developers of distributed energy resources to interconnect with the utility’s grid.
Interconnection: Kentucky

Kentucky Interconnection Policy:

- **Applicable Technologies**: PV, Wind, Biomass, Small Hydro
- **System Capacity Limit**: 30 kW for Level 1 Scrutiny
- **Applicable Utilities/Customer Classes**: All
- **External Disconnect Switch Requirement**: Yes

Source: Freeing the Grid
Interconnection: Situation and Recent Developments

- KY interconnection breakpoint at 30kW a significant barrier to development of commercial/utility-scale market.
- Federal level
  - Federal Energy Regulatory Commission (FERC) reissued its Small Generator Interconnection Procedures (SGIP) to permit greater streamlining and more rapid interconnection approvals
  - New SGIP has led Ohio to consider more streamlined interconnection procedures.

Source: Freeing the Grid
IREC developed its model interconnection rules in an effort to capture best practices in state interconnection policies.

www.irecusa.org
# A Policy Driven Market

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Solar Access

Solar Access Laws:

1. Increase the likelihood that properties will receive sunlight
2. Protect the rights of property owners to install solar
3. Reduce the risk that systems will be shaded after installation
Fontainebleau V. Eden Roc (1959)

A landowner does not have any legal right to the free flow of light and air across the adjoining land of his neighbor.
Solar Access

Source: DSIRE

- Solar Easements Provision
- Solar Rights Provision

U.S. Virgin Islands

Local option to create solar rights provision

Source: DSIRE
Solar Access: Kentucky

Solar Easement Policy (KRS 381.200):

In Kentucky, solar easements may be obtained for the purpose of ensuring access to direct sunlight. Easements must be expressed in writing and will become an interest in real property that may be acquired and transferred.

Source: DSIRE
Solar Access

Resource Solar ABCs

A comprehensive review of solar access law in the US – Suggested standards for a model ordinance

www.solarabcs.org
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Mitigate Soft Costs

Source: NREL (http://www.nrel.gov/docs/fy12osti/54689.pdf)
Mitigate Soft Costs

- Other Paperwork: $0.21 per Watt
- Permitting
- Installation Labor
- Customer Acquisition

Source: NREL (http://www.nrel.gov/docs/fy12osti/54689.pdf)
Challenge: Installation Time

New York City’s Goal: 100 days from inception to completion

Germany Today: 8 days from inception to completion
Time to Installation

Average Time to Permit a Solar Installation

- **7.2x more man-hours needed in the US**

<table>
<thead>
<tr>
<th>Hours</th>
<th>US</th>
<th>Germany</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
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<tr>
<td>14</td>
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<td>4</td>
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<td>0</td>
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</table>
Permitting Costs

Average Cost of Permitting in the US and Germany

Source: NREL, LBNL
Germany’s Success

Consistency and Transparency through Standardized Processes
Planning for Solar

Remove barriers by:

- Make qualified solar projects a by-right accessory use
- Modify regulations to clarify what types of solar projects are allowed where
- Streamline the permitting process
# Zoning Code: Solar Framework

<table>
<thead>
<tr>
<th>Section</th>
<th>Topics to Address</th>
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<tbody>
<tr>
<td><strong>Definitions</strong></td>
<td>Define technologies</td>
</tr>
<tr>
<td><strong>Applicability</strong></td>
<td>Primary vs. accessory use</td>
</tr>
</tbody>
</table>
| **Dimensional Standards**| • Height  
• Size                          |
|                          | • Setbacks  
• Lot coverage                     |
| **Design Standards**     | • Signage  
• Disconnect                      |
|                          | • Screening  
• Fencing                         |
Typical Requirements:

- Permitted as accessory use
- Minimize visibility if feasible

Requirements:
- District height
- Lot coverage
- Setback
Zoning Codes: Large Scale Solar

Typical Requirements:

- Allowed for primary use in limited locations
- Requirements:
  - Height limits
  - Lot coverage
  - Setback
  - Fencing and Enclosure
This Essential Info Packet provides a number of articles and guidebooks to help planners plan for solar in their communities.

planning.org/research/solar
The Permitting Process: Challenges

18,000+ local jurisdictions with unique permitting requirements

Source: http://www.nrel.gov/docs/fy12osti/54689.pdf
Local permitting processes add on average $2,516 to the installation cost of residential PV

Source: SunRun
The Permitting Process: Challenges

Source: Forbes
Expeditied Permitting

Solar Permitting Best Practices:

- Post Requirements Online
- Implement an Expedited Permit Process
- Enable Online Permit Processing
- Ensure a Fast Turn Around Time

Source: Interstate Renewable Energy Council/Vote Solar
Expedited Permitting

Solar Permitting Best Practices:

✔ Collect Reasonable Permitting Fees

✔ Do Not Require Community-Specific Licenses

✔ Narrow Inspection Appointment Windows

✔ Eliminate Excessive Inspections

✔ Train Permitting Staff in Solar

Source: Interstate Renewable Energy Council/Vote Solar
Permitting: Best Practices

Resource  Residential Solar Permitting Best Practices

Provides explanations of nine best practices designed to streamline local solar permitting processes, along with examples of implementation.

Expedited Permitting: Case Study

Breckenridge, Colorado
Population: 4,540

Breckenridge charges no fees to file for a solar permit
Expeditied Permitting: Case Study

Breckenridge offers a short turn around time for solar permits

Expedited Permitting: Case Study

Expedited Permitting:

- Simplifies requirements for PV applications
- Facilitates efficient review of content
- Minimize need for detailed studies and unnecessary delays
Expeditied Permitting

Resource  Interstate Renewable Energy Council

Outlines emerging approaches to efficient rooftop solar permitting

www.irecusa.org
Mitigate Soft Costs

Source: NREL (http://www.nrel.gov/docs/fy12osti/54689.pdf)

- Other Paperwork
- Permitting
- Solar Readiness
- Installation Labor
- Customer Acquisition

Per Watt

$0.59

$1.60
$1.40
$1.20
$1.00
$0.80
$0.60
$0.40
$0.20
$0.00

Source: NREL (http://www.nrel.gov/docs/fy12osti/54689.pdf)
Creating solar-ready guidelines and promoting energy efficiency at the outset can help make future solar installations easier and more cost effective.
Local Example: Owensboro Metropolitan Planning Commission

iOMPC Comprehensive Plan (Section 7)

As our limited supplies of fossil fuels become further depleted, the potential for solar energy and orientation may demand more of our time and effort. An increase in our awareness of solar issues now will help us lay the ground rules for the solar access, orientation, and compatible building designs that will be appreciated for generations to follow.

Planning for solar at the subdivision stage would greatly increase solar potential and cut the costs for its installation.

Solar Readiness

Require builders to:

✓ Minimize rooftop equipment

✓ Plan for structure orientation to avoid shading

✓ Install a roof that will support the load of a solar array

✓ Record roof specifications on drawings

✓ Plan for wiring and inverter placement
Solar Readiness

During Construction

After Construction

60% Savings when a building is solar ready

Solar Readiness

Up to 30% More Energy Production with a south facing roof

Solar Readiness

Resource  NREL

Creating a solar ready guide for buildings:

- Legislation
- Certification programs
- Stakeholder Education

www.nrel.gov

Source: NREL
Solar Readiness Model Ordinance

Resource  American Planning Association

Includes references to ordinances requiring solar-ready homes in select communities.

www.planning.org/research/solar
Agenda

10:00 – 10:30  Introductions and Overview
11:40 – 12:15  Planning and Zoning for Solar
12:15 – 12:30  Break
12:30 – 12:40  Interactive Activity Revisited
12:40 – 1:25   Solar Financing Strategies in the Region
1:25 – 1:35    Break
1:35 – 2:50    Local Discussion Panel and Audience Discussion
<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
</tr>
</thead>
<tbody>
<tr>
<td>10:00 – 10:30</td>
<td>Introductions and Overview</td>
</tr>
<tr>
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<td>Break</td>
</tr>
<tr>
<td>1:35 – 2:50</td>
<td>Local Discussion Panel and Audience Discussion</td>
</tr>
</tbody>
</table>
Activity: Identifying Benefits

What is the greatest benefit solar can bring to your community? [Blue Card]

Right Now
Write answer on card

During Session
Compile results

After Break
Group discussion
Benefits Poll
Benefits of Solar Energy

- Economic growth
- Local jobs
- Energy independence
- Stabilizes price volatility
- Valuable to utilities
- Smart investment
Benefit: Stabilize Energy Prices

Historical Avg Real-Time LMP (NEMABOS)

Source: ISO New England, Inc.
Benefits: Valuable to Utilities

Source: Rocky Mountain Institute
(http://www.rmi.org/Content/Files/eLab-DER_cost_value_Deck_130722.pdf)
Benefits: Valuable to Utilities

Levelized Value of Solar ($/MWh) in PA and NJ

Solar homes sold
20% faster
and for
17% more
than the equivalent non-solar homes
in surveyed California subdivisions

**Benefit:** Smart Investment for Homes

From SunRun:

- 3 kW = $16,500 added sale premium
- 6 kW = $33,000 added sale premium
- 9 kW = $49,500 added sale premium

Source: Tracking the Sun IV, SunRun
Benefit: Smart Investment for Business
Benefit: Smart Investment for Business

Top 20 Companies by Solar Capacity

- Walmart
- Costco
- Kohl's
- Apple
- Ikea
- Kohl's
- Costco
- Walmart

Enough Solar to Power > 73,000 U.S. homes

Source: Solar Energy Industries Association
Benefit: Smart Investment for Government

Source: Borrego Solar
Activity: Addressing Barriers

What is the greatest barrier to solar adoption in your community? [Green Card]

**Right Now**
Write answer on card

**During Session**
Compile results

**After Break**
Group discussion
Activity: Addressing Barriers
Activity: Addressing Barriers

- High Upfront Cost & Low ROI
- Lack of Information & Education
- Unfriendly Policy Environment & Lack of Incentives
- Local Zoning & Permitting
- Aesthetics & Historic Preservation
- Utility Support
- Lack of Support from HOAs
- Reliability Concerns
- Environmental Impact
- Other
Barriers Poll
Some things you may hear...

- My area isn’t sunny enough for solar
- Going solar is too expensive
- Solar is not ready to compete as a serious energy source
- The government should not “pick winners and losers”
Fact: Solar works across the US

Source: National Renewable Energy Laboratory
Fact: Solar is a ubiquitous resource

Fact: Declining Solar Costs

US Average Installed Cost for Behind-the-Meter Residential PV

Fact: Declining Solar Costs

US Average Installed Cost for Behind-the-Meter Residential PV

43% drop in price 2009 - 2013

Subsidies and Support

Subsidies for Conventional and Solar Energy, 2010

- **Oil and Natural Gas**: $2,820
- **Nuclear**: $2,499
- **Coal**: $1,358
- **Solar**: $1,134

Subsidies and Support

Subsidies and Support

Subsidies for Conventional and Solar Energy, 1950-2010

- Oil: $369 billion
- Natural Gas: $121 billion
- Coal: $104 billion
- Nuclear: $73 billion
- Solar: $17 billion

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# The Solar Equation

## Cost
- Installed Cost
- Maintenance
- Direct Incentive

## Benefit
- Avoided Energy Cost
- Excess Generation
- Performance Incentive
A policy driven market designed to mitigate costs and increase the value of solar production.
The Solar Equation

**Cost**
- Installed Cost
- Maintenance
- Direct Incentive

**Benefit**
- Avoided Energy Cost
- Excess Generation
- Performance Incentive
## A Policy Driven Market

<table>
<thead>
<tr>
<th>Federal</th>
<th>State &amp; Utility</th>
<th>Local</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investment Tax Credit</td>
<td>Renewable Portfolio Standard</td>
<td>Solarize</td>
</tr>
<tr>
<td>Accelerated Depreciation</td>
<td>Net Metering/Interconnection</td>
<td>Property Assessed Clean Energy</td>
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<tr>
<td>Qualified Energy Conservation Bond</td>
<td>Solar Access</td>
<td></td>
</tr>
<tr>
<td>Direct Cash &amp; Performance Incentives</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Investment Tax Credit

Type: Tax Credit

Eligibility: For-Profit Organization

Value: 30% of the installation cost

Availability: Through 2016
Accelerated Depreciation

Modified Accelerated Cost-Recovery System (MACRS)

- Straight Line
- MACRS (2014+)

Project Value vs. Year

0% 2% 4% 6% 8% 10% 12% 14% 16% 18% 20% 22% 24%

0 2 4 6 8 10 12 14 16 18 20 22 24

Year
Qualified Energy Conservation Bond

US Treasury

Qualified Energy Conservation Bond (QECB)

Local Gov

Project

Bond Holders

$
Qualified Energy Conservation Bond

US Treasury

Local Gov

Project

Bond Holders

QECB

+ 3.7%
+ 2.3%

$
# A Policy Driven Market

<table>
<thead>
<tr>
<th>Federal</th>
<th>Investment Tax Credit</th>
<th>Accelerated Depreciation</th>
<th>Qualified Energy Conservation Bond</th>
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</thead>
<tbody>
<tr>
<td>Local</td>
<td>Permitting &amp; Interconnection</td>
<td>Tax Credits &amp; Exemptions</td>
<td>Direct Cash &amp; Performance Incentives</td>
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<tr>
<td>Solarize</td>
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<tr>
<td>Property Assessed Clean Energy</td>
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</tr>
</tbody>
</table>

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**Powered by SunShot**

U.S. Department of Energy
State Corporate Tax Credit – for Systems


**Eligibility:**

**Value:** $3/W DC for PV, up to $1,000 per taxpayer for installations on multi-family residential rental units or commercial property; $500 for single family residential rental unit

**Requirements:** Must be installed by a North American Board of Certified Energy Practitioners (NABCEP)-certified installer. PV panels and inverters must meet National Electrical Code (NEC) and be certified by Underwriters Laboratories (UL).

Source: DSIRE
State Corporate Tax Credit – for Facilities

**Type:** Solar Thermal Electric, Solar PV, Landfill Gas, Wind, Biomass, Hydroelectric, Renewable Fuels

**Eligibility:** $500 for solar and wind installations; $250 for geothermal installations.

**Value:** $3/W DC

**Requirements:** All tax credits combined may not exceed 50% of the capital investment in the project. Negotiated incentive package may not exceed 25 years.

Source: DSIRE
State Personal/Individual Tax Credit


**Eligibility:** Residential, Multi-Family Residential

**Value:** $3/W DC, up to $500 for solar and wind installations

**Requirements:** Must be installed by a North American Board of Certified Energy Practitioners (NABCEP)-certified installer. PV panels and inverters must meet National Electrical Code (NEC) and be certified by Underwriters Laboratories (UL).

Source: DSIRE
Performance-Based Incentive: TVA Green Power Providers

**Type:** Solar PV, Wind, Biomass, Small Hydroelectric

**Eligibility:** Commercial, Residential, Nonprofit, Local Government, State Government, Fed. Government, all directly served TVA customers

**Value:** $1,000 upon installation, with Years 1-10: retail electric rate + premium payment, and Years 11-20: retail electric rate. 2014 premium rate for PV: 4 cents/kWh.

**Requirements:** The system must comply with environmental regulations and national standards, be certified by a licensed electrician, and comply with all applicable codes. PV installations approved by TVA in Calendar Year 2013 must be installed by a renewable energy professional with entry-level NABCEP certification.

*Source: DSIRE*
Performance-Based Incentive: TVA Solar Solutions Initiative

**Type:** Solar PV

**Eligibility:** 36 MW of systems sized to: 50 kW-1 MW.

**Value:** 10-year incentive of $0.06/kWh.

**Requirements:** The system must comply with environmental regulations and national standards, be certified by a licensed electrician, and comply with all applicable codes. PV installations approved by TVA in Calendar Year 2013 must be installed by a renewable energy professional with entry-level NABCEP certification.

http://www.tva.com/renewablestandardoffer/ssi_faq.htm

Source: DSIRE
Sales Tax Incentive

**Type:** Solar PV

**Eligibility:** 50 kW minimum, with minimum capital investment of $1M, and capped at 50% of project cost.

**Value:** Up to 100% of sales and use tax.
Ownership Options

- Direct Ownership
- Third-Party Ownership
- Community Ownership
Direct Ownership

**Benefits**
- Low – cost electricity
- REC revenue
- Utilize cheap debt
  - Bonds
  - Low interest loans

**Drawbacks**
- Large upfront cost
- Long term management
- Can’t take tax benefits
- Development risk
- Performance risk
A Variation on Direct Ownership:
Energy Service Performance Contracting

- **How it works**
  - Energy services company (ESCO) sells an interested customer a package of energy efficiency measures (lighting, HVAC, etc.).
  - Package can include measures with both rapid and slower payback periods.
  - The ESCO guarantees a certain level of electric bill savings for the customer backed up by the efficiency measures.

- **What Role Can Solar Play in a Performance Contract?**
  - Solar PV can act as an energy efficiency measure.
  - PV, as a longer-payback energy efficiency measure, can be offered as part of a package of longer- and shorter-payback ESCO-offered incentives that saves larger customers money.

- **Could also be offered as a bundled 3rd party PPA**
A Variation on Direct Ownership: Energy Service Performance Contracting

**Benefits**

- Low – cost electricity
- REC revenue
- Utilize cheap debt
  - Bonds
  - Low interest loans

**Drawbacks**

- Large upfront cost
- Long term management
- Can’t take tax benefits
- Development risk
- Performance risk
Third Party Ownership

Benefits

- No upfront cost
- No O&M costs
- Low risk
- Predictable payments
- Tax benefits

Drawbacks

- Don’t keep RECs
- Higher ROI for investor
- Can’t use bonds
- Not available in all states
Note: This map is intended to serve as an unofficial guide; it does not constitute legal advice. Seek qualified legal expertise before making binding financial decisions related to a 3rd-party PPA. See following slides for additional important information and authority references.
Benefits of PPAs

Percentage of New Residential Installations Owned by Third Party in CA, AZ, CO, and MA

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Activity: Next Steps

What do you pledge to do when you leave today’s workshop? [Orange Card]
Next Steps

What do you do next?
Sign up for a 20 minute consultation to learn more about how we can help you.

Speak with one of our trainers after the workshop, or email solar-usa@iclei.org
Appendix
Bond-PPA Hybrid

Morris County, New Jersey
Population: 492,276
Bond-PPA Hybrid

Government Bond Holders

15 year term 4% interest Bond

Capital Lease Agreement

Developer

IRS sees as project owner

Bond Holders

$ $
Bond-PPA Hybrid

Capital Lease Agreement

Government

Developer

Bond Holders

Bond
Bond-PPA Hybrid

Government

Bond Holders

Developer

Power Purchase Agreement

Incentives

IRS sees as project owner
Bond-PPA Hybrid

**Pros**
- No upfront cost
- No O&M costs
- Low risk
- Predictable payments
- Tax benefits
- Utilize low cost bonds

**Cons**
- Don’t keep RECs
Replication of “Morris Model”

- Legality of PPA Model
- Laws Governing Public Contracts
- Laws Governing Bonding
- Laws Governing Procurement

Solarize

Group Purchasing
Solarize: Mitigate Soft Costs

- Other Paperwork: $0.69 per Watt
- Permitting
- Installation Labor
- Customer Acquisition

Source: NREL (http://www.nrel.gov/docs/fy12osti/54689.pdf)
<table>
<thead>
<tr>
<th>Barriers</th>
<th>Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>High upfront cost</td>
<td>Group purchase</td>
</tr>
<tr>
<td>Complexity</td>
<td>Community outreach</td>
</tr>
<tr>
<td>Customer inertia</td>
<td>Limited-time offer</td>
</tr>
</tbody>
</table>

**Solarize: Advantages**
Solarize: Advantages

Customer Acquisition

10x the cost for customer acquisition

Source: NREL, LBNL
Solarize: Advantages

Benefits to Local Government:

Low implementation cost: $5,000 - $10,000

Quick turn-around: 9 Months

Long-term impact: Sustainable ecosystem
Solarize: Process

- Select Installer
- Marketing & Workshops
- Enrollment
- Site Assessment
- Decision & Installation
Solarize: Case Study

Harvard, Massachusetts
Population: 6,520

Solarize: Case Study

Solarize Mass Harvard

Select Installer
- April 2011

Marketing & Workshops

Enrollment

Site Assessment

Decision & Installation
- Dec 2011

April 2011
Group Purchasing

Harvard Mass Group Purchasing Tiers

Average PV Cost July 2011: $5.75 / watt
Solarize: Case Study

Solarize Mass Harvard

Select Installer

Marketing & Workshops
*May – July 2011*

Enrollment

Site Assessment

Decision & Installation

April 2011

Dec 2011
Solarize: Case Study

Marketing Strategy:

- Electronic survey of 1,100 households
- Email newsletters and direct mailings
- Float in July 4 parade
- Articles and advertisements in local newspaper
- Facebook page and online discussion board

Source: Vote Solar
Solarize: Case Study

Solarize Mass Harvard

- Select Installer
- Marketing & Workshops
- Enrollment: June – Oct 2011
- Site Assessment
- Decision & Installation

April 2011 → Dec 2011

429 households signed up

429 households signed up

Powered by SunShot
U.S. Department of Energy
Solarize: Case Study

151 feasible households

Select Installer: April 2011
Marketing & Workshops
Enrollment
Site Assessment: Oct 2011
Decision & Installation: Dec 2011

Solarize Mass Harvard
Solarize: Case Study

Solarize Mass Harvard

Select Installer
Marketing & Workshops
Enrollment
Site Assessment

Decision & Installation
Oct – Dec 2011

75 Contracts

April 2011 to Dec 2011

75 Contracts
Group Purchasing

Harvard Mass Group Purchasing Tiers

- 1 kW - 100 kW
- 100 kW - 200 kW
- 200 kW - 300 kW
- 300 kW +

403 kW capacity contracted
Solarize: Case Study

75 new installations totaling 403 kW

30% reduction in installation costs

575% increase in residential installations
Solarize: Lasting Impact

Annual Portland Residential PV Installations

Source: NREL
Solarize: Resources

Resource  The Solarize Guidebook

A roadmap for project planners and solar advocates who want to create their own successful Solarize campaigns.

www.nrel.gov
Benefits and Barriers of Solar Adoption

A presentation for:
Solar Powering Your Community Workshop
Owensboro, Kentucky

By: Jason Delambre, CEM

March 27, 2014
The Swanson effect
Price of crystalline silicon photovoltaic cells, $/watt

Source: Bloomberg, New Energy Finance
Figure 1 - Evolution of global PV cumulative installed capacity 2000-2012 (MW)

ROW: Rest of the World. MEA: Middle East and Africa. APAC: Asia Pacific.
Figure 19 - Global PV cumulative installed capacity share in 2012 (MW; %)

- Germany (32,411; 31%)
- Italy (16,361; 16%)
- China (8,300; 8%)
- USA (7,777; 7%)
- Japan (6,914; 7%)
- Spain (5,166; 5%)
- France (4,003; 4%)
- Belgium (2,650; 2%)
- Australia (2,412; 2%)
- Czech Republic (2,072; 2%)
- United Kingdom (1,829; 2%)
- Greece (1,536; 1%)
- India (1,205; 1%)
- Rest of the World (12,554; 12%)
SMART GRID
A vision for the future — a network of integrated microgrids that can monitor and heal itself.

- **Smart appliances**: Can shut off in response to frequency fluctuations.
- **Demand management**: Use can be shifted to off-peak times to save money.
- **Solar panels**: Executed special protection schemes in microseconds.
- **Processors**: Detect fluctuations and disturbances, and can signal for areas to be isolated.
- **Storage**: Energy generated at off-peak times could be stored in batteries for later use.
- **Generators**: Energy from small generators and solar panels can reduce overall demand on the grid.

- **Offices**: Isolated microgrid
- **Wind farm**: Central power plant
- **Houses**: Industrial plant
The now-cold fluid is pushed up into the building.

Heat is directed into the ground.

The moderate temperature of the ground lowers the temperature.

Cold is directed into the ground.

The now-hot fluid is pushed up into the building.

The moderate temperature of the ground raises the temperature.

Energy Star
Solar Financing

A presentation for:
Solar Powering Your Community Workshop
Owensboro, Kentucky
By: Jason Delambre, CEM &
Robert Clark

March 27, 2014
SMART GRID
A vision for the future — a network of integrated microgrids that can monitor and heal itself.

- Smart appliances
  - Can shut off in response to frequency fluctuations.

- Demand management
  - Use can be shifted to off-peak times to save money.

- Solar panels
- Houses
- Offices

- Processors
  - Execute special protection schemes in microseconds.

- Sensors
  - Detect fluctuations and disturbances, and can signal for areas to be isolated.

- Storage
  - Energy generated at off-peak times could be stored in batteries for later use.

- Generators
  - Energy from small generators and solar panels can reduce overall demand on the grid.

- Disturbance in the grid
  - Isolated microgrid
  - Central power plant
Committed to the future of rural communities.
Fort Knox Energy Program
One of the Nation’s Best

Mr. R.J. Dyrdek, Energy Manager, DPW
Our Second Largest bill on Post behind the labor bill!!

Summary Account Number: 3000-0000-1580

Payment Due Date: 08/24/11
Amount Due By Due Date: $1,421,040.00
Previous Balance: $0.00
Amount Due 3 Days After Due Date: $1,435,270.53

Contact Phone #: (502) 624-8358

PLEASE RETURN THIS PORTION WITH YOUR PAYMENT

Check here if plans(s) requested on back of stub

#7223000584#
US GOVT. - FORT KNOX
FORT KNOX - MEREDITH
ATTN: GARY MEREDITH
BLDG 1110 12S SIXTH AVE / ENERGY
FORT KNOX KY 40121-5719

01030000000158000001435270530014210400000000000000045
http://www.youtube.com/watch?v=e4FaGDpX3xA&vq=medium
FOX 41 Fort Knox Energy Video
2.1 MegaWatt Solar Array

- Nolin RECC, our Electrical Privatization Contractor, is constructing a 2.1 MW Solar Array on post.
- Nolin is financing the project over 25 years. Fort Knox will pay for KWH produced at a rate comparable to our blended electric rate.
- This green renewable power will supplant electricity generated by LG&E coal-fired power plants. The rate we pay for this solar power is extremely cheap for green power.
- This will support EPACT 2005 mandate of >7.5% renewable energy by 2013
- The Solar Array will be located in a 10 acre field west of Bldg #6034.
- Fort Knox has an additional 1.56 MW of solar power installed at various locations on post.
### Performance of the 2,100 kW solar field.

<table>
<thead>
<tr>
<th></th>
<th>Budgeted Output</th>
<th>Actual Energy Output</th>
<th>Estimated Demand Reduction Savings</th>
<th>Unit Cost</th>
<th>LG&amp;E Bill Savings</th>
<th>Net Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Energy (kWh)</td>
<td>Energy (kWh)</td>
<td>Demand (kW)</td>
<td></td>
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<tr>
<td>Jun-13</td>
<td>N/A</td>
<td>23,800</td>
<td>1,284</td>
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<tr>
<td>Jul-13</td>
<td>Partial Month</td>
<td>373,120</td>
<td>1,284</td>
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<tr>
<td>Aug-13</td>
<td>250,919</td>
<td>16,844.45</td>
<td>$18,842.38</td>
<td>$1,356.60</td>
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<td>Sep-13</td>
<td>231,636</td>
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<td>Oct-13</td>
<td>231,104</td>
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<td>$18,842.38</td>
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<td>Nov-13</td>
<td>157,873</td>
<td>16,844.45</td>
<td>$18,842.38</td>
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<tr>
<td>Dec-13</td>
<td>150,291</td>
<td>16,844.45</td>
<td>$18,842.38</td>
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<td>Jan-14</td>
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<td>$18,842.38</td>
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<td>Feb-14</td>
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<td>Mar-14</td>
<td>240,076</td>
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<td>Apr-14</td>
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<td>$18,842.38</td>
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<td>May-14</td>
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<td>16,844.45</td>
<td>$18,842.38</td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes:** Unit cost is the current yearly average cost of energy per kWh. This is presently 5.7¢/kWh.
## Fort Knox Energy Cost Trends and Statistics

- More than 6M SF use Geothermal HVAC
- 1.57 MW of Solar on roofs
- 2.1 MW ground mntd solar
- All buildings over 7.5K Sq Ft. metered and controlled
- Energy Security Project underway to sustain Post energy requirements without outside utilities

<table>
<thead>
<tr>
<th>Fiscal Year</th>
<th>KSF</th>
<th>Total Utility Costs</th>
<th>Total Energy (MMBtu)</th>
<th>Total HDD</th>
<th>Total CDD</th>
<th>$/MMBtu</th>
<th>MMBtu/KSF (AEWRS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FY2012</td>
<td>17,941</td>
<td>$13,913,551.00</td>
<td>1,079,927</td>
<td>3,408</td>
<td>1,854</td>
<td>$12.88</td>
<td>58</td>
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<tr>
<td>FY2011</td>
<td>17,590</td>
<td>$15,613,089.00</td>
<td>1,345,229</td>
<td>4,187</td>
<td>1,725</td>
<td>$11.61</td>
<td>72</td>
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<tr>
<td>FY2010</td>
<td>17,988</td>
<td>$15,833,449.00</td>
<td>1,512,596</td>
<td>4,409</td>
<td>2,026</td>
<td>$10.47</td>
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<td>FY2009</td>
<td>16,329</td>
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<td>1,294</td>
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<td>$16,208,852.00</td>
<td>1,464,183</td>
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<td>1,265</td>
<td>$11.07</td>
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<td>4,406</td>
<td>1,496</td>
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Maude Complex Geothermal Pond
FORT KNOX ENERGY BRIEF

NO #1 in CONUS as reported by IMCOM – EOY 2013

Energy per Unit Area Comparison

<table>
<thead>
<tr>
<th>Installation</th>
<th>FY03 (MBTU/KSF)</th>
<th>FY13 (MBTU/KSF)</th>
<th>% Change</th>
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<tr>
<td>USAG SCHINNEN</td>
<td>85.48</td>
<td>26.69</td>
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<td>USAG HEIDELBERG</td>
<td>62.77</td>
<td>30.33</td>
<td>-51.68</td>
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<tr>
<td>FORT KNOX</td>
<td>116.73</td>
<td>57.15</td>
<td>-51.04</td>
</tr>
<tr>
<td>PICATINNY ARSENAL</td>
<td>269.47</td>
<td>153.64</td>
<td>-42.98</td>
</tr>
<tr>
<td>USAG LIVORNO</td>
<td>71.99</td>
<td>41.73</td>
<td>-42.04</td>
</tr>
</tbody>
</table>

• We had 50 buildings score in the top 75 percentile in 2013
• In 2013 our 2012- 49 Energy Star buildings put just short of the top 25 cities
• Building 6434-1/2/3/5 all got 2013 awards and 6434- 6 got a 2014 Award
Program Results

• Improved comfort measured by decreased comfort complaints (90% red.)
• Decreased energy consumption (51% from 2003 baseline)
• Annually saves Fort Knox over $10 million due to energy initiatives
• Funding invested in energy conservation far exceeds funding spent on utility bills.
• Decreased pollutants: Geothermal systems have greatly reduced # of boilers. Over 63 gas & fuel oil boilers & hw heaters rated 1-10 MMBTU eliminated since 2006.
• Reduced maintenance expenditures & extended useful life of HVAC systems. Over 20 MY reduction in Boiler operation and maintenance personnel.
• Currently 52 buildings on Fort Knox are certified “Energy Star”. Anticipate another 110 will be rated Energy Star when the application process is completed.
• Decreased Water Consumption by 8% over the past year.
• Fort Knox has been recognized as a leader within the Army and local community for their energy conservation practices.
“Sustain, Support and Defend”

Mr. R.J. Dyrdek, Energy Manager, DPW
When ‘Zero’ Means Everything!

Affordable & Obtainable
Net Zero Energy Design Strategies

Kenny Stanfield, AIA, LEED® AP
An automobile’s energy performance is measured in miles per gallon (MPG) – the HIGHER the BETTER, or more EFFICIENT.
A building’s energy performance is measured in 1,000 British Thermal Units (kBtu) - the LOWER the BETTER, or more EFFICIENT.
Energy Costs

In Kentucky, the average cost of 1 kBtu of energy = $2,500.00
The average school consumes 73 kBtus of energy per SF/YR.
The average annual cost of energy for a typical 72,000SF elementary school in Kentucky is $182,500.00.
How “Green” is Green?

Climate Zone 4
73 kBtus annually

Energy Star - 25% improvement
54 kBtus annually

LEED® Certified Buildings
51 kBtus annually
How “Green” is Green?

AEDG 50% Reduction (From ASHRAE 90.1)

36.5 kBtus annually

NET ZERO READY

25 kBtus annually

NET ZERO

18.2

Richardsville Elementary
What Is A Net Zero Building?

A **Net Zero Energy Building** Has A Net Site Energy Consumption Of Zero Over A Typical Year Of Operation - (25 kBtu Max)
Richardsville Elementary
The Nation’s First Net Zero Public School

72,285 SF
500 Students

$168.00 SF w/out Solar
$206.50 SF w/ Solar

$18.2 kBtu/SF/YR
In 2012, **NO Energy Costs**

+ TVA paid WCPS $37,277.31
the solutions
Site Design & Building Orientation

- north/south building orientation provides active daylighting in academic spaces
- filter storm water run-off
- native, drought-resistant landscaping reduces irrigation
- permeable paving reduces storm water run-off
- reduce or eliminate detention basins
- outdoor educational opportunities for students and faculty
Energy Efficient Systems

- compact building volume reduces area of exposed exterior surfaces
- super-insulated exterior wall and roof systems
- eliminate external air infiltration
- reduce or eliminate large, uninsulated mechanical platforms
- occupancy sensors
- energy efficient HVAC systems
- dual compressor heat pumps and distributive pumping system reduces energy demand
- reduce make-up air in unoccupied or partially occupied spaces
- distributive utility metering
2011 AS&U’s Special Citation – This is an exceptional demonstration of a net-zero school—they have delivered on this commitment. It simply puts to rest the statement ‘It can’t be done.’”

—2011 jury
High Performance Thermal Envelope

- Compact Building Volume Reduces Areas Of Exposed Exterior Surfaces
- Super Insulated Exterior Wall & Roof Systems
- Reduce External Air Infiltration
- Reduce Or Eliminate Large Mechanical Platforms
Richardsville: Energy Usage

- HVAC: 44%
- Lighting: 21%
- Plugs: 11%
- Kitchen: 18%
- IT: 6%

18.2 kBtu/sf yr
Geothermal HVAC System

- Dual Compressor Or Two-Speed Heat Pump Units
- Part Load Efficiency
- Distributive Pumping
- One Heat Pump Per Two Classrooms
Outside Air Ventilation

- Dedicated Outside Air Systems (DOAS)
- Heat Recovery Wheel
- Demand Control Ventilation Based On CO₂ And Occupancy
- Occupant Diversity
Daylight Harvesting

- reflect natural light into classrooms
- reduce glare at work surfaces
- automated dimming reduces artificial lighting requirements
- interior solar tubes supplement daylighting
- sloped ceilings project natural light into the classroom
- aerogel insulated glazing and low-e coating reduces solar heat gain
Lighting – Unoccupied

- Dark Sky Approach
- Local Police Collaboration
- Façade Lighting Controls
- Eliminate Building Night Lighting
Healthy Kitchen Design

- Test Kitchen Evaluation & Recommendations
- **ENERGY STAR** Appliances
- Eliminate Type I Hood – Type II Hoods
- Healthy Foods & Locally Grown
Energy Free Lunches

By Jennifer Worlie

Sam Dorris, who will be a second-grader at Nichols Elementary in Warren County, spent a happy lunch break on Monday, and he didn’t even eat school lunch, spilling out his name, a bag of food. Cans of soup—canned while cooking through the end of his life. He said his classmates were eating the novelty of not eating a lunch in the cafeteria instead of the usual hot pack lunch on a tray. The fact that this lunch was saving energy.

"The other day," he said, "we had a first-grader at Warren County and he brought a bag of energy-savings lunch."

Elementary schools in Warren County have four "Energy-Saving Lunch Days" per week, which include the campuses during the spring and fall seasons, and numerous other lunches are available in the cafeteria. "We had 20 percent of the energy in our schools was being consumed by the kitchens," said Food Service Manager Gemma Gravely, who said the district had to be creative in its approach. "They understand that all of the food should be fried. But if it's presented in a different way, you may try something you've never thought you didn't like," she said. "It's a healthy, balanced lunch."

Second-grader Dakota Murray said he not only eats more vegetables, but he also has fun at lunch. "I like the energy savings," he said. "I like the vegetables and the fruits and the green stuff."

"It's easier to eat this way and you don't have to do the work," said student Nick Williams, Warren County's energy manager. "The energy savings from these few days are not determined, but effects like this are very important."

"I think they're doing this to make the cafeteria look better. But it's hard to measure these savings."

"I think it's important for our food service to serve such meals for the overall educational benefits," he said. "It also displays the support for the overall educational benefits."

Student manager Dakota Williams said he felt the same way about the energy-savings lunch program. "I think it's important for our food service to serve such meals for the overall educational benefits," he said. "I also display the support for the overall educational benefits."

"It's easy to eat this way and you don't have to do the work," said student Nick Williams, Warren County's energy manager. "The energy savings from these few days are not determined, but effects like this are very important."

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Computers

- TVA Test Case
- 7.5% Of Energy In “Tested” School Was Consumed By Computers
- Wireless Technology Throughout
- Laptop Carts In Lieu Of Computer Labs
- Equipment Off At Night
- Reduces Power Consumption By 50%
Richardsville PV System Phase I

• 60% Of Required Generation
• Operational February 2011
• 208 kW Thin Film
• 245 MWh/yr Electric Production
Richardsville PV System Phase II

- 100% Required Generation
- Operational September 2011
- 138 kW On Shade Structure
- Delayed For Old School Demolition
- 163 MWh/YR Electric Production
Solar Electric Generation Cost

- **Solar Package & Shade Structure**
  - $2,766,664 - $7.93/kW
  - January 2010

- **Awarded $1,380,000 Grant**
  - Stimulus Funds

- **TVA Pays $0.12/kWh**
  - Greater Than the Selling Price
# Net Zero Energy MWh Summary

<table>
<thead>
<tr>
<th>Read Date 2012</th>
<th>MWh Consumed</th>
<th>MWh Generated</th>
<th>MWh Difference</th>
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<tbody>
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<td>December</td>
<td>30.2</td>
<td>20.1</td>
<td>10.1</td>
</tr>
<tr>
<td>November</td>
<td>37.1</td>
<td>29.7</td>
<td>7.4</td>
</tr>
<tr>
<td>October</td>
<td>33.2</td>
<td>24.6</td>
<td>-1.4</td>
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<tr>
<td>September</td>
<td></td>
<td>21.1</td>
<td>0.5</td>
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<tr>
<td>August</td>
<td></td>
<td></td>
<td>-17.3</td>
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<td>July</td>
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<td></td>
<td>-29.4</td>
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<td>June</td>
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<td>April</td>
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<td>-5.5</td>
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<td>March</td>
<td>30.6</td>
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<tr>
<td>February</td>
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<td>19.5</td>
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<tr>
<td>January</td>
<td>26</td>
<td>14.9</td>
<td>11.1</td>
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<td><strong>Total</strong></td>
<td><strong>396</strong></td>
<td><strong>443.8</strong></td>
<td><strong>-47.8</strong></td>
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## Net Zero Energy Cost Summary

<table>
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<tr>
<th>Read Date</th>
<th>Consumption Cost</th>
<th>Generation Cost</th>
<th>Monthly Cost</th>
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<td>December</td>
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<tr>
<td>November</td>
<td>$4,856</td>
<td>($6,477)</td>
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<td>October</td>
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<td>($7,529)</td>
<td>($2,574)</td>
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<tr>
<td>September</td>
<td>$4,955</td>
<td>($7,836)</td>
<td>($3,653)</td>
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<tr>
<td>August</td>
<td>$3,767</td>
<td>($12,120)</td>
<td>($8,353)</td>
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<td>July</td>
<td>$4,548</td>
<td>($12,719)</td>
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<td>June</td>
<td>$5,012</td>
<td>($9,705)</td>
<td>($4,693)</td>
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<tr>
<td>May</td>
<td>$4,200</td>
<td>($7,556)</td>
<td>($3,356)</td>
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<td>April</td>
<td>$4,242</td>
<td>($6,805)</td>
<td>($2,563)</td>
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<td>March</td>
<td>$4,857</td>
<td>($4,166)</td>
<td>$691</td>
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<tr>
<td>February</td>
<td>$4,010</td>
<td>($3,235)</td>
<td>$775</td>
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<td><strong>Total</strong></td>
<td><strong>$56,350</strong></td>
<td><strong>($96,514)</strong></td>
<td><strong>($40,164)</strong></td>
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Zero energy costs & earned $40,164 in 2012!
Three Dimensional Teaching Tool

Every hallway has an energy related theme. The Geothermal Hall demonstrates how water heats and cools the school.

Green Screens demonstrate the school’s daily energy use.
Growing Minds... Energy Teams

- The Energy Initiative Is Spreading District Wide
- Each School Has An Energy Team With An Energy Kit To Monitor Consumption & To Perform Energy Audits For Efficiency
- Teams Focus On Energy Awareness, Student Achievement (Math And Science) And Building Energy Leaders
Utility Bills Don’t Lie…

WARREN RURAL ELECTRIC COOPERATIVE CORPORATION

ACCOUNT NUMBER: 307917042

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<thead>
<tr>
<th>SERVICE</th>
<th>METER LOCATION</th>
<th>CHARGES</th>
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<td>TVA FUEL COST</td>
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<td>DISTRIBUTION CHARGE</td>
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<td>POWER GENERATION CREDIT</td>
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<td>SCHOOL TAX</td>
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<td>CURRENT CHARGES FOR SERVICE</td>
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<tr>
<td>PREVIOUS BALANCE</td>
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Current Bill Due Date Does Not Apply to The Previous Balance

Customer Name: WARREN RURAL ELECTRIC COOPERATIVE CORPORATION

Billing Date: 08/16/12
Payment Due Date: 08/16/12
Current Due Date: 08/16/12

Failure to receive bill does not relieve customer's payment obligations.
Any previous unpaid balance is subject to disconnection without further notice.

Forbes - New Posts - Most Popular - Lists

Net Zero Schools in Kentucky: Models for the Future Come from Surprising Places

This week, I asked a close friend to guess which state boasted the nation's first net zero public elementary school. "California?" he ventured. "Vermont?" "Massachusetts?" he said. No, no, and no. How about Kentucky, the nation's third largest coal producer, with 85 bns in annual coal revenues and the nation's fourth largest electricity costs (at just over 7 cents per kilowatt-hour)?
Thank you

Kenny Stanfield, AIA, LEED® AP

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