



Renewable Energy In the Community



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Change the way buildings use energy and water

40% of all energy used

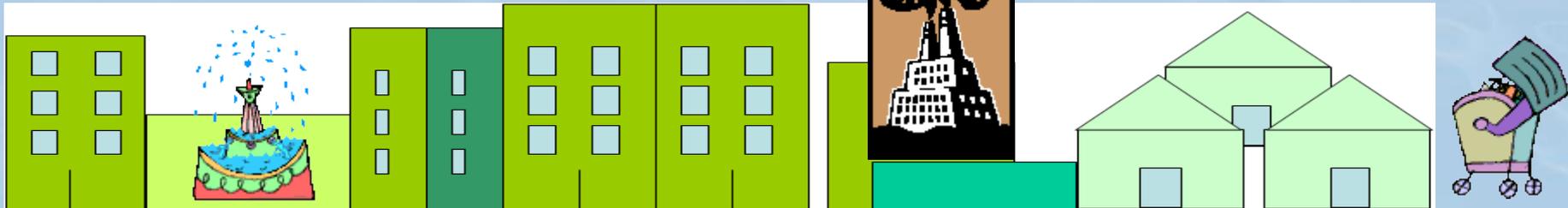


12% of freshwater

88% potable water

48% of Atmospheric emissions

40% of municipal solid waste



40% of all wood, steel and other raw materials

US uses 5 billion gallons of water to flush toilets - daily

- 80% percent of Americans now live in cities. By 2050, 90% will.
- 75% of US built environment will be new or renovated in the next 30-years

- Refurbishing windows
- Reflective surface behind the radiators
- Energy management control
- New or improved mechanical systems
- Web-based tenant energy system
- 38% energy reduction
- \$4.4 million per year savings

IN 1931, IT BECAME THE WORLD'S TALLEST BUILDING.
NOW IT WILL BECOME ONE OF THE MOST ENERGY EFFICIENT.



38% more energy efficient. And in the top 10% of all U.S. office buildings in energy efficiency.

How? Johnson Controls, a global leader in energy and sustainability, working with a world class team of energy efficiency experts, has developed an innovative process and designed to retrofit the Empire State Building the smart & durable solutions in energy conservation, significantly lower carbon emissions, and technologies that are more comfortable and productive. The improvements will pay for themselves over time — no guesswork. And we can implement this approach for any well-ventilated office building in the world interested? Visit www.johnsoncontrols.com/esb

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Solar strengthens communities

For many years we have committed to help foster the growth, development, of solar technology in communities all over the world

Solar technology is not only beneficial for reducing the amount of greenhouse gases, but it also helps strengthen our communities in numerous ways.

#1 Creating Jobs

- Solar energy creates jobs in the community
 - construction, maintenance, engineering

#2 Educating Youth, Adults, and Professionals

- A number of solar energy education programs have been constructed to train educators and students at community and technical colleges.

#3 Decreases Dependence on Imported Energy

- Renewable Energy should be home grown

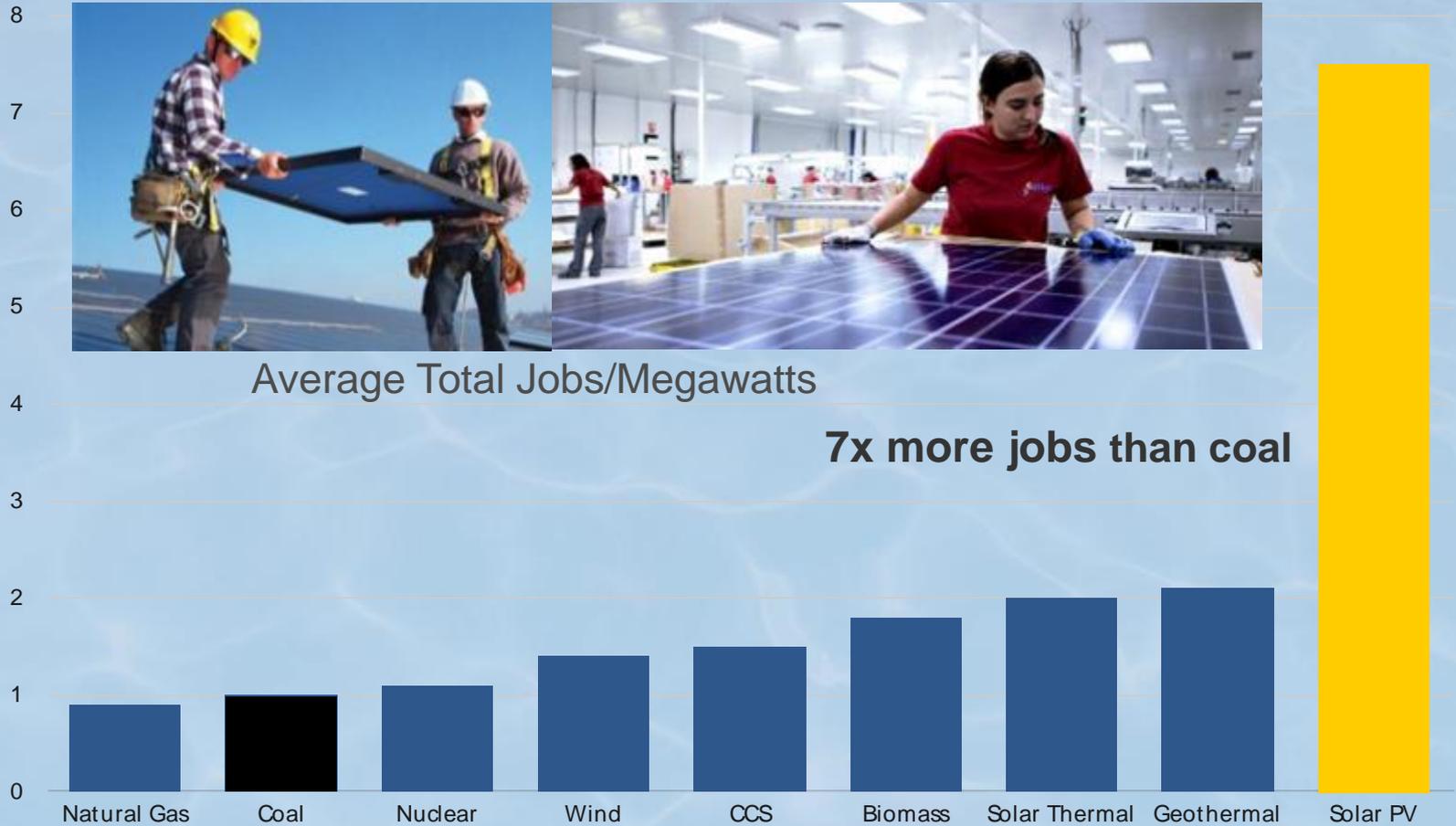
#4 Encourages a Paradigm Shift in Thinking

- By installing solar systems in schools, kids grow up thinking about water being heated and the lights illuminated as a result of the solar panels on their roof.

#5 Reduces Carbon Emissions and Water Use

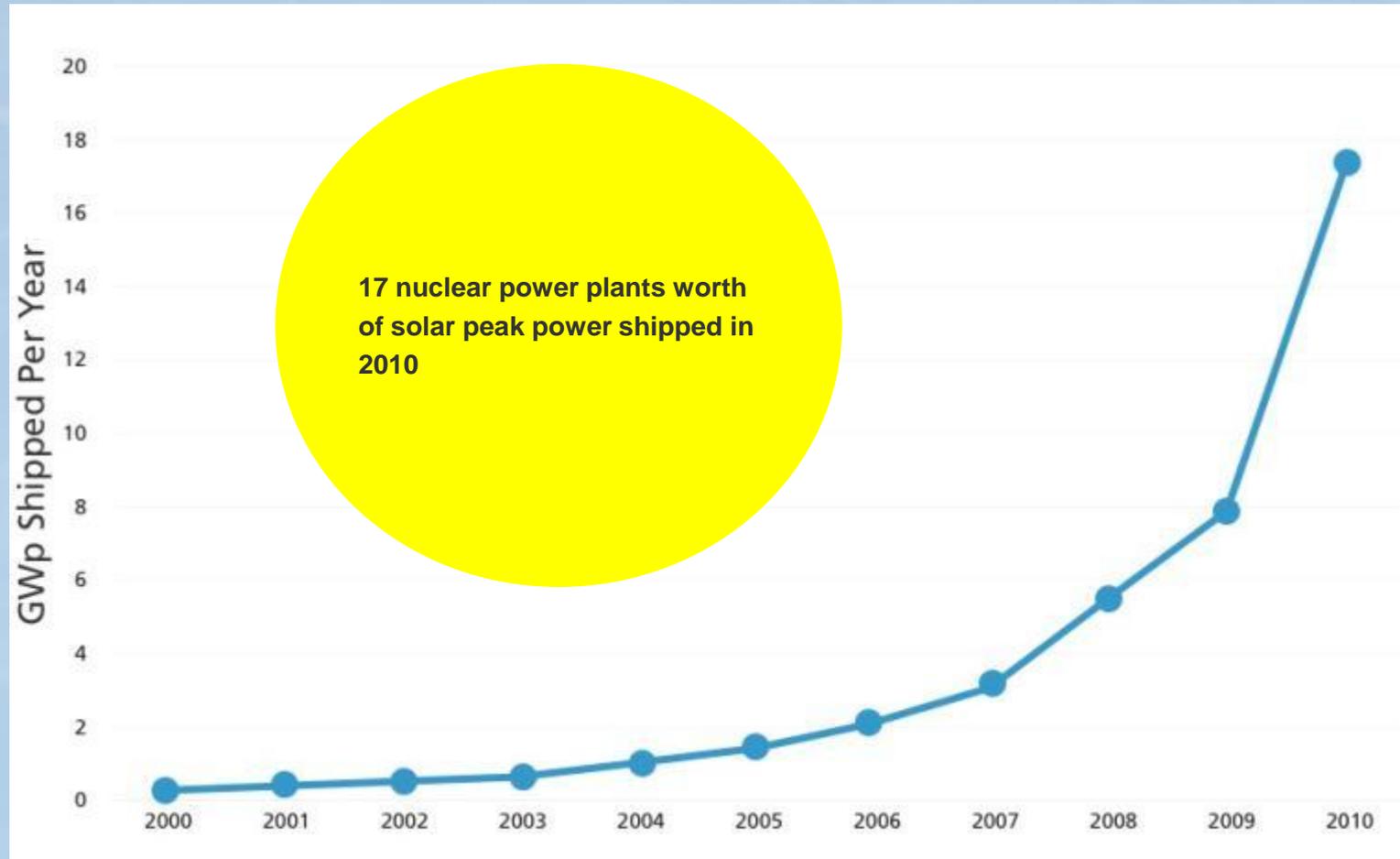
- About 40% of our water consumption is for cooling power plants as they generate electricity. 40% of electricity use is needed to produce, pump, and clean water.

Solar Creates Jobs



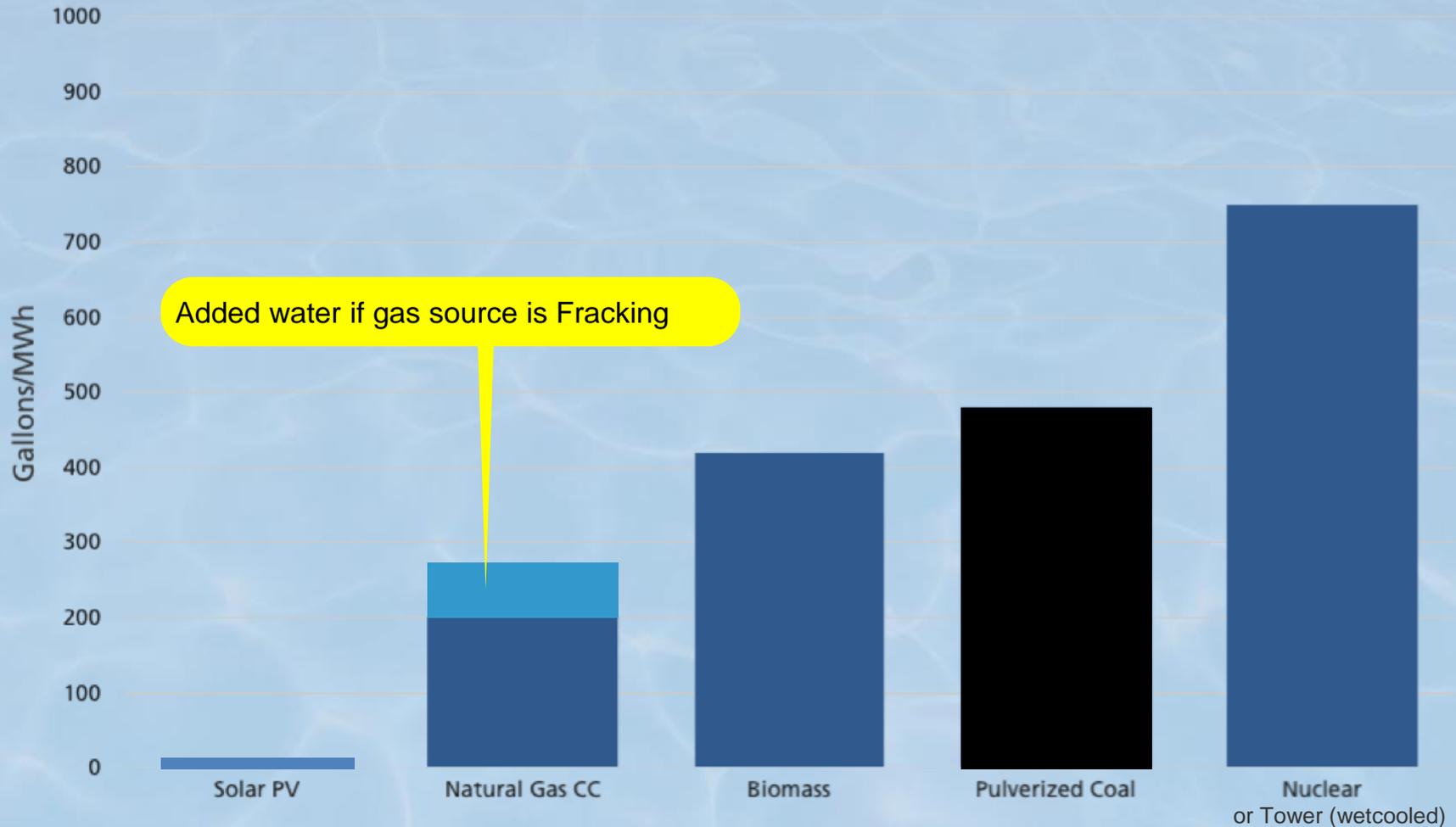
Sources: Kammen, David M et al, 2004, Report of the Renewable and Appropriate Energy Lab, Putting Renewables to Work: How Many Jobs Can the Clean Energy Industry Create?, Energy Resources Group, Goldman School of Public Policy, University of California, Berkeley. Wei, Max et al, 2010, Putting Renewables to Work: How Many Jobs Can the Clean Energy Industry Create?, Energy Resources Group, Goldman School of Public Policy and the Haas School of Business, University of California, Berkeley, in Energy Policy, vol 38, issue 2, February 2010.

Solar Growing Rapidly, Averaging 65% Compound Annual Growth Rate for the Past 5 Years



Source: PV Industry Growth Data from Paula Mints, Principal Analyst, Solar Services Program, Navigant

Solar PV Uses Far Less Water than Other Power Sources



Source: Adapted from DOE 2010, Table 8.3



5757 Green Bay Avenue



385 kW Solar PV Crystalline and Thin Film

Johnson Controls
Global Headquarters



4000-gallon storage tank
34- Solar Thermal collectors

August 19, 2006 www.aerialscapes.com

Solar Solutions: Two Options for Communities

- **Solar Thermal**
 - Heat Energy
 - Displaces:
 - Natural Gas
 - Electricity
 - LPG

- **Solar Photovoltaic**
 - Photo (light)- Voltaic (electric)
 - Solar Electricity
 - Displaces Utility Grid Delivered Power
 - Solar Lighting
 - Stand Alone Remote Generator

Solar Water Heating



Solar Thermal system supplies hot water to the cafeteria, fitness center and lavatories



Solar Storage and Heat Exchanger



Expansion Tank and Glycol Make-up



Solar Circulation Pumps



BTU Meter Quantifies the Energy Production



Solar Thermal Technologies

High Temperature

Electric Power Generation
Air-Conditioning
Industrial Process Heat



Mid Temperature

Hot Water
Air-Conditioning



Low Temperature

Pool & Spa

Hot Water Demand

Building Type	Administrative	Elementary School	Middle School	High School w/showers	Dormitory	Dining Hall	Fire Station
Demand	1 gal./ worker/day	0.6 gal./ student/day	1.0 gal./ student/day	1.8 gal./ student/day	8-10 gal./ student or senior per day	2.4 gal./meal served	20-30 gal./day/ firefighter
Building Type	Senior Center	Police Station	Corrections	Animal Care	Military Barracks	Laundry	Hospital
Demand	2 gal./person/ day w/o meals, 6 gal./person/ day w/ meals	8-10 gal./ person/day	14 gal./person/day	1 gal./animal/ Day	8-10 gal./troop/ day	45 gal./load	52 gal./ bed/day

SOLAR THERMAL is DESIGNED for 50-80% of the ACTUAL LOAD

Plug and Play with Pre-Engineered Designs



PROPAC®



MASS STORAGE SYSTEMS

Fire Station Crash #3

O'Hare International Airport



Engine Company 26 Chicago, IL



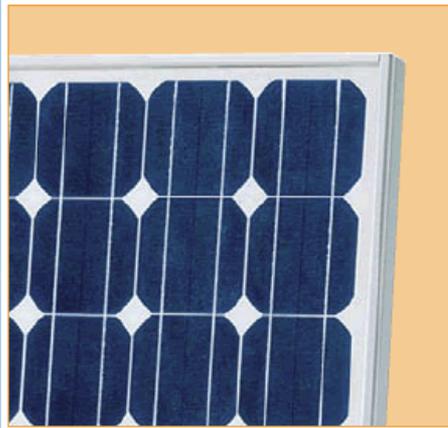


Rules of Thumb - Solar Thermal

- 1 ft² of collector area for every 1 to 2 gallons of hot water/day
- \$120-\$150/ft² of Collector / Panel Area – installed



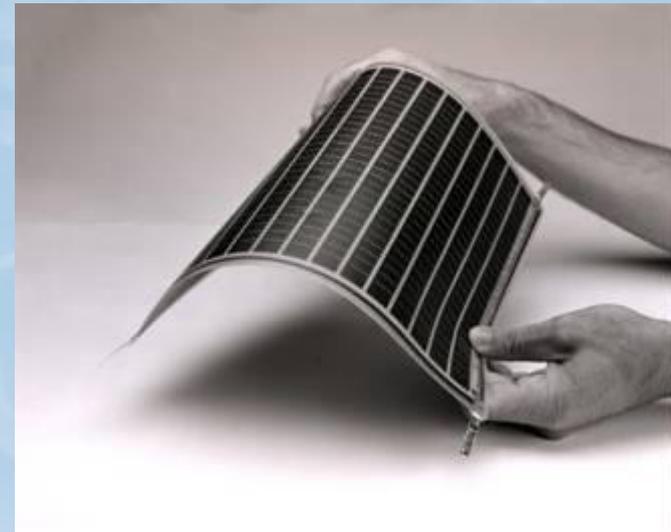
Different Types of PV Modules



Single crystal or
Monocrystalline



Polycrystalline or
Multicrystalline

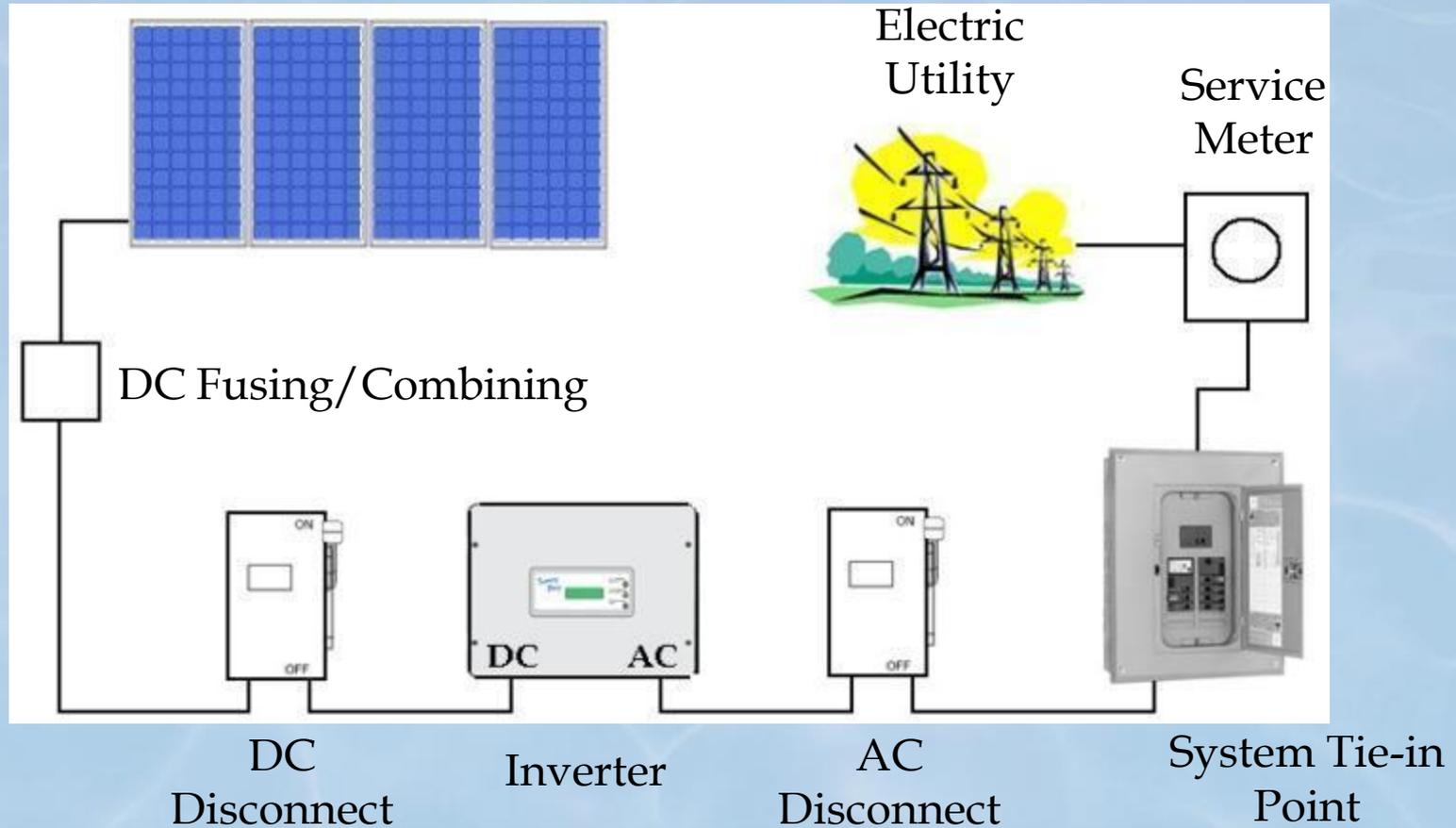


Thin Film,
Amorphous

U.S. DOE

Basic Grid-Connected PV System Components

PV Modules



Determines the actual performance at the customers site.

Indianapolis, IN
Each 5.25kW block =
6635 kWh/year

Atlanta, GA	7235 kWh/yr
Miami, FL	7220 kWh/yr
Louisville, KY	6635 kWh/yr
Milwaukee, WI	6616 kWh/yr
Lexington, KY	6460 kWh/yr



Station Identification	
City:	Indianapolis
State:	Indiana
Latitude:	39.73° N
Longitude:	86.28° W
Elevation:	246 m
PV System Specifications	
DC Rating:	5.2 kW
DC to AC Derate Factor:	0.790
AC Rating:	4.1 kW
Array Type:	Fixed Tilt
Array Tilt:	35.0°
Array Azimuth:	180.0°
Energy Specifications	
Cost of Electricity:	7.3 ¢/kWh

Results			
Month	Solar Radiation (kWh/m ² /day)	AC Energy (kWh)	Energy Value (\$)
1	3.09	413	30.15
2	4.06	489	35.70
3	4.44	560	40.88
4	5.22	619	45.19
5	5.88	700	51.10
6	6.03	667	48.69
7	6.09	691	50.44
8	5.78	667	48.69
9	5.21	593	43.29
10	4.63	567	41.39
11	3.00	367	26.79
12	2.31	303	22.12
Year	4.65	6635	484.36



Orlando Convention Center – 1.16 Mega Watt



Rules of Thumb Solar PV

Area

30° tilt ~ 250 ft² roof/kW

10° tilt ~ 175 ft² roof/kW

sloped roof ~100 ft² roof/kW

Weight

1 – 2 lb/ ft² Attached

4 - 7 lb/ ft² Ballasted

Performance 5 kW system

WI ~ 6,000kWh

TX ~ 6,750 kWh

AZ ~ 8,000kWh

Cost

\$5 to \$6 /watt installed





Tampa Housing Authority

Building Integrated PV (BIPV)
Replace the Roof & Get a Solar System
20-year Warranty
for
Roof and the Solar System



Johnson Controls, Inc Corporate Headquarters in Glendale, WI



Solar Integrated Roof System

Laminate modules going on

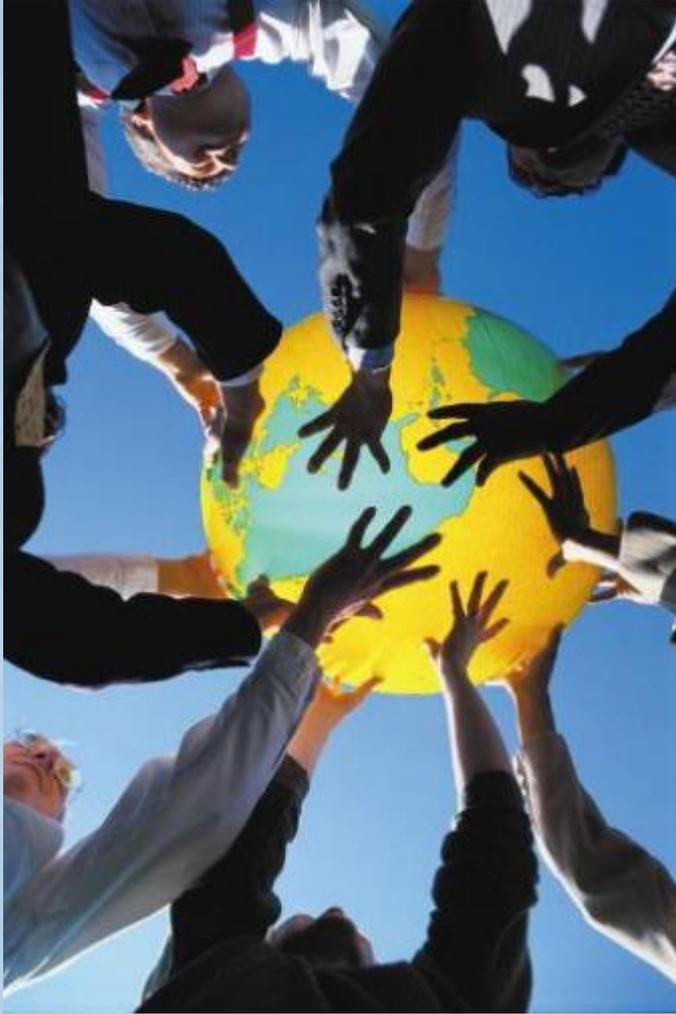
Database of State Incentives for Renewables & Efficiency

What Incentives are Available for your Project?

The screenshot shows the DSIRE website interface. At the top, there is a navigation bar with links for "NC Solar Center", "IREC", "Contacts", "About Us", and "NCSU". Below this is the DSIRE logo and the text "Database of State Incentives for Renewables & Efficiency". A description states: "DSIRE is a comprehensive source of information on state, local, utility, and federal incentives that promote renewable energy and energy efficiency. Choose one or both databases to search:". There are two checkboxes: "Renewable Energy" (checked) and "Energy Efficiency". Below this is a map of the United States with state incentives highlighted in purple. A legend indicates "Federal Incentives" and "US Territory Incentives". On the left side, there is a sidebar with links for "FAQs", "Summary Maps", "Summary Tables", "Search By", "Glossary", "Links", "Library", and "New / Updated Incentives". At the bottom left, it says "Last Updated: 01/03/08". At the bottom right, there is a footer with "© 2007 NC State University NC Solar Center" and a navigation bar with links for "FAQs", "Summary Maps", "Summary Tables", "Search By", "Glossary", and "Links".



City of Tulare, CA



Thank you