

# What's New Under the Sun?

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Growing Pains for an Industry !!

# ***AGENDA***

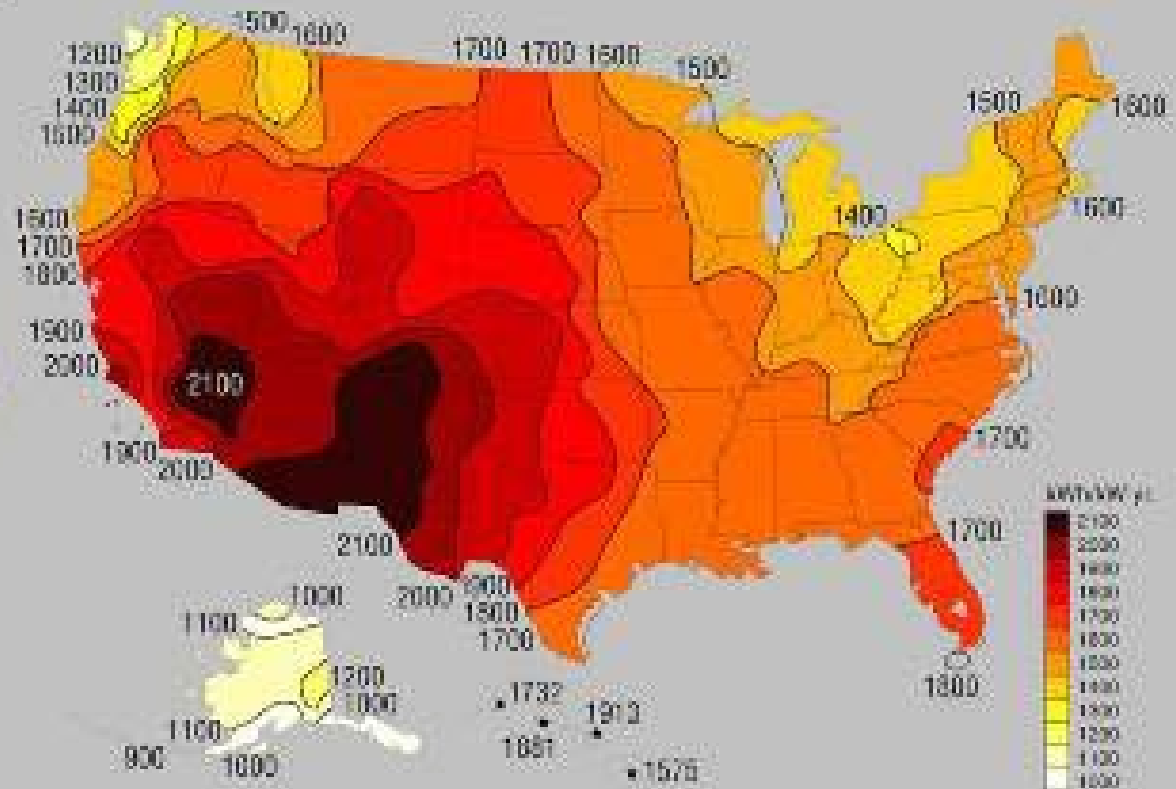
Using the solar resource

Deployment of technology

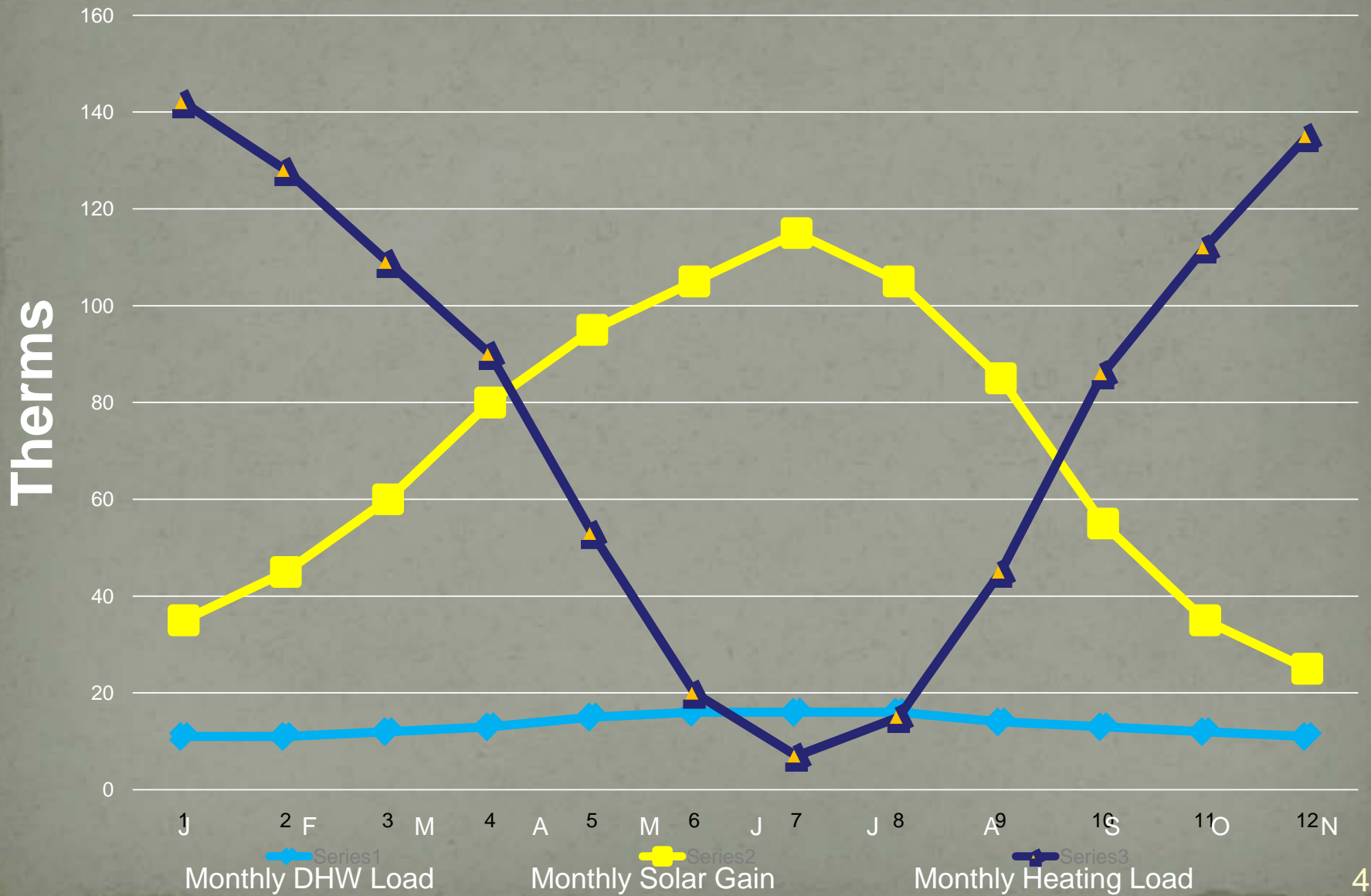
Growing the market

Areas of conflict

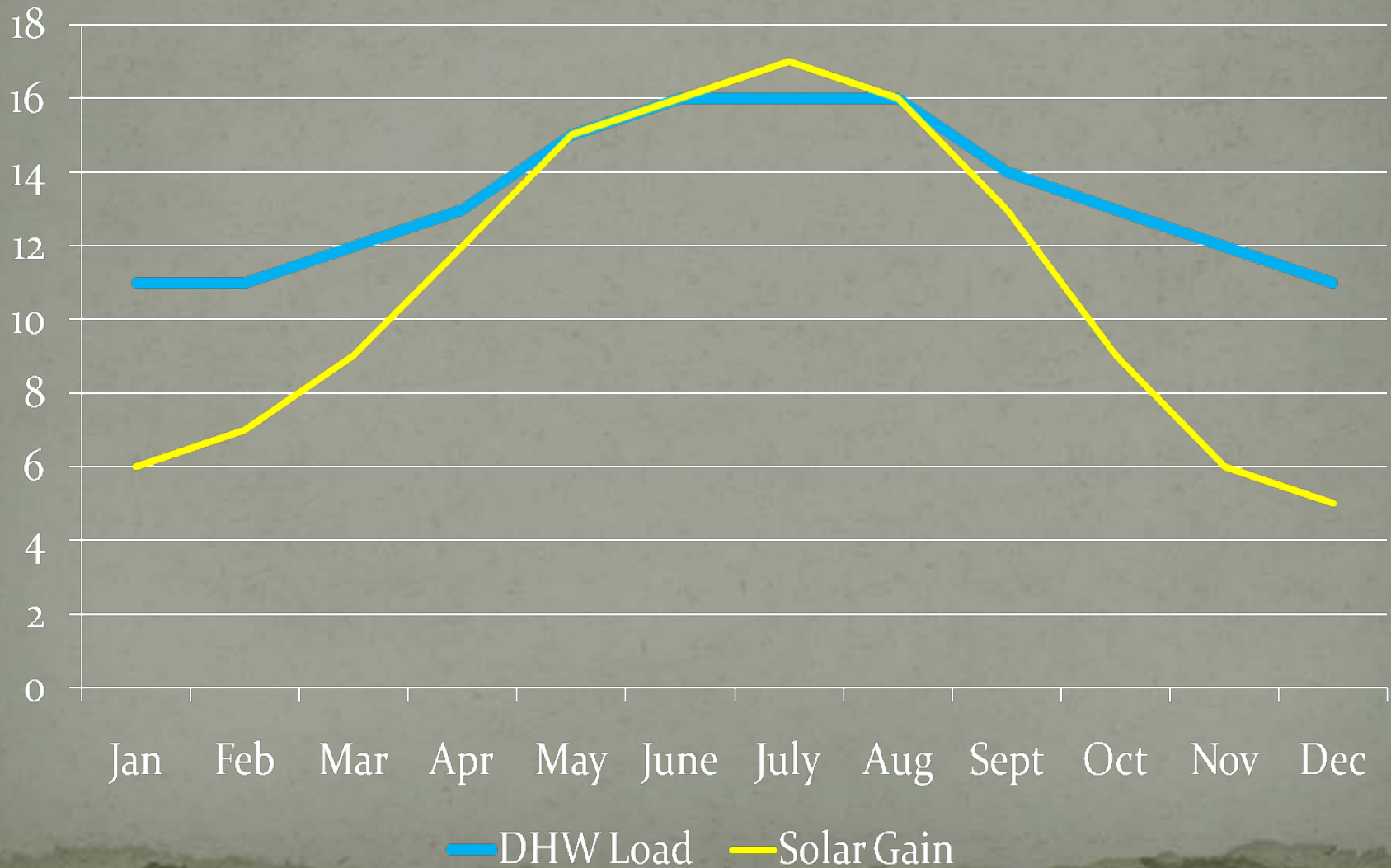
# Solar Resource: Germany vs. US



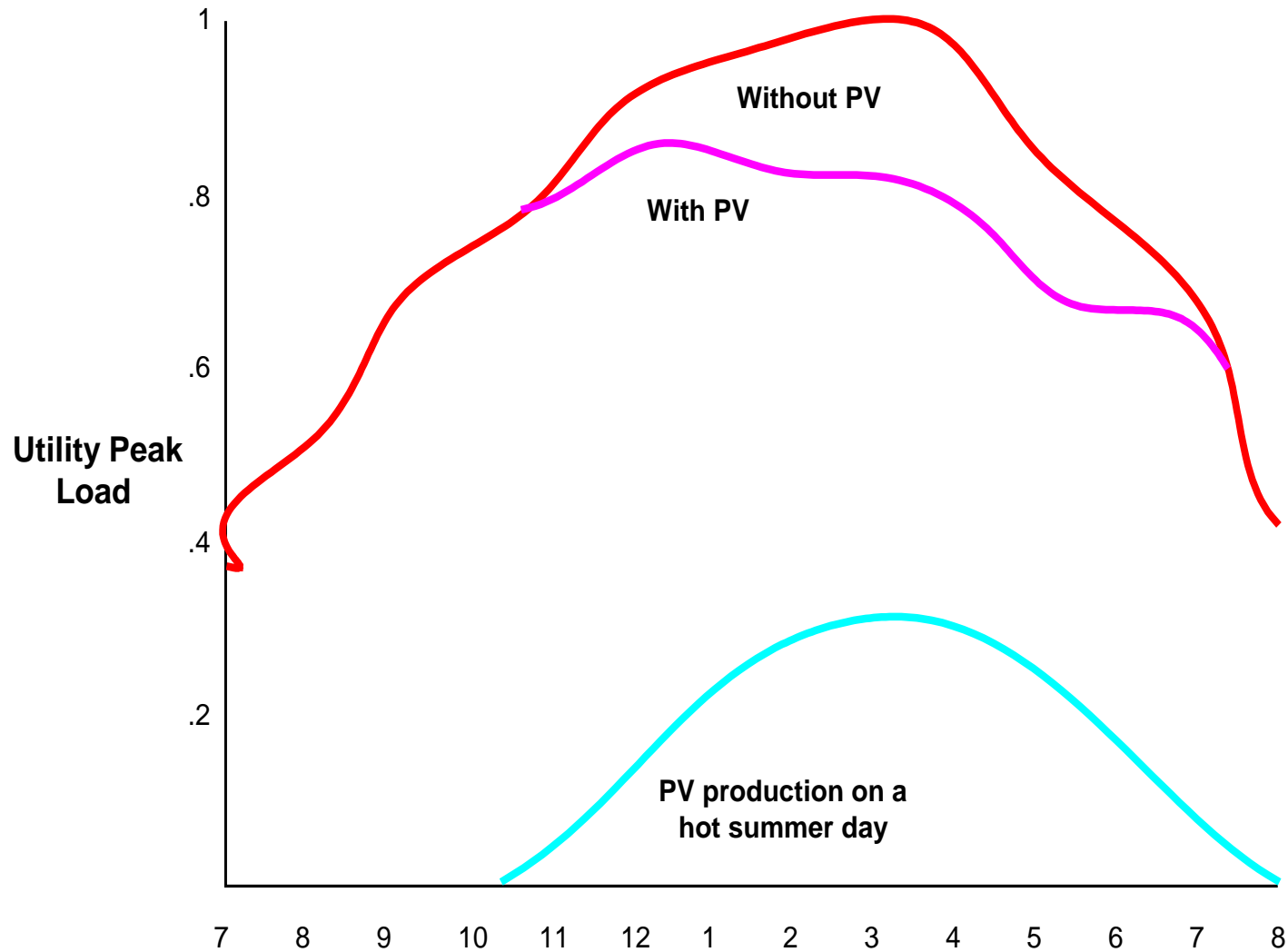
# Space-heating Mismatch



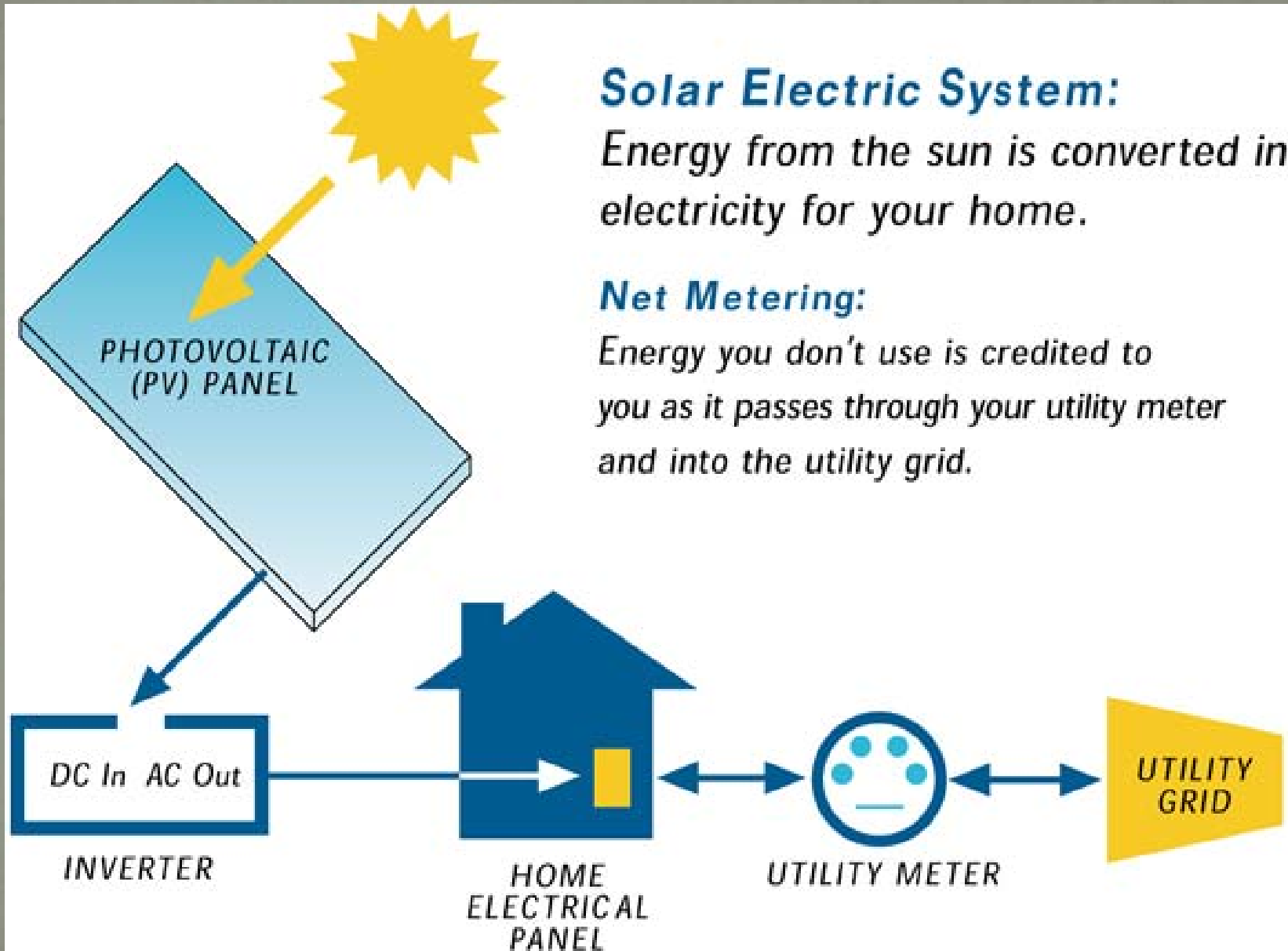
# *Domestic Hot Water Only*



# Summer Peak Shaving





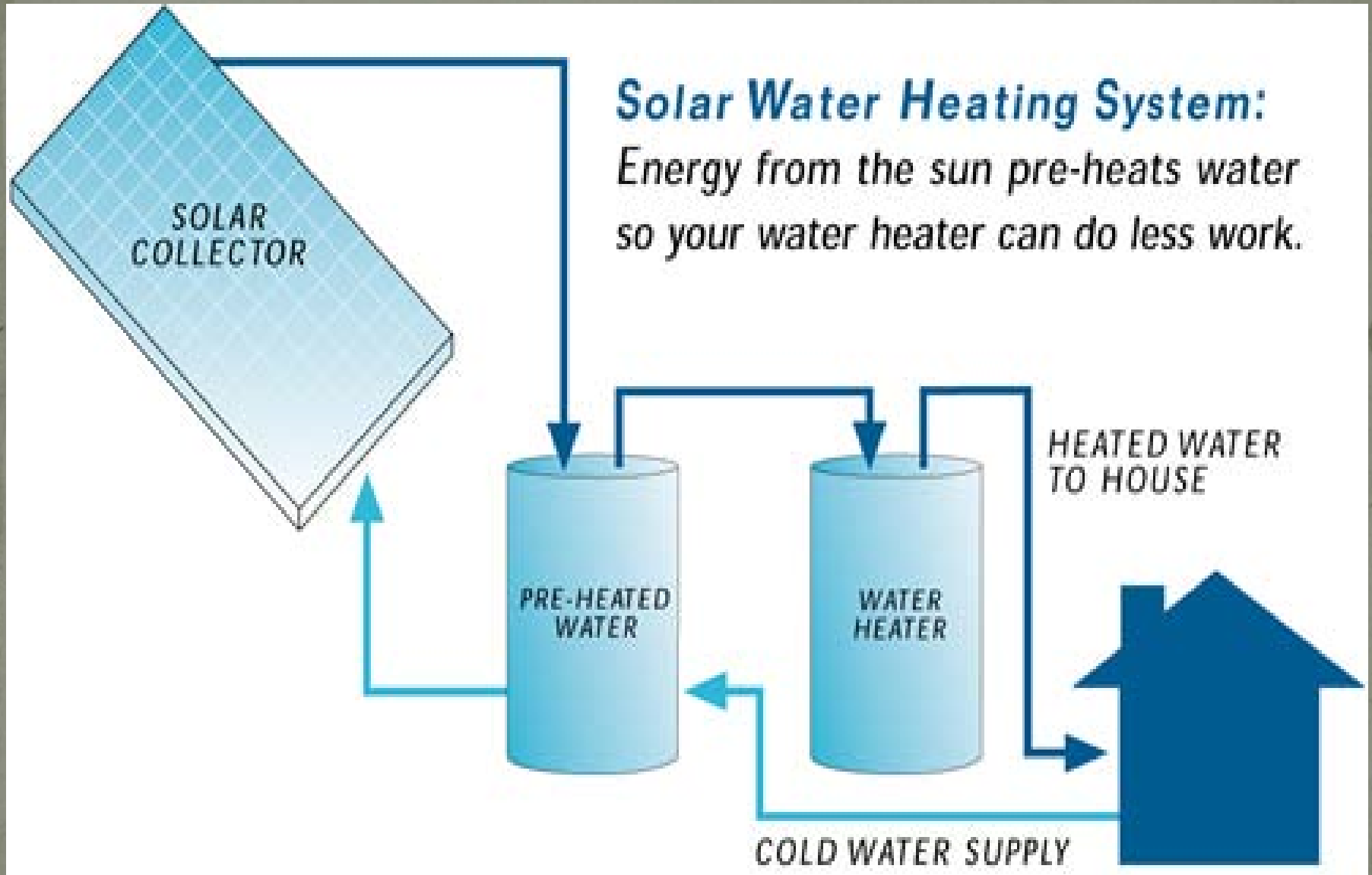


## **Solar Electric System:**

*Energy from the sun is converted into electricity for your home.*

## **Net Metering:**

*Energy you don't use is credited to you as it passes through your utility meter and into the utility grid.*





# ***Best Thermal Applications***

- Industrial process heat
- Agriculture → Animals  
→ Food drying
- Commercial hot water
- Domestic hot water
  
- Space-heating ?







# ***Solar Ready Means:***

- **Intention** → planning
- **Structural engineering** → first!!
- **Keeping it in the budget**
  - **Incentives & Financing tools**
  - **Preparation for “Phase II”**
- **Streamline the GANTT chart**
- **Matched to patterns of use**



# ***“Highest Best Use”***

- Solar Energy is variable → **Primary**  
→ Use like Paycheck
- Fossil Fuel is stored → **Backup**  
→ Use like Savings

# Islands of PV Modules









Where  
do ya  
put that  
tank?













# Apartment Building





## Assumptions (Inputs)

Total Installed Cost (\$):	<b>\$32,500</b>
Allocation to Business (%):	<b>100</b>
Annual Therms Saved:	<b>800</b>
Price/ therm (\$)	<b>\$1.0000</b>
Energy Inflation Rate (%):	<b>7</b>
Loan Down payment (%):	<b>100</b>
Down Payment (\$):	<b>\$32,500</b>
Amount of Loan (\$):	<b>\$0</b>
Interest Rate (%):	<b>4</b>
Loan Term (Years):	<b>5</b>
Month Installed:	<b>0</b>
Net Federal Tax Rate (%):	<b>30</b>
Net State Tax Rate (%):	<b>8</b>
O & M Cost (\$/therm):	<b>\$0.020</b>
O & M Inflation Rate (%):	<b>2</b>
Utility Rebate (%):	<b>2.00</b>
State Tax Credit (%):	<b>0</b>
Federal Tax Credit (%):	<b>30</b>
Basis for Depreciation	<b>\$19,600</b>

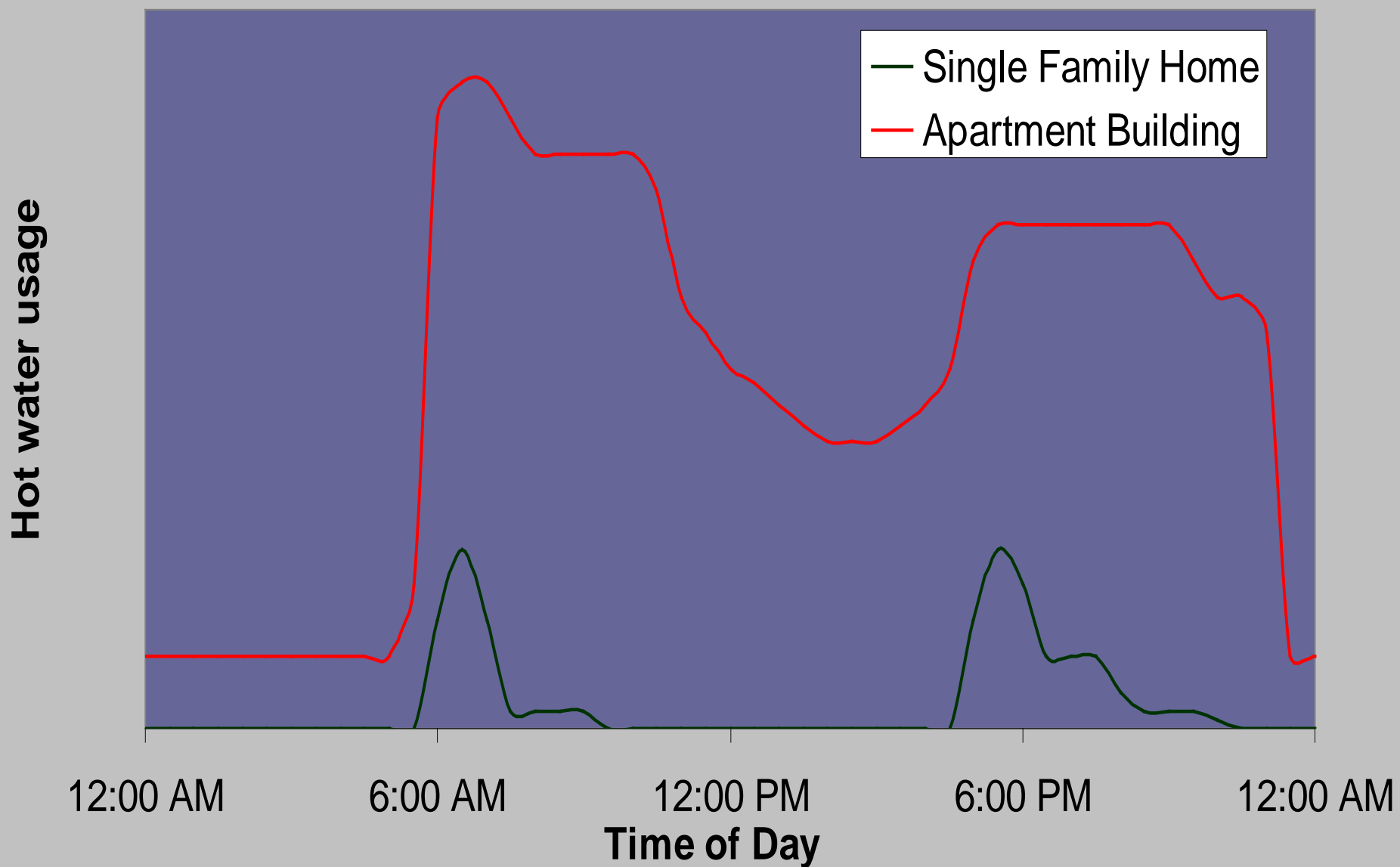
## Annual Cash Flow Model

Year	Net Energy	O&M Costs	Net Depreciate.	Net Loan Payments	Annual Cash Flow	Total Cash Flow
0					(\$17,718)	(\$17,718)
1	\$800	\$0	\$2,383	\$0	\$3,183	(\$14,535)
2	\$856	\$0	\$1,430	\$0	\$2,286	(\$12,249)
3	\$916	\$0	\$858	\$0	\$1,774	(\$10,475)
4	\$980	(\$250)	\$858	\$0	\$1,588	(\$8,887)
5	\$1,049	\$0	\$429	\$0	\$1,478	(\$7,409)
6	\$1,122	\$0	\$0	\$0	\$1,122	(\$6,287)
7	\$1,201	\$0	\$0	\$0	\$1,201	(\$5,087)
8	\$1,285	(\$270)	\$0	\$0	\$1,015	(\$4,072)
9	\$1,375	\$0	\$0	\$0	\$1,375	(\$2,698)
10	\$1,471	\$0	\$0	\$0	\$1,471	(\$1,227)
11	\$1,574	\$0	\$0	\$0	\$1,574	\$347
12	\$1,684	(\$1,300)	\$0	\$0	\$384	\$731
13	\$1,802	\$0	\$0	\$0	\$1,802	\$2,533
14	\$1,928	\$0	\$0	\$0	\$1,928	\$4,460
15	\$2,063	\$0	\$0	\$0	\$2,063	\$6,523

# ***Thermal System: 320 SF***

Total system cost	\$32,500
State rebate	(\$ 7,500)
Federal ITC 30%	(\$ 7,500)
Depreciation	(\$ 7,500)
<b>Residual investment</b>	<b>\$10,000</b>
Offset \$1,000 of nat. gas/year	10-yr payback

# Weekday Water Usage



# Residential SDHW







# Thermal System: 64 SF

Total system cost	\$ 9,000
State rebate	(\$ 2,500)
Federal ITC 30%	(\$ 2,500)
Depreciation	(\$ 0 )
<b>Residual investment</b>	<b>\$4,000</b>
Offset \$200 of nat. gas/year	20-yr payback



# Case Study: Science House



# PV System: 10.2 kW

Total PV System Cost	\$88,000
MN state rebate	(\$20,000)
Xcel Solar Rewards	(\$22,900)
Fed investment tax credit	(\$13,500)
Accelerated depreciation	(\$17,600)
<b>Residual Cost</b>	<b>\$14,000</b>
<b>Offset 13,000 kwh/year →</b>	<b>10 year payback</b>

## A TYPICAL TIMELINE FOR GETTING A PV SYSTEM UP AND RUNNING



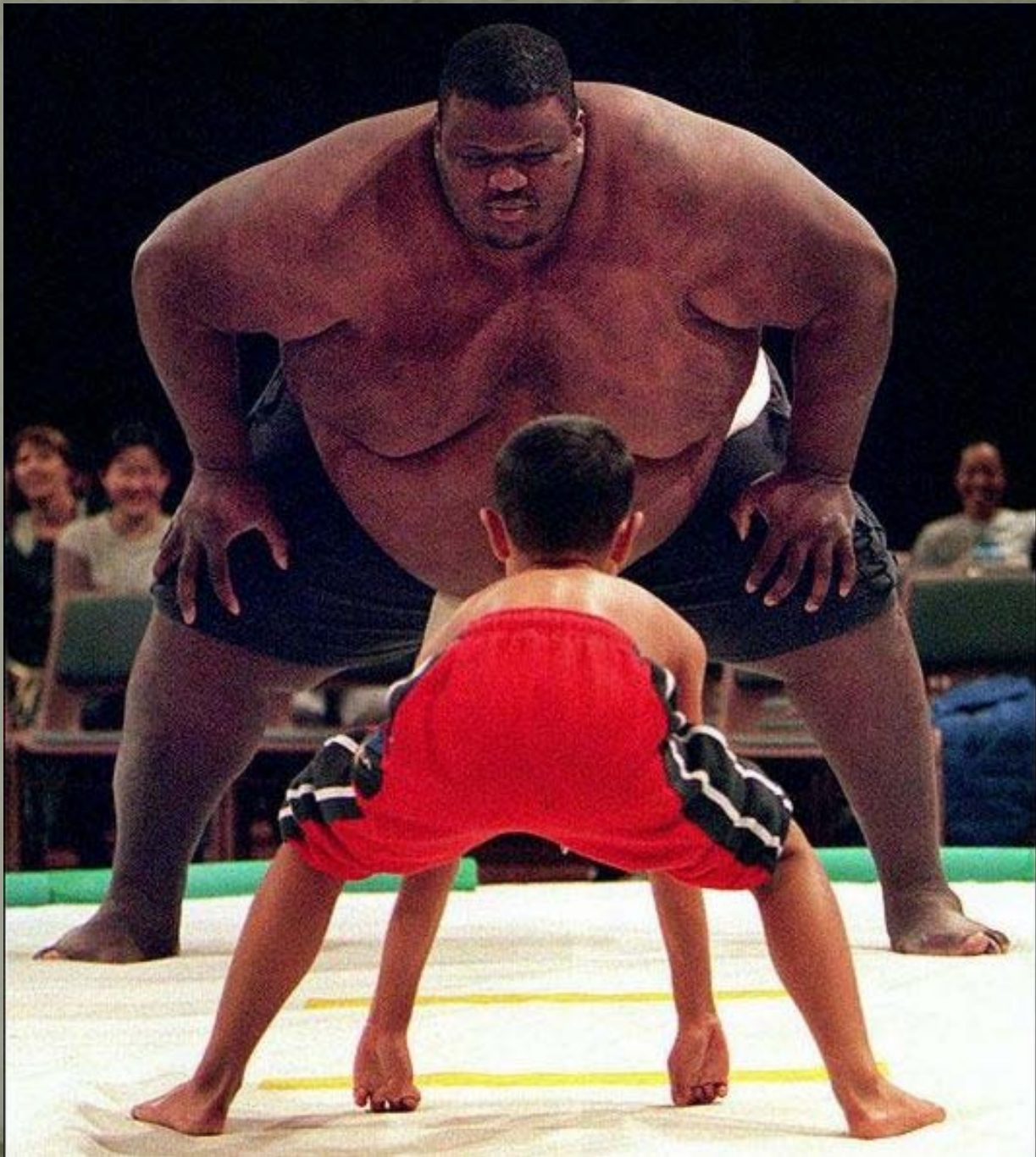
# *Market Drivers*

- Energy Independence
- LEED certification
  - Pulling building owners toward green
  - Design professionals compete to be green
- 25 X 25 legislation
  - Strong motivator for utility programs
- Carbon Credit Trading
  - The new administration views renewable energy as a foundation of the economy



# ***Utilities: Are we friends again?***

- “25 by 25” is on **their** backs
- 30% by 2020 for Xcel Energy – 10 yrs!
- They know it can't be ALL wind-based
- **Market value of solar attributes ?**
- Use this to attract investors









# ***The Attributes of PV:***

1. **No emissions** during operation
2. **No fuel cost!! Ever!!**
3. **Very low maintenance** cost
4. **Grid support** at critical times
5. **Reduced risk** of carbon costs
6. **Levelized peak power cost**
7. **Lower transmission** costs



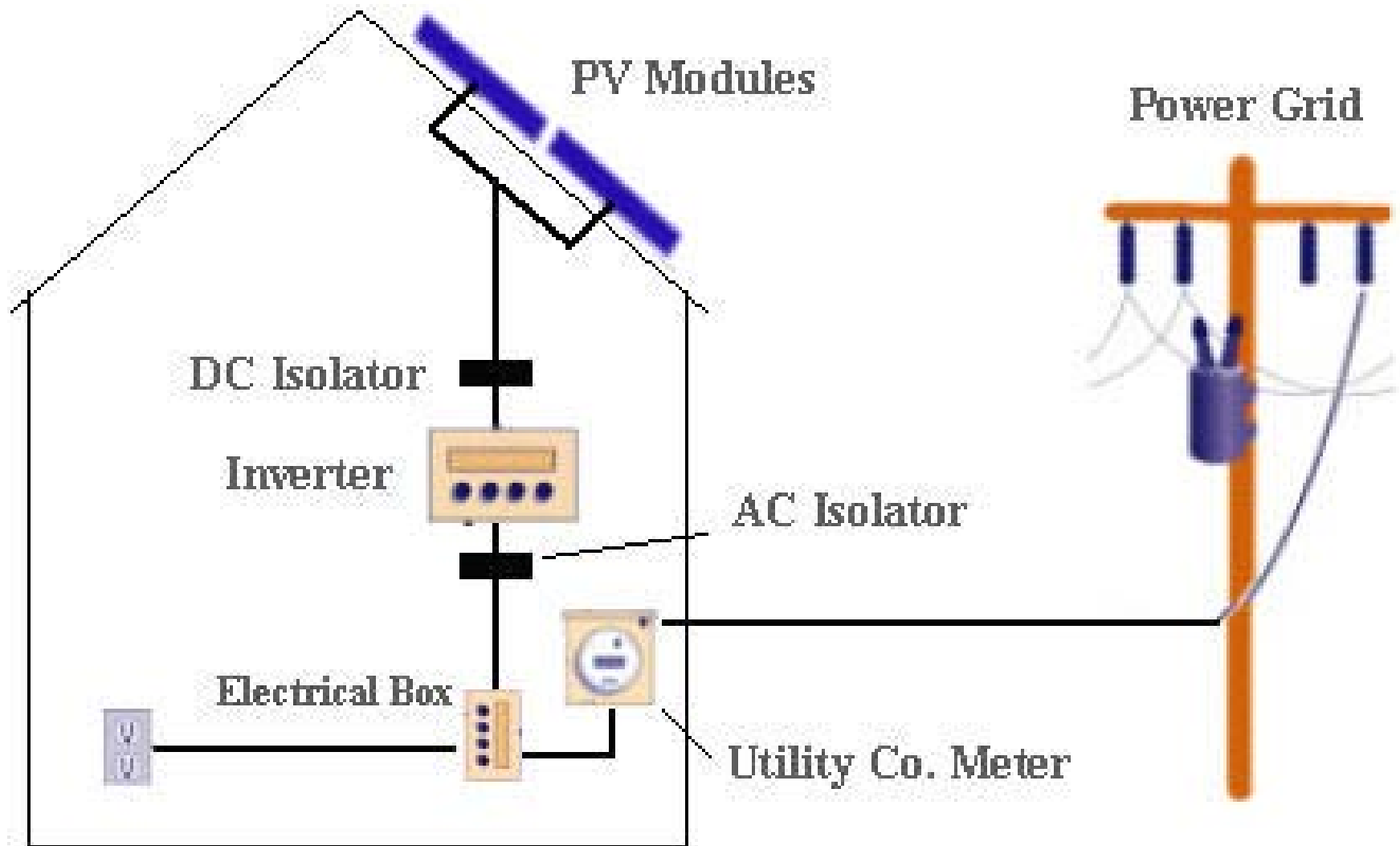
# PV Laminate on Flat Roofs





PV Roof Tiles

# Basic PV System





# Micro-inverters



# What's Coming ?

- Low-concentration PV
- Building-integrated PV
- Financing programs
- Performance-based incentives
- Bulk-purchase programs
- More local manufacturing

# Shading Affects Performance





# New Programs

- 1 Block Off the Grid San Francisco
- Solarize Portland Portland, OR
- Solar Gardens Colorado
  
- bulk purchase Twin Cities
- Solar Reward Twin Cities
- Solar leasing Twin Cities

# Conflict / Opportunity

**Solar access**

**Zoning and permitting**

→ **homeowners**

**associations**

**Who gets to do the work?**

**Product longevity**

**Financing deals**

**Liability**

# ***Challenges for Solar Biz***

1. Financing for ROI
2. Quality control
3. System performance
4. Business development





# Innovative Power Systems

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# *Life-cycle Costing Example*

## Remote PV System

- ▣ \$20,000 for 2 kW
- ▣ 20-year system life
- ▣ Battery maintenance
- ▣ Labor: \$5,000
- ▣ No fuel costs !
  
- ▣ Total cost: \$20,000

## Remote Generator

- ▣ 2 kW unit      \$3,000
- ▣ 3 overhauls    1,000
- ▣ 3 more units   9,000
- ▣ Total labor    5,000
- ▣ 20 years gas   5,000
  
- ▣ Total cost: \$23,000