

Solar Power, Energy Storage, Saving the World, and You

Or - how to save a buck and feel good about
yourself in the process



1. Reasons for going solar
2. Cost of solar
3. Disadvantages of solar (and their remedies)
4. Calculate the cost of solar for you
5. Question and Answer period

1. Reasons for going solar

1. The Good of Humanity

Extreme weather
Rising Sea Levels
Drought

Greenhouse Gases (ex. CO₂) absorb heat

Atmospheric CO₂ concentration 419 ppm 2022

up from 390 ppm 2010 (~ 2.5ppm/year)

Average global temperature up ~2°F since 1880

(15% decline in cognitive brain function at 945 ppm)

CO₂ is a byproduct of all hydrocarbon (read oil, natural gas, and coal) combustion

Average U.S. residential utility customer electricity use in 2020 = 10715 kWh

Natural gas energy density = 27.0kWh/gal.

Natural gas lbs CO₂/gal = 3

Coal energy density = 22.9kWh/gal.

Coal lbs CO₂/gal = 19

Best case scenario per household (natural gas fired power plant): 10 yrs x 10715kWh/yr x 1 gal/27.0Kwh x 3 lbs CO₂/gal = **11905 lbs CO₂ produced**

Worst case scenario per household (coal fired power plant): 10715kWh/yr x 10 yrs x 1 gal/22.9Kwh x 19 lbs CO₂/gal = **88901 lbs CO₂ produced**

12 Photovoltaic (solar) panel, 4.8kW system (25 year warranty) producing 320% of energy used at my house last year: 0lbs CO₂ produced

WAR

U.S. Pays 3.6% of Russia's GDP
for oil and natural gas

Los Angeles Times

Op-Ed: Stop financing Putin's war machine. Cut off Russia's oil and gas sales

Europe and the United States are united against Putin's brutal invasion of Ukraine, yet those countries currently pay Russia upward of \$1 billion per day for oil and natural gas. Revenue from oil- and gas-related taxes and tariffs accounted for 45% of Russia's federal budget in January.

1. Reasons for going solar

2. To save \$

The Mercury News

NEWS > CRIME AND PUBLIC SAFETY > CRASHES AND DISASTERS • News

PG&E electricity and gas bills are slated to jump 9% in early 2022

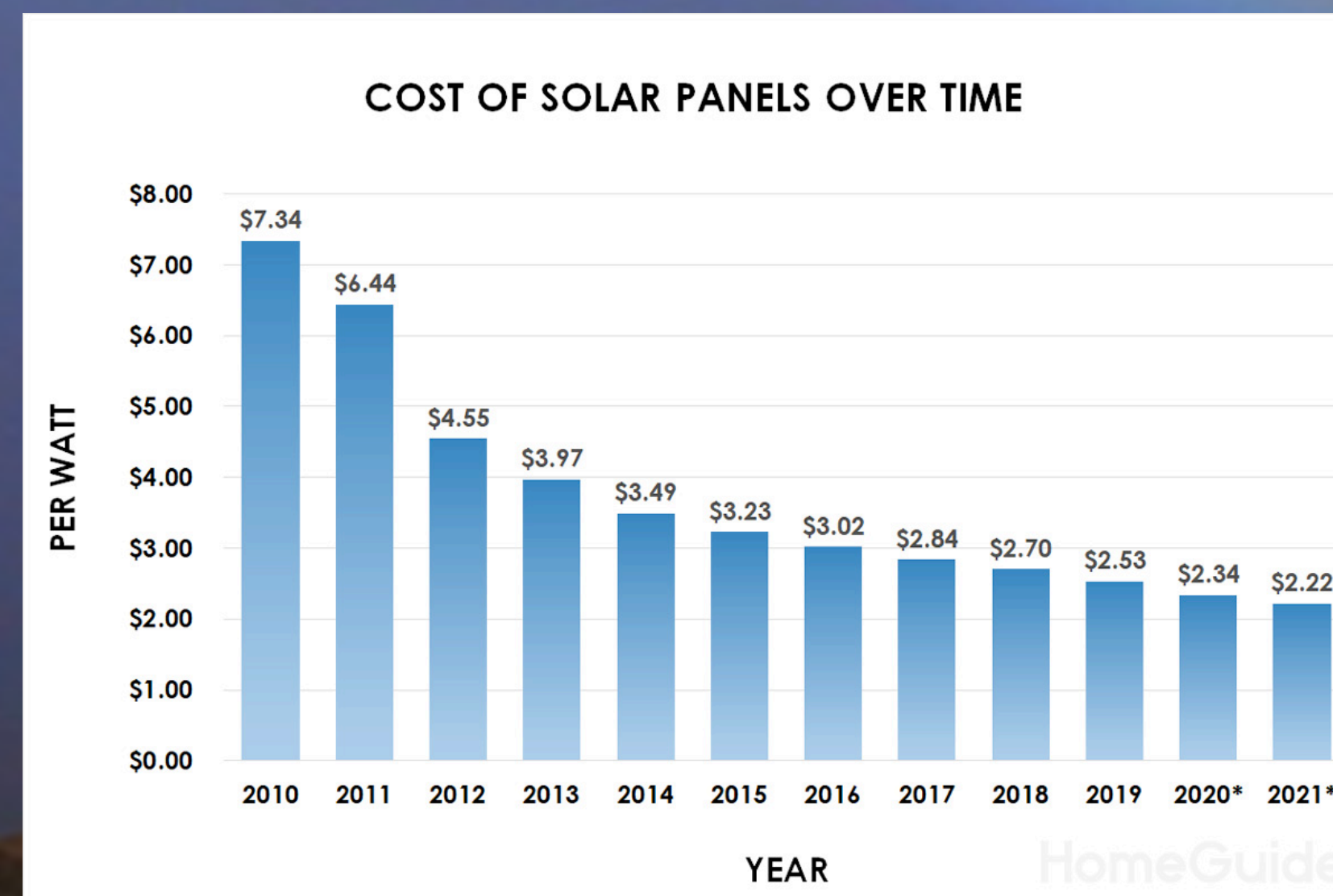
Average PG&E monthly bills are due to top \$220

$\$220/\text{month} \times 12 \text{ months} \times 10 \text{ years} = \$26,400$

Every 4 years PG&E “reassess” (read *increases*) what they charge customers for energy

12 PV panel, 4.8kW system (25 year warranty)

and a 13kWh battery (10 year warranty) less government tax credits and rebates = \$19500



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2. Cost of solar

1. Average cost per kWh in California = \$0.2143 or ~ \$214/month or ~\$2600/year
 - Increases every 4 years (up 7% from 2020)
 - Never ends (you will pay every month, forever)
 2. Average cost per watt from Solar = \$2.68/watt or ~\$1000 for a 400w panel
 - 1 time investment
 - Panels last ~25 years
 - Government Incentives (tax credits, rebates) decrease price
 - Quantity of Incentives is income and location dependent
3. Upshot
- Solar will ultimately *decrease* your energy cost

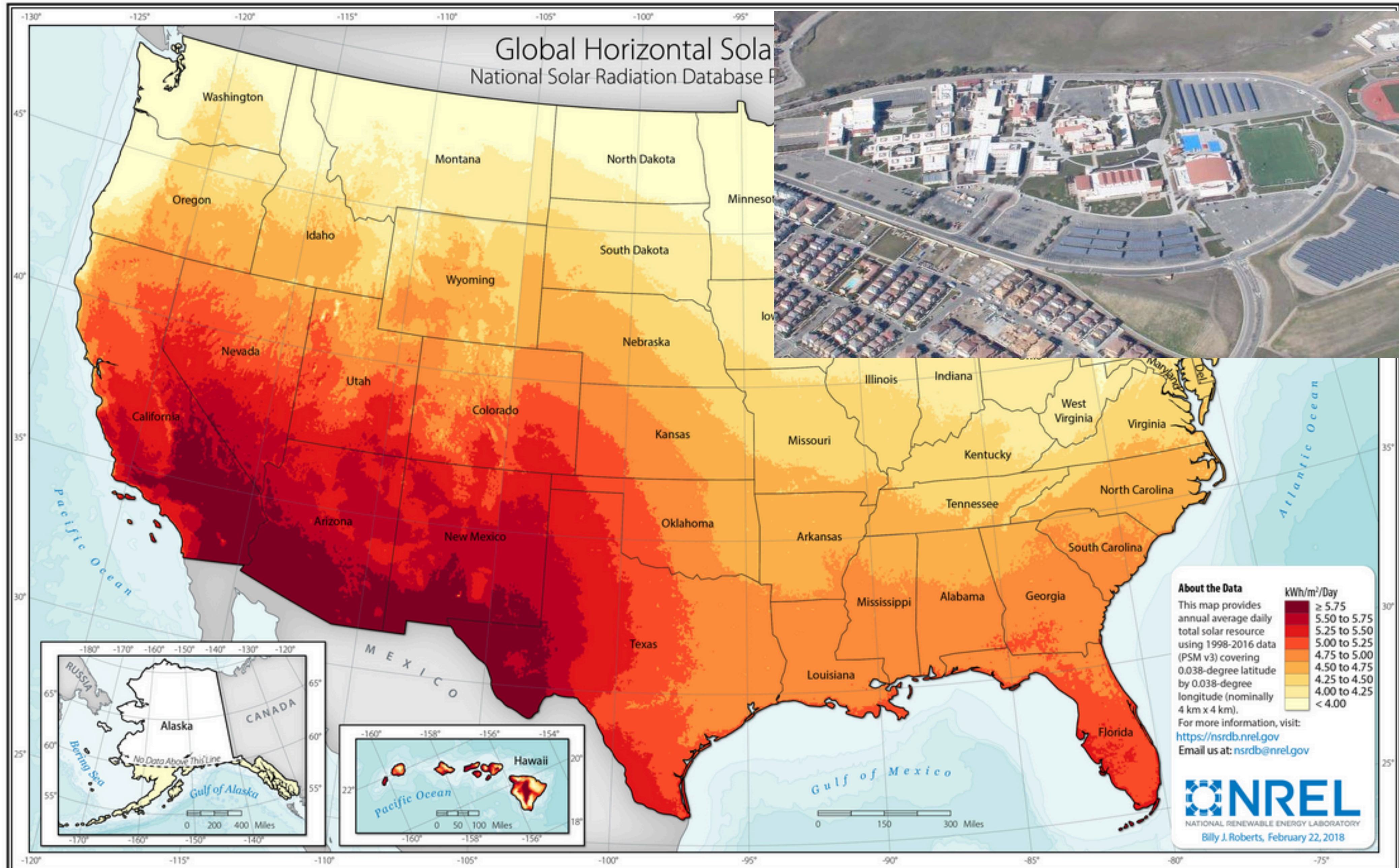
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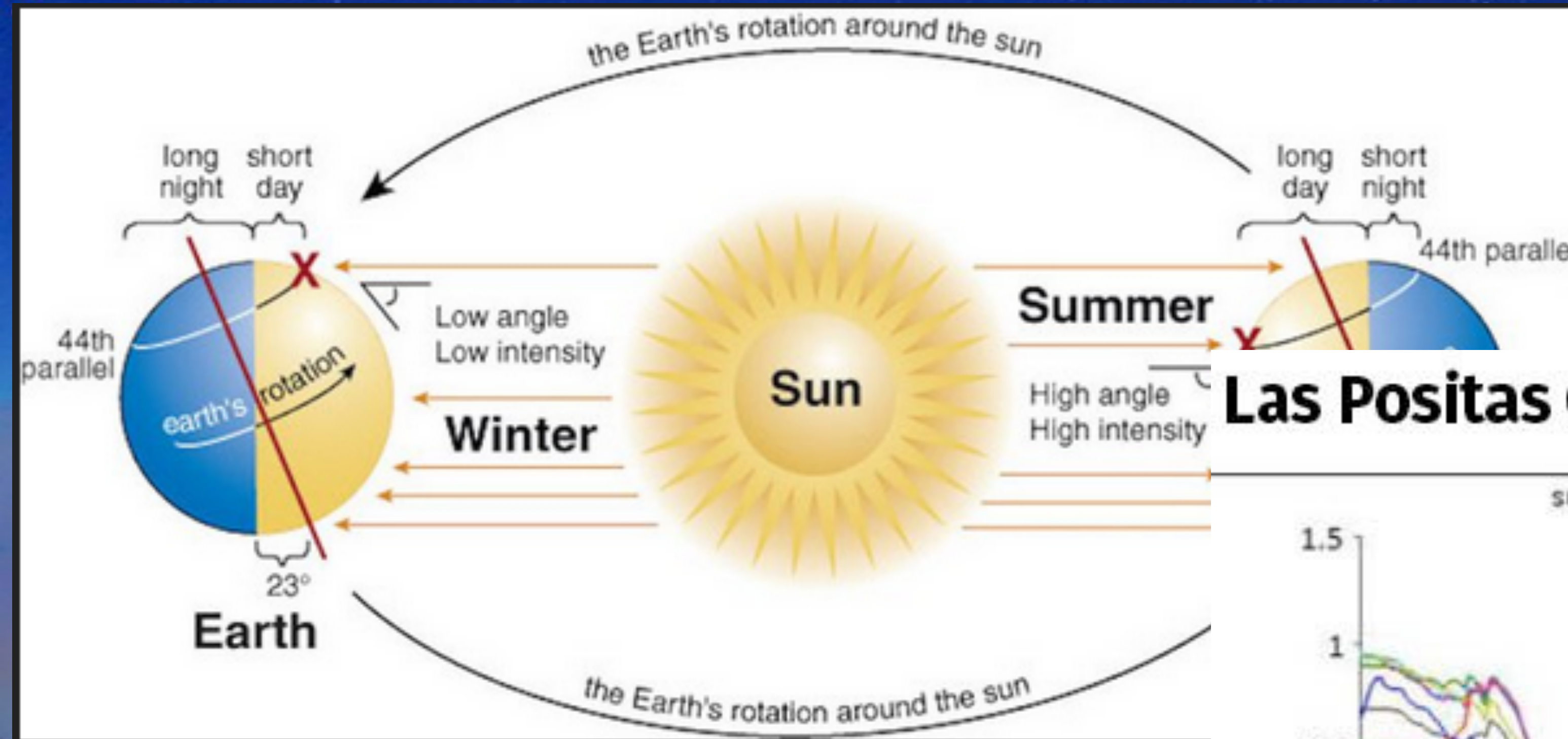


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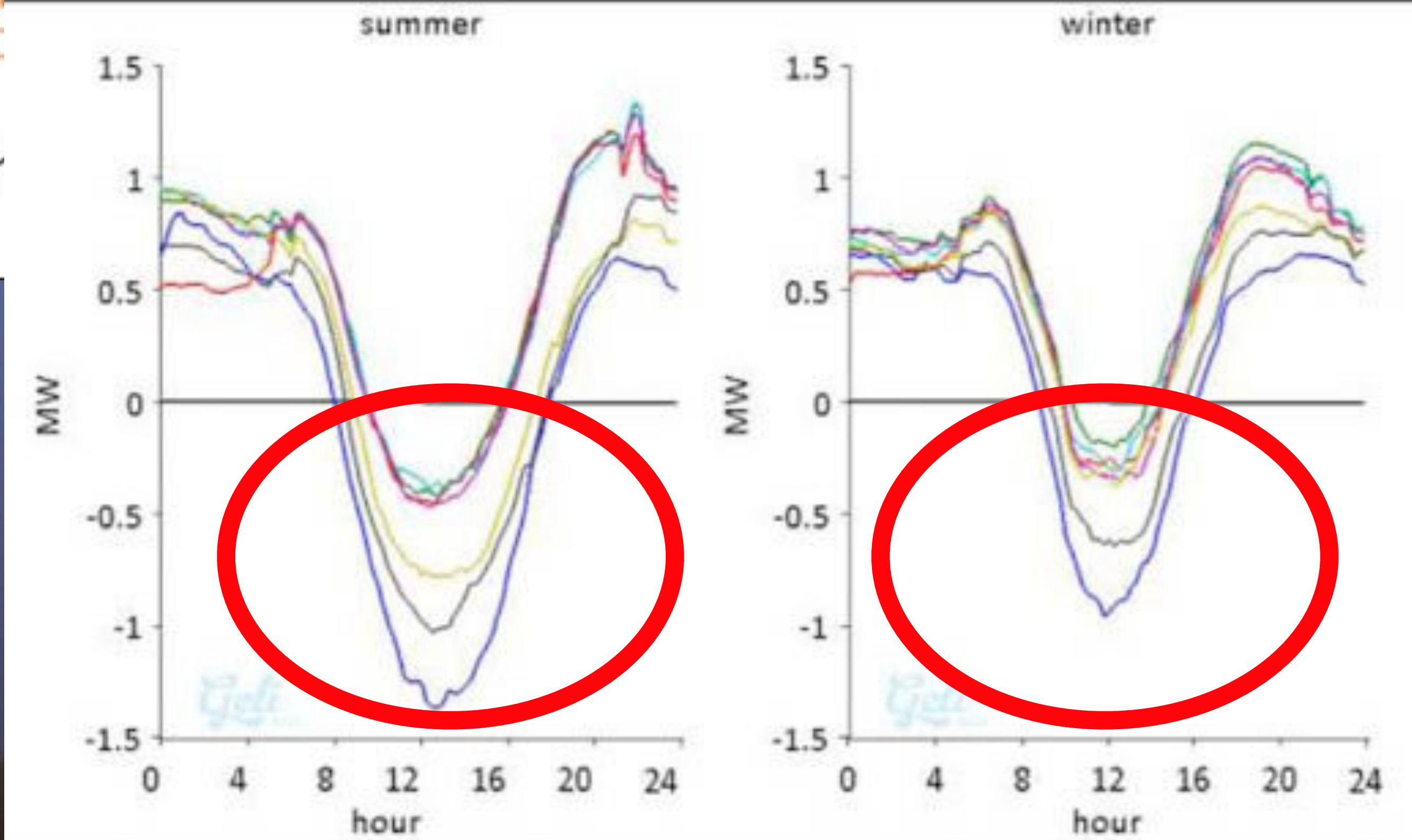
3. Disadvantages of solar (and their remedies)



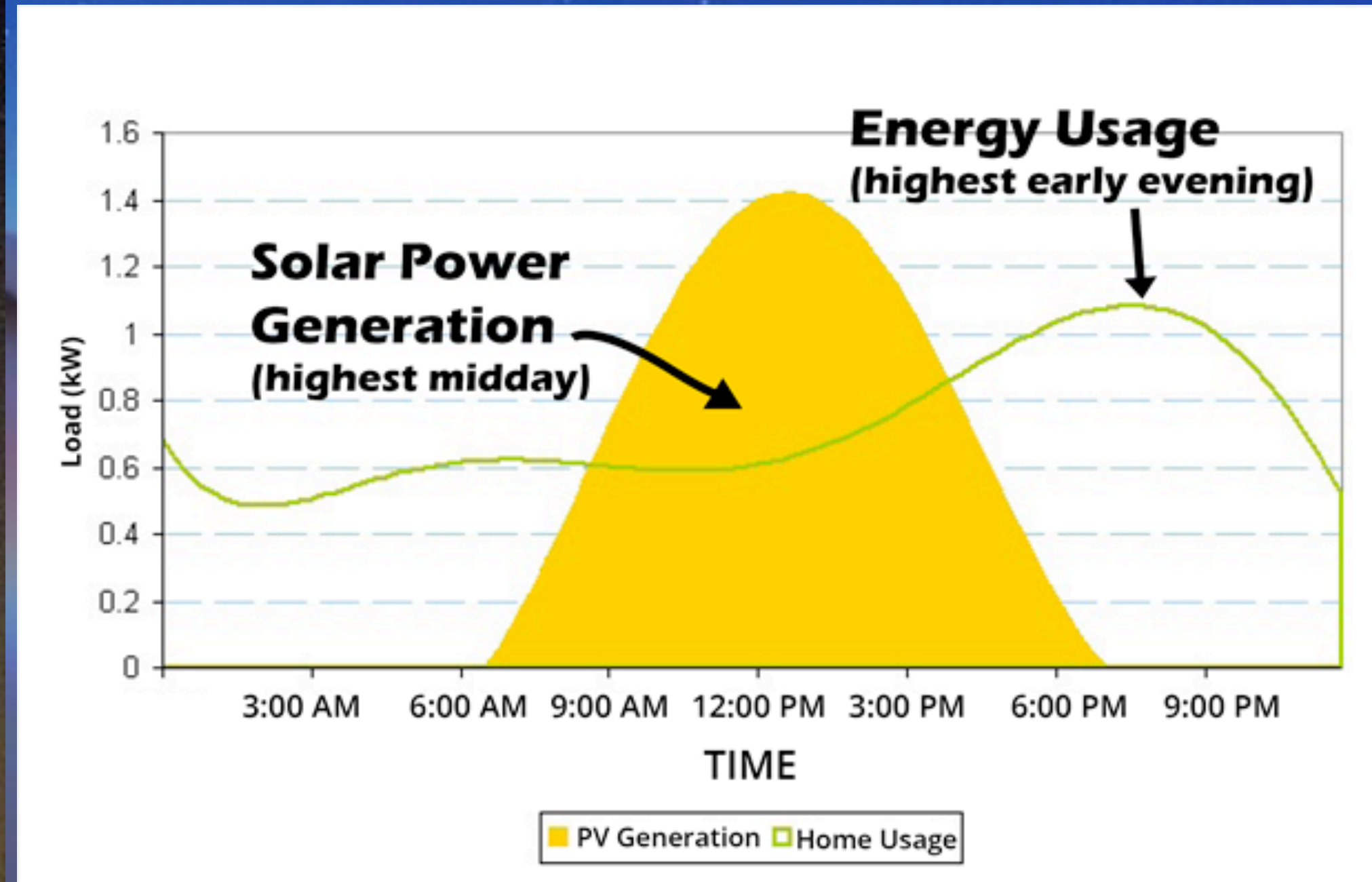
3. Disadvantages of solar (and their remedies)



Las Positas College Power Demand by Season



3. Disadvantages of solar (and their remedies)



Batteries!

Solar Energy Storage - Batteries

Average battery cost ~\$15000

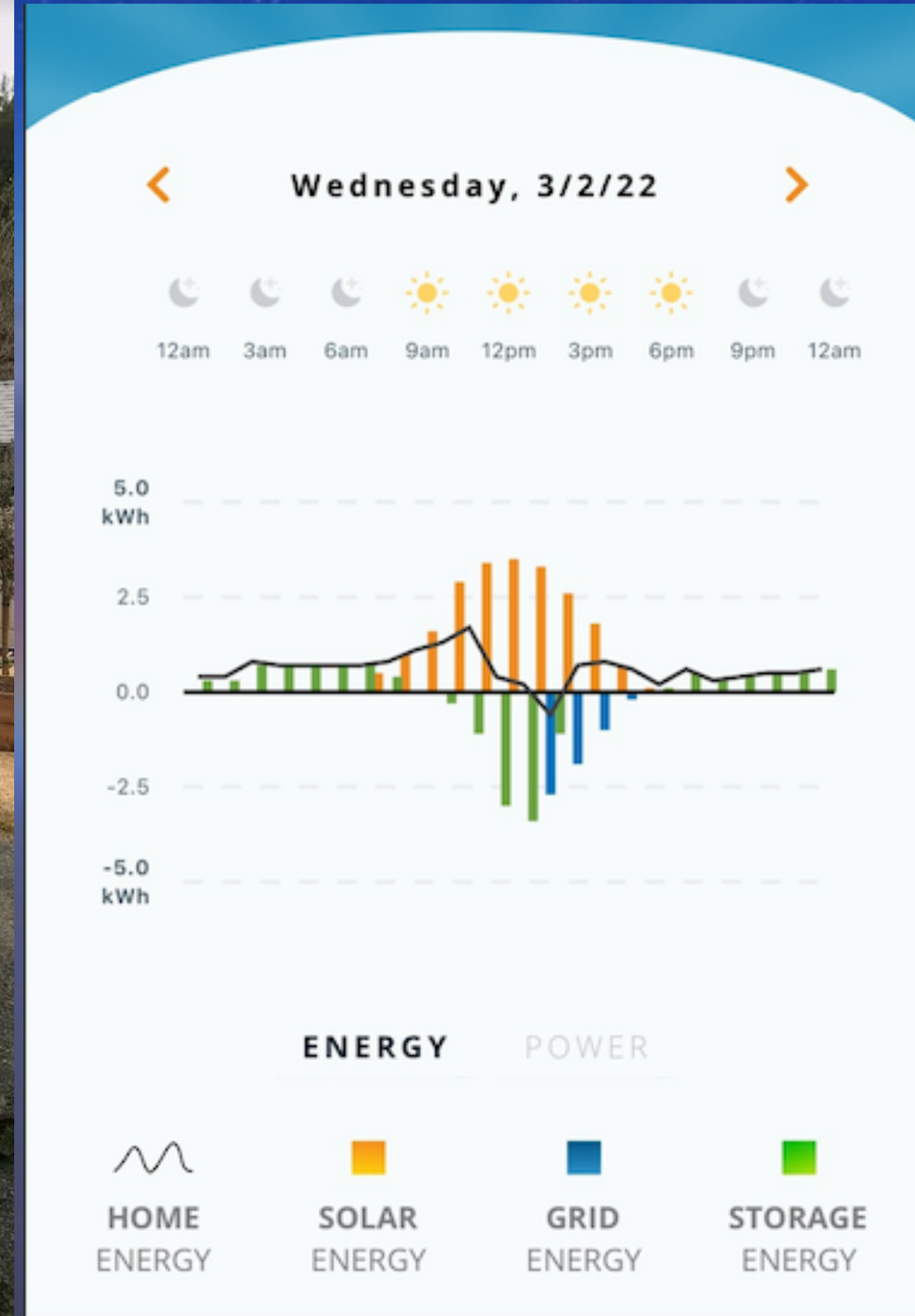
DISTRIBUTED BATTERIES



Small battery packs allow homeowners to store energy from their rooftop photovoltaic systems to use when the sun goes down.



Tesla, China's BYD, and Germany's Sonnen have "behind the meter" systems on the market in the U.S. About 9 megawatts' worth of residential storage deployed in the U.S. in the first quarter 2016, bringing the output to around 100 megawatts.



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Purchasing Solar Panels, Energy Storage Systems:

Tax Credits - Reduce the amount of federal or state tax you owe. Currently all PV, and, separately, all energy storage systems are eligible for 26% credit from the federal government.

Rebates - Money direct to you. Usually with the idea that you will immediately give it to the company you purchased the system from.

Self-Generation Incentive Program (SGIP)

Energy Storage Rebates for
Your Home **Available NOW!**



Am I eligible for SGIP rebates?

Any residential customer of Pacific Gas and Electric Company (PG&E), Southern California Edison (SCE), Southern California Gas Company (SoCalGas), or San Diego Gas & Electric (SDG&E) **is eligible for a General Market SGIP rebate of approximately \$250/kilowatt-hour**, which means

the rebate covers approximately 25 percent of the cost of an average energy storage system.

In addition to this **General Market** rebate, there are two additional categories of higher SGIP rebates for residential customers: **Equity** and **Equity Resiliency**.

Payments for excess energy generated - Some energy providers will pay you for the excess energy you generate and export to the grid. PG&E, SCE, SDG&E will pay you between 2-3 cents per kWh through CA - Net Energy Metering.

Database of State Incentives for Renewables and Efficiency (DSIRE)

Steps to calculating your solar costs as compared to your current energy costs

1. Find the monthly kWh of energy used on your most recent bill. Add this to your previous two bills and divide by 3. This is your average energy requirement per month.
2. Divide the monthly average by 30 days, then divide again to get energy used per hour (kW)
3. *Ex. Average home use = 900kWh/month x 1month/30days x 1day/24hours = 1.25kW*
4. Multiply your hourly energy need by 1000 to get watts: $1.25\text{kW/hr} \times 1000\text{w}/1\text{kW} = 1250\text{W/hr}$
5. Assume 5 hours peak sunlight (more or less depending where you live and season)
6. *Ex. 5 hr x 1250W/hr = 6250W (size of system you need)*
7. Size of system you need x \$2.68/watt = cost for system you need
8. subtract 26% tax credit = net cost of system
9. Solar panels last ~25 years. Take your average monthly energy cost from your bills used above. If you're a PG&E customer add 18.1% to reflect recent rate hikes.
10. Multiply that cost by 12 months and then by 25 years. Compare it to the solar cost.
11. Assume \$15000 for 13kWh storage battery (between \$10000 - \$20000)
12. Less 26% tax credit and 13kWh x \$250/kWh rebate ~\$7850 net battery cost

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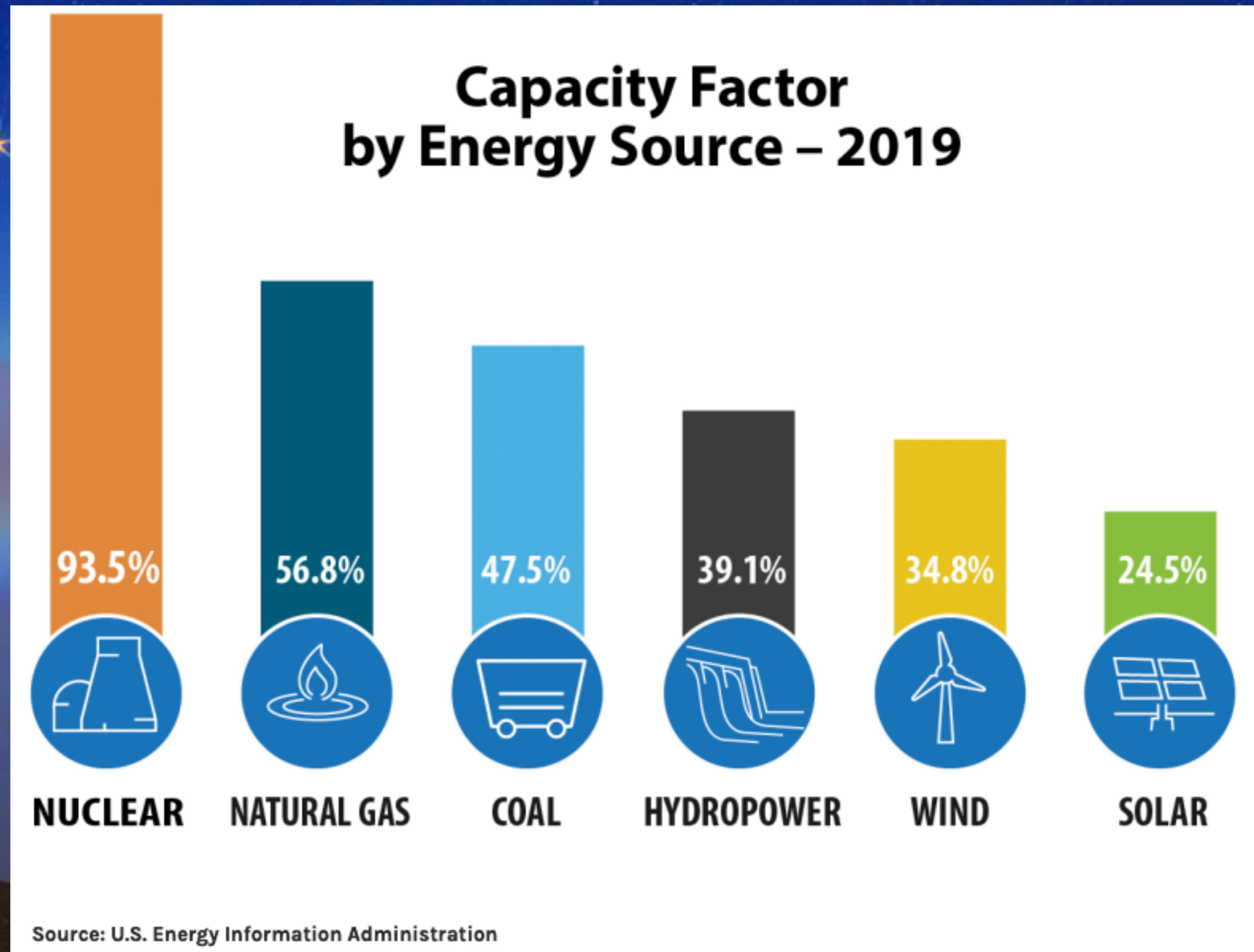
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Google form for feedback. Please comment!

<https://forms.gle/R6tdgkb8MSx24FmK6>

Solar Power and Renewables: Economics



Capacity Factor - How often a power plant is running at maximum power. 100% means all of the time.