




Solar Roofs

Ozioma Ozor-Ilo, Marco Gutierrez,
Henry Ulrich, Henry Baring



Outline

- ◀ Solar Roof Overview
 - ◀ Cost Breakdown
 - ◀ Tesla vs. Local
 - ◀ Carbon Emission
 - ◀ Real World Implementations
 - ◀ Takeaways
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Overview

A solar roof replaces an existing roof with solar tiles, powering a house for years with the produced energy.



***But is a
solar roof
worth it?***

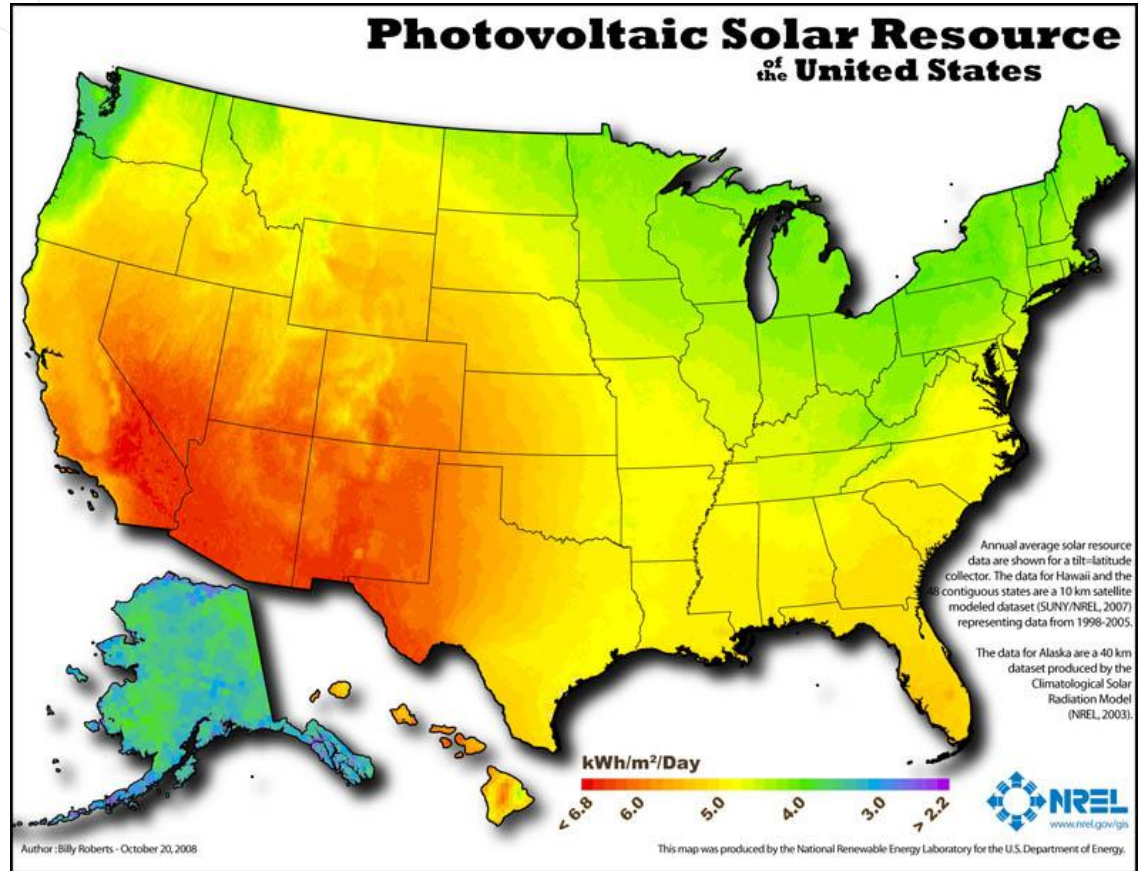




Considerations

- ◀ Location and Sunlight Availability
 - ◀ Installation
 - ◀ Reliability
 - ◀ High Initial Cost
 - ◀ Expensive Energy Storage
 - ◀ Energy Usage
 - ◀ Aesthetics
- 

US and the sun



A map on how much sun each part of the US gets

Cost Breakdown

What is the true value of a solar roof?





Asphalt Roof Cost

\$4-\$5 SQ. FT

\$1-\$2 sq. ft + \$3 sq. ft for installation

\$8,000

Installation for a 1,500 sq. ft



Slate Roof Cost

\$10-\$13.3 SQ. FT

estimation for installation

\$15,000-\$20,000

Installation for a 1,500 sq. ft



<https://www.fixr.com/costs/slate-roof-installation#:~:targetText=On%20an%20average%2C%20the%20installati%20on.cost%20around%20%2415%2C000%2D%2430%2C000.>



Solar Roof Cost

\$21.85 SQ. FT

estimation for installation

~\$32,775

Installation for a 1,500 sq. ft





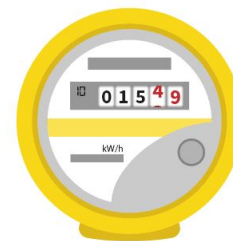
Sell Back

Public Policy

- Public Utility Regulatory Policies Act (PURPA 1978)
- Renewable Energy Credit \Rightarrow 1 MW of Solar power
- State Mandates

Two methods:

- Net Metering
- Wholesale agreements



<https://www.sullivanpower.com/solar-academy/how-solar-works>

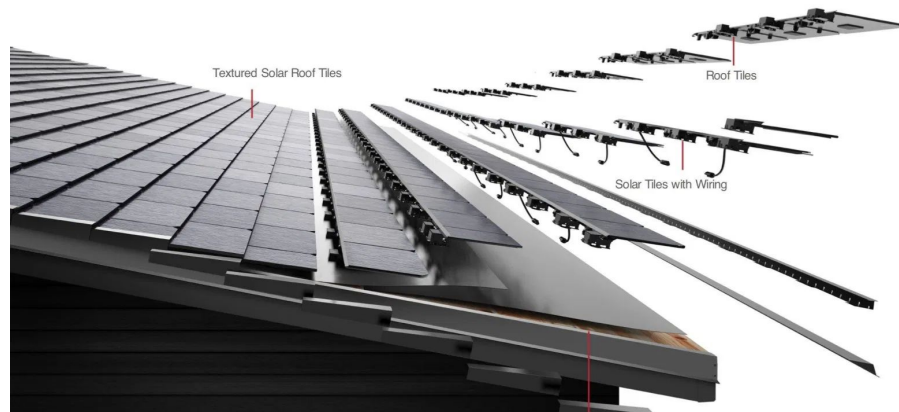
Tesla vs. Local





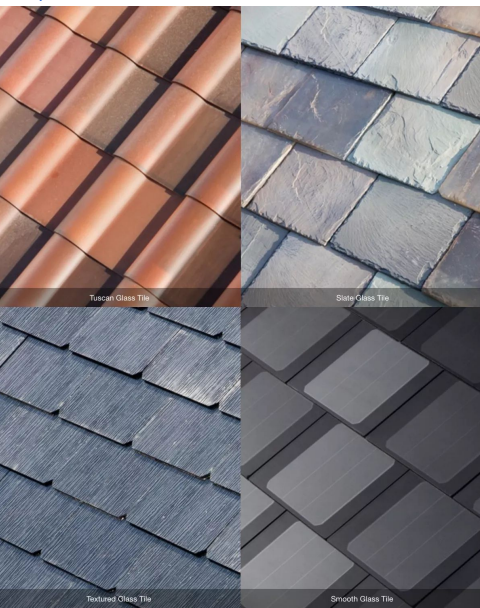
Tesla Solar Roof

**Solar, “without
the compromise”**



<https://electrek.co/2019/10/23/tesla-solar-roof-v3-launch/>

<https://electrek.co/2019/10/23/tesla-solar-roof-v3-launch/>



- ◀ Solar cells between layers of glass
- ◀ 25 year warranty





Back to the Future



A THREE-STORY GOTHIC REVIVAL IN SALISBURY MILLS, N.Y.

BUILT: 1850 | INTERIOR SQUARE FOOTAGE: 2,700 | ROOF SQUARE FOOTAGE: 1,175

WHAT THE ROOF COSTS

Solar Roof: 70% solar tiles, 30% nonsolar tiles **\$38,400**

One Powerwall battery **\$7,000**

WHAT THE OWNER GETS BACK

Federal tax credit **\$12,500**

Estimated energy savings over 30 years **\$46,800**

AFTER 30 YEARS A SOLAR ROOF WOULD SAVE

\$13,900

Through the Roof



TWO-STORY HOME IN BELLAIRE, TEXAS

BUILT: 1990 | INTERIOR SQUARE FOOTAGE: 4,562 | ROOF SQUARE FOOTAGE: 2,779

WHAT THE ROOF COSTS

Solar Roof: 50% solar tiles, 50% nonsolar tiles **\$73,600**

Two Powerwall battery **\$12,500**

WHAT THE OWNER GETS BACK

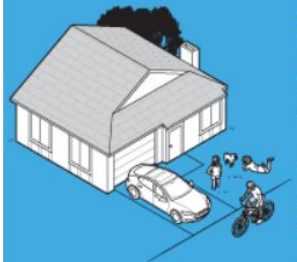
Federal tax credit **\$21,300**

Estimated energy savings over 30 years **\$52,100**

AFTER 30 YEARS A SOLAR ROOF RESULTS IN A SAVINGS SHORTFALL OF

-\$12,700

Soak Up the Sun



ONE-STORY RANCH IN THOUSAND OAKS, CALIF.

BUILT: 1975 | INTERIOR SQUARE FOOTAGE: 1,500 | ROOF SQUARE FOOTAGE: 1,878

WHAT THE ROOF COSTS

Solar Roof: 50% solar tiles, 50% nonsolar tiles **\$49,800**

One Powerwall battery **\$7,000**

WHAT THE OWNER GETS BACK

Federal tax credit **\$13,900**

Estimated energy savings over 30 years **\$84,700**

AFTER 30 YEARS A SOLAR ROOF WOULD SAVE

\$41,800





Tesla Solar Roof

Cost Breakdown:

2135 Bissonnet Street -
about 2,750 ft²

Predicted \$39,109 for a 10.6
kW roof

- Approximately \$1,638/yr
- Payback time: 23.88 yr
- \$10,031 net gain




<https://electrek.co/2019/06/12/tesla-solar-roof-v3-shingle-price/>






Rooftop Solar Panels in Houston

- ◀ In Texas, in order to sell power back to electrical companies from solar systems, one must work with a solar company that provides credits on excess power, such as Reliant, Green Mountain, etc.
- ◀ Cost Breakdown for Houston
 - ◀ Average cost for a typical 6kW¹ system: \$11,782².
 - ◀ Average payback period: 7.57 years³.
- ◀ Averages for Houston
 - ◀ Electrical Consumption: 14,016 kWh per year⁴.
 - ◀ System needed to 100% offset electricity: \$11.2kW².
 - ◀ Cost of 11.2kW system after savings: \$24,461².
 - ◀ Payback time: 7 years 10 months².

 = 7¢/kWh

 = 23¢
/kWh¹

1. <https://www.solar-estimate.org/solar-panels/houston-texas>

2. <https://www.solarreviews.com/solar-panels/solar-panel-cost/cost-of-solar-panels-in-texas/solar-panels-cost-in-harris-county/houston>

3. <https://homeguide.com/costs/solar-panel-cost>

4. <https://www.electricitylocal.com/states/texas/houston/>



Houston Solar Panel Cost Examples

- With Energysage.com's Solar Calculator¹ and using the average residential monthly bill in Houston of \$128 and commercial monthly bill of \$668².



Cost: \$18,000
System: 9.0kW
Payback: 11.5 years
20 yr. Savings: \$14,000



Cost: \$18,000
System: 8.9kW
Payback: 11.4 years
20 yr. Savings: \$14,000



Cost: \$124,000
System: 63.2kW
Payback: 13.4 years
20 yr. Savings: \$36,000

- <https://www.energysage.com/solar/calculator/>
- <https://www.electricitylocal.com/states/texas/houston/>
- <https://www.solarreviews.com/solar-panels/solar-panel-cost/cost-of-solar-panels-in-texas/solar-panels-cost-in-harris-county/houston>



Solar Panels at Rice

- ▶ Two arrays are installed on the roof of Jones College.
- ▶ Panels face the sun in mid-afternoon in the summer, when electricity is most expensive.
- ▶ Excess energy is used to power other buildings on campus.



Jones College Solar Panels

Array	South (2014) ¹	North (2018) ²
Number of Panels	186	132
Wattage	50 kW	47.5 kW
Generation per year	~60,000 kWh	60,000 kWh

1. <https://news.rice.edu/2014/12/12/a-bright-future-on-the-roof-of-jones-college/>
2. <https://news.rice.edu/2018/04/16/jones-college-catching-more-rays/>




Carbon Emission





Usual Energy Consumption

- ◀ The average home in the US uses 30 kWh/day
 - ◀ In Texas, 1.16 lbs CO₂ produced for every kWh (2017)
 - ◀ Going off-the-grid, could remove 12,700 lbs of CO₂ annually
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Real World Implementation



California Solar Mandate

- ▶ Beginning in 2020, all new homes will be required to have 2-3 kW
- ▶ Adds \$8,000-\$12,000 to new home
- ▶ 80,000 new homes a year (15,000 currently have solar installation)
- ▶ \$40/month increase mortgage, \$80/month energy savings



California Solar Mandate

- ▶ Won't necessarily catch on in other states
- ▶ Utilities have fought against solar roof mandates



<https://www.gocamsolar.com/blog/solar-panel-snow-removal>

Selling your Solar Powered Home

Homes that have been fitted with solar panels of any kind sell for 4.1% more on average






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Conclusion:

A solar roof is/not worth it



Takeaways

- ▶ Tesla solar roofs are a considerable alternative for harnessing solar energy
 - ▶ There are many considerations to take into account for your home
 - ▶ The benefits of adding solar panels to a normal home in Houston generally outweigh the costs
 - ▶ The people have the power to drive change as much as the government does
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Conclusion:

Do people own homes for long enough
(distinction between retrofit and new home
mandate)?





Questions?

