Module 2: Screening and Identifying PV Projects

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City and County Solar PV Training Program

Learning Objectives

- **Understand the different factors that impact the technical and economic potential of a PV project**

- **Understand the steps of the PV screening process**

- **Understand how to use REopt Lite to screen your site for PV project potential**

PV: photovoltaics

PV Project Implementation Process

Module 1:

Develop your goals and team

Module 2:

Identify Sites and Screen

Module 3:

Complete Detailed Site Evaluation

Module 4:

Decide on a Financial Model and Use all Available Incentives

Module 5:

Issue a request-for-proposals

Drivers of PV Project Potential

Will PV Work for Your Site?

Solar Resource

PV Costs & Incentives

Space Available

Utility Cost & Consumption

Financial Parameters

Solar Resource
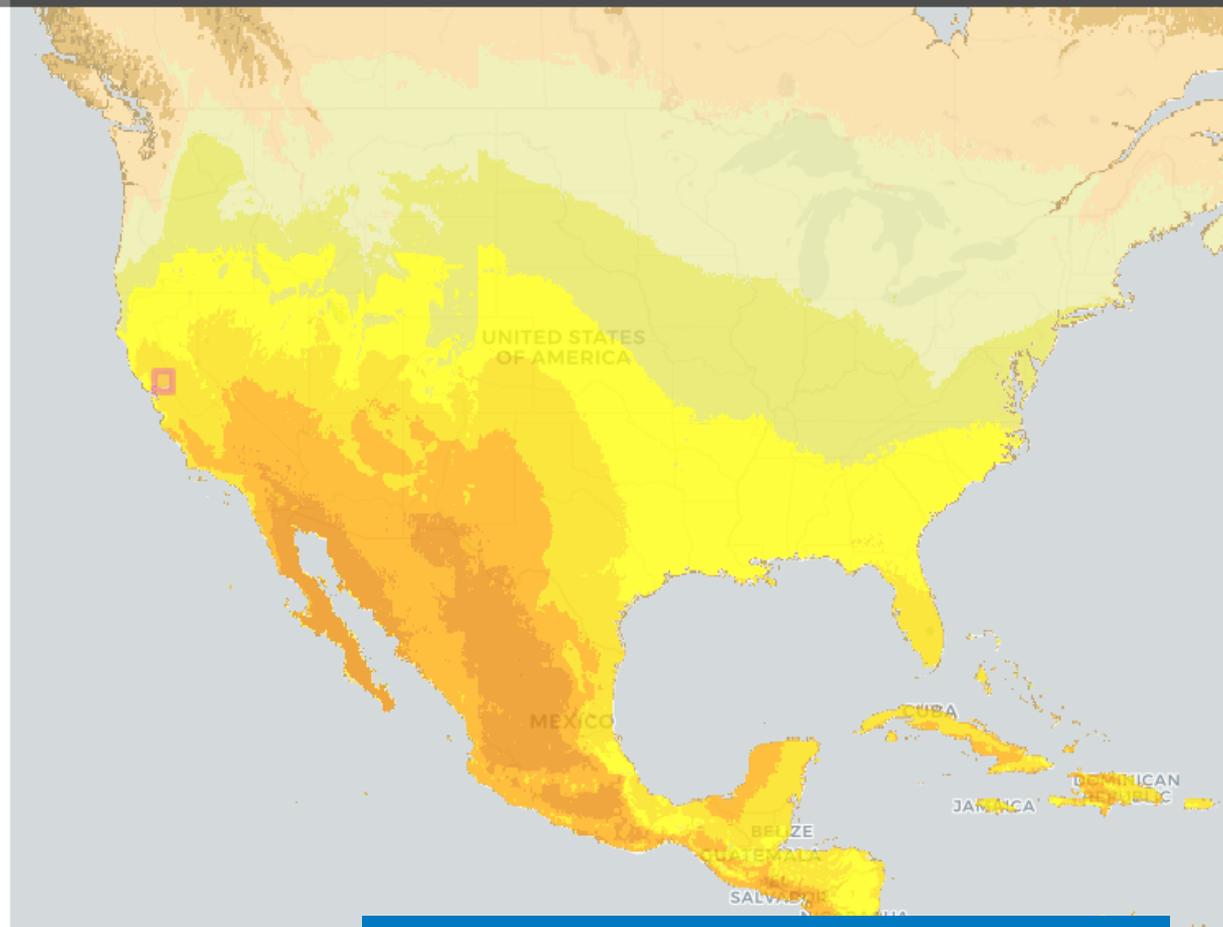
NSRDB: National Solar Radiation Database

Where can I view my solar resource?

NSRDB Viewer
https://maps.nrel.gov/nsrdb-viewer/

Solar Resource

- PVWatts uses solar resource data and energy production models to estimate energy production from PV systems in a given location

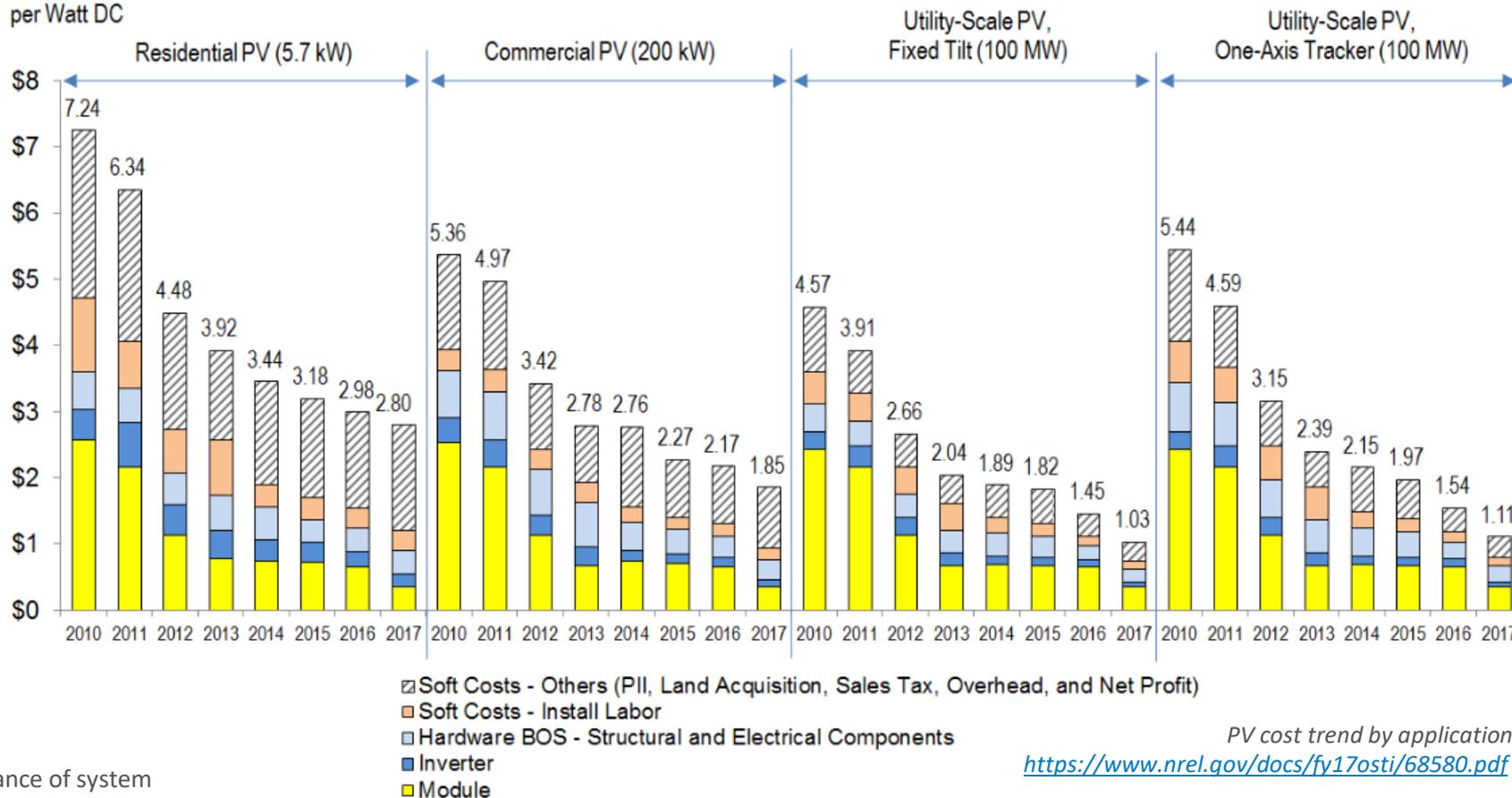- Users enter their location and PV system size in a simple interface

Get Started: Enter a Home or Business Address **GO »**   **HELP** **FEEDBACK**

NREL's PVWatts® Calculator

RESULTS

🖨 **Print Results**

76,392 kWh per Year *

System output may range from 70,961 to 78,646kWh per year near this location.
Click HERE for more information

Month	Solar Radiation (kWh / m^2 / day)	AC Energy (kWh)	Energy Value ($)
January	3.57	4,666	516
February	4.21	4,881	539
March	5.61	7,108	785
April	6.15	7,342	811
May	6.46	7,791	861
June	6.74	7,671	848
July	6.60	7,578	837
August	6.44	7,397	817
September	5.99	6,791	750
October	4.99	6,044	668
November	3.80	4,892	518
December	3.38	4,431	490
Annual	**5.33**	**76,392**	**$ 8,440**

Where can I estimate energy production from PV?

PVWatts
http://pvwatts.nrel.gov/

PV Costs

2017 USD per Watt DC

Residential PV (5.7 kW) · **Commercial PV (200 kW)** · **Utility-Scale PV, Fixed Tilt (100 MW)** · **Utility-Scale PV, One-Axis Tracker (100 MW)**

Residential PV (5.7 kW): 7.24 (2010), 6.34 (2011), 4.48 (2012), 3.92 (2013), 3.44 (2014), 3.18 (2015), 2.98 (2016), 2.80 (2017)

Commercial PV (200 kW): 5.36 (2010), 4.97 (2011), 3.42 (2012), 2.78 (2013), 2.76 (2014), 2.27 (2015), 2.17 (2016), 1.85 (2017)

Utility-Scale PV, Fixed Tilt (100 MW): 4.57 (2010), 3.91 (2011), 2.66 (2012), 2.04 (2013), 1.89 (2014), 1.82 (2015), 1.45 (2016), 1.03 (2017)

Utility-Scale PV, One-Axis Tracker (100 MW): 5.44 (2010), 4.59 (2011), 3.15 (2012), 2.39 (2013), 2.15 (2014), 1.97 (2015), 1.54 (2016), 1.11 (2017)

Legend:
- Soft Costs - Others (PII, Land Acquisition, Sales Tax, Overhead, and Net Profit)
- Soft Costs - Install Labor
- Hardware BOS - Structural and Electrical Components
- Inverter
- Module

PV cost trend by application
https://www.nrel.gov/docs/fy17osti/68580.pdf

BOS: balance of system
PII: personally identifiable information
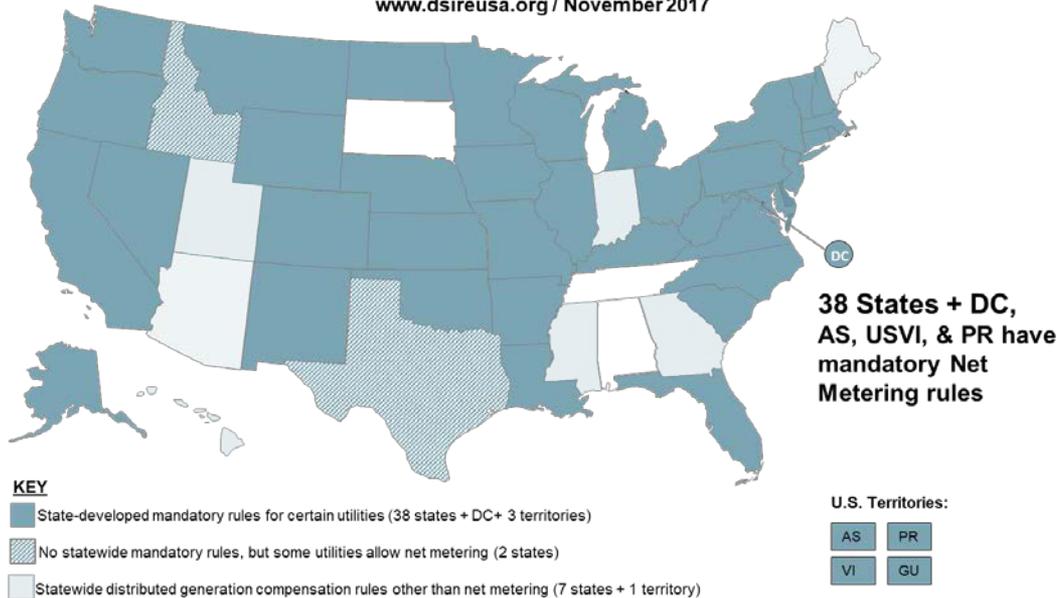
Where can I find information about installed PV costs?

Annual Technology Baseline
https://atb.nrel.gov/

Incentives

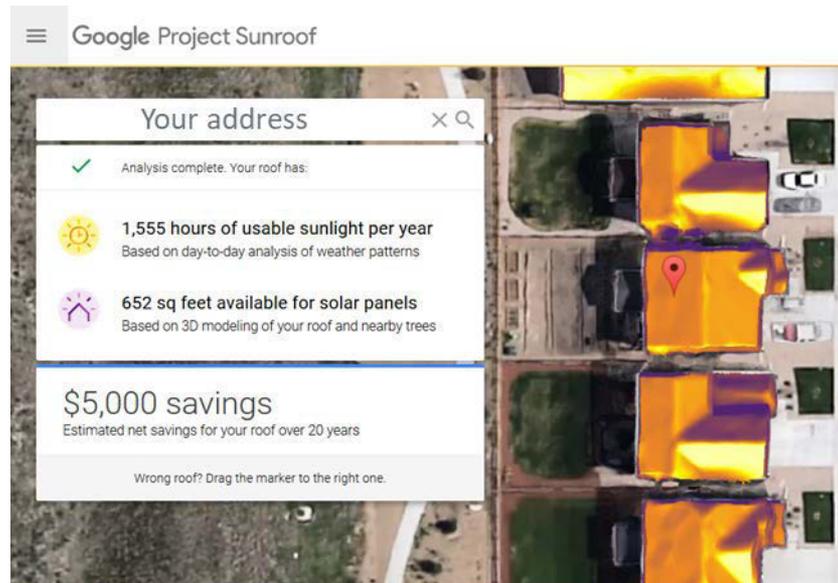| Incentive Type	How they work	Unit
Capacity	Based on the total installed size of the system	$/kW
Production	Based on electricity production	$/kWh
Net metering	Credit if generation exceeds load	kW

Net Metering
www.dsireusa.org / November 2017

38 States + DC, AS, USVI, & PR have mandatory Net Metering rules

KEY
- State-developed mandatory rules for certain utilities (38 states + DC+ 3 territories)
- No statewide mandatory rules, but some utilities allow net metering (2 states)
- Statewide distributed generation compensation rules other than net metering (7 states + 1 territory)

U.S. Territories:
AS   PR
VI   GU

Where can I find information about PV incentives?

DSIRE
http://www.dsireusa.org/

Space Available for PV

Google Project Sunroof

Your address

✓ Analysis complete. Your roof has:

☀ 1,555 hours of usable sunlight per year
Based on day-to-day analysis of weather patterns

☀ 652 sq feet available for solar panels
Based on 3D modeling of your roof and nearby trees

$5,000 savings
Estimated net savings for your roof over 20 years

Wrong roof? Drag the marker to the right one.

Potential Carport PV Area

Potential Roof PV Area

Potential Ground PV Area

Where can I find information about how much PV I can install?

Google Project Sunroof
https://www.google.com/
get/sunroof#p=0

Utility Cost and Structure

Bill Component	How it's billed	How PV can help
Energy Charges	Amount of kWh consumed (can vary by time of day)	PV can reduce the kWh purchased
Demand Charges	Based on highest demand (kW) of the month	PV can reduce the kW if production coincides with monthly peak
Time of Use (TOU) Charges	Energy or demand during certain times are billed at a higher rate	Especially impactful if PV production coincides with higher TOU rates
Fixed Charges	Fixed cost per month	PV cannot offset these

Other types of charges include:
- Minimum charge
- Departing load charge
- Standby charge

Maximum Demand Charge ($)
- > 30
- 20 – 30
- 10 – 20
- 1 – 10
- 0
- No Data
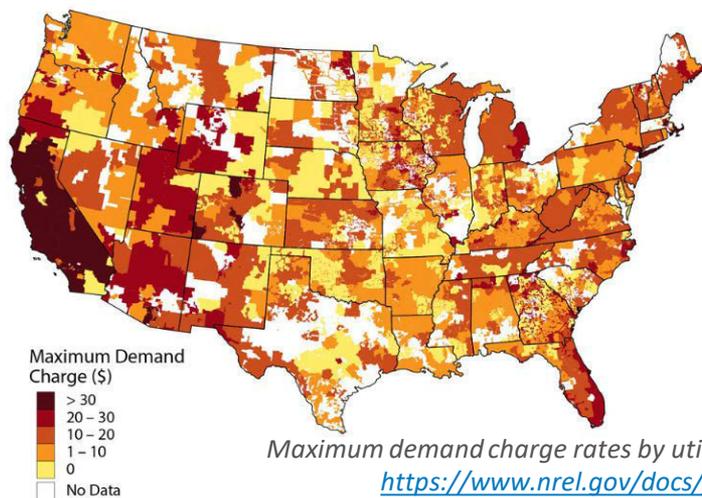
Maximum demand charge rates by utility service territory
https://www.nrel.gov/docs/fy17osti/68963.pdf

Where can I find information about my utility rate?

Utility Rate Database
https://openei.org/wiki/
Utility_Rate_Database

Example: Energy Savings from PV Generation

Legend: PV Serving Load · Grid Serving Load · Electric Load

Y-axis: kW (0, 500, 1,000, 1,500, 2,000, 2,500)

X-axis: Monday, Tuesday, Wednesday, Thursday, Friday, Saturday, Sunday
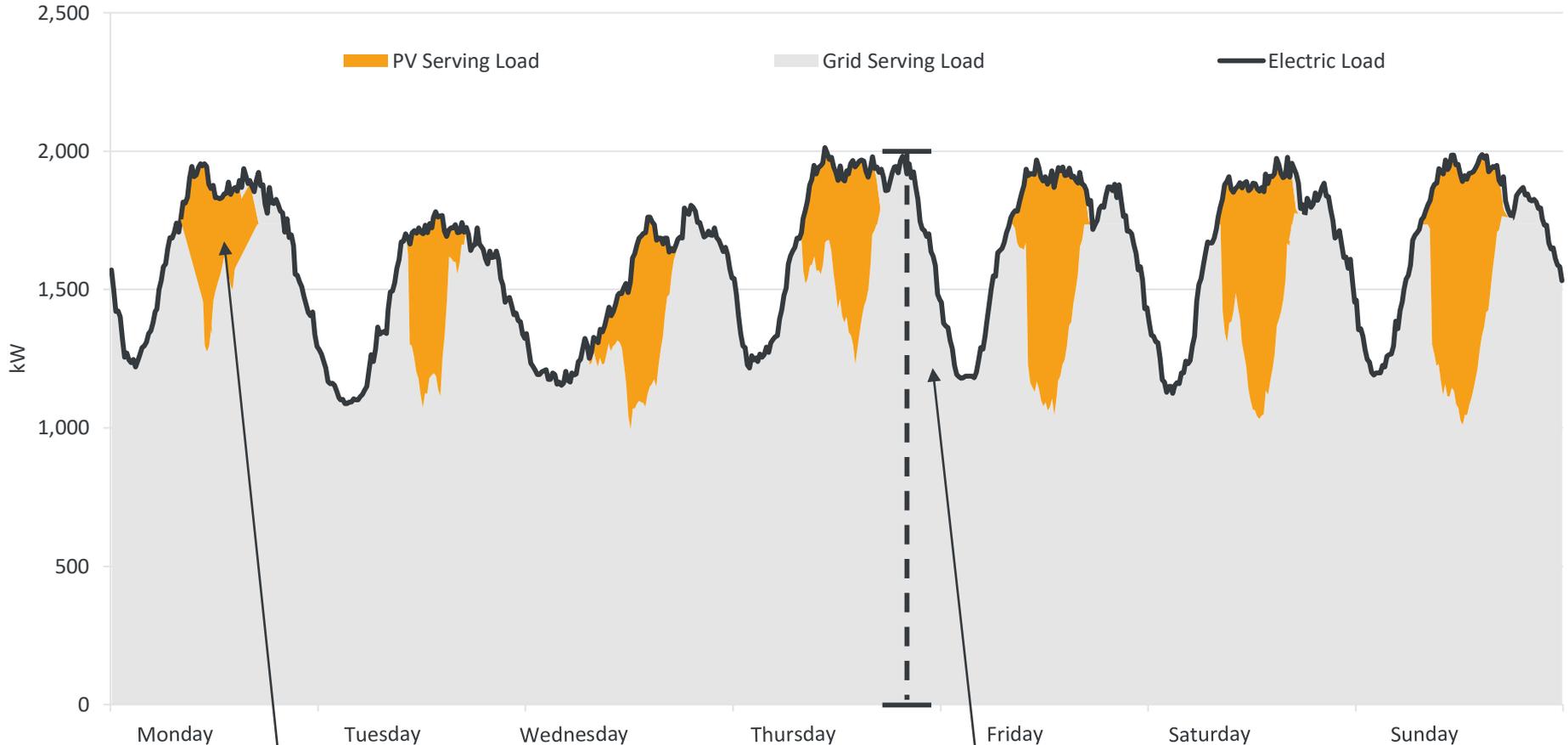
∫ **Energy cost: Area under curve**
PV offsetting energy use

Demand cost: Max height
PV not offsetting max demand

Example: Demand Savings from Battery Storage
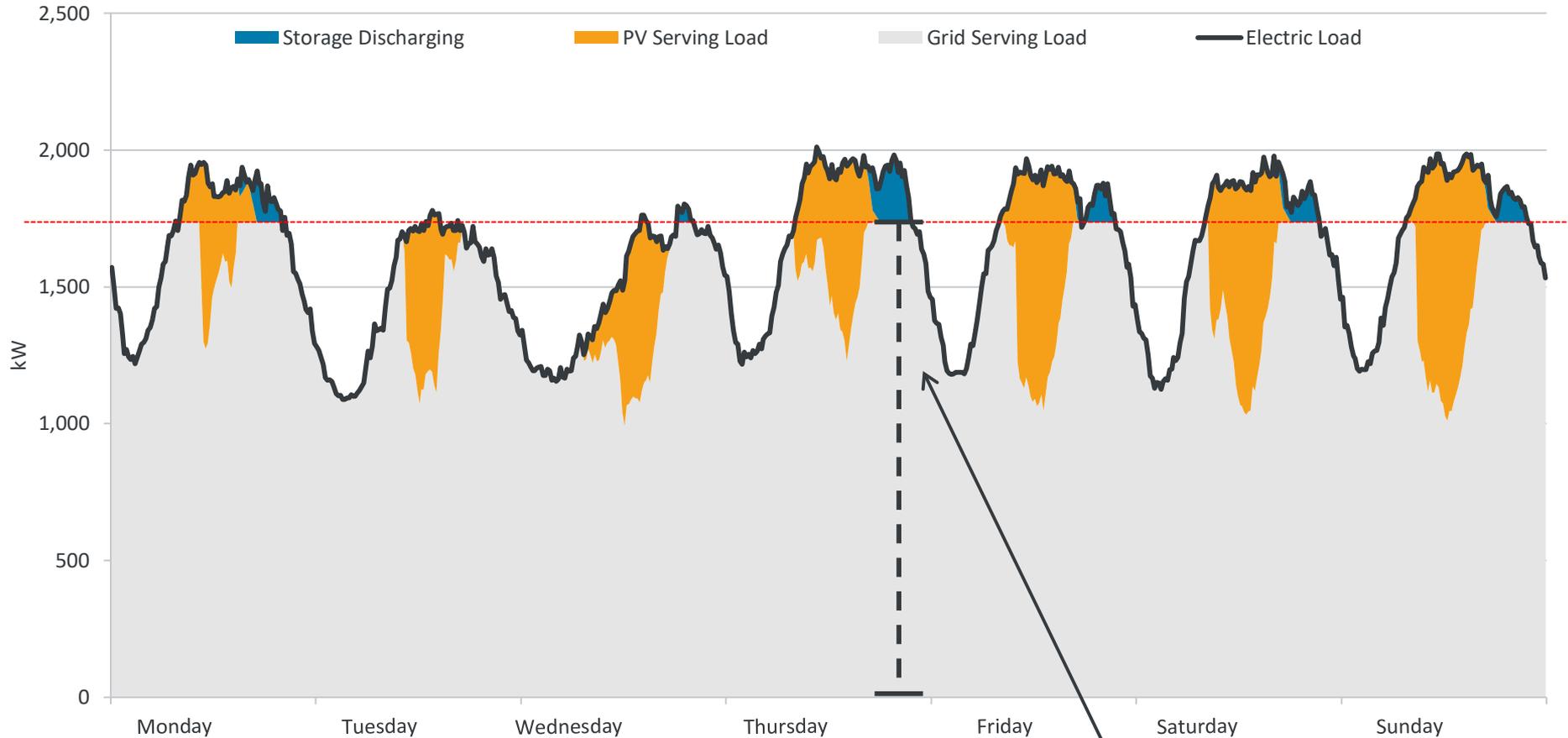
A battery, along with PV, can be used to lower demand costs

Financial Parameters

Parameter		Impacts on PV
Inflation Rate	General expected inflation rate	Future O&M costs
Utility Cost Escalation Rate	How electricity costs are expected to change	Costs that PV is offsetting
Discount Rate	Cost of money	Financing costs

Energy Cost Escalation Rate Impact of Future Electricity Costs

EIA High

EIA Reference

$0.093/kWh–
$0.152/kWh

EIA Low

AEO: Annual Energy Outlook
EIA: Energy Information Administration
O&M: operation and maintenance
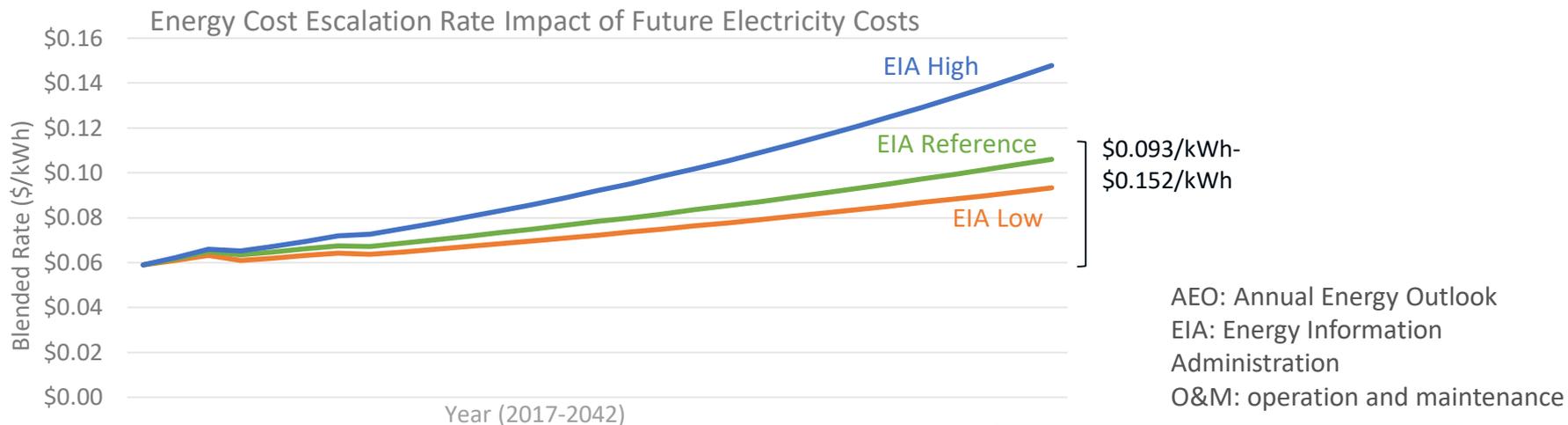
Where can I find information about my financial parameters?

EIA
https://www.eia.gov/
outlooks/aeo/

PV Screening Process

PV Screening Steps

1. Define goals of analysis

2. Collect and review data

- **Start with readily available data**
- **Obtain more detailed data if project appears feasible**

3. Run analysis

- **Adjust data and analysis goals if needed**
- **Run additional iterations to refine analysis**

Iterative process

4. Identify sites for more in-depth assessment

Purpose and Uses of Screening Results

- The purpose of a screening is to:
  - Quickly and efficiently down-select to viable technologies and sites
  - Reduce potential costly investments of time and money in unlikely projects

- An initial screening provides:
  - Go/no-go decisions
  - Indicator of technical and economic viability

- An initial screening *doesn't* provide:
  - Final answers
  - Investment-grade audit results

Tools That You Can Use

PV analysis tools take into account the factors that impact project potential

Publicly available tools can be used to gauge initial potential, optimize system sizing, and refine project economics

	Expertise and Effort Needed	Required Inputs	Key Outputs
Distributed Generation Screening Maps	Low	• Location	• Map interface with geospatial layers • High-level economics
PVWatts Calculator	Low	• Location • System configuration	• PV energy generation (no economics)
REopt Lite Web Tool	Medium	• Location • Energy consumption • Rate tariff	• Optimized system size and dispatch • High-level economics
System Advisor Model (SAM)	High	• Energy consumption • Rate tariff • Detailed system configuration • Financing inputs	• Detailed technology performance • Detailed economic modeling

PV Screening Process using REopt Lite

See Separate Video

Thank You

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www.nrel.gov

This presentation was recorded as part of NREL's City and County Solar Photovoltaics Training Program. To hear the recording, please visit: https://www.nrel.gov/technical-assistance/local-governments.html.

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