HOUSTON PUBLIC WORKS

Green BUILDING RESOURCE CENTER

GBRC ONLINE EDUCATION EVENT
IN PARTNERSHIP WITH USGBC TEXAS

OUTDOOR POWER REIMAGINED: A WIRELESS SOLAR SOLUTION

SPEAKER

Jeremy Sigmon
Sales Director, PowerStack USA

The clean energy economy, decarbonization, net-zero buildings, and smart cities each rely on clean, reliable, and distributed energy. Jeremy Sigmon, formerly of the U.S. Green Building Council and now with Texas-based manufacturer PowerStack, is working with designers, contractors, and landowners to deploy an emerging, attractive, resilient solution for outdoor power supply in a slender profile known as "Vertical Solar." He will provide an overview and update on solar power diffusion in the marketplace, discuss wireless and off-grid technologies, and illustrate the various industry challenges that the PowerStack is designed to overcome as a compelling option for enabling the deployment of outdoor services in smart cities and communities.

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+13462487799,,99176573196#,,,,*806653196# US
DATE/TIME: NOVEMBER 16 | 12PM

TO RSVP: STEVE.STELZER@HOUSTONTX.GOV
OR CALL 832.394.9050
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Solar re-imagined

Learning Objectives:

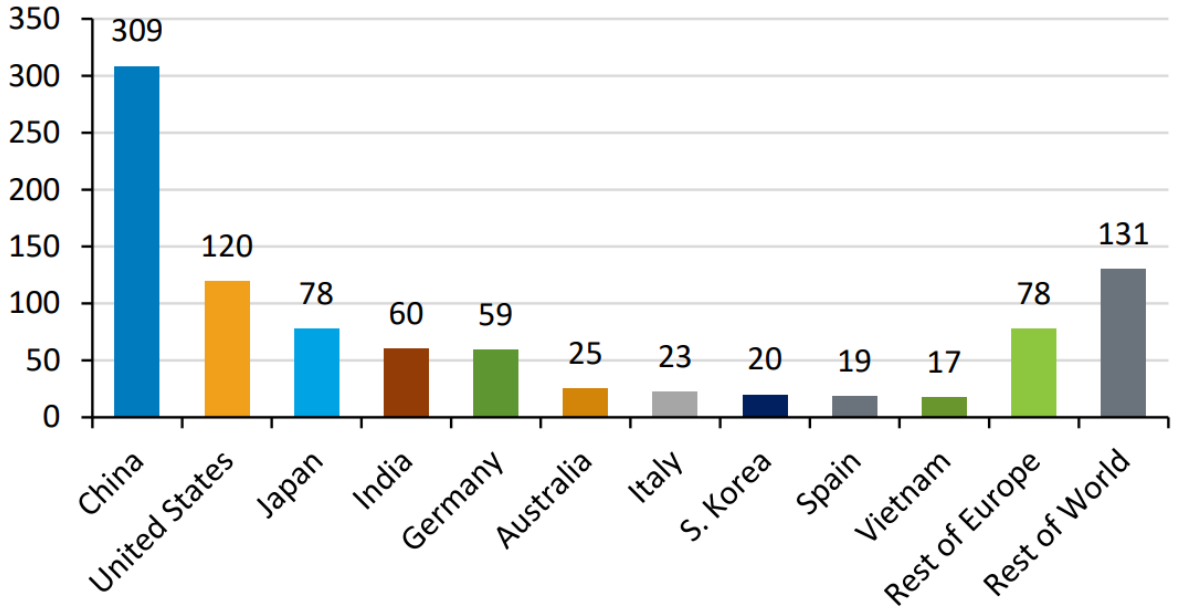
1. Identify trends in solar energy deployment
2. Describe challenges to deploying “smart” technology infrastructure
3. Outline benefits of and challenges to common off-grid solar solutions
4. Characterize “vertical solar” and its benefits for civic infrastructure

Identify trends in solar energy deployment

The USA is an important global player

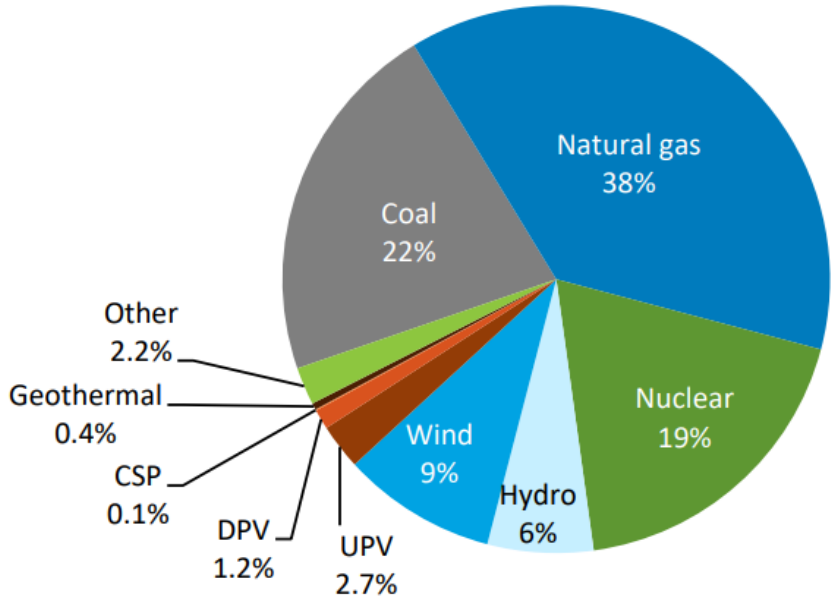
- US solar capacity continues to grow (now ~4% of annual generation), representing 44% of new generation in 2021, with declining investments in new fossil fuel generation
- Carbon-free electricity is currently 39% of US generation, half of which is nuclear

Cumulative PV Deployment, 2021 (939 GWdc)



Source: IEA, Snapshot of Global PV Markets: 2022 in NREL, Spring 2022 Solar Industry Update

2021 US Generation (Total 4,165 TWh)

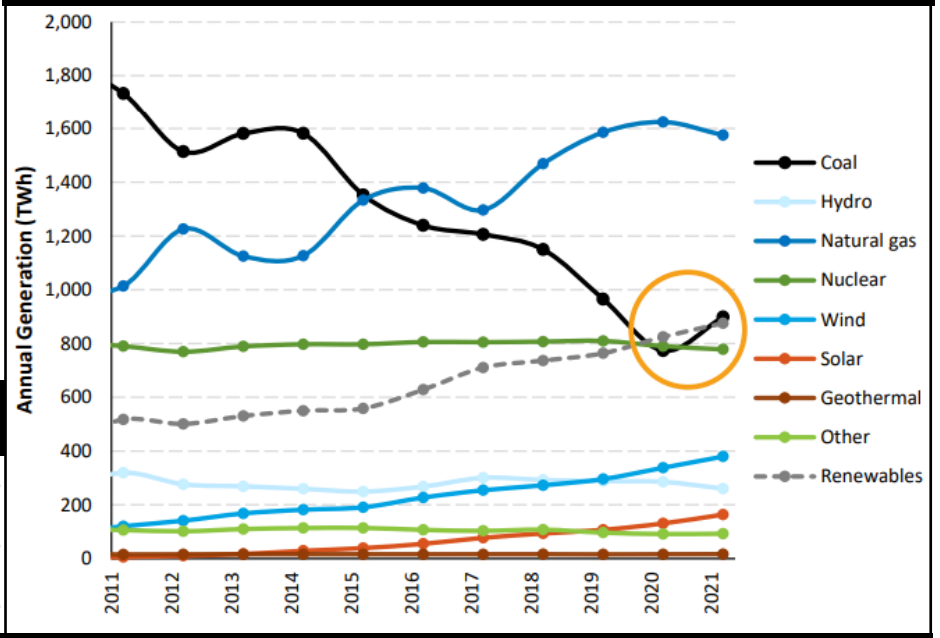


Source: EIA, "Electric Power Monthly" Tables 6.1, 6.1A, February 2022, "Electricity Data Browser," April 5, 2022 in NREL, Spring 2022 Solar Industry Update

But other nations lead the field

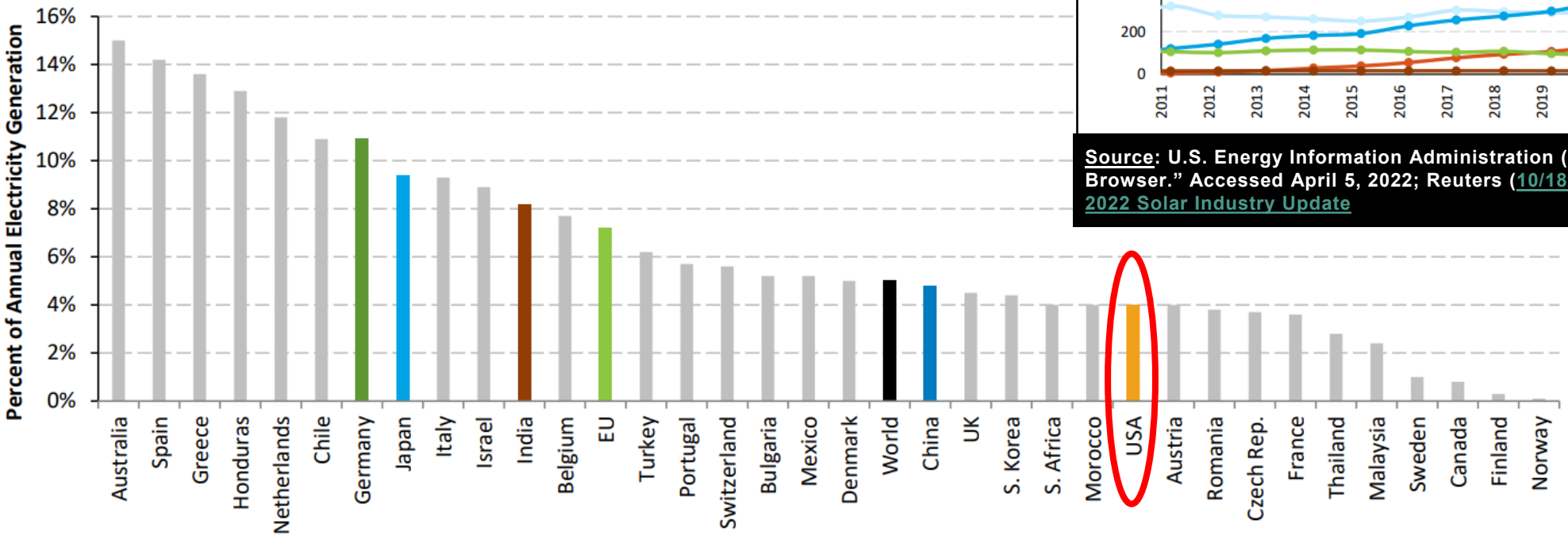
- Despite major development, current growth, and abundant solar resources, the US has a long way to go to provide a greater percentage of its electricity from solar

US Generation (2011-2022)



Source: U.S. Energy Information Administration (EIA), "Electricity Data Browser." Accessed April 5, 2022; Reuters (10/18/21) in NREL, Spring 2022 Solar Industry Update

Global Solar Deployment (% of National Electricity Generation 2022)

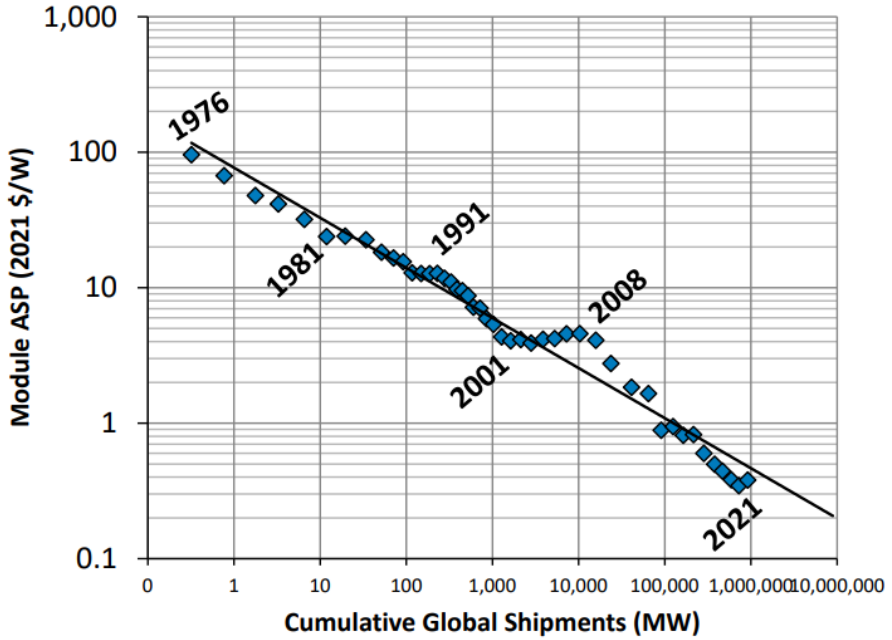


Source: IEA, Snapshot of Global PV Markets: 2022 in NREL, Spring 2022 Solar Industry Update

Prices continue to fall while generation climbs

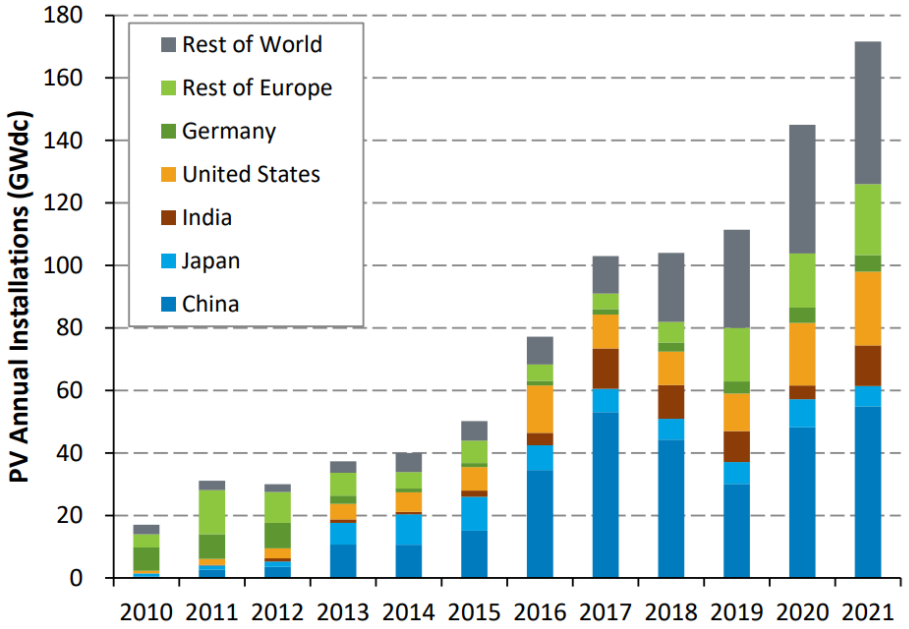
- As global solar deployment has increased, the average selling price (ASP) has declined, now below $0.50 per watt. When deployed, prices can be as low as $3 per installed watt (residential) or $1.75 per installed watt (utility)
- Global solar deployment continues to grow (esp. in China) and clean domestic power is more geopolitically urgent

"Swanson's Law" / PV Experience Curve



Source: SPV Market Research. Report SPV-Supply10. April 2022. in NREL, Spring 2022 Solar Industry Update

Global Annual PV Capacity Additions by Country

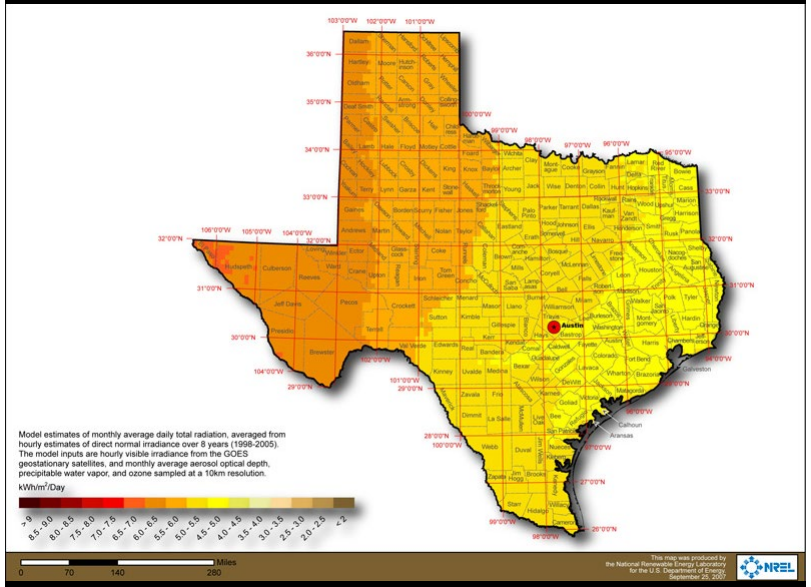


Source: IEA, Snapshot of Global PV Markets: 2022 in NREL, Spring 2022 Solar Industry Update

Texas has sun (and knows how to use it)

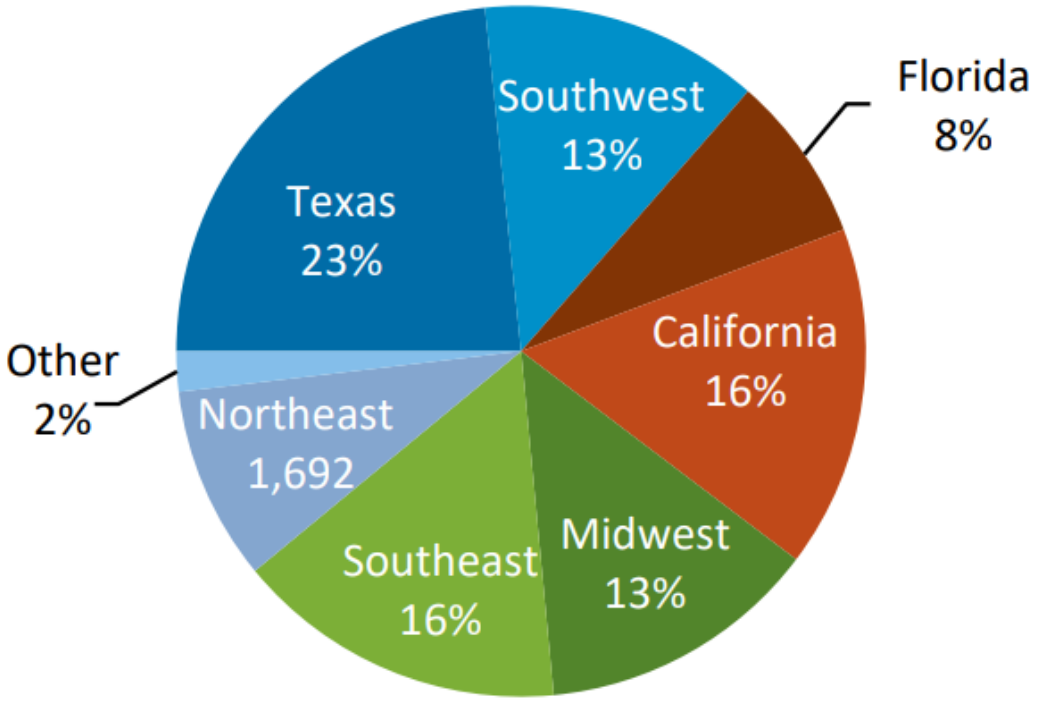
- As the U.S. pushes towards decarbonizing the power sector and the economy, vast new investment is needed in renewable energy technologies and storage.
- The Inflation Reduction Act promises $300+ billion into renewable energy, efficiency, and infrastructure – including solar + storage.
- Recent figures show Texas is the biggest growth market for solar – primarily large, utility-scale installations.

Solar Radiation at Latitude Tilt (Texas)



Source: NREL Geospatial Data Science – Solar Resources Maps and Data.

2021 US PV Installations by Region (18.6 GWac)



Source: EIA, "Electric Power Monthly," forms EIA-023, EIA-826, and EIA-861 (April 2022, February 2021, February 2019). in NREL, Spring 2022 Solar Industry Update

And countless off-grid outdoor power systems, too

- Thousands (maybe millions) more small-scale, off-grid PV systems may be uncounted across the country
- Common deployments:
  - **Traffic signage**
  - **Temporary systems**
  - **Remote gate entry**
  - **Green retrofits**
  - **Smart city applications**
- Smart city technology is in high demand…

Source: PowerStack USA

Describe challenges to deploying “smart” technology infrastructure

Smart City Infrastructure

Cities and communities are demanding new technologies to improve the operations and livability of their spaces.

Safety	Improved lighting, security and emergency response
Connectivity	Facilitating connectivity nodes for Wi-Fi, fixed wireless and IoT gateways (LPWAN and NB-IoT)
Environment	Air quality monitoring, energy use optimization, and flood / fire detection

Where there is reliable and abundant power supply, these technologies can be powered by the grid, however **not all locations are electrified or accessible for grid power**.

Powering smart technology is often not smart

Running traditional outdoor power to new locations is **slow, expensive and typically utilizes dirty grid power**.

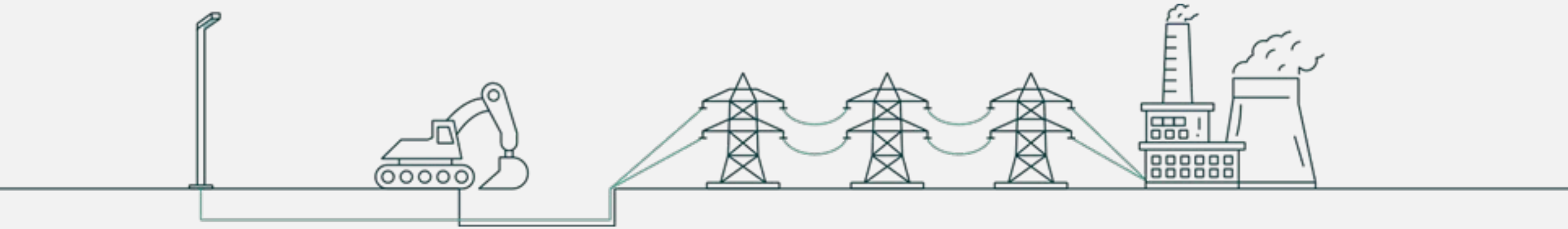
While hard-wiring AC power makes sense in some applications, for low-power uses outdoors away from existing power, these traditional methods require **excessive time, material, and skilled / licensed labor**.

30-50%

of project costs are in trenching and wiring

90%+

of time of project time waiting for permits and trenching cable



Lower power technology means more is possible

More is possible today than ever before with low DC voltage

Factors driving down power consumption include:

- **Low-power hardware** – sensors and devices
- **Event driven activity** vs. constant-on
- **LED lighting**
- **Edge computing** – back hauling data for processing

Outline benefits of and challenges to common off-grid solar solutions

Off-grid power makes good sense

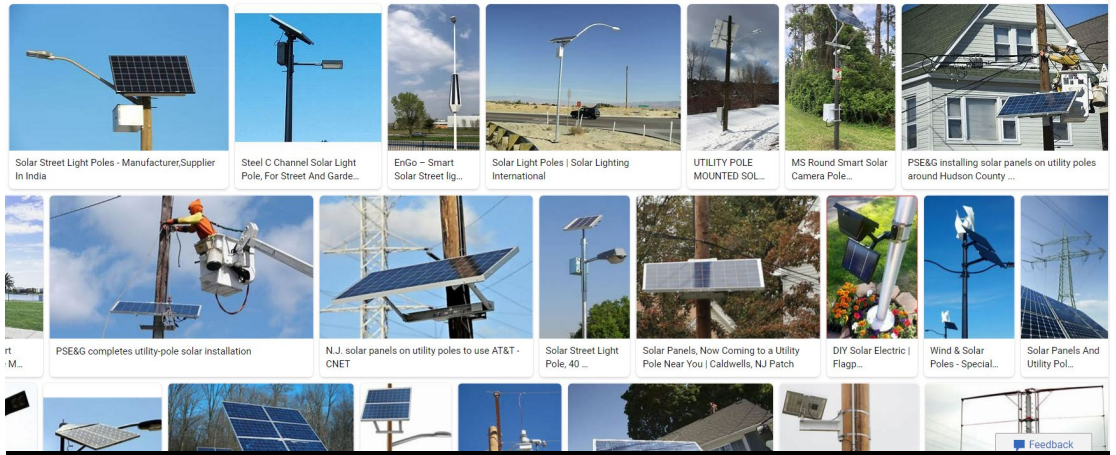
The choice for outdoor power loads is clear:

GO SOLAR (plus storage)!! Either ground-mounted or pole-mounted

Benefits

- No trenching or overhead wires
- No time or expense with utility interconnections
- A right-sized system for low-power needs
- Up when the grid is down
- No utility bills
- A fully-owned asset with low maintenance
- Demonstration of sustainability commitment

Source: ActivSolar via Flickr Creative Commons.

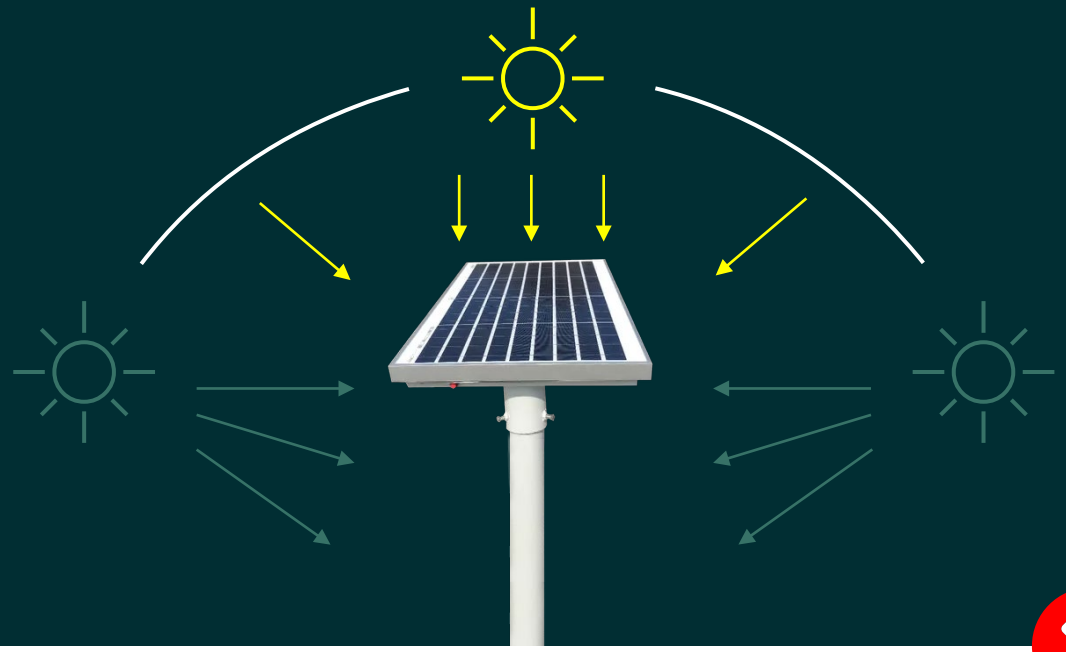


Source: Google search for “solar pole” via Google.

Traditional Solar Poles

There’s room for improvement!

Tilted solar panel designs require a singular orientation and plane of array, **compromising aesthetics** and **limiting effectiveness** in low-angle winter sunlight.



we can do better

Solar batteries and panels are **not integrated** , requiring site assembly **heavy machinery** to install and maintain

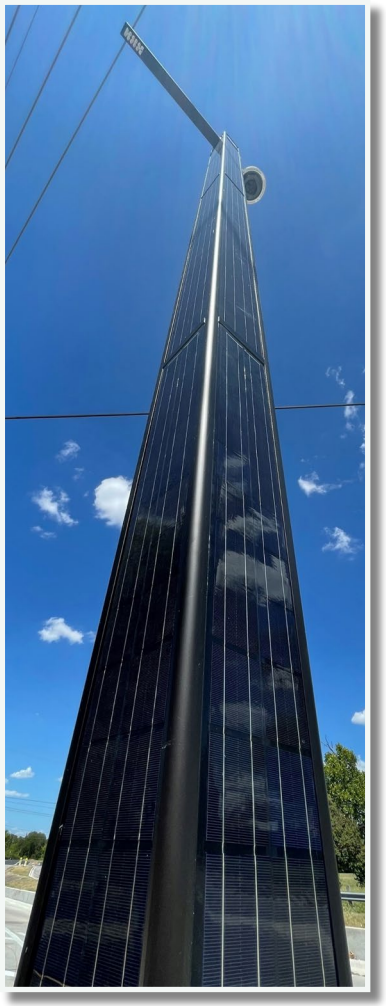
Mounted solar panels act as a **wind sail** , increasing camera deflection levels and requiring larger foundations

Exposed components and fixed angle panels put traditional pole-mounted solar systems at risk of **damage and vandalism**

Minimal battery back -up (typically 1-3 days provided) and a **3-5 year warranty**

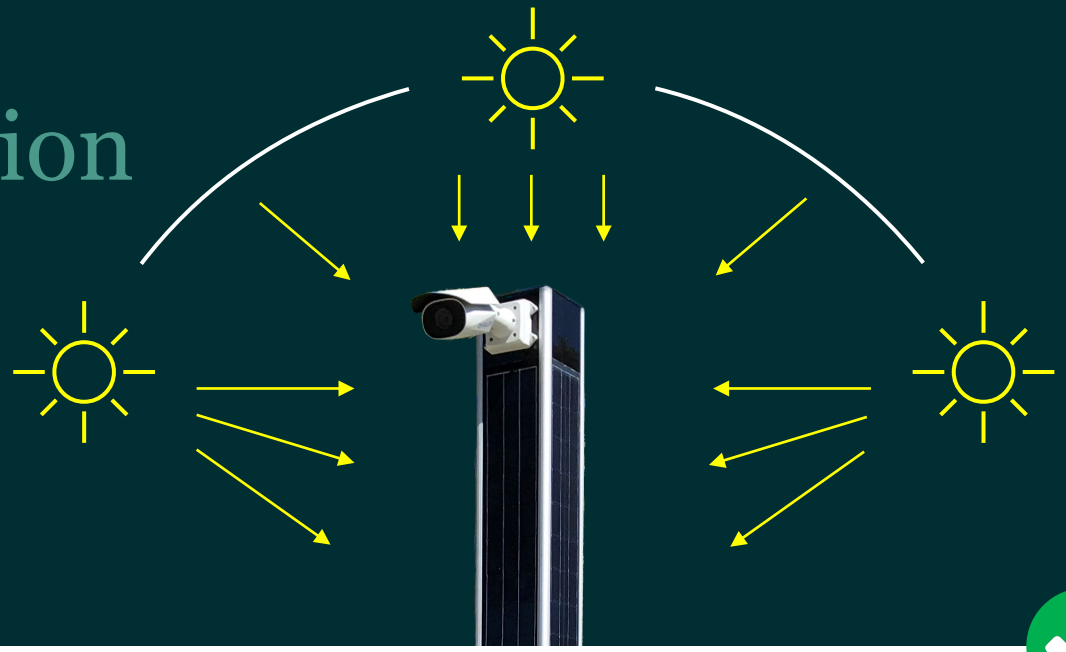
Characterize “vertical solar” and its benefits for civic infrastructure

Introducing Vertical Solar



Optimizing Form + Function

Vertical, architectural design seamlessly integrates with its surroundings



optimized!

100% solar energy generated through **vandal resistant** solar panels

Capturing the sun from any angle allows for **universal integration** into any site

5 day battery back-up and **10 year warranty**

Slender system can withstand winds up to 155mph, minimizing camera deflection

Simplified compliance and ESG benefits

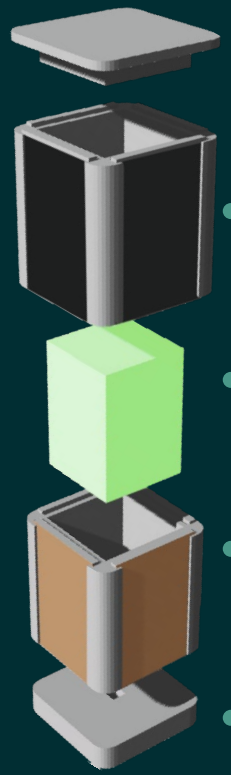
LOWER PERMIT BURDEN:

- In many jurisdictions, an electric permit is not required for systems < 50 watts and < 50 volts.
- PowerStack is made in the USA (Buy America) with UL-listed components.
- Construction permit may depend on pole size and new foundation requirements.
- Permits are always encouraged where relevant. Consult your local contractor and building department!

APPLICABLE LEED CREDITS:

- **Sustainable Sites:** Light Pollution Reduction
- **Energy + Atmosphere:** Renewable Energy (incl. possible incentives)
- **Materials + Resources:** Building Lifecycle Impact Reduction
  - Concrete-free foundation. No trenching, wire, conduit, or heavy machinery for wiring traditional outdoor systems away from existing power supply.
- **Integrative Process:** Innovation
  - Novel means of reducing site impact and costs through fully off-grid durable and resilient solar-powered pole for outdoor loads.

Modular system

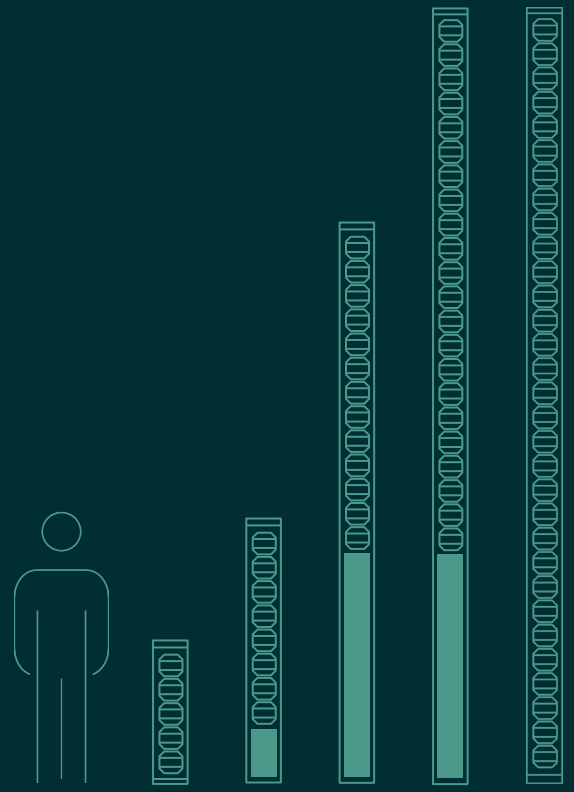


Solar Power Modules

Modular Battery Units

Spacer Modules

Base Unit



3’ tall - - - - - - - - - - - - 25’ tall

PowerStack’s modular design allows for easy configuration to any location on Earth.

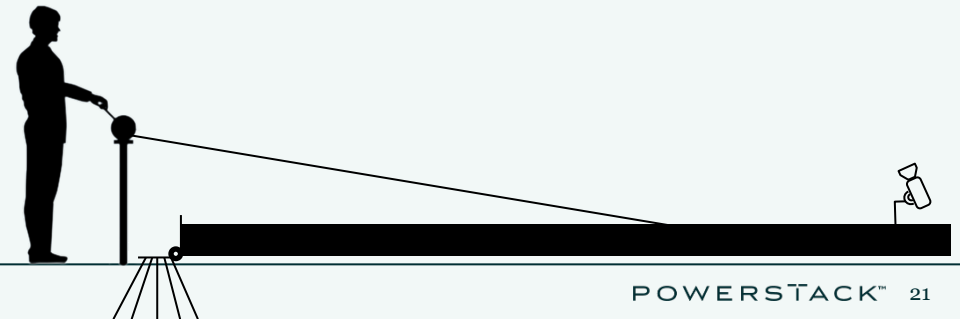
Our software tools can quickly determine the best configuration for the power needed at specific locations.

Easy installation + service

Powerstack poles (including foundations) can be installed in under 1 hour (the record is 28 mins) saving time and money on projects.

The proprietary hinge base plate design means poles up to 25ft can be raised and serviced without heavy machinery. Installation and service workers remain safely on the ground.

1. Base plate secured to the ground with taproot system and hand-held jackhammer
2. PowerStack unit winched into vertical position and anchored to base plate
3. PowerStack is ready!




CAUTION
Legal Graffiti Art Wall
Significant risk of overspray onto vehicles.
OWNERS PARK CARS HERE AT OWN RISK.
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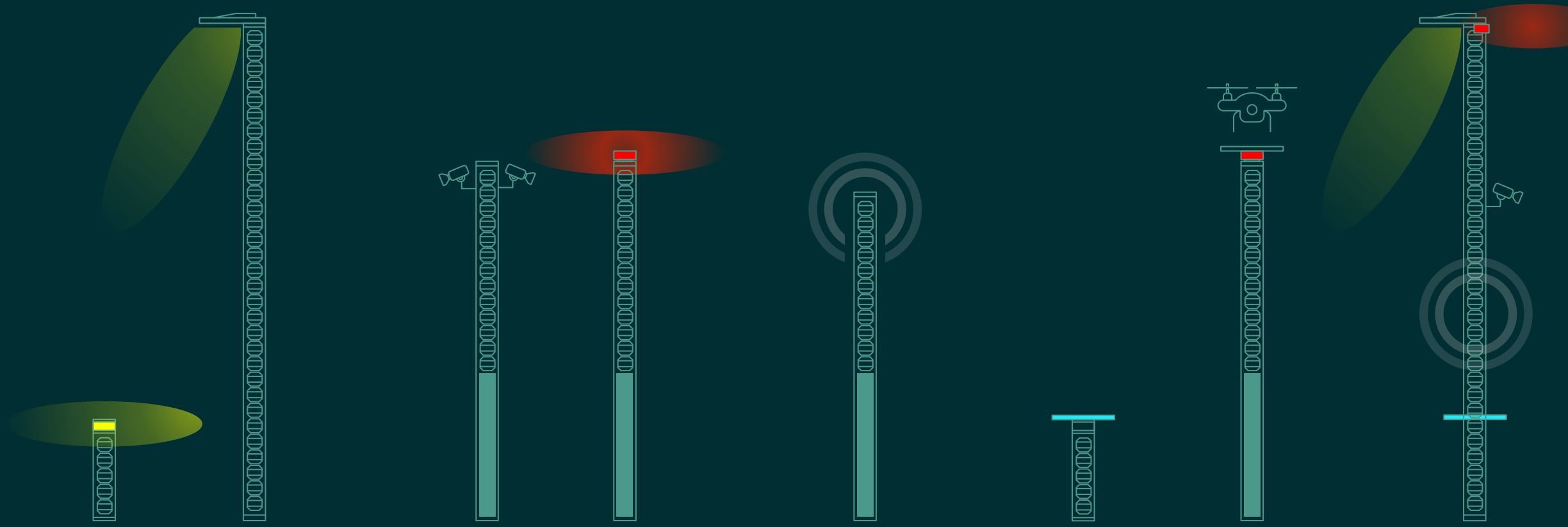
Many outdoor power applications available



Bollards
Street lighting
CCTV
Security + environmental sensors
WIFI & wireless networking
Device chargers
Drone nests
Combined solutions

Light
Monitor
Connect
Charge

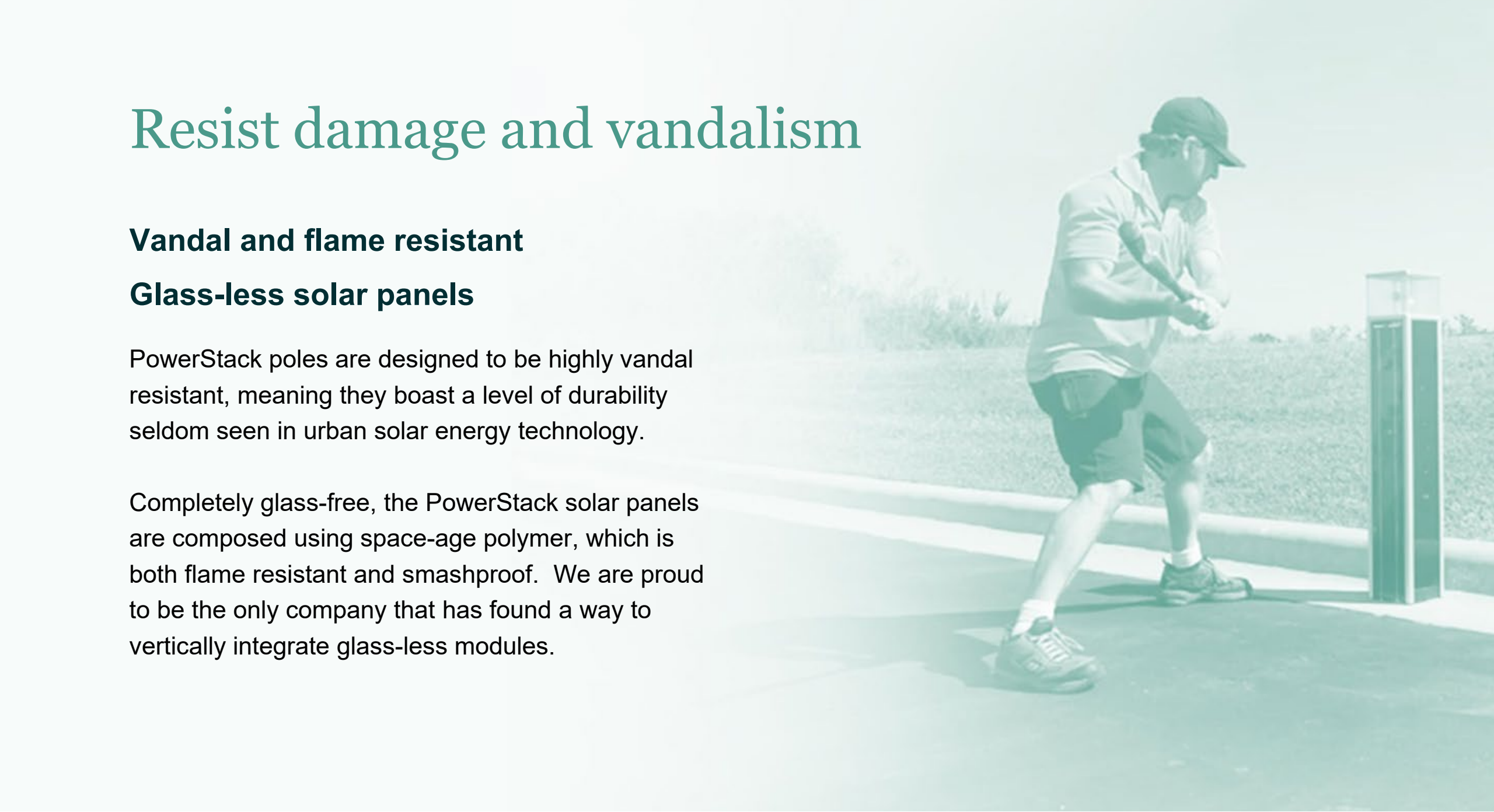
Resist damage and vandalism

Vandal and flame resistant

Glass-less solar panels

PowerStack poles are designed to be highly vandal resistant, meaning they boast a level of durability seldom seen in urban solar energy technology.

Completely glass-free, the PowerStack solar panels are composed using space-age polymer, which is both flame resistant and smashproof. We are proud to be the only company that has found a way to vertically integrate glass-less modules.



A new PowerStack in Houston

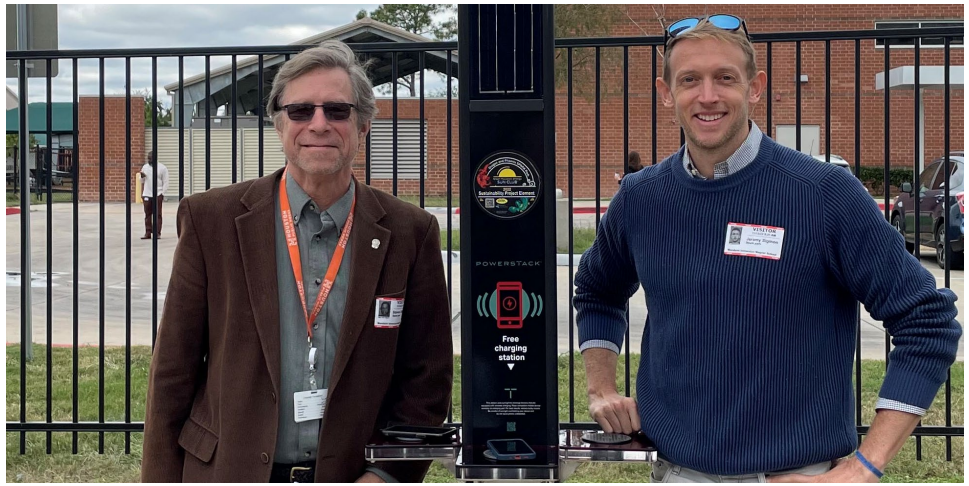
Houston SPARK School Park Program

PowerStack is proud to support the Houston SPARK Park initiative in its mission to help public schools develop their playgrounds into public parks for the community.

Features and Benefits:

- 4-port wireless charging station
- 20-minute installation
- Vandal- and flood-resistant
- < 50 W, < 50 V, requiring no electrical permit
- Customer-designed label
- Popular with adults and children!

November 15, 2022



Dragon dancers and SPARK support team at Mandarin Immersion School – including Steve Stelzer of the Houston Green Building Resource Center

Houston Councilmember Edward Pollard

PowerStack saves on life-cycle costs

Up to 50% more cost-effective
over a 20-year lifecycle

With PowerStack, you can **slash time and money** on your next project. Eliminate digging and trenching, a concrete foundation, and heavy machinery for installation and service. With system reliability and a 10-year warranty, the PowerStack solution offers **compelling savings compared to traditional hard-wired AC power** installation for lighting, security, telecom, and/or other IoT devices.

Case Study: Austin, TX *	AC pole	PowerStack
Product (pole, foundation, fixture)	$129,000	$202,000
Installation	$142,000	$5,000
Project Management	up to 150 days (or 5 months)	up to 30 days (or 1 month)
20-yr Maintenance	$100,000	$52,000
Total 20-year lifecycle cost	**$371,000**	**$259,000**

** Indicative, based on 25-pole installation of 20 ft light poles to power LED lights over 1 mile of roadway. Detailed version available.*

PowerStack saves time and money

Case Study Overview:

A customer requires 25 poles to provide roadway lighting every 195 feet for 1 mile near Austin, Texas. A 4,200 lumen LED light (30 watts) will run at full brightness all night, year-round, from a 20' pole. The fixtures to be powered are Acuity Lithonia LED fixtures. The customer evaluates the lifecycle costs of a traditional, hard-wired AC power pole with the PowerStack system.

ASSUMPTIONS	
Number of poles installed	25
Spacing (in feet)	195
Pole height (in feet)	20
Hourly labor rate	$100
Price per kWh	$0.1250
Wattage of LED fixture	30
Lumens of LED fixture	4200
Nightly run-time of LED fixture (in hours)	12

What can PowerStack power?

Connect

Deployed communications

Charge

Mobile device recharging

Monitor

Total-site monitoring

Light

Illuminating critical areas

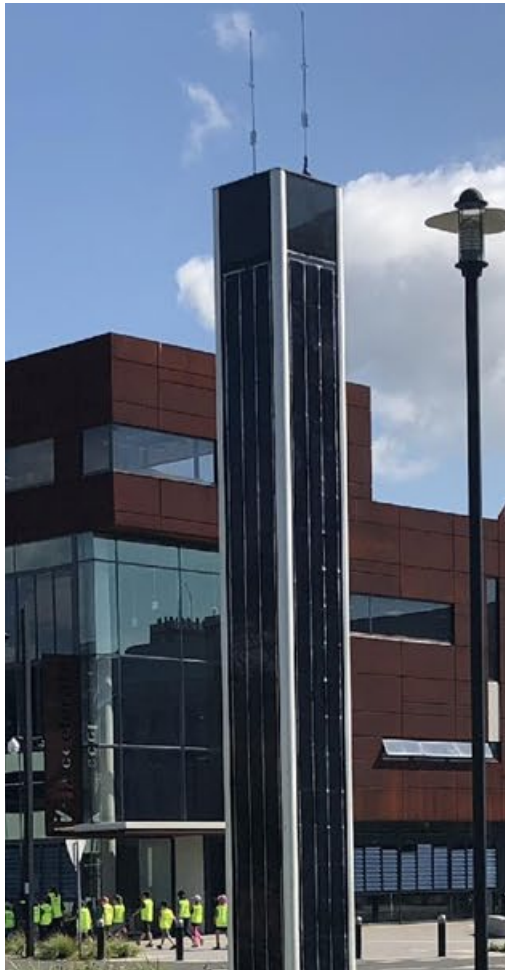
Street lighting

Pathway and parking lot lighting

Bollard lighting

CCTV and data analytics

WiFi hot spots with 4G connections



Device charging

PowerStack in Texas and beyond

- Ask your designer or contractor for PowerStack.
- Find us in Dripping Springs, online at powerstack.energy/usa
- Or visit our many examples deployed in the field, including:


DRIPPING SPRINGS, TX


AUSTIN, TX


WACO, TX


HOUSTON, TX


HOUSTON, TX


ANGLETON, TX

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