Siting Solar Without Cutting Down Trees

Griztko Erickson

AMP and Lexington, Massachusetts

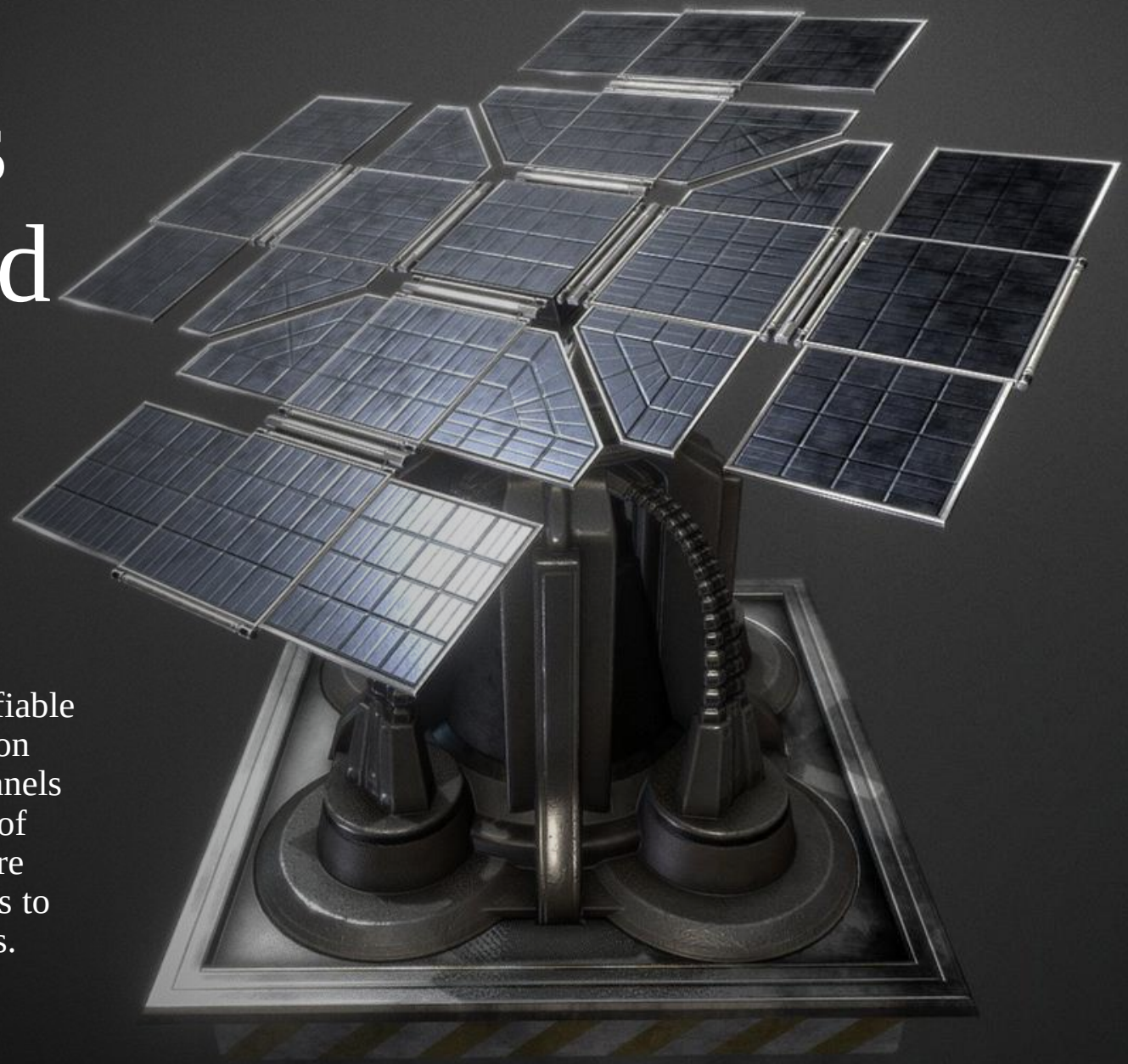
- This project starts with the AMP’s Proposal to Lexington to be the anchor in a community solar deal
- The project would have required a 10-acre deforestation and was backed with claims that solar panels have a better climate change value than trees
- Better climate change value refers to the decrease in emissions from losing dependency on fossil fuels being greater than the carbon that 10-acres of forest would sequester.

Is it Just about the Carbon Value?

Trees offer much more than their functionality as carbon sinks

- Trees sustain both habitats and biodiversity (a 2019 study from the UN’s Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services suggests 1 million plant and animal species worldwide face extinction)
- Trees provide urban cooling and flood control
- Prevent erosion
- Filter toxins from the air and water
- Provide natural resources
- Raise property values

Do Trees really need to be cut down?



Forests offer vital and unquantifiable benefits aside from just carbon sequestration. Because solar panels can be fitted on many kinds of impervious surfaces, there are functioning, viable alternatives to deforestation for solar farms.

DOER Model Zoning Bylaw

- According to Mass Audubon: “In recent years, more than 25% of all new solar arrays were large-scale ground mounted arrays on former forests or farmlands.” At this rate, more than 100,000 acres of land will be converted.
- DOER Model Zoning Bylaw discourages solar siting in locations that result in land or natural resource loss, such as farm and forest land. This is because of the environmental benefit of trees.
- Not only is it environmentally beneficial to look at solar siting alternatives, but our bylaws also encourage it.

Highways and Roads

- Highways and roads offer an empty space for solar panels but, unfortunately, they have their pros as well as their cons.
- Solar fitted on to highways and roads is often susceptible to weather damage and car accidents.
- However, there are ways to circumvent these negatives

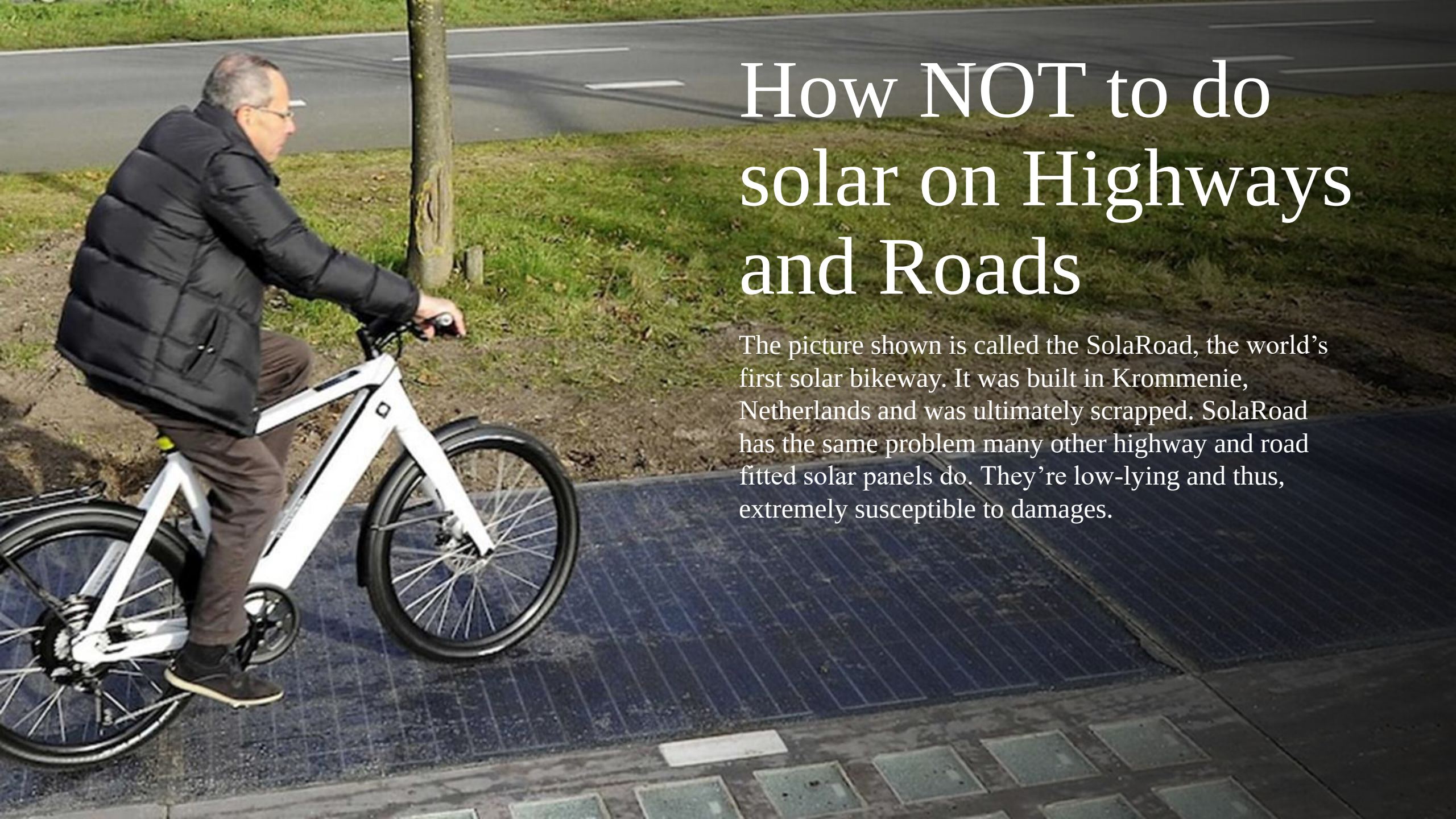
PV-SÜD initiative

- Conceptual solar-highway system based in Austria, Germany and Switzerland
- Solar panels are fitted as a canopy over the highway to avoid damage from weather and car accidents.

Daejeon-Sejong bike path

- 20-mile bike path in South Korea running from Daejeon to Sejong.
- Bike lane is fitted in between the highway lanes.
- Generates 50 kwh per square meter annually

Daejeon-Sejong bike path: Another Angle



How NOT to do solar on Highways and Roads

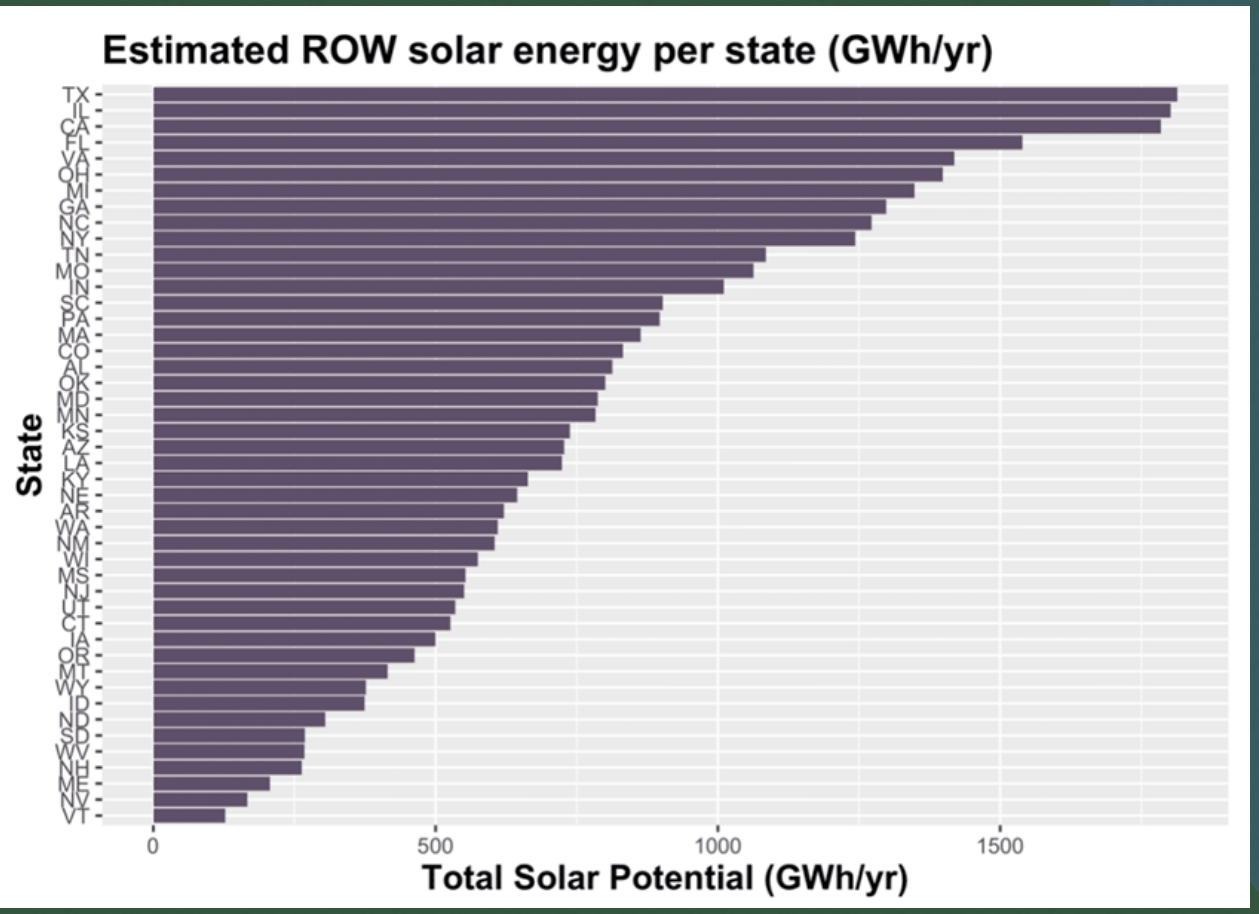
The picture shown is called the SolaRoad, the world’s first solar bikeway. It was built in Krommenie, Netherlands and was ultimately scrapped. SolaRoad has the same problem many other highway and road fitted solar panels do. They’re low-lying and thus, extremely susceptible to damages.

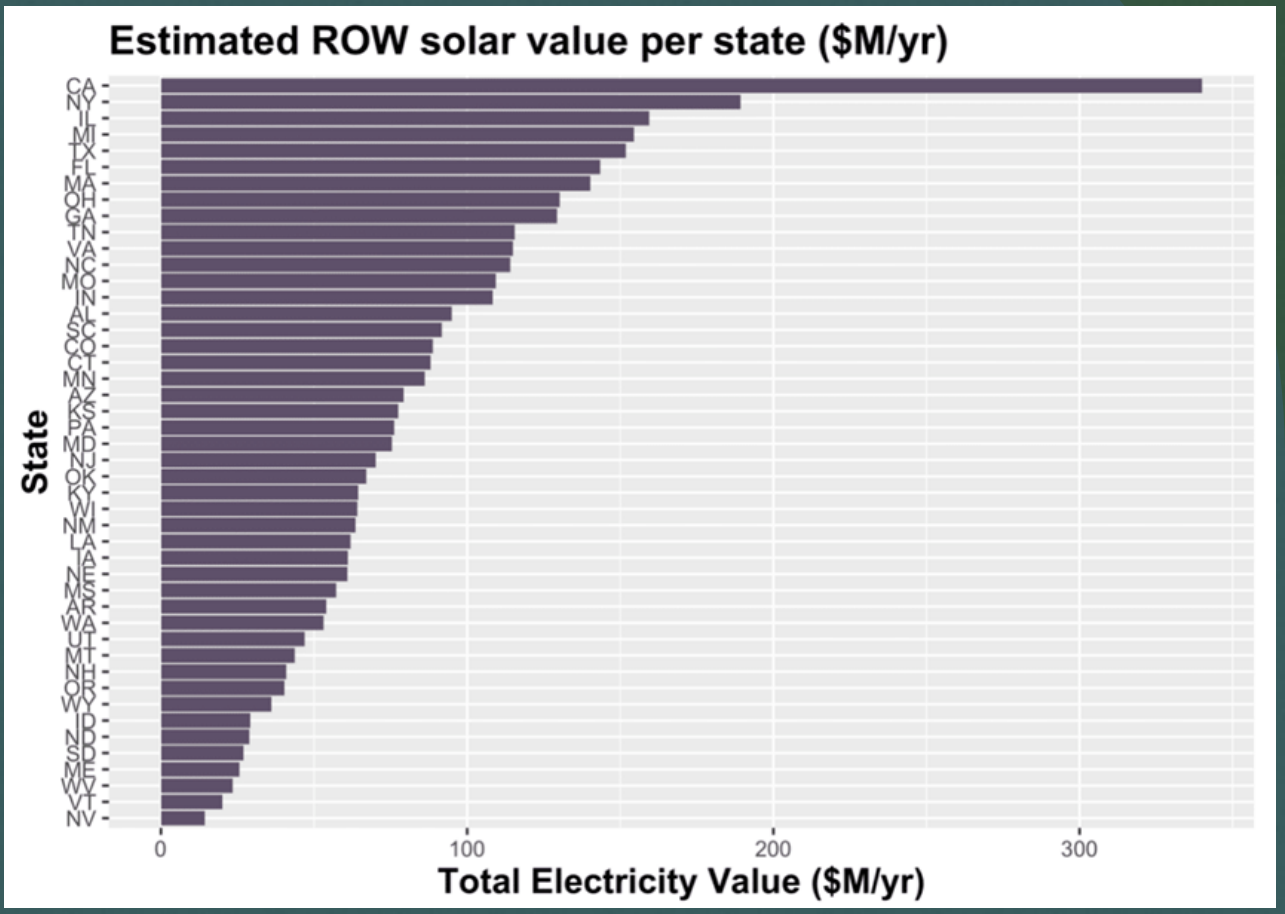
Right of Way Solar on Highway Intersections

One of the best sites for solar panels on highways is near exits, which are often surrounded by empty space. Right of Way Solar offers:

- unshaded acreage
- ease of access
- public ownership status
- lack of competing development efforts

An Alternate Angle


Estimated ROW solar energy per state (GWh/yr)
State
TX
IL
CA
FL
VA
OH
MI
GA
NC
NY
TN
MO
IN
SC
PA
MA
CO
AL
OK
MD
MN
KS
AZ
LA
KY
NE
AR
WA
NM
WI
MS
NJ
UT
CT
IA
OR
MT
WY
ID
ND
SD
WV
NH
ME
HI
VT
0
500
1000
1500
Total Solar Potential (GWh/yr)


Estimated ROW solar value per state ($M/yr)
State
CA
CO
NY
IL
MI
TX
FL
MA
OH
GA
TN
VA
NC
MO
IN
AL
SC
CO
CT
MN
AZ
KS
PA
MD
NJ
OK
KY
WI
NM
LA
IA
NE
MS
AR
WA
UT
MT
NH
OR
WY
ID
ND
SD
ME
WV
VT
NV
0
100
200
300
Total Electricity Value ($M/yr)

Right of Way Solar on a Korean Highway

Right of Way Solar Under Powerlines

- It's estimated that all the space under powerlines in the United States combined could power 20% of the country.
- However, some of the terrain is unviable for solar panels and utility companies still need some space for services and repairs.
- An article by Grist includes these considerations with a heavily conservative estimate of there being 2,200 square miles of space under this powerlines available for solar.
- These 2,200 is enough to supply over 720 billion kilowatt-hours of electricity to the country but there aren't any current iniatives to place these site solar panels under powerlines.

Carports and Rooftops

Parking lots and rooftops offer limitless space for solar, as well as other conveniences:

Solar carports protect parked cars from heat and weather

Carports also function as charging station for electric cars

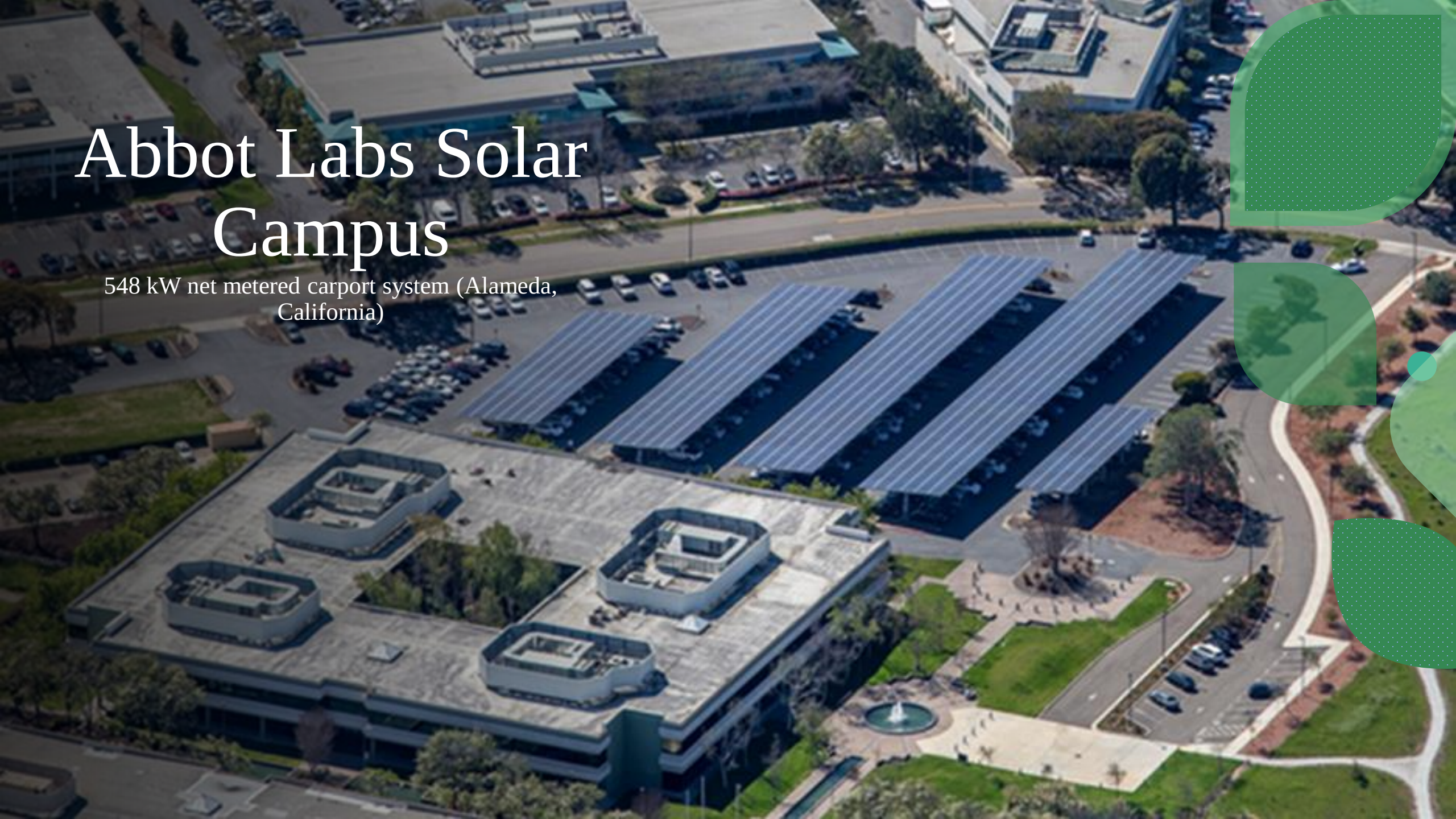
Extremely viable and already in practice.

Google Headquarters

1.9 MW Installation, including rooftops and Carports (Mountain View, California)

Abbot Labs Solar Campus

548 kW net metered carport system (Alameda, California)



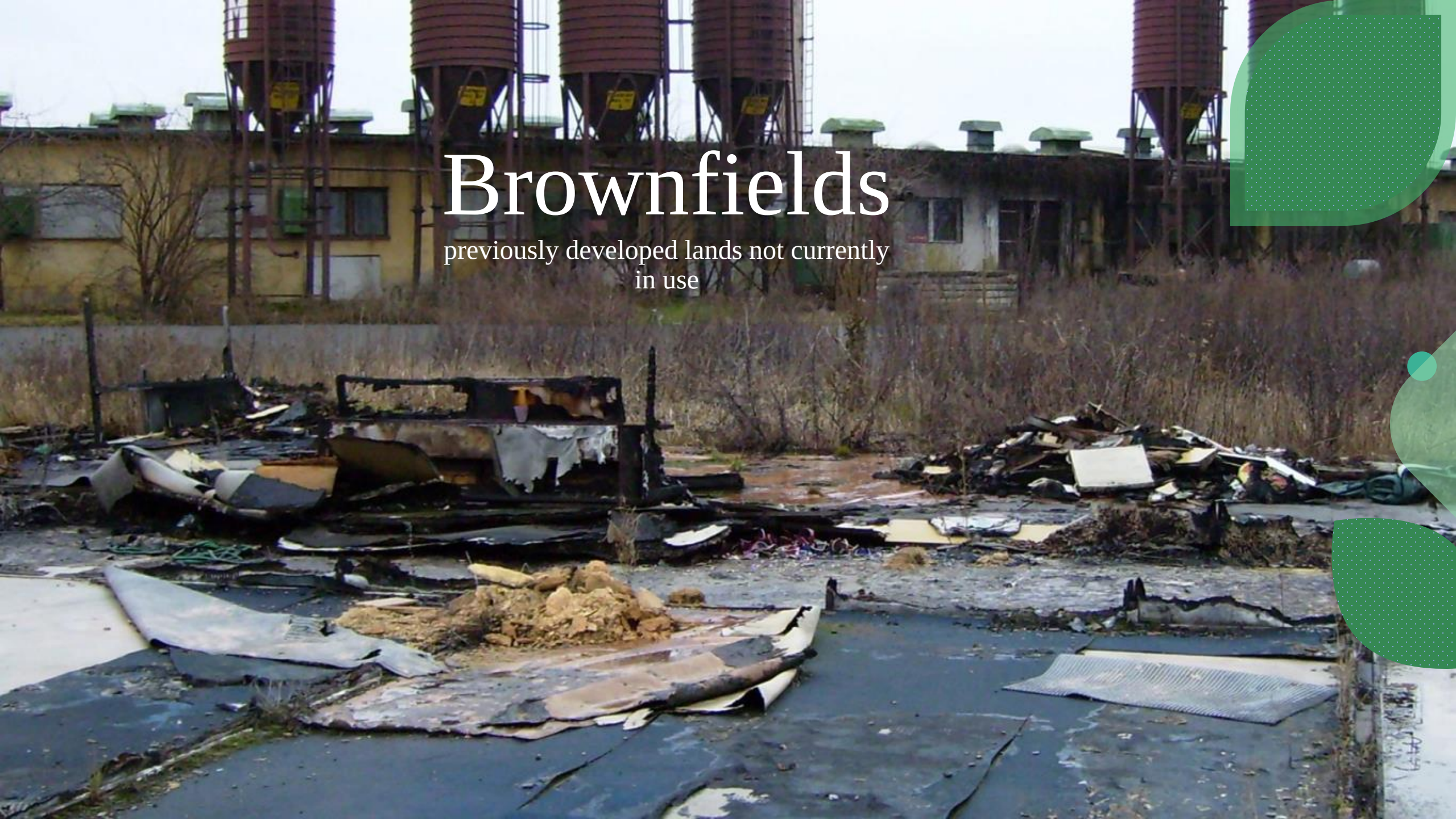
Eastern Long Island Solar Project

12.8 MW system across 21 acres and 6 different sites.
Largest Carport system in NYS (Suffolk County, New York)

McClellan Air Force Base USVA Hospital

558 kW rooftop and carport system (Sacramento, California)

McClellan Air Force Base USVA Hospital



Brownfields

previously developed lands not currently in use

The Usefulness of Brownfields

- The unused and impervious space of brownfields makes them very viable for solar projects.
- Brownfields exist all around the country
- Many loans, grants, and even tax incentives are also given to applicants wanting to develop the land
- Case studies exist to show the success of brown fields in being converted to solar facilities.

Case Study Examples

- **Brockton Brightfields (Brockton, MA)**
  - 1,395 photovoltaic panels on a 3.7-acre site
  - Generated nearly $145,000 in annual revenue for the city

- **Philadelphia Navy Yard (Philadelphia, PA)**
  - 7-acre, 1.5 MW solar facility that powers 1,800 Homes

Philadelphia Navy Yard

Availability of Brownfields in Massachusetts

Potential Host City:	Springfield, MA	Fitchburg/Gardner/Leominster, MA	New Bedford, MA	Taunton, MA	Falmouth, MA	Gloucester, MA	Greenfield, MA	Sturbridge, MA	Williamstown, MA	Provincetown, MA
Population:	153,060	101,305	95,072	55,874	31,531	28,789	17,456	9,268	7,754	2,942
Distance to Nearest Public 24 Hour DCfast Stations:	21 mi	25 mi	47 mi	14 mi	20 mi	31 mi	20 mi	28 mi	35 mi	50 mi
Potential Host Site:	Century Shopping Center/Riverdale Shops/Springfield Plaza	The Mall at Whitney Field	Dartmouth Mall	Taunton Library	Falmouth Plaza	Walgreens/CVS	Mohawk Mall Shopping Center	The Center at Hobbs Brook	Williamstown College Museum of Art	Province Lands Rd Parking
	Civic Center Garage	Fitchburg State University	Elm St. Parking Garage	Trucchi Shopping Center	Walmart (general mall area)	City Hall	Hampton Inn and Suites	Hampton Inn Sturbridge	Williamstown Public Library	Province Lands Visitor Center
	Springfield Museums	Fitchburg CVS	New Bedford Public Library		Rite Aid	Sawyer Free Library	John W Olver Transit Center	Sturbridge Host Hotel & Conference Center	Williams College	Provincetown Public Parking
	CityStage	Central Valley Plaza Shopping Center	State Pier Marine Terminal		Falmouth Public Library	Waterfront Parking	Greenfield Public Library	CVS	The Williams Inn	MacMillan Pier Parking Lot
	Springfield Amtrak	Fitchburg City Hall	City Hall		Gus Canty Community Center		YMCA			Grace Hall Parking Lot
		Leominster Public Library	Springfield Marriot		Ferry Parking		CVS			
		Johnny Appleseed State Park								
		Water Tower Plaza								
		Leominster Walgreens								
		Timpany Plaza/Gardner Plaza Shopping Center								
		Hannaford Supermarket/Rite Aid (Gardner)								

Solar Trees

- Solar Trees aren’t as much of a viable method of solar siting, but they do serve as excellent examples of how many creative solar options exist.
- Much Smaller Scale and can be integrated anywhere
- Provide shading and charging stations for phones
- Dubai’s solar palm trees also function as tour guides and provide Wi-Fi

Singaporean Solar Supertrees

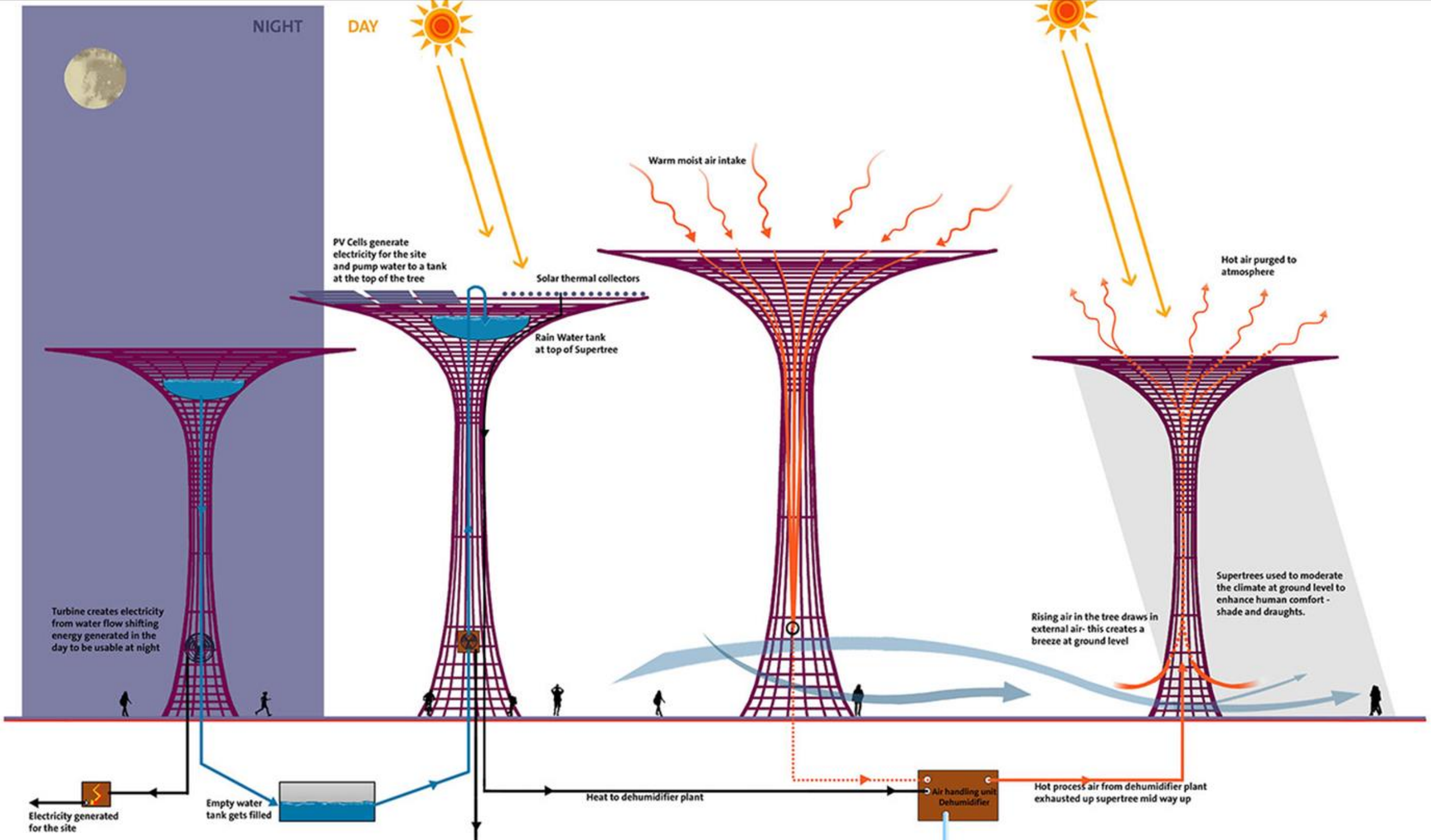
250-acre eco-tourism project

Vertical Gardens fitted with a solar panel on top

The Solar panels provide energy to power the garden and the watering system

A very interesting integration of nature and solar

Super-Trees: Another Look


NIGHT
DAY
PV Cells generate electricity for the site and pump water to a tank at the top of the tree
Solar thermal collectors
Rain Water tank at top of Supertree
Warm moist air intake
Hot air purged to atmosphere
Turbine creates electricity from water flow shifting energy generated in the day to be usable at night
Supertrees used to moderate the climate at ground level to enhance human comfort - shade and draughts.
Rising air in the tree draws in external air- this creates a breeze at ground level
Electricity generated for the site
Empty water tank gets filled
Heat to dehumidifier plant
Air handling unit Dehumidifier
Hot process air from dehumidifier plant exhausted up supertree mid way up

Pairing Agriculture and Solar

- Solar in certain places even has direct environmental benefits.
- Solar on farms or the general pairing of agriculture and solar doesn’t sound very intuitive, however, native plants and vegetable gardens do have a place under solar panels
- They promote biodiversity, food production, and generally increase the aesthetics of what would be grass fields.
- They also supplement the lives and survival of pollinators
- Allow for nutrient and land recharge of degraded lands, as well as extended growing periods.
- Potential for water use reduction

Infrastructure

Unfortunately, one of the biggest things holding these solar alternatives back is infrastructure.

It’s rather difficult to move solar-generated energy from one location to another.

However, it’s a reality we’re going to have to face and it’ll, luckily, become more and more efficient as investments grow and the technologies are made more efficient.

Roof and carport systems can still power entire facilities and right of way solar can still be carried to a nearby battery.

Conclusion

- There are indeed viable alternatives to deforestation for solar farms and there will definitely be more in the future.
- Solar of all forms has unlimited potential. There doesn’t have to be a choice between renewables and maintaining our forests.

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