



GEAPS EXCHANGE

KANSAS CITY • 2022



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GEAPS Exchange 2022

Benefits of Onsite Solar PV at Agricultural Facilities



Ola Boye, PE., ENV SP

Power System Engineering, Inc.

Manager - Energy Resources



**Power System
Engineering, Inc.**



Josh Mulder, PE.

Power System Engineering, Inc.

Vice President – Industrial Engineering



**Power System
Engineering, Inc.**

GEAPS Exchange 2022

Benefits of Onsite Solar PV at Agricultural Facilities

About Power System Engineering

Forward-Thinking Professionals Helping Clients
and Colleagues Achieve Their Goals



Facts:

- Founded in 1974
- 100+ Employees
- Engineers, Economists, Designers, Analysts, Technicians

Service:

- Utility System Planning & Studies
- Utility System Design
- Utility Rates and Data Analytics
- Utility Automation
- Communications Infrastructure
- Energy Resource Planning
- Energy Resource Design (Solar & BESS)
- Technical Operations Support

Offices:

- Madison, WI
- Blaine & Prinsburg, MN
- Marietta & Cincinnati, OH

Today's Topics

Solar Trends in the US

Solar System Components & Characteristics

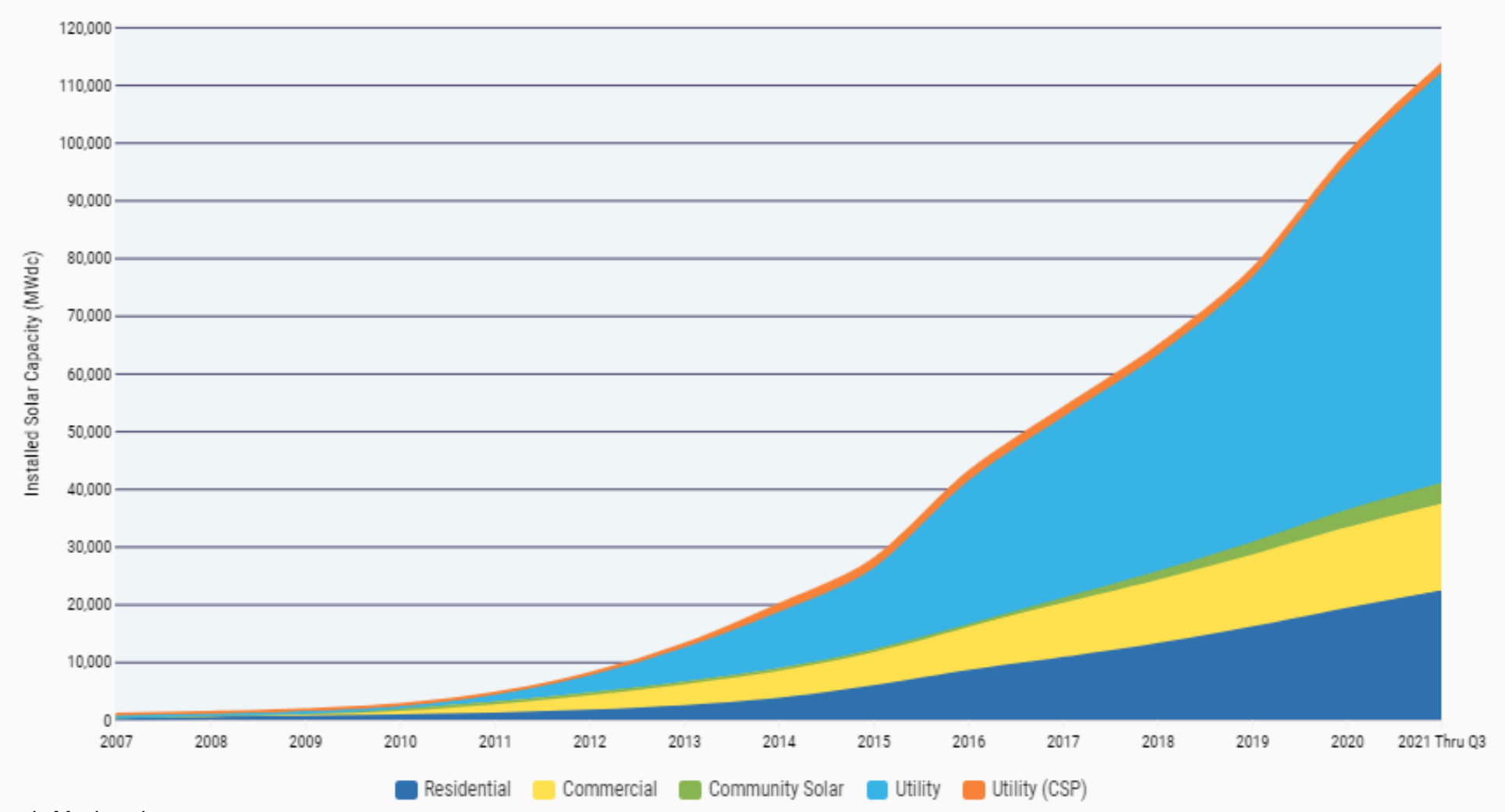
Technical Aspects

Economic Aspects

Case Study

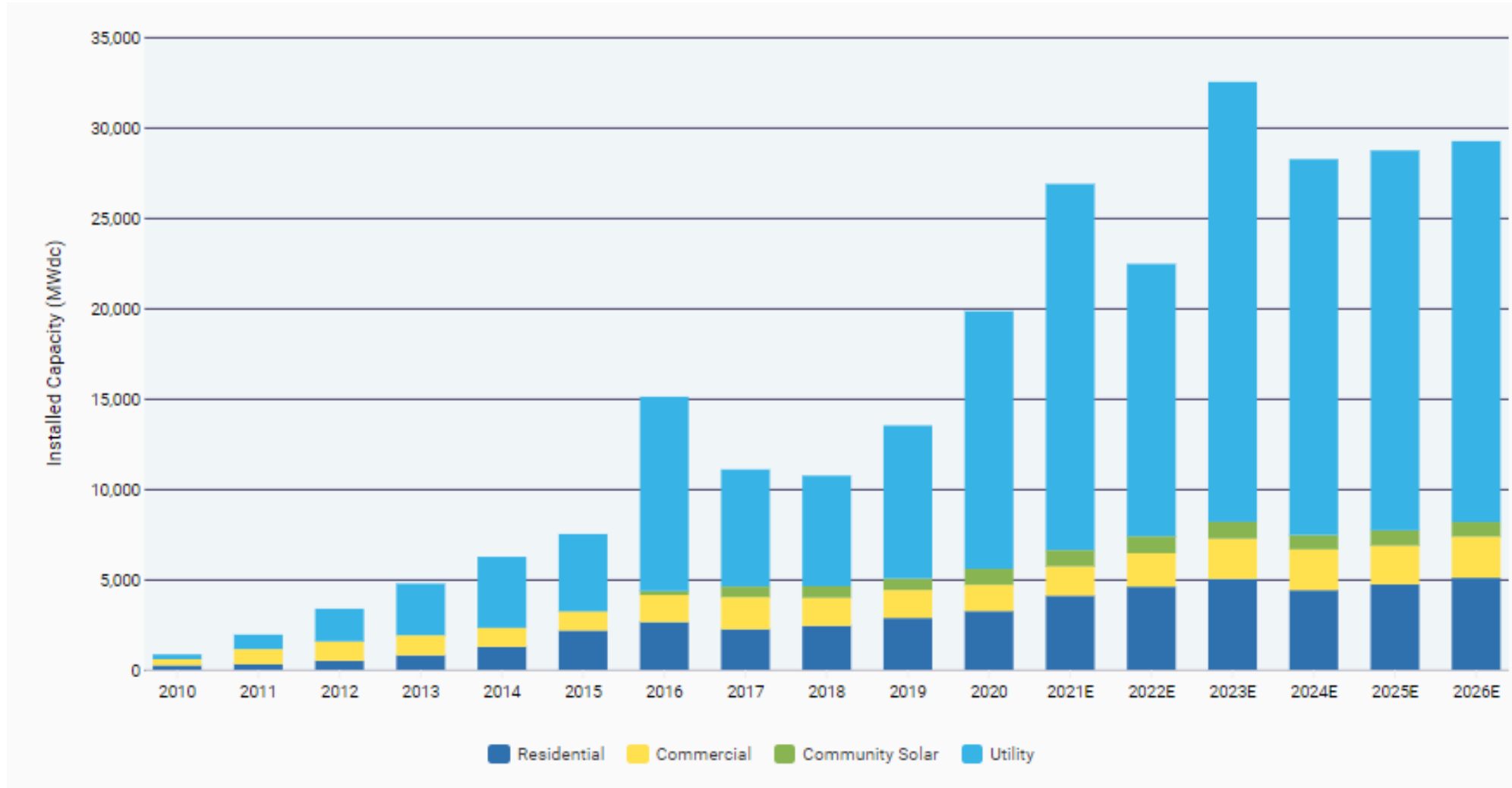
Questions

U.S Solar Installations



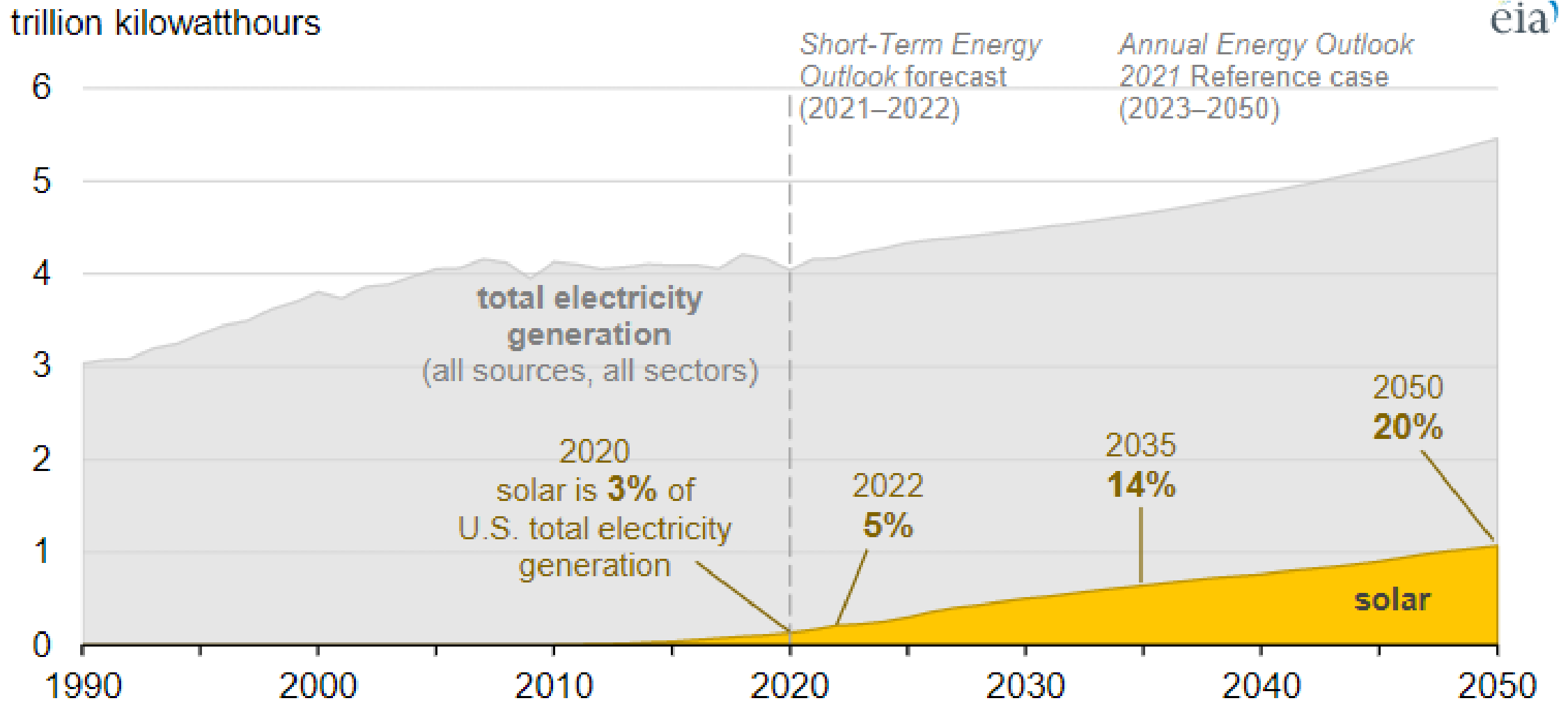
Source: Woods Mackenzie

U.S. Solar PV Deployment Forecast



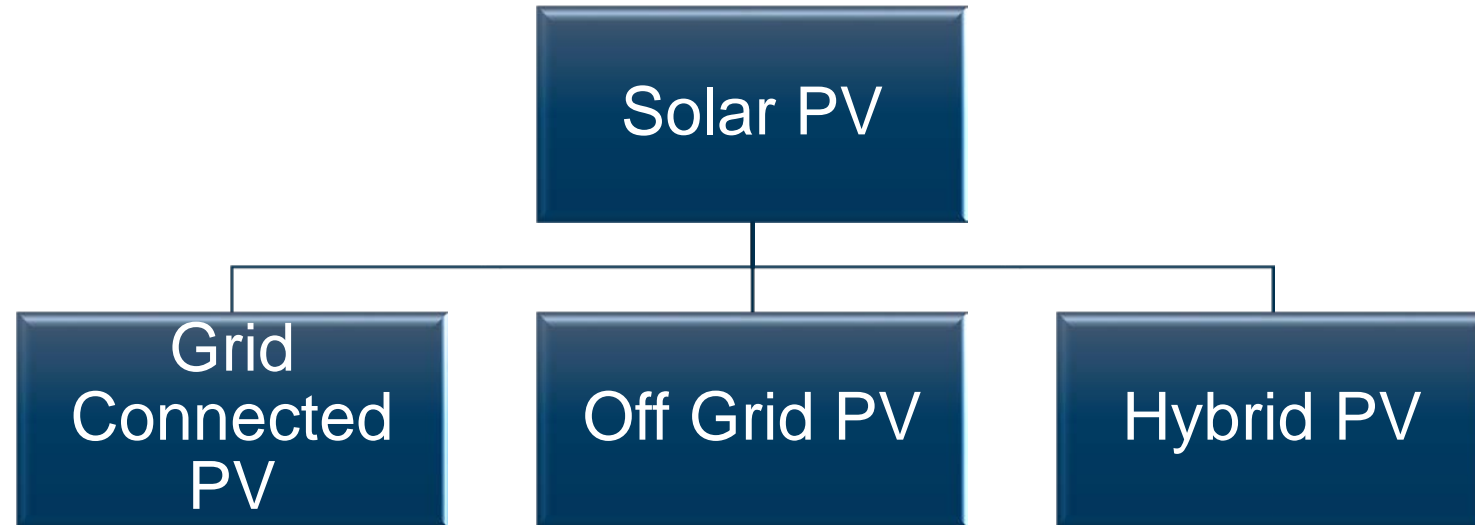
Source: Woods Mackenzie

U.S Electric Generation – Energy Production

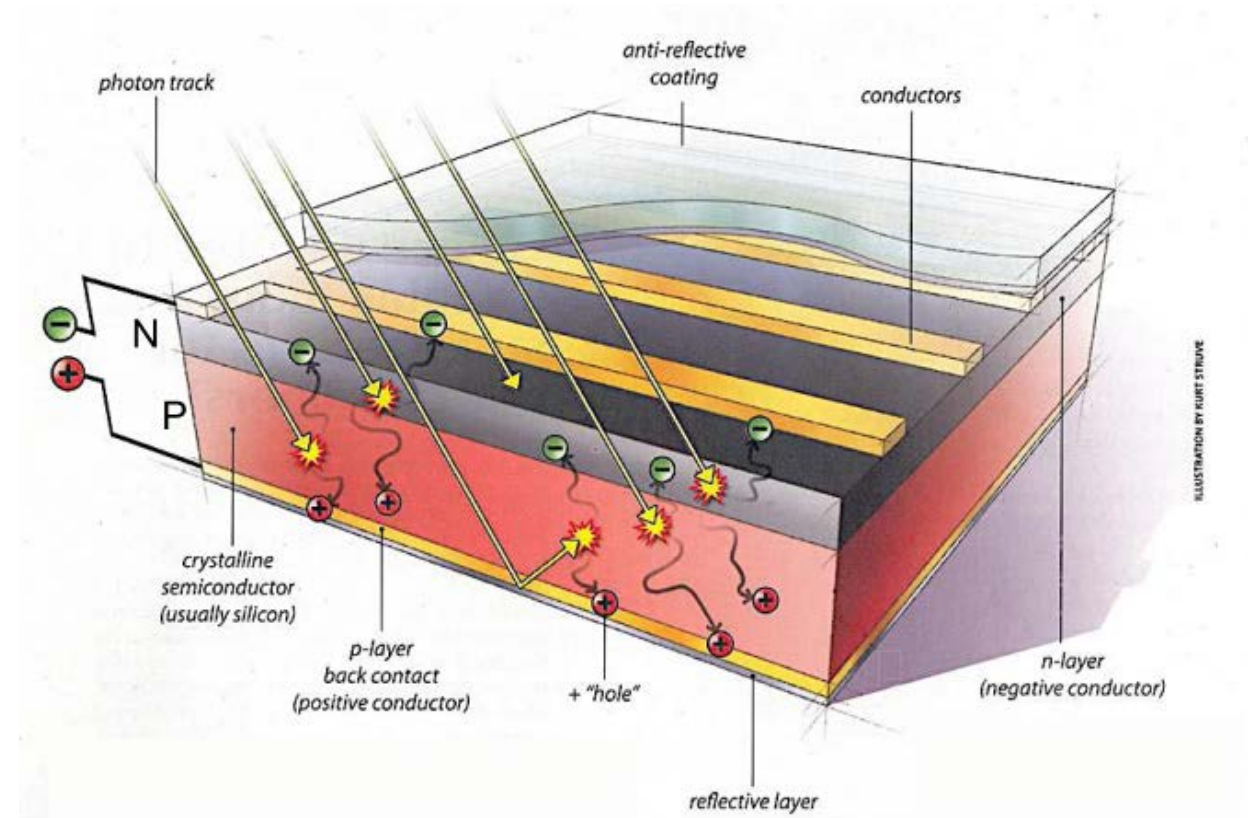
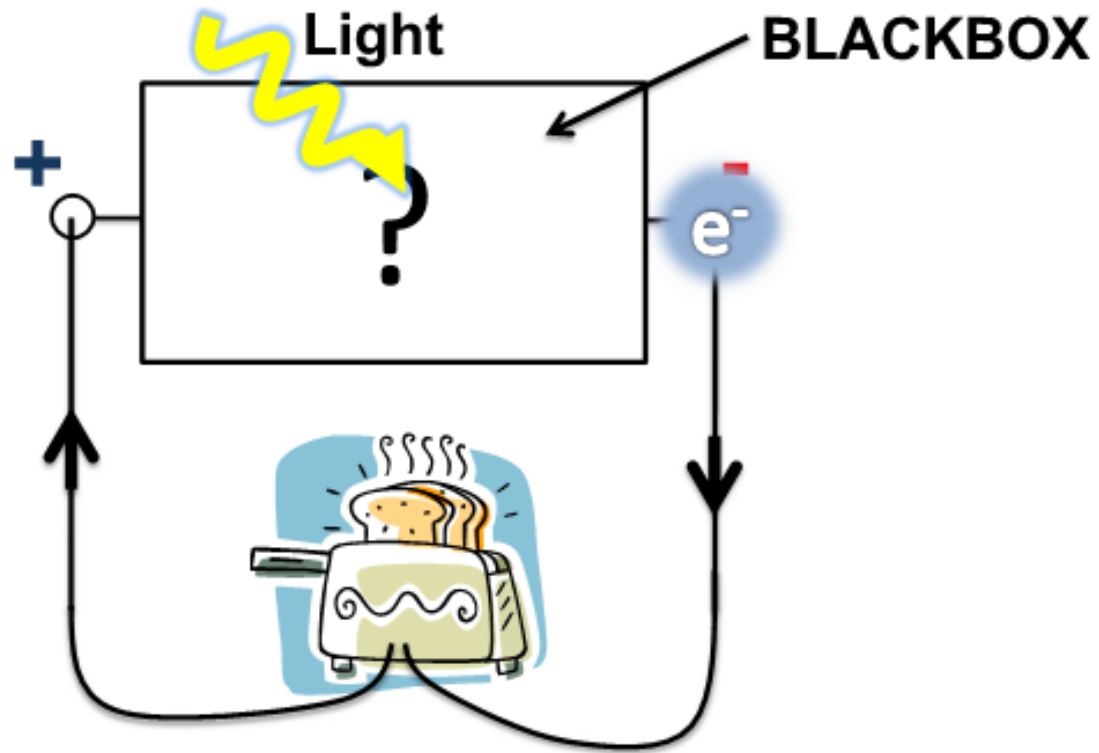


Source: Energy Information Administration

Solar PV System

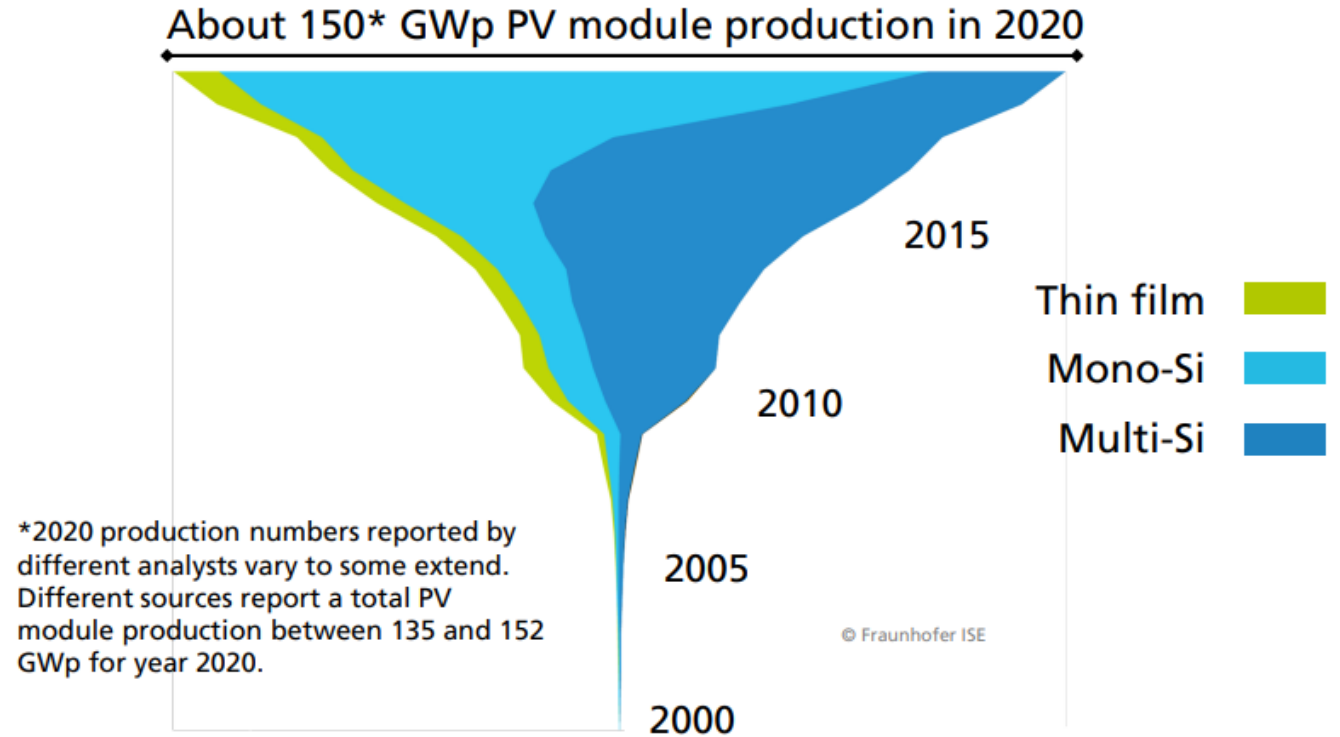
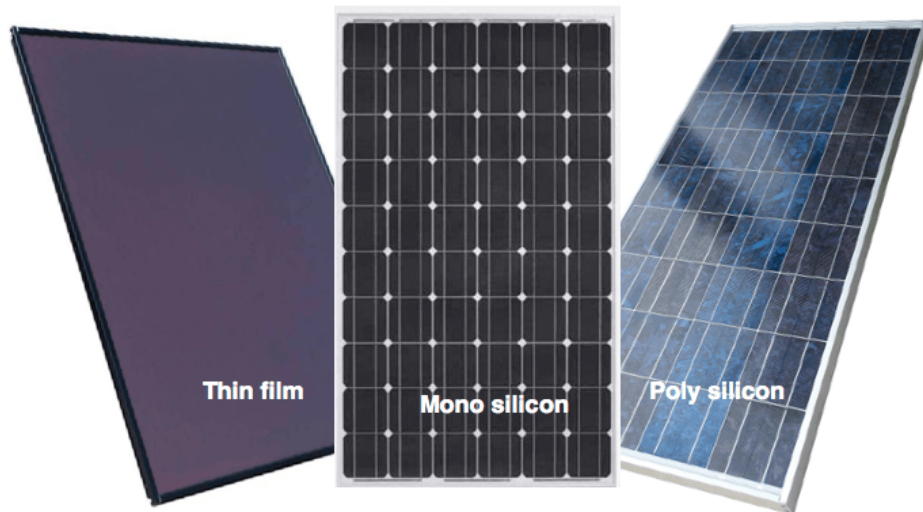


Solar PV Module

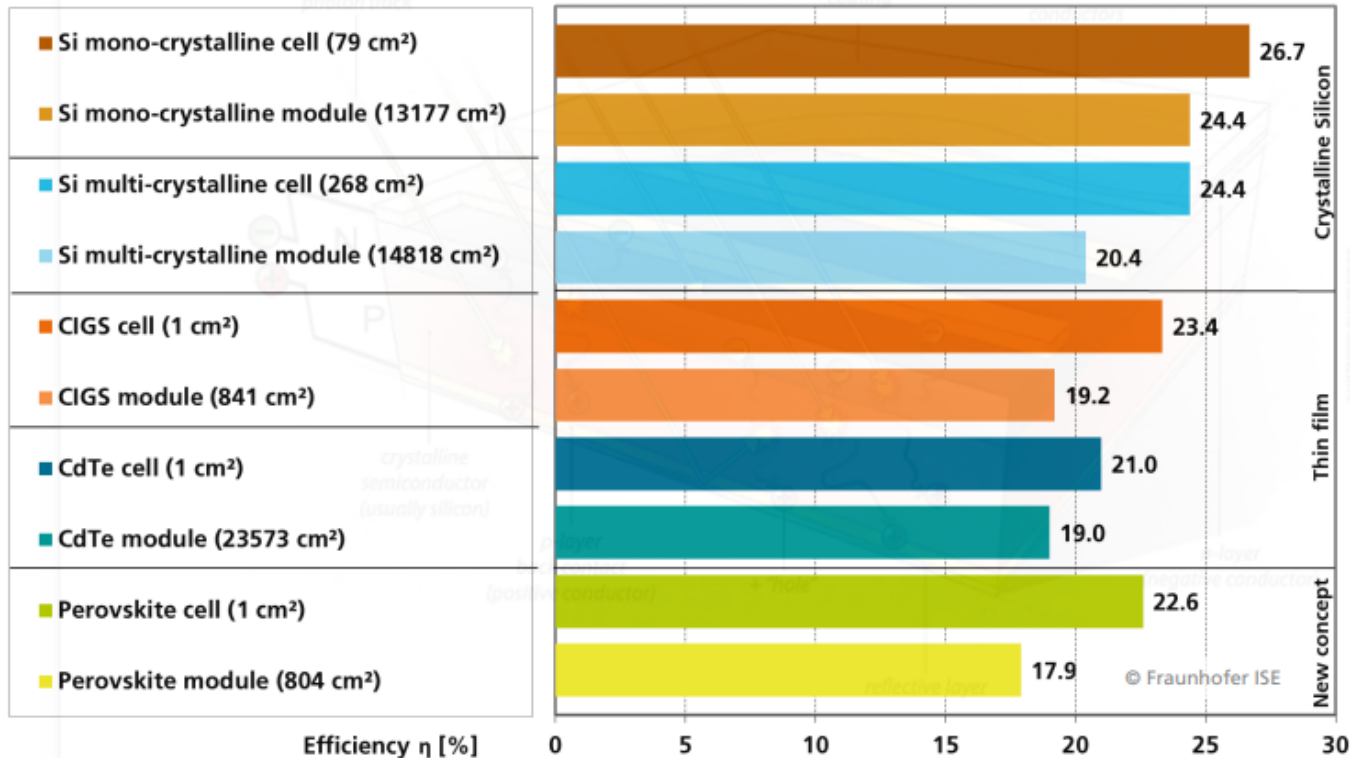


Solar PV Module

- Major Types of Solar PV Module;
 - Polycrystalline
 - Monocrystalline
 - Thin Film

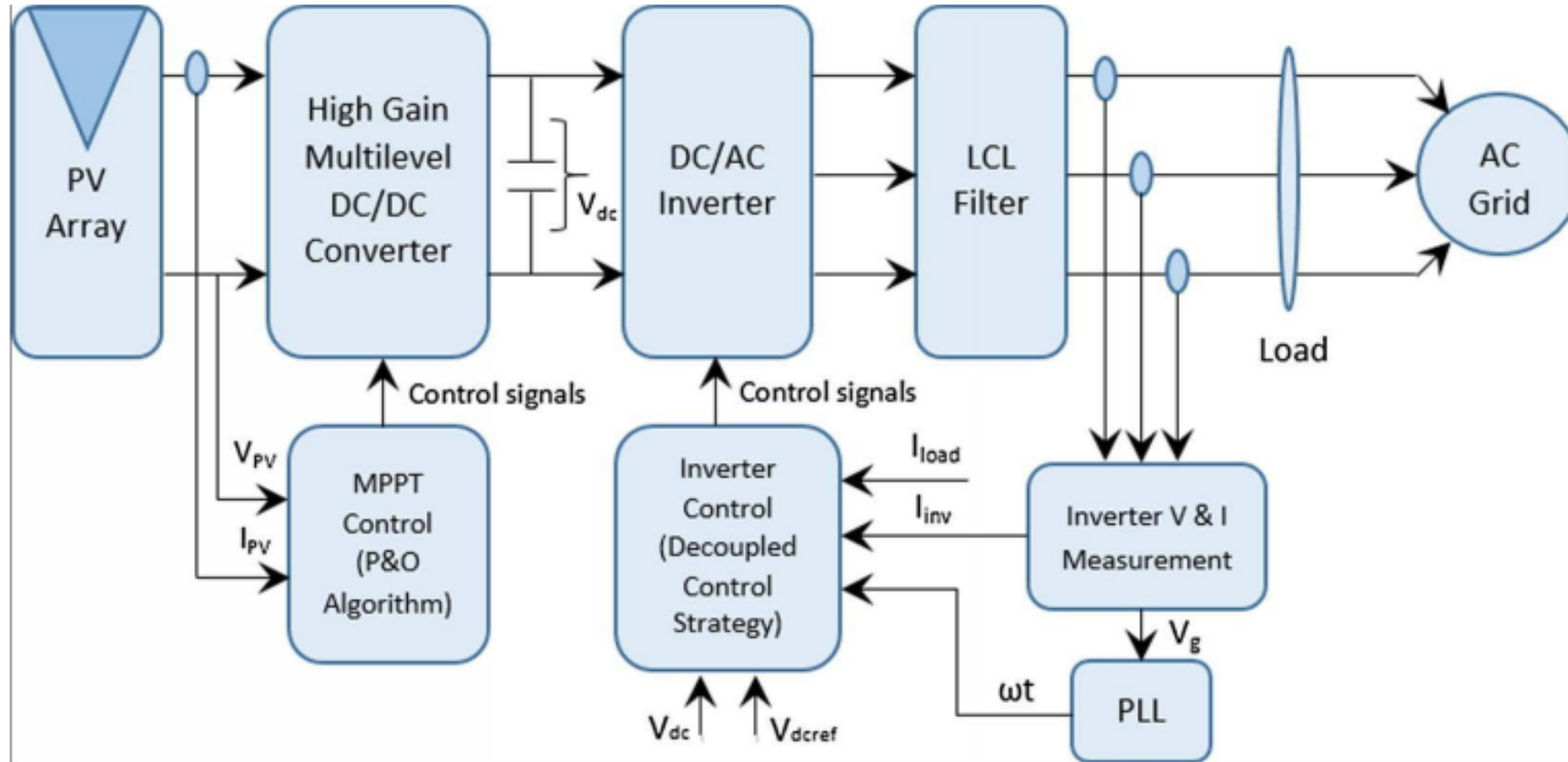


Solar PV Module



- Module Efficiency of about ~20-25%
- Factor to consider when selecting a PV Module?
 - Efficiency
 - Maximum Production vs Max Offset
 - Cost vs Value
 - UL Certification
 - Tier 1 vs Tier 2 vs Tier 3
 - Warranties
 - Lifetime
 - Maintenance...

Solar PV Inverter



Solar PV Inverter

Microinverter

Residential applications
Single Phase 208V, 240V
<500W



String Inverter

Residential, Commercial & Small Utility
scale applications
Single Phase & Three Phase
3kW – 150kW



Central Inverter

Utility Scale applications
Three Phase
>500kW



Solar Mounting System



Rooftop Solar



Ground Mount
Solar



Solar Carport

Technical, Economic Aspects & Case Study

Solar Resource Assessment

SOLAR RESOURCE MAP

PHOTOVOLTAIC POWER POTENTIAL



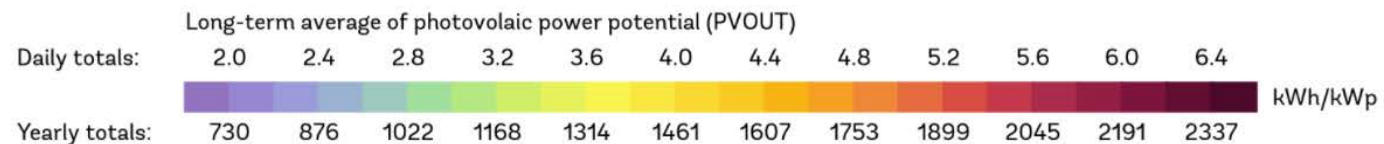
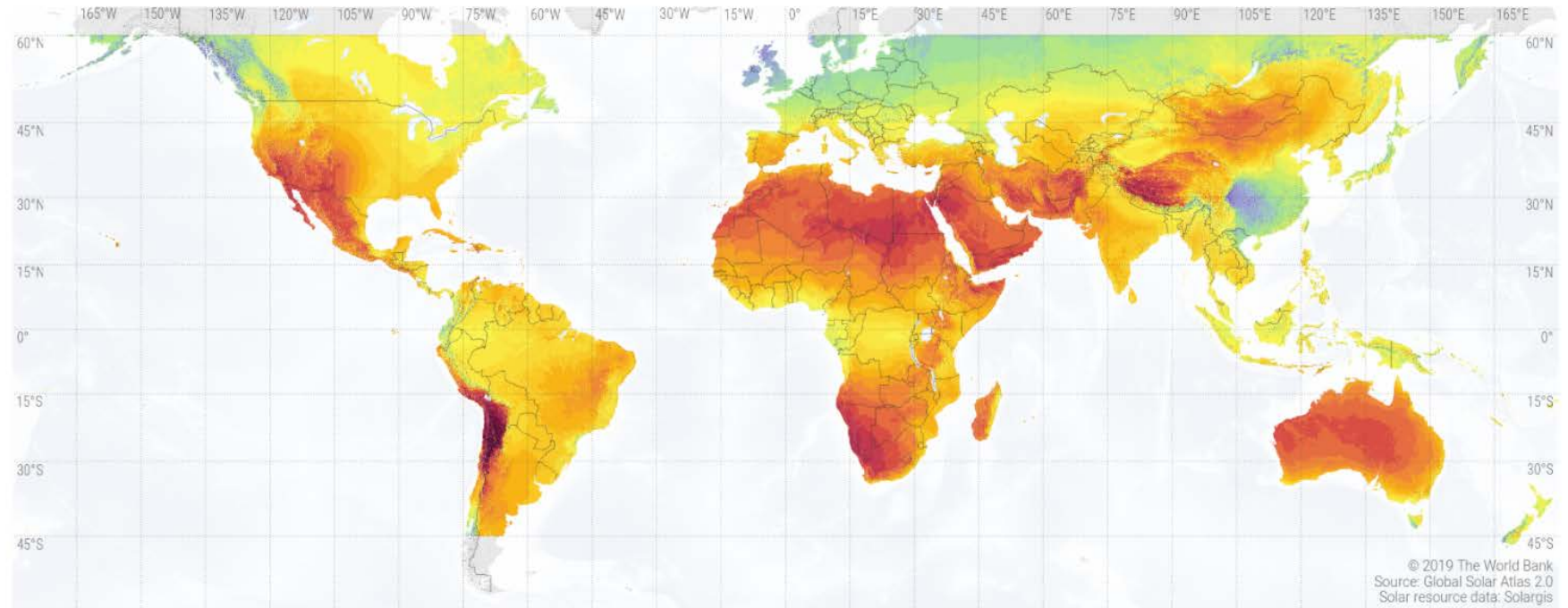
WORLD BANK GROUP

ESMAP

SOLARGIS

Factors to Consider:

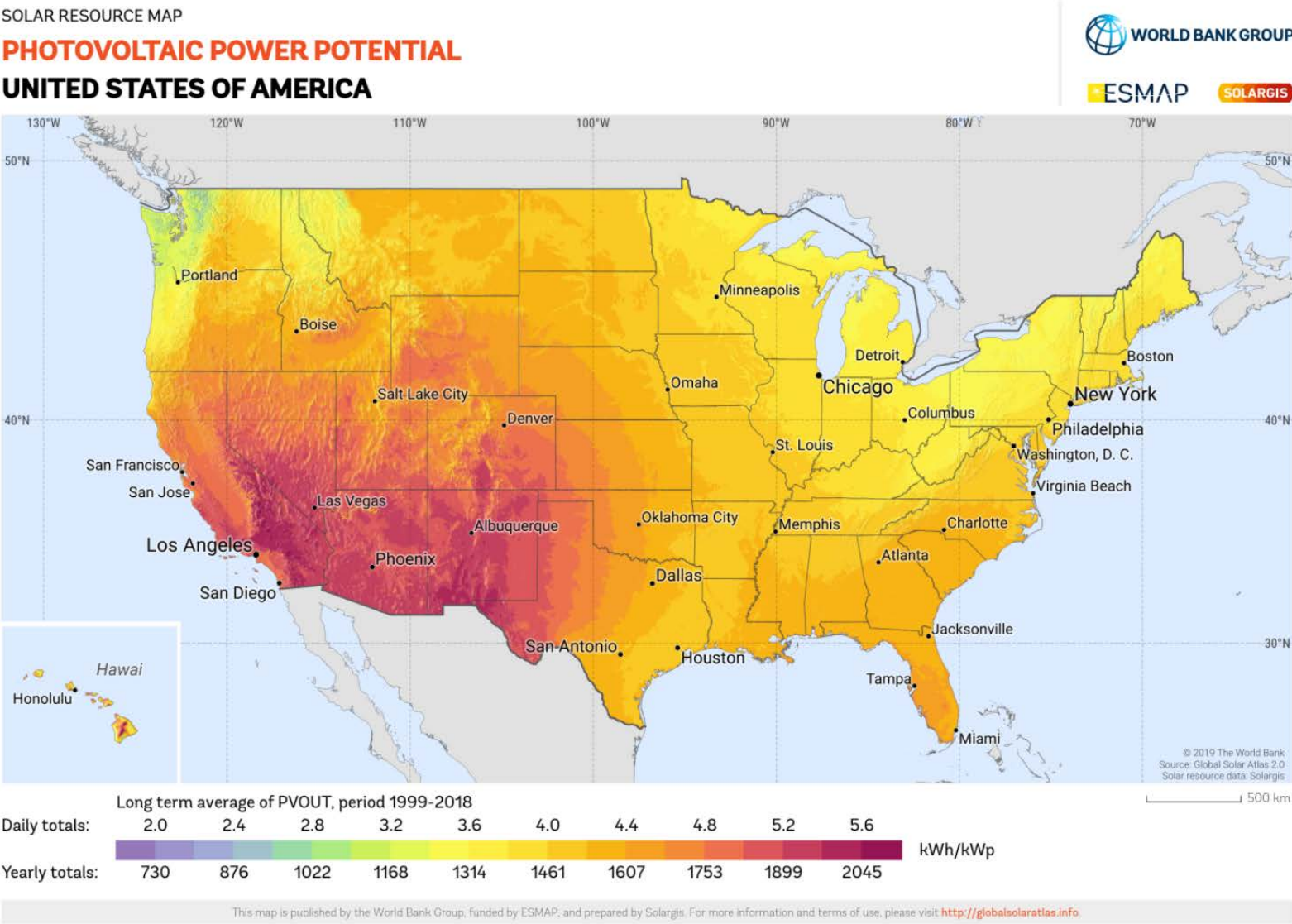
- Location
- Module Orientation
- Module Selection
- Balance of System Efficiency



This map is published by the World Bank Group, funded by ESMAP, and prepared by Solargis. For more information and terms of use, please visit <http://globalsolaratlas.info>.

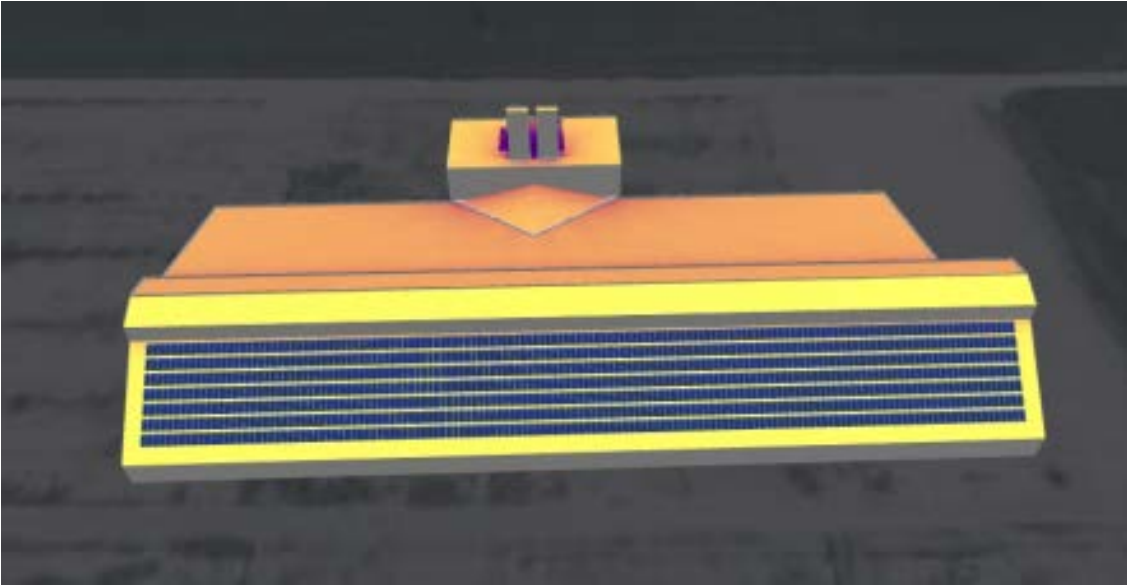
Solar Resource Assessment

Close-up map of the US PV Potential



Solar Resource Assessment

PV Production Simulation of a Dry Fertilizer Facility



SIMULATION RESULTS



Installed DC Power

424.41 kWp



Max Achieved AC Power

360.00 kW



Annual Energy Production

647.50 MWh



CO2 Emission Saved

457.78 t



Equivalent Trees Planted

21,026



Max Achieved DC Power

424.41 kW



DC/AC Oversizing

118 %



Max Active AC Power

360.00 kW



Performance Ratio

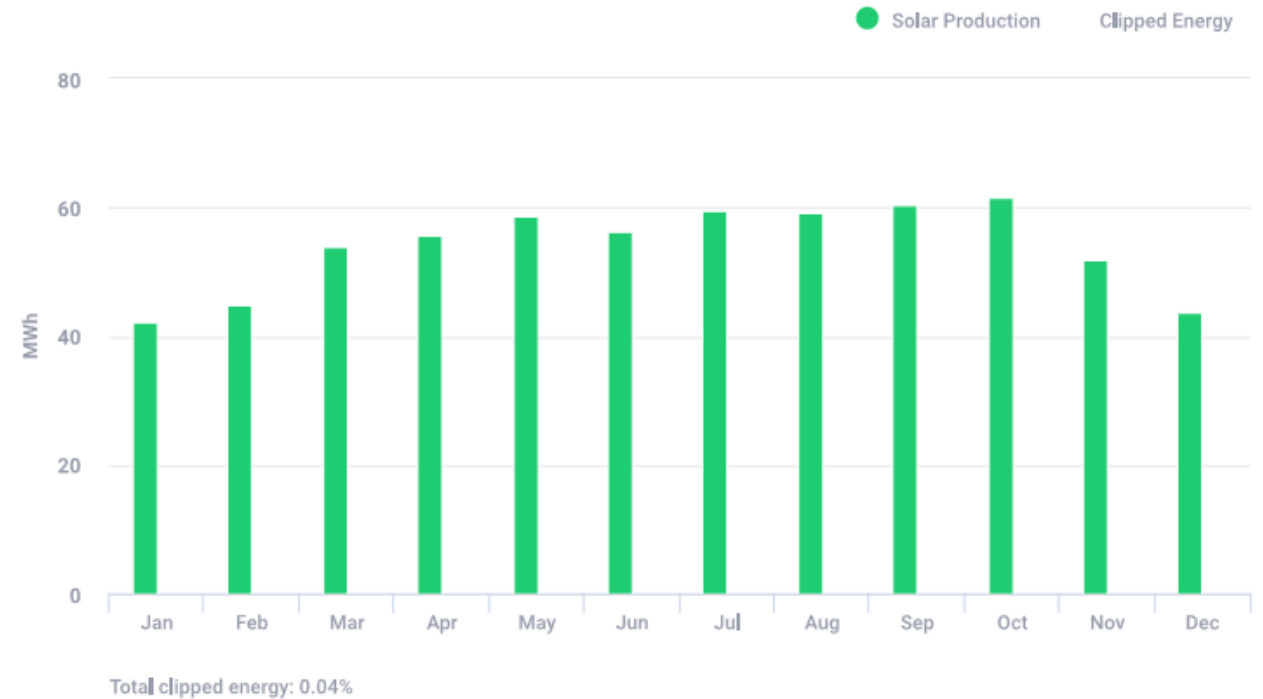
84 %



Performance Index

1,526 kWh/kWp

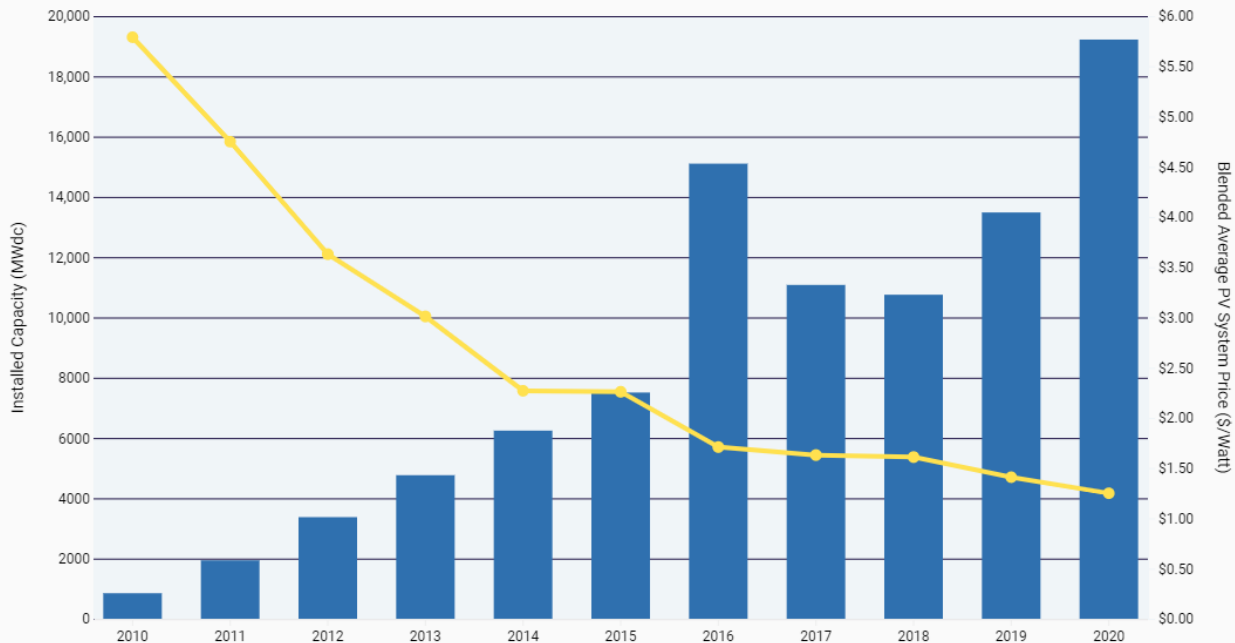
ESTIMATED MONTHLY ENERGY



Solar System Costs

Solar Declining Costs

U.S. Solar PV Price Declines & Deployment Growth

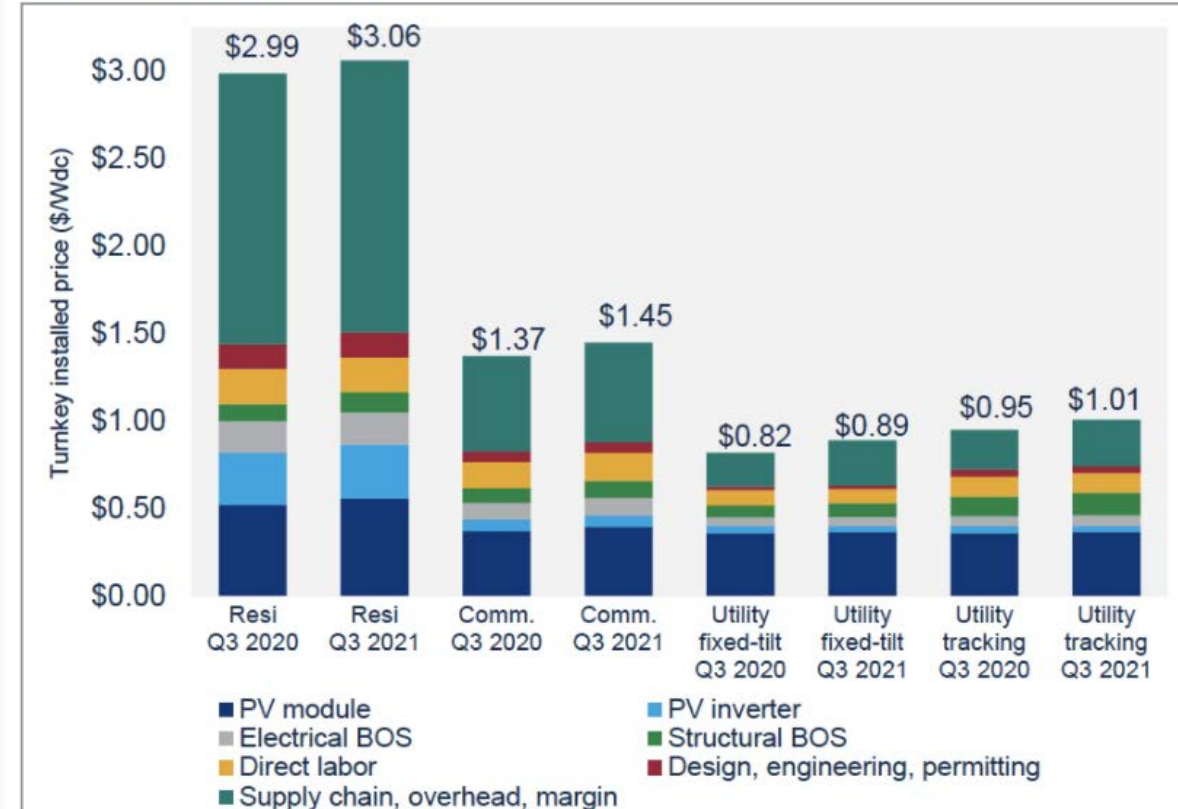


Source: SEIA/Wood Mackenzie Power & Renewables U.S. Solar Market Insight 2020 Year in Review



Average Cost of Solar PV

Modeled US national average system prices by market segment, Q3 2020 and Q3 2021



Source: Wood Mackenzie

Federal Incentives



- Federal Investment Tax Credit
 - Receives 26% of the full system cost as credit against your total tax liability for the year installed
 - Modifications in Build Back Better Act. Currently Passed in House
- MACRS & Bonus Depreciation
- USDA REAP Grant:
 - Provides guaranteed loan financing and grant funding to agricultural producers and rural small business for renewable energy system or to make energy efficiency improvements.
 - Loan

USDA REAP Grant

- USDA REAP Grant:
 - Provides guaranteed loan financing and grant funding to agricultural producers and rural small businesses for renewable energy system or to make energy efficiency improvements.
- Applicants:
 - Applies to Agricultural producers with at least 50 percent their gross income coming from agricultural operations
 - Small businesses in eligible rural areas
- Funding:
 - Loan guarantees on loans up to 75 percent of total eligible project costs
 - Grants for up to 25 percent of total eligible project costs



Rural Development
U.S. DEPARTMENT OF AGRICULTURE



Rural Energy for America Program

ITC Changes in BBB Act

Changes to the ITC by project type and qualifications in House-passed version of the BBB Act

Start of construction →	2021	2022	2023	2024	2025	2026
Current ITC for customer-owned residential solar	26%	26%	22%	0%	0%	0%
Current ITC for utility solar, commercial solar, and third-party owned residential solar	26%	26%	22%	10%	10%	10%
<u>Proposed ITC for residential solar</u> (not subject to prevailing wage or apprenticeship requirements)		30%	30%	30%	30%	30%
<u>Proposed ITC for commercial and utility solar</u>						
Projects <1 MW		30%	30%	30%	30%	30%
Projects ≥1MW that meet prevailing wage and apprenticeship requirements		30%	30%	30%	30%	30%
Projects ≥1MW that do not meet prevailing wage and apprenticeship requirements		6%	6%	6%	6%	6%
Projects ≥1MW that do not meet prevailing wage and apprenticeship requirements, meet domestic content requirements		8%	8%	8%	8%	8%
Projects (all sizes) that meet prevailing wage, apprenticeship requirements, and domestic content requirements		40%	40%	40%	40%	40%
Adder for projects located in low-income communities		10%	10%	10%	10%	10%
Adder for projects that qualify as low-income economic benefit projects		20%	20%	20%	20%	20%
<u>Proposed value of refundability (direct pay)</u>						
Projects <1 MW or that meet domestic content requirements		100%	100%	100%	100%	100%
Projects ≥1 MW		100%	100%	90%	85%	0%



Source: Wood Mackenzie; Note: Information in table reflects provisions in the BBB Act as of November 19th, 2021

Other Incentives & Financing



- State Incentives
 - Renewable Energy State Programs
 - Utility Rebates
 - Net Metering
- Financing Structures
 - Lease
 - Purchase Power Agreement (PPA)

Case Study: Tyson Foods Feed Mill Aurora, MO



Project Highlights

- Capacity: 597 kWDC / 429 kWAC
- Production Estimate: 837,300 kWh/Yr
- Ground Mount System
- \$100,000/yr of direct energy cost savings per year
- \$3.9 million in energy savings over 30 years



Is Solar PV for you...

- Increase energy efficiency
- Independence against rising energy prices
- Take control of your energy usage
- Easy coupling with Energy Storage & EV Charging
- Advance Sustainability Goals



Thank You

We look forward to helping you achieve your goals.

Ola Boye, PE

Manager, Energy Resources

Direct: (608) 265-3549

Mobile: (712) 441-3238

Email: ola@powersystem.org

Josh Mulder, PE

Vice President, Industrial Engineering

Direct: (320)-978-8046

Mobile: (320) 981-0311

Email: mulderj@powersystem.org

www.powersystem.org



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SAVE THE DATE!

FEBRUARY 25-28, 2023
Kansas City Convention Center
Kansas City, Missouri



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