# Solar Power on the Farm

CHRIS LENT, NCAT SUSTAINABLE AGRICULTURE SPECIALIST

NCAT ATTRA SUSTAINABLE AGRICULTURE

# Sustainable Agriculture

NCAT's trusted sustainable agriculture work helps farmers in everything from the basics of starting a farm to marketing locally grown products, and from organic specialty crop production to regenerative livestock management, NCAT's sustainable agriculture specialists provide trusted, practical multimedia resources to nearly 35,000 farmers each year. In fact, NCAT's ATTRA Sustainable Agriculture website is accessed nearly 3.3 million times each year.

ATTRA.NCAT.ORG

**800-346-9140 or**
**askanag@ncat.org**



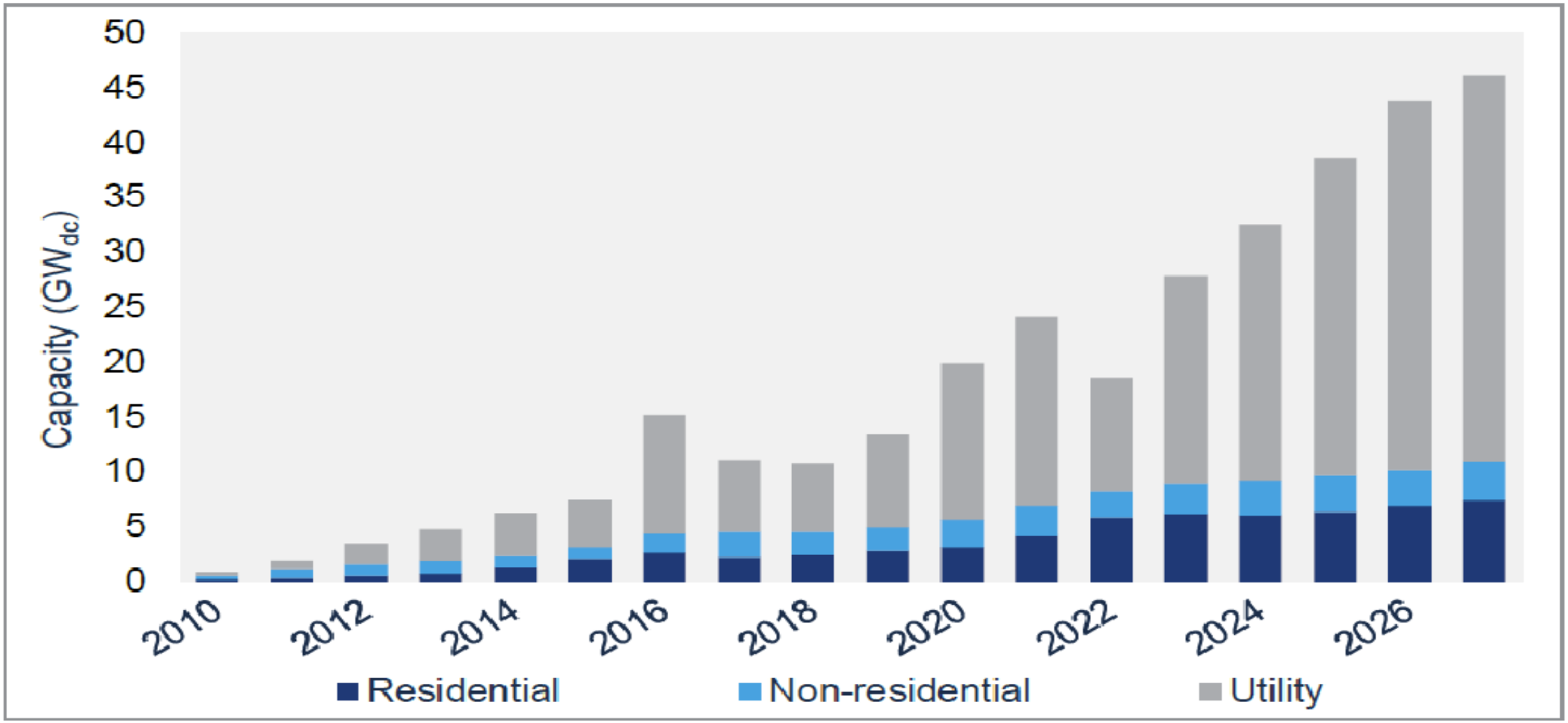
Lent's Organics

**Utility Scale:** Large solar installations that produce electricity for the energy grid at wholesale prices.

**Commercial Scale:** Small to medium installations to supply a business or organization with electricity… usually through a PPA.

**Residential or Farm Scale:** Small installations on homes and farms (5 to 50 kW) to offset electric use.

# U.S. PV installation historical data and forecast, 2010-2027




SEIA Solar Energy Industries Association®

Wood Mackenzie
A Verisk Business

Source: SEIA/Wood Mackenzie Solar Market Insight Report, Q4 2022

# Types of Solar

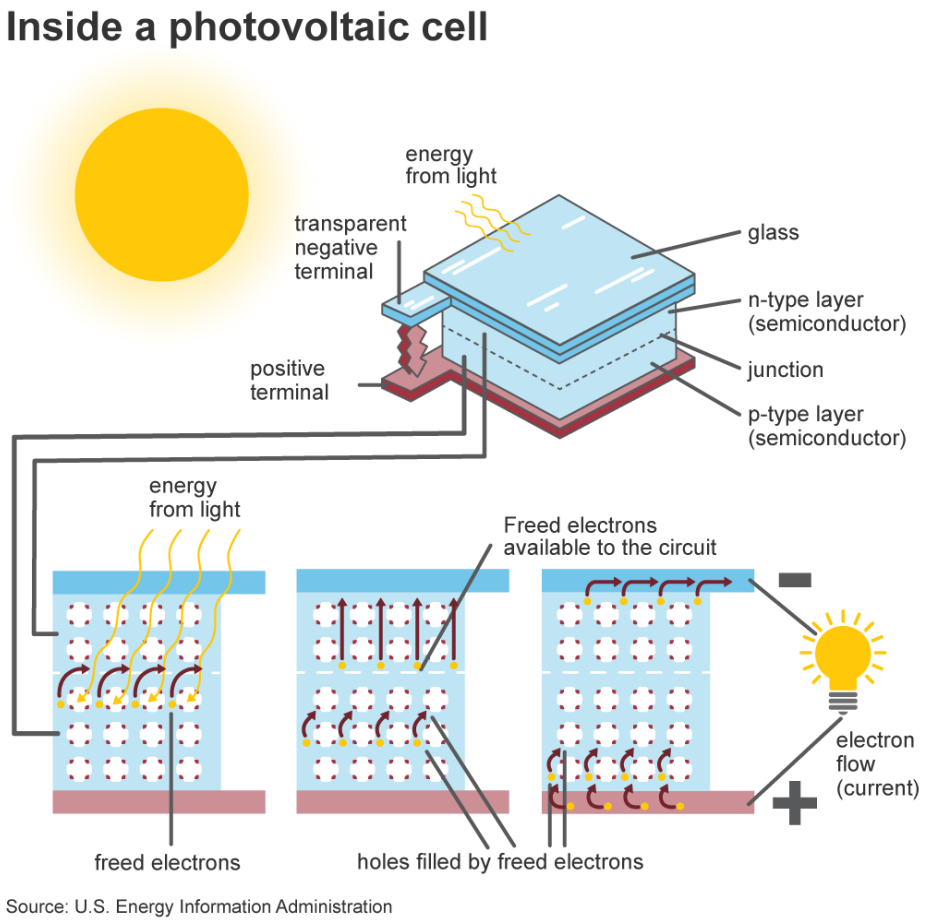
## Solar Thermal

Photo: Matt Stiemen, Dickenson College Farm

## Solar Photovoltaic (PV)

Photo: NCAT

# PV Components and Workings




- Tempered glass panel with a metal frame
- Semiconductor material like silicone
- Conductors to pick up the electrons
- Produce Direct Current (DC)

# Why Solar?

- Reduces a farms operating costs
- Solar locks in energy costs
- Tax and grant incentives
- Compatible with many agricultural operations (roof and ground space)
- Reduces carbon emissions
- Self sufficiency

Photo: Chris Lent, NCAT

# Cons of Solar

Photo: NCAT

- Need for capital
- Intermittent
- Need the space
- Lose of power when gride goes down

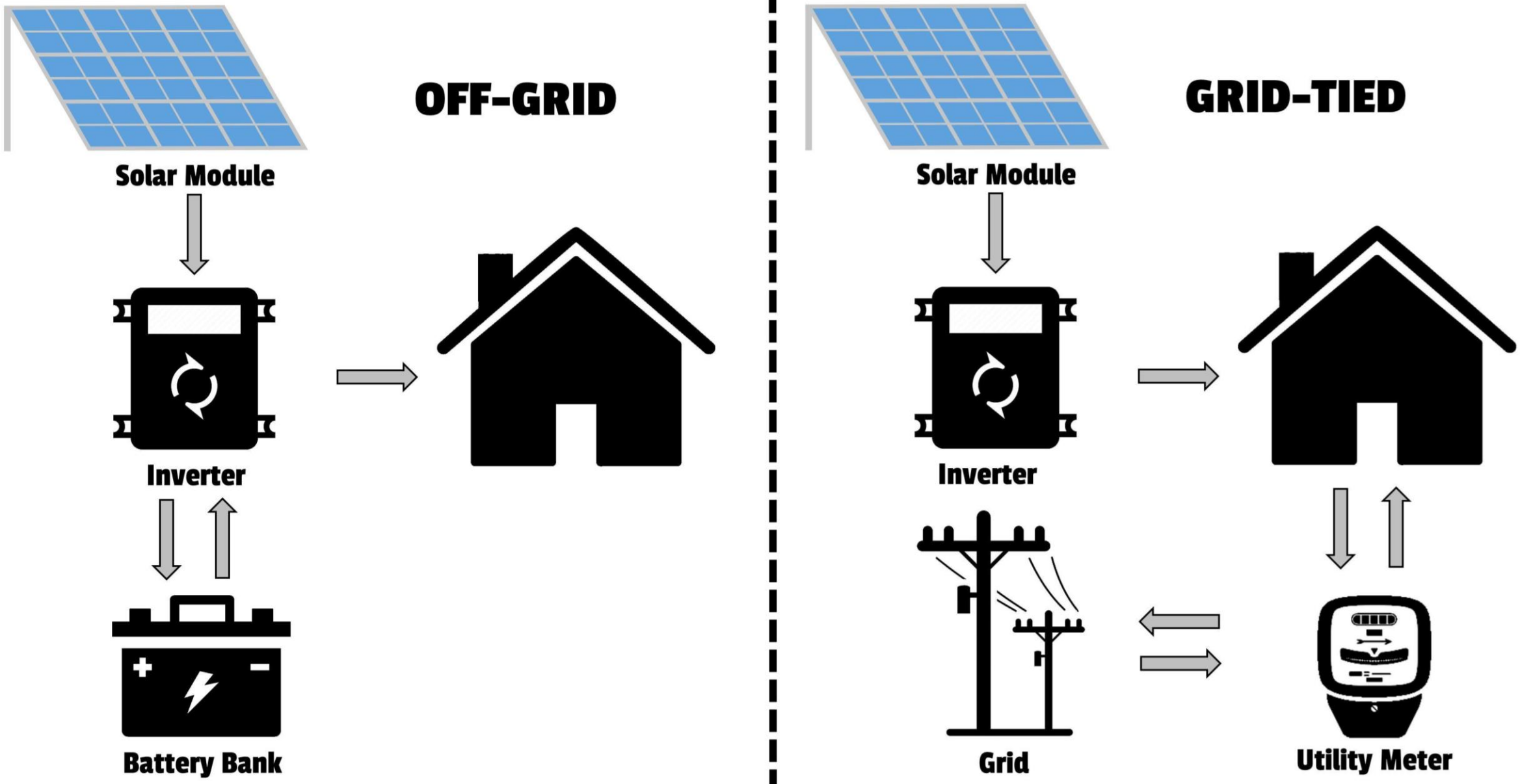
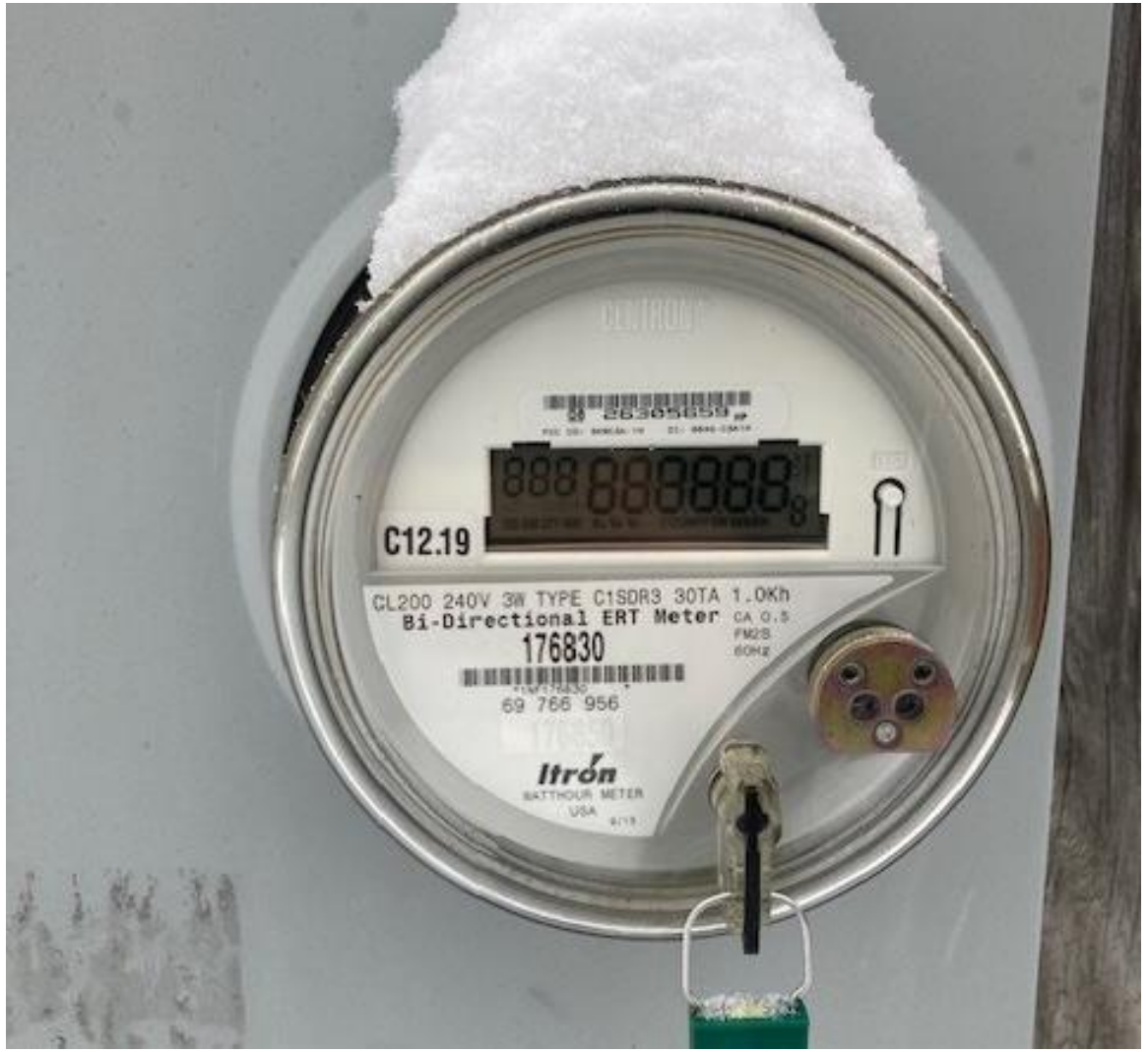



Diagram: UMD Extension

# Grid Tied vs Off Grid


Photos: Chris Lent, NCAT

# Net Metering




- When more energy is being produced by the solar system than is being used by the farm, a bi-directional meter allows the energy to be sent back to the energy companies grid.

# PV for Remote Power

**Water Pumping**

**Fencers/Gates**

**Remote Buildings**

# Livestock Watering

- Two panels (60W)
- Controller
- Submersible pump
- 1500-gallon storage
- 2500 gallons per day

*ATTRA publication*: Solar-Powered Livestock Watering Systems – ATTRA – Sustainable Agriculture (ncat.org)

# Start With Low Hanging Fruit

- Lighting
- Timers
- Leaks
- Insulation
- Maintenance
- Cleaning
- Thermostats
- Motors
- Fans

Tutorial: Farm Energy Efficiency – ATTRA – Sustainable Agriculture (ncat.org)

# Passive Solar Design

## Passive Solar Design (nrel.gov)

Photos: Chris Lent, NCAT

# Roof Mount

Photo: Chris Lent, NCAT

- Less expensive
- No ground space used
- Less likely to get damaged
- Less visible
- May be a faster install

- Roof repair/replacement is harder
- Need a south facing roof
- Applications: Livestock housing, workshops/sheds, farmhouse, and greenhouse.

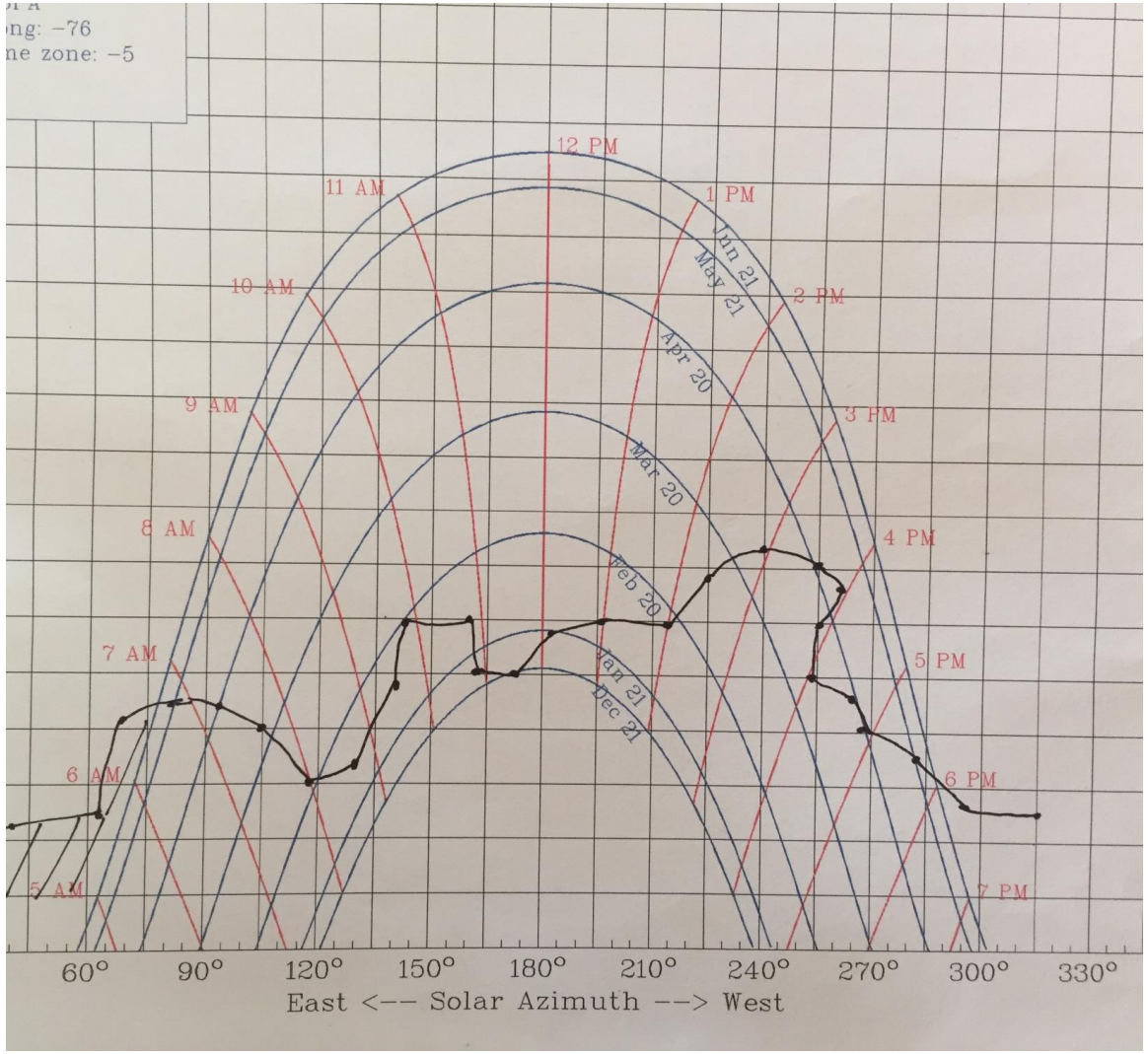
# Ground Mount

- Safer install
- Easier to maintain
- Optimal orientation
- Improved land use
- Tracking systems

- More easily damaged
- More expensive
- Local zoning
  - Setbacks
  - Height restrictions
- Be careful of shade
- Site near electric pole

Photo: Agrisolar Clearinghouse

# Sun Chart Shade Location




- UNH Fact Sheet: How to site a greenhouse to receive the most sun (unh.edu)
- UO SRML: Polar coordinate sun path chart program (uoregon.edu)

# Solar Lease or PPA

Pros:

- No up-front costs
- Reduced energy bills
- No maintenance
- Predictable payment

Cons:

- Not eligible for federal tax credit, state incentives, or SRECs
- Lower long-term savings
- Price increases each year
- Home value is not increased

# Steps Toward Solar

- Contact a contractor
- Solar sight survey
- Quote review and comparison
- Contract
- Scheduling
  - Installation
  - Interconnect agreement with utility

- Qualified Solar Developer Directory | The Pennsylvania Solar Center (pasolarcenter.org)

# Quote Comparison

- Components and Location
- Warranties
- Incentives
- Scope
- Project Schedule
- Payment Terms
- Savings and Payback
- Environmental Impact

# Working with a Contractor

Photo: NCAT

- Responsiveness
- Years of experience
- Recommendations
- Registered with states Secretary of State office?
- Solar contractors' license?
- Certified through NABCEP?
- Can they help with incentives
  - REAP
  - SRECs

# Solar incentives (PV)

- **Federal 30% tax credit**
- **Solar Renewable Energy Certificates (SRECs)**
- **Net metering**
- **Federal Modified Accelerated Cost-Recovery System (aka accelerated depreciation); *only for businesses, not residences. 5-year depreciation for state taxes.***

# Rural Energy for America Program (REAP)

**Guaranteed Loans & Grants for Renewable Energy Systems & Energy Efficiency Improvement**

- Loan guarantees on loans up to 75 percent of total eligible project costs.
- Grants for up to 50% of total eligible project costs.
- Combined grant and loan guarantee funding up to 75% of total eligible project costs.
- Four application periods: End of March, June, September, and December
- Rural Energy for America Program Renewable Energy Systems & Energy Efficiency Improvement Guaranteed Loans & Grants | Rural Development (usda.gov)

# Battlefield Lavender: Centralia, Missouri

- 13.2 kilowatt
- 44 – 300-watt panels
- 30% federal tax incentive
- Cost: $28,000
- $2,700 annual savings (at current rates)
- 10-year simple payback

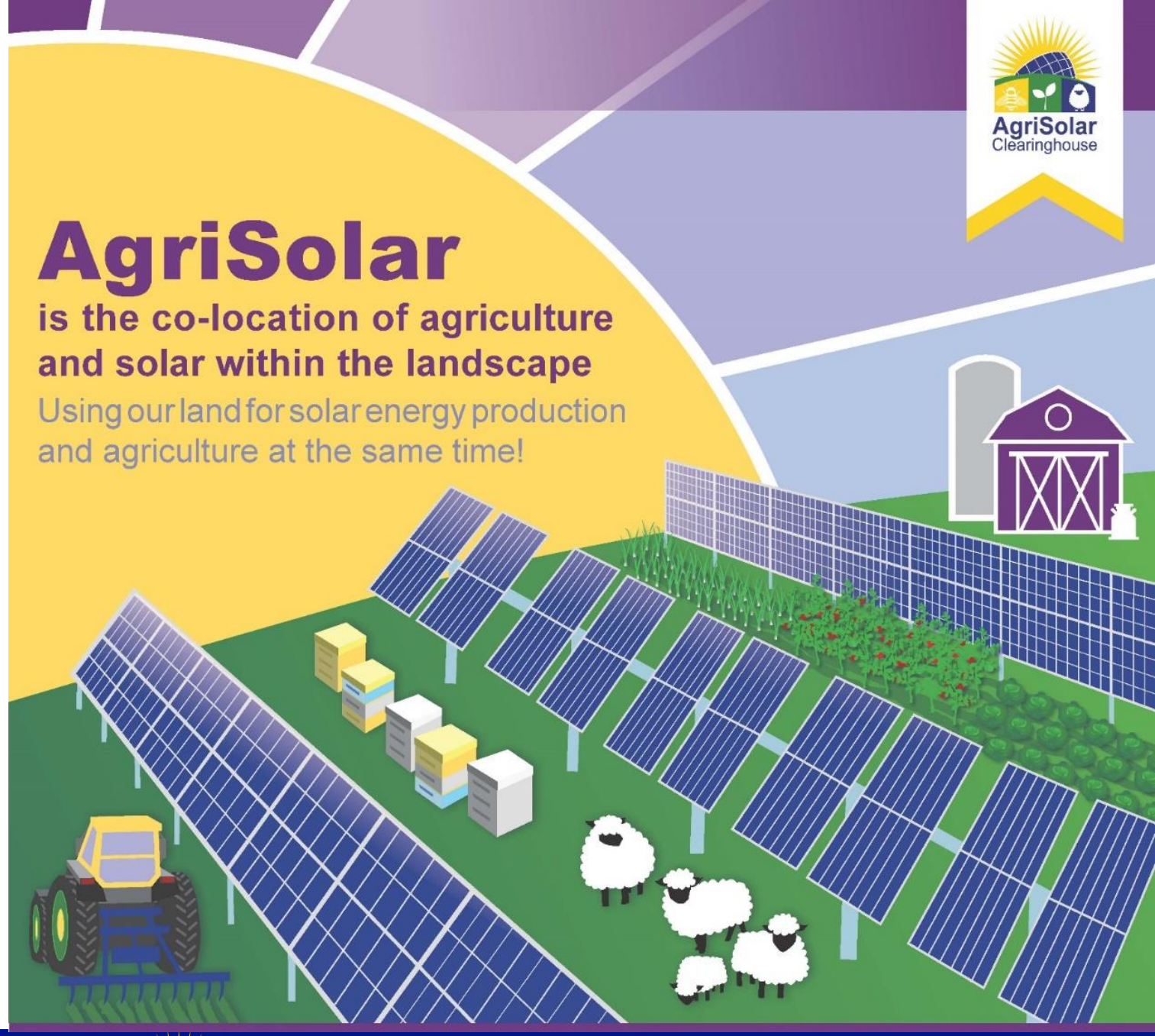
# Patchwork Farm and Greenhouse

- 30 kW system
- Cost: $67,979
- 30% tax credit: $20,393
- REAP: $16,744
- Annual savings: 3,749
- Net metering credit: $1,200
- SREC: $1,465
- Simple payback: 6 years

Photo: Scott Case, Patchwork Farm

# What is Agrisolar?

- Agrisolar is the co-location of agriculture and solar within the landscape.
- This can include solar co-located with:
  - crops
  - grazing
  - beekeeping
  - pollinator habitat
  - aquaculture
  - dairies
  - crop processing
  - etc.
- In addition to photovoltaics, it also includes concentrated solar installations.



# With Agrisolar, You Harvest the Sun Twice.

- Once with the solar panel and again with crops, forage, honey, and habitat.

- Agrisolar can help you get the most productivity out of your land, while also supporting the land, community, and ecosystem around it.

# There are Several Applications of Agrisolar:

- Solar + Crops
- Solar + Greenhouses
- Solar + Grazing
- Solar + Processing
- Solar + Dairy
- Solar + Beekeeping
- Pollinator-friendly solar
- Aquavoltaics (solar on water)

# Solar Grazing Resources

- The American Solar Grazing Association is an excellent resource.
- This CBS news story highlights agrisolar and solar grazing potential.
- This video shares the story of Solar Shepherd: How A Shepherd and Solar Developer Are Joining Forces to Grow Sheep, Clean Energy
- This solar grazing section of the Information Library has a wealth of information.


ASGA

# Tutorials

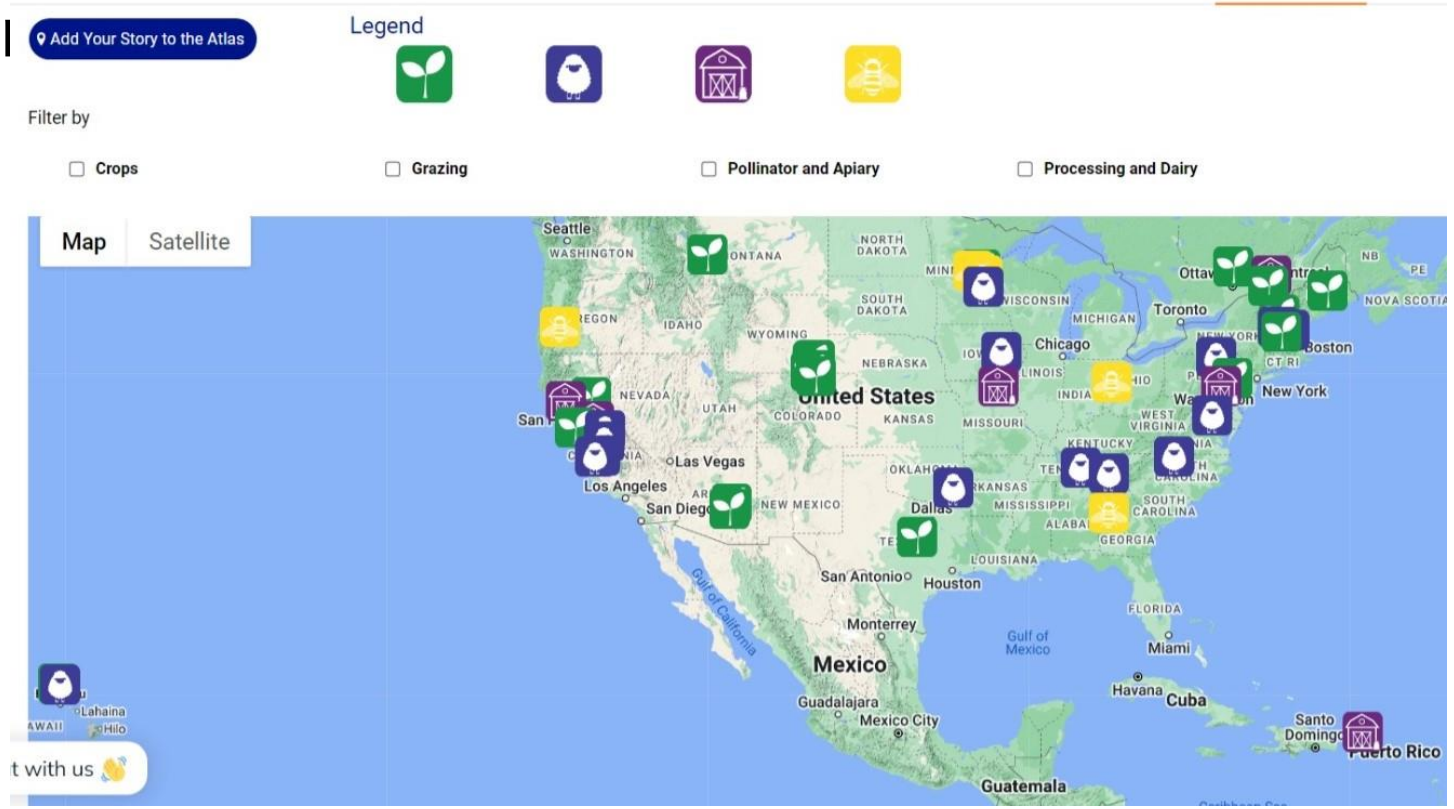

- Made in the Shade: Growing Crops under Solar Panels
- Ecosystem Services of Solar-Pollinator Habitats
- Innovative Agrisolar Design, a Round-table Discussion
- Policy Approaches for Dual-use and Agrisolar Practices
- Agrisolar Ownership, Lease, and Land Planning
- Agrisolar in the Pacific Northwest
- Crunching Numbers on Agrisolar: Context and Costs of Agrivoltaics in the US

# Information Library

- We offer an Information Library that includes peer-reviewed and government articles on a wide array of topics, from crop research to best practices.
- All library items are free to download.
- Each article is summarized for easy browsing and the entire library is searchable.

# Inspiration and Lessons Learned for Your Project

Our Storytelling Atlas is an interactive tool for finding agrisolar projects across the United States. Visit the atlas to see how others are implementing agrisolar in their projects or contact agrisolar@ncat.org if you need help findi




Back

Photo: Owens Farm

# Knowlton Farm, Massachusetts

Photo: Agrisolar Clearinghouse, NCAT

# Jack’s Solar Garden, Colorado

# Thank you!

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