Agrivoltaics for Farm Viability in Vermont

for Renewable Energy Vermont conference, 2026

October 14, 2026

Tim Upton, Ethan Winter, Lewis Claghorn-Fox

Alex DePillis, moderator

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October 14, 2026 | Burlington, VT

Outline

- ***Panelist introduction***
- ***Farmland and farming in Vermont***
- ***Developer perspective and energy permitting in Vermont***
- ***Policy options***
- ***Questionnaire results, Q & A***

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What you will get

Summary knowledge of the state of play and some specifics of:

- Solar-on-farmland regulations in Vermont
- Using sheep to manage vegetation in solar sites
- Policy options
- "Extras"
  - Agrivoltaic technology providers and their products.
  - … and more exciting information resources!

You will hold well-informed opinions on next steps in Vermont, both personally and as necessary policy.

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Real-time survey

- *Five questions.*
- *You can answer them on your phone.*
  - *Now you have an excuse to look at your phone during the presentation.* ☺
- **Between presentation and Q & A, we share your responses.**
  - **Compiled and anonymous.**



Presenters

- Ethan Winter
  - AFT works to save America's farms and ranches by protecting agricultural land, promoting sound farming practices, and keeping farmers on the land.
- Lewis Fox
  - Agrivoltaic Solutions provides managed grazing services to solar developers as well as consultation on site design and planning.
- Tim Upton
  - VHB supports renewable energy (wind, hydro, solar, RNG) developers through facility planning, design, siting, and permitting.
- Moderator: Alex DePillis, Vermont Agency of Agriculture, Food and Markets
  - Alex gives technical and business support to farmers to farm within solar projects. In the energy permitting process, he reviews proposed projects for their potential impact on farmland. He also offers technical and business support for other farm-integrated energy projects such as biogas from manure.

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SAVING THE LAND THAT SUSTAINS US

AGRIVOLTAIC SOLUTIONS

vhb

VERMONT
AGENCY OF AGRICULTURE, FOOD AND MARKETS

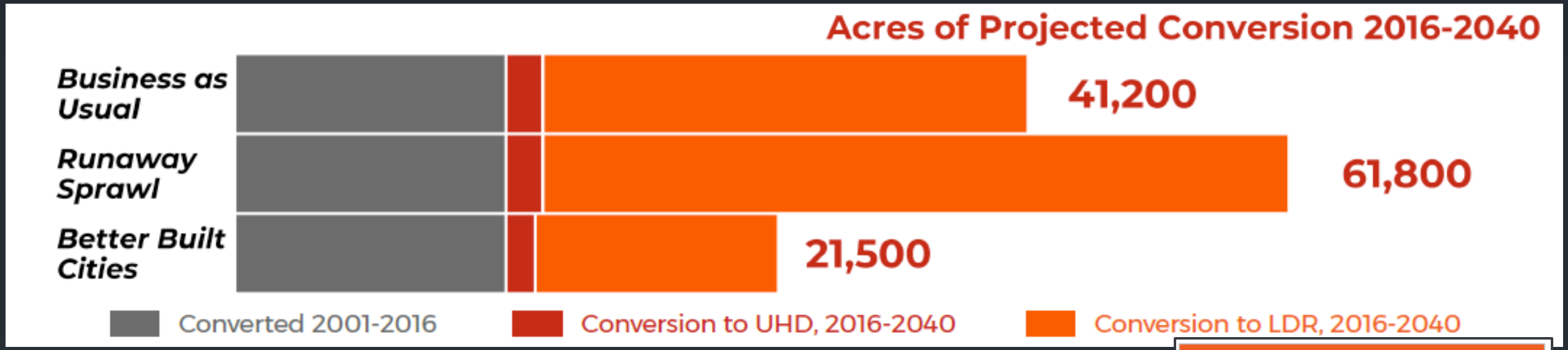


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American Farmland Trust *Farms Under Threat*



LDR PAVES THE WAY FOR FURTHER DEVELOPMENT

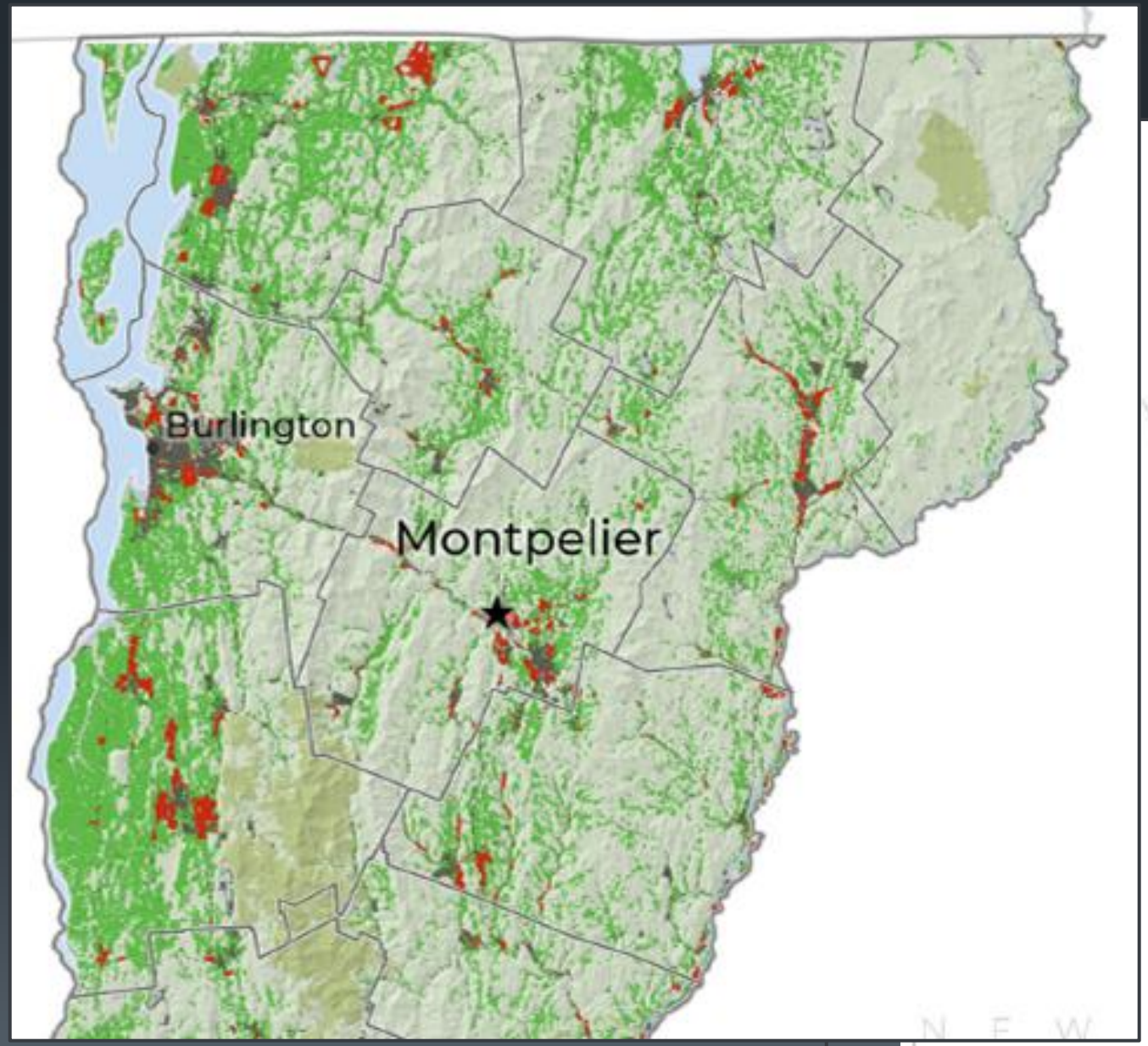
Agricultural land that was in LDR areas in 2016 is

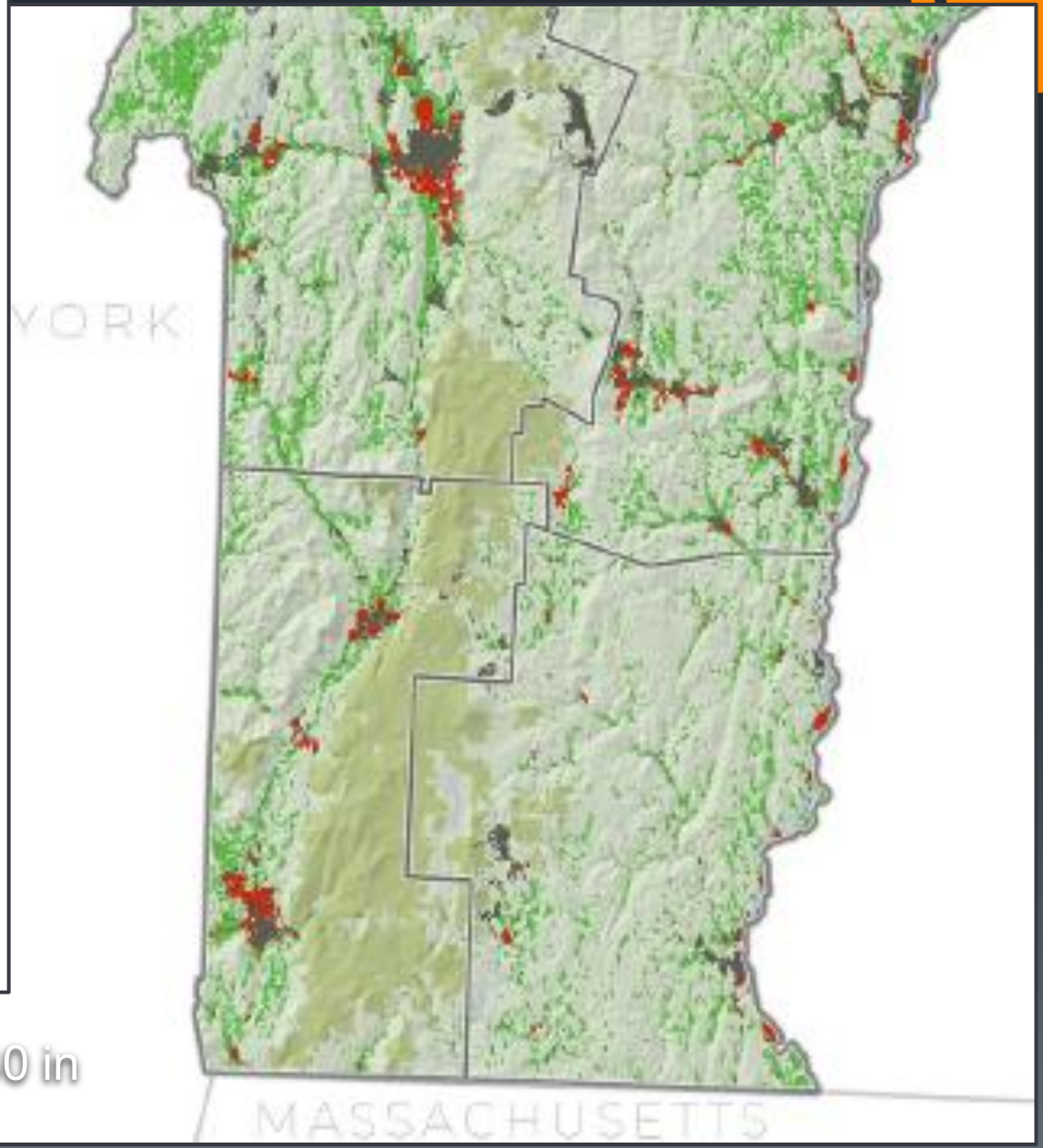
5 TIMES MORE LIKELY

to be converted to UHD by 2040, compared to other agricultural land.

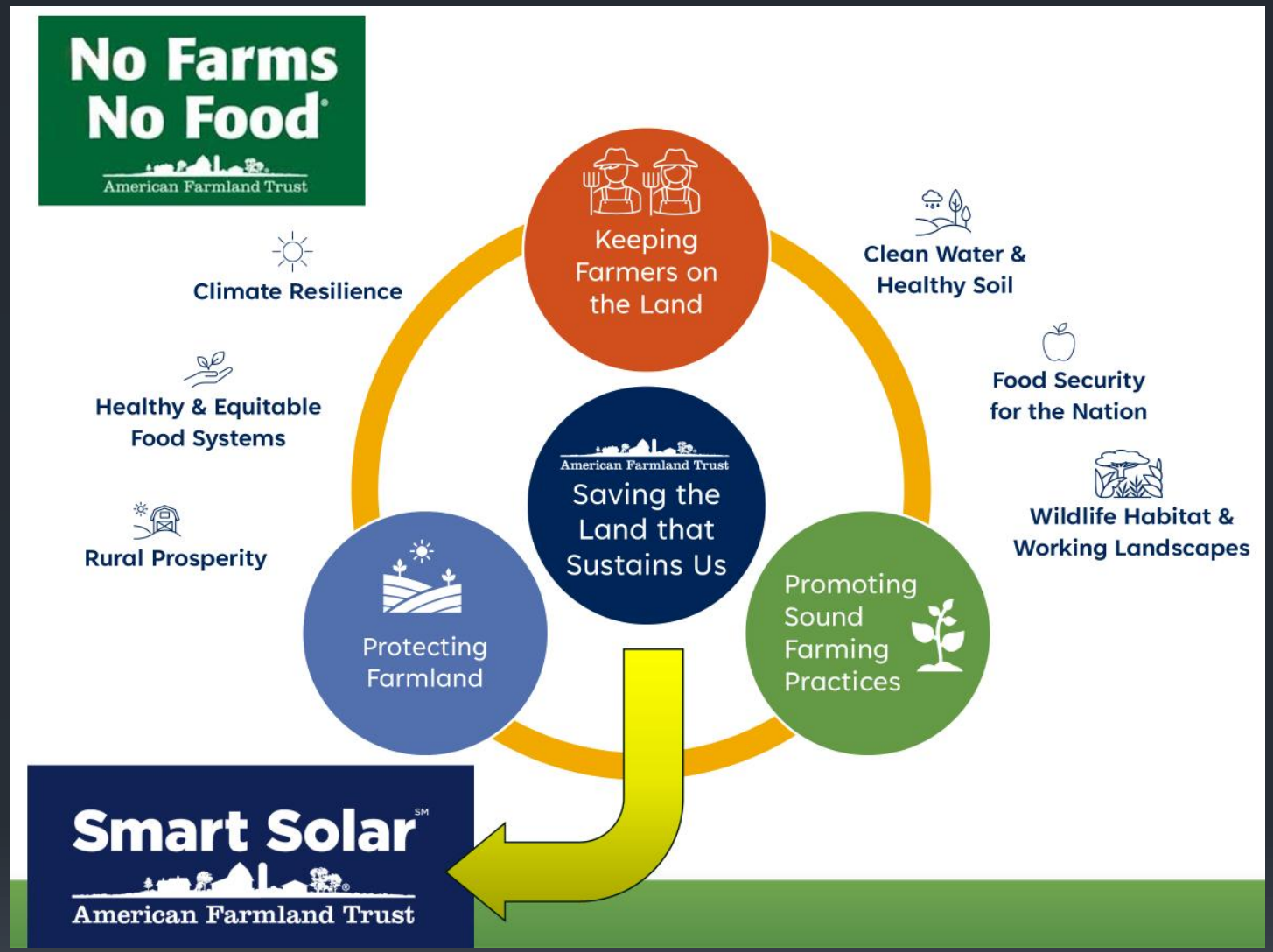
UHD = urban and highly developed.
LDR = low-density residential

https://development2040.farmland.org/



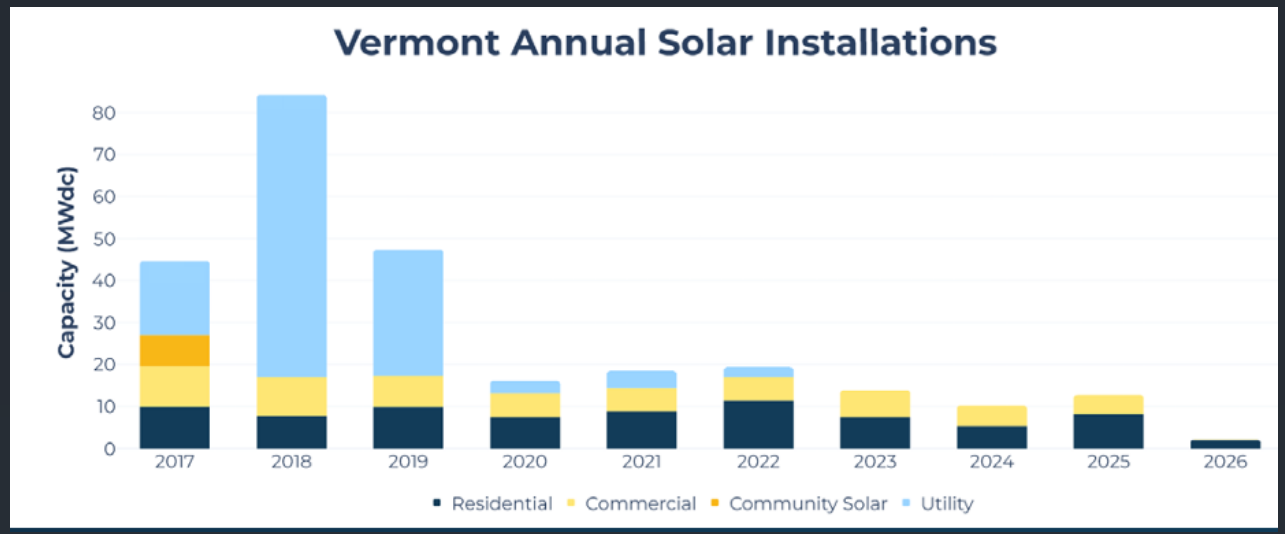


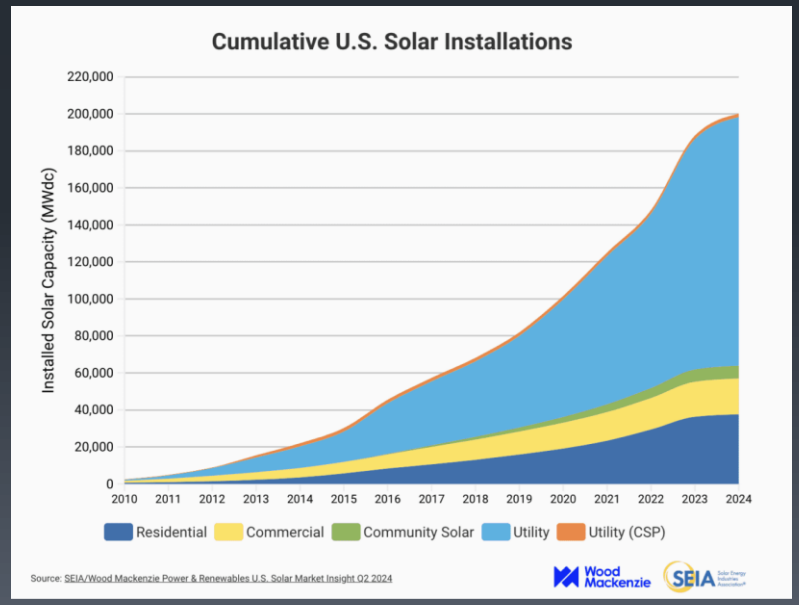
Projected agricultural land conversion from 2016-2040 in the Business as Usual scenario.



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“Here Comes The Sun” – What about Vermont?

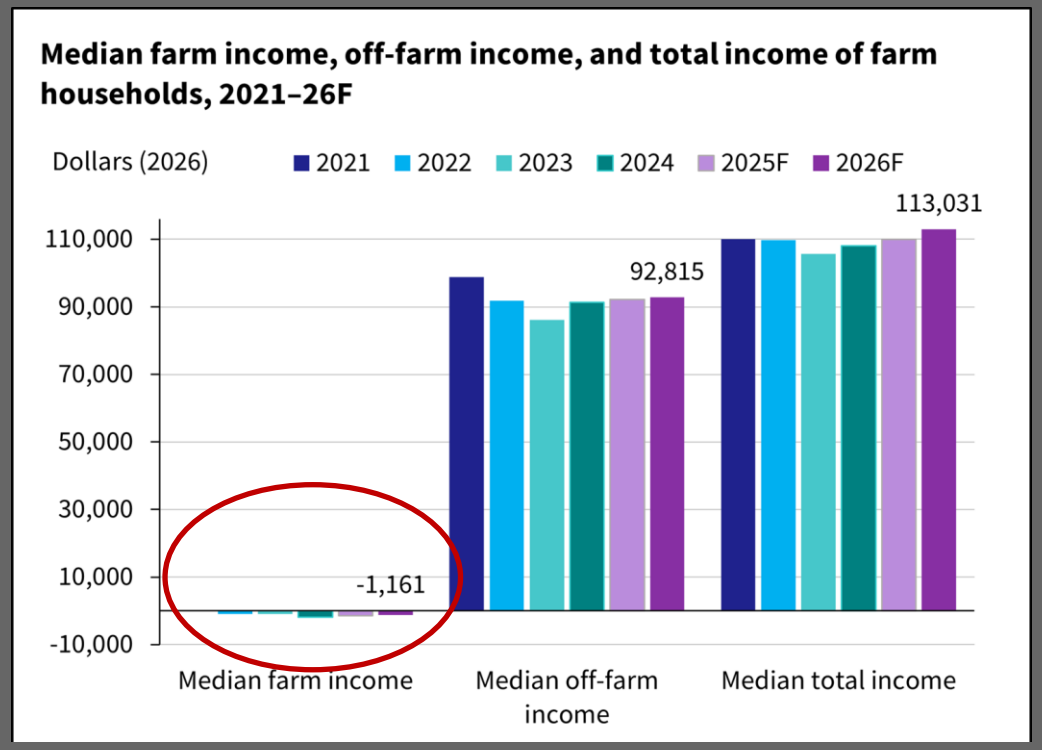


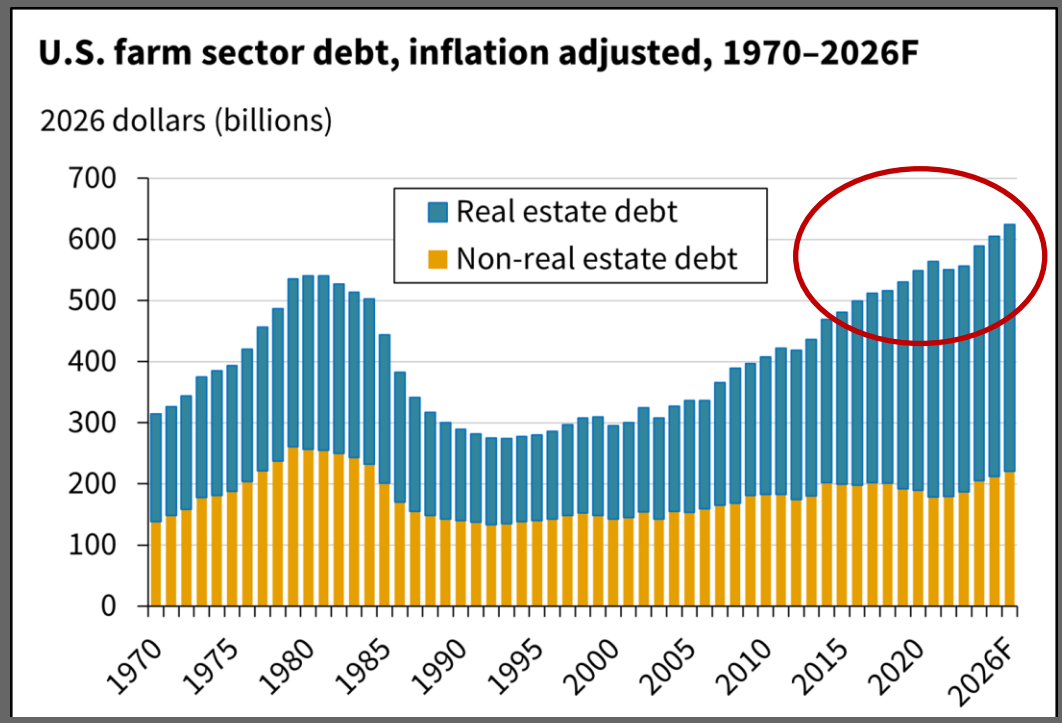


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SourceL SEIA, SEIA-Vermont (Sept 2026)

Underlying Challenges to Farm Viability





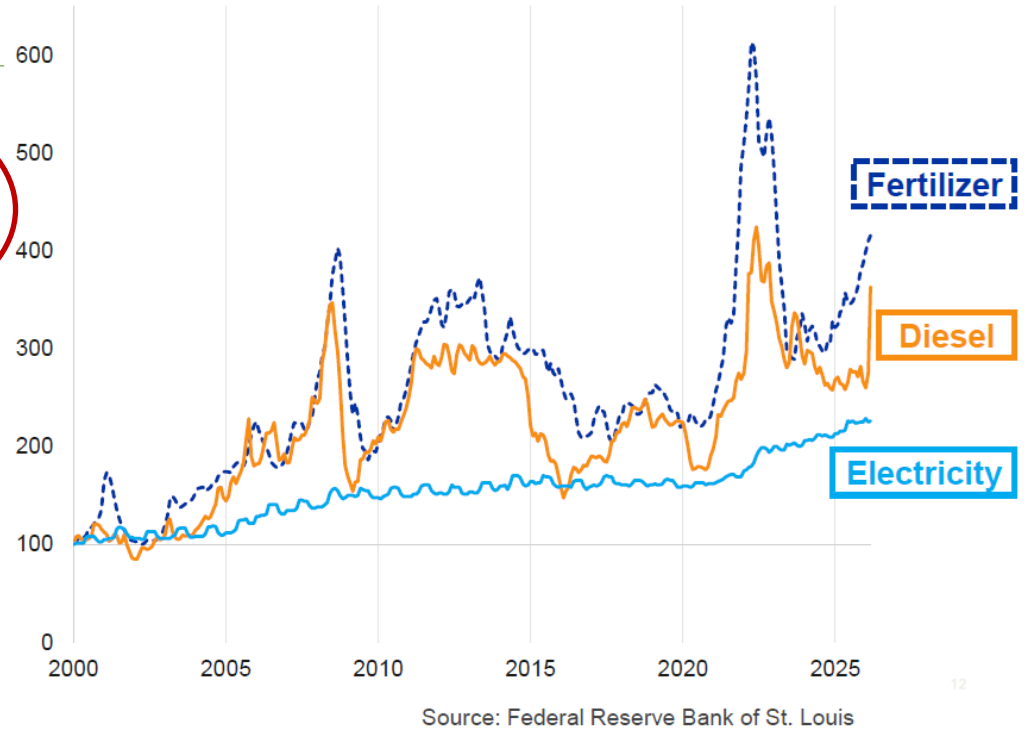
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Source: USDA, Economic Research Service (2026, February 5)
Farm Sector Income & Finances - Highlights from the Farm Income Forecast | Economic Research Service

Underlying Challenges to Farm Viability

On-Farm Energy Use

- Price increases since 2000
  - Fertilizer – **4.2x**
  - Diesel – **3.6x**
  - Electricity – **2.3x**
- Diesel prices are **strongly correlated** with fertilizer prices
- Electricity prices are **not strongly correlated** with fertilizer prices



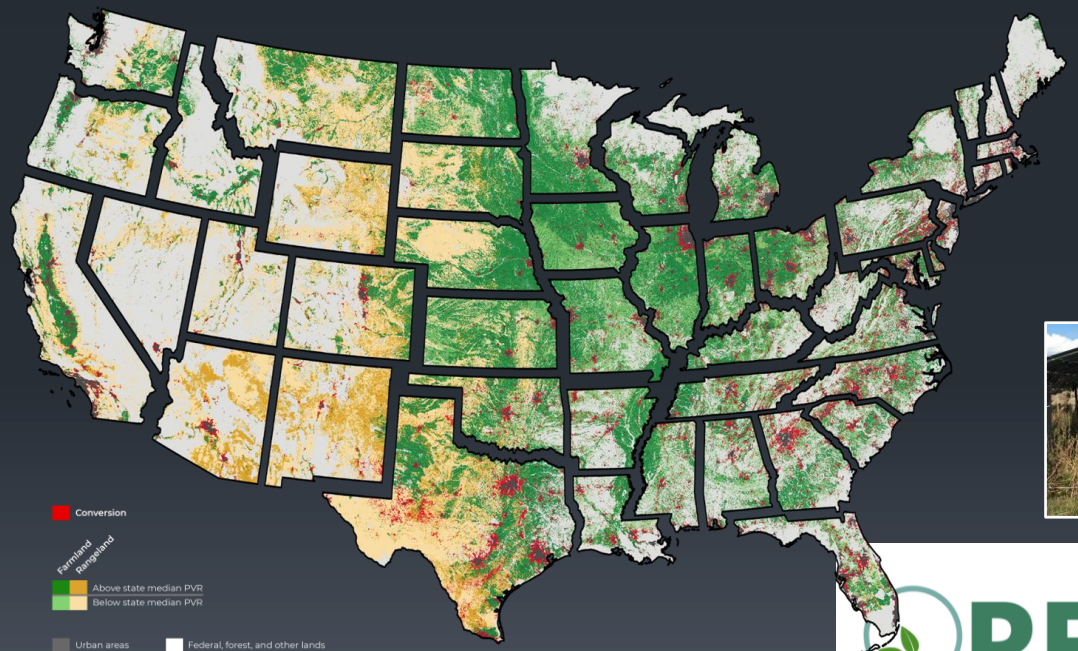
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Smart Solar advances equally important goals:

1. Strengthen farm viability
2. Safeguard soils and lands best suited for agriculture
3. Accelerate solar energy deployment











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Solar Designed For Farming Can Strengthen Agricultural Viability – Why Not Vermont?

- Vermont has ~6,500 farms on ~ 1,173,900 acres in 2022, down 4% and 2% from 2017
- Average farm covers 180 acres
- Number of dairy cows is down substantially (37% drop in last Ag Census)
- **57% of Vermont farms lost money**

- Farmland conversion largely driven by low density residential development
- Hayfields most common farmland converted for commercial development
- Land for solar is fraction (10%) of acreage used for golf courses in Vermont

In Vermont, farm viability is the challenge, not solar development

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Source: USDA - NASS, Vermont Agency of Agriculture, Food & Markets

Solar Designed For Farming Can Strengthen Agricultural Viability – Why Not Vermont?

- Solar lease income substantially more than on-farm income (10x/acre)
- Vegetation management via livestock grazing is cost effective and improves soil health over time – a proven approach
- Solar grazing offers long-term income (eg $350-500+ per acre) and access to pastureland producers cannot afford to own

Opportunities to harmonize solar and farming for greater benefits + increased public support for projects sited on farmland

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Source: USDA - NASS, Vermont Agency of Agriculture, Food & Markets



Defining "Agrivoltaics"

Agricultural Production + Solar Energy Generation

AFT definition:

Intentional

Producing marketable product(s) Designed with farmer involvement

Production through project life

"A system under which solar energy production and agricultural production, including crop or animal production, occurs in an integrated manner on the same piece of land through the duration of a project."

Photo by Werner Slocum / NLR

Agrivoltaics: Livestock Grazing









Photos by United Agrivoltaics, Agrisolar Clearinghouse, BlueWave Energy, Rutgers University

Agrivoltaics: Crops & Hay









Photos by Werner Slocum / NREL, Next2Sun, Hyperion Systems, Lightstar Renewables

Ecovoltaics (different, but complementary)







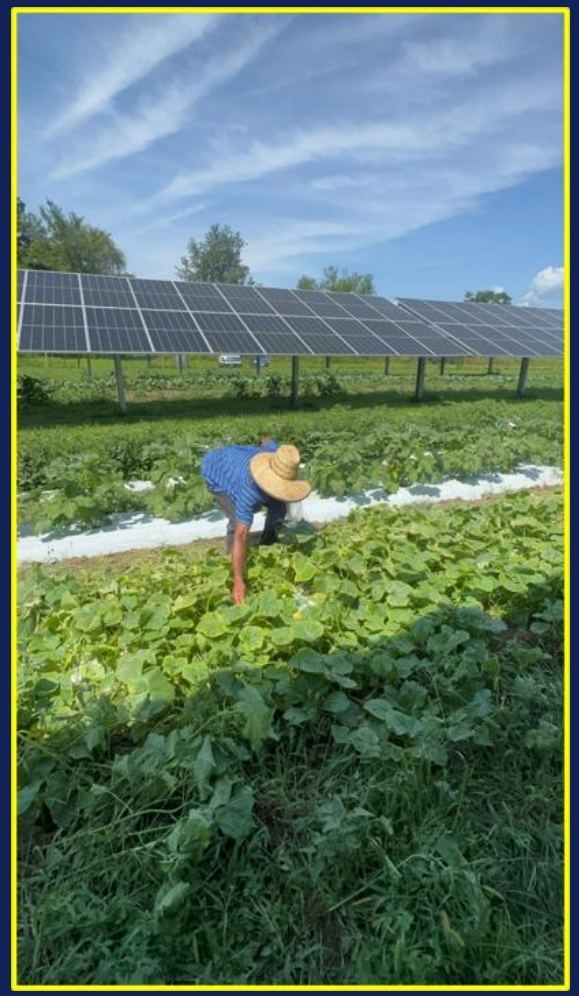
Photos by Rob Davis, Dennis Schroeder / NREL, Pivot Energy

What should Agrivoltaics look like in Vermont?

How can we get there?







Photos by AgriSolar Clearinghouse, Tony Hendrich, AFT/Lightstar

Prosperity Partners

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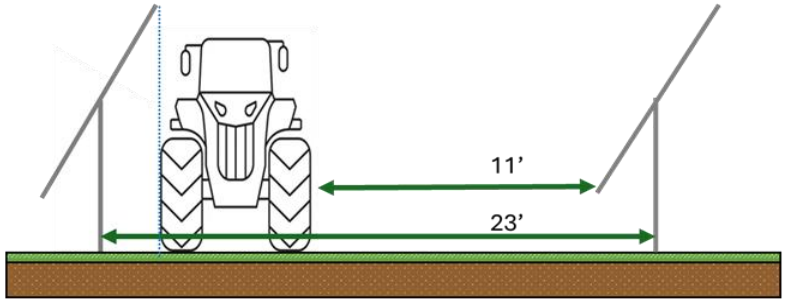
Leveraging AFT expertise to advance Smart Solar

Fee-for-service solar and business technical assistance and project consulting (**specifically solar developers)**

Work directly with development, EPC, and asset management teams and with lease partners (landowner) to ensure projects are sited, designed, managed to protect farmland and strengthen farm viability

Taking Smart Solar principles to ground farmer-first technical support needed to go from concept to implementation

FROM THIS



TO THIS



Smart Solar℠

American Farmland Trust®





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Photos: NREL / Jack's Solar Garden, AFT/ Rutgers Agrivoltaics Program

Solar Grazing – Taconic End Sheep

A second-generation dairy farm transitions to solar grazing



Adoption of Solar Grazing

- *ASGA*
- *2024 Census of Solar Grazing*



Adoption of Solar Grazing

Why sheep grazing specifically?

TACONIC END SHEEP
Leicester, Vermont



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Impact on Farm Viability



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What are our challenges?



What can help grow this industry in Vermont?

- *Advocacy from AAFM during permitting*
- *Prioritizing agrivoltaics for projects sited on farmland*



How can solar developers help?




TACONIC
END SHEEP
Leicester, Vermont
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Energy Permitting in Vermont

- Grid-tied electric generation requires a Certificate of Public Good from the Public Utility Commission under 30 V.S.A. Section 248. AAFM is required to participate in the review process for projects over a certain size.
- The PUC is required to find that projects not have an "undue adverse effect on aesthetics, historic sites, air and water purity, the natural environment, the use of natural resources, and the public health and safety, with due consideration having been given to the criteria specified in 10 V.S.A. §§ 1424a(d) and 6086(a)(1) through (8) and (9)(K), impacts to primary agricultural soils as defined in 10 V.S.A. § 6001, and greenhouse gas impacts." These criteria include impacts to air quality, streams, wetlands, flooding and river corridors, soil erosion, wildlife habitat, aesthetics, endangered species, historic resources, etc.
- Criterion 9(K) - impacts on Primary Agricultural Soils – is the most recent addition to the list. The Agency of Agriculture, Food, and Markets (AAFM) is required to participate in the review process for projects over a certain size on PAS and "… may provide evidence and recommendations concerning any findings to be made..." [§ 248(a)(4)(F)].
- Suitable sites for solar generation very often include areas of PAS. Under Section 248 all PAS retains its classification so that any future changes are reviewed as if the solar project had never been built. Projects are required to have a decommissioning plan, and AAFM evaluates whether developers will be able to restore soils to their pre-construction condition.
- Projects are also subject to other state and federal environmental regulations (stormwater, wetlands, T/E species, FHARC, etc.). Responsibility for protection of multiple natural and cultural resources necessarily creates conflicting design restrictions.



When Goals Collide

- Vermont has a strong tradition of protecting natural resources and attempting to preserve a landscape featuring small towns, agricultural fields, and forested hills, and has added ambitious goals and directives related to climate change generally and more specifically to local production of clean energy.
- Solar generation is needed to successfully achieve Vermont's energy transition, including both small-scale residential sites and larger-scale ground-mounted arrays.
- The location of generation facilities is driven by a multitude of factors, starting with grid compatibility, land availability, and topography. With each additional site consideration, the puzzle gets more complicated (forest cover, open space/aesthetics, PAS/farmland, wetlands, river corridors and flood hazard areas, archaeological resources, infrastructure upgrades, etc., etc.)
- Efforts to preserve a wide range of resources inevitably create conflicting pressures in site selection (forest cover, farmland, habitat, wetlands, etc.).

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Farmed wetlands

- 10 V.S.A Section 902(5): “Wetlands” means those areas of the State that are inundated by surface or groundwater with a frequency sufficient to support significant vegetation or aquatic life that depend on saturated or seasonally saturated soil conditions for growth and reproduction. Such areas include marshes, swamps, sloughs, potholes, fens, river and lake overflows, mud flats, bogs, and ponds, but excluding such areas as grow food or crops in connection with farming activities.
- Vermont Wetland Rules Section 3.1(a)(2): Farming activities means the cultivation or other use of land for growing food, fiber, Christmas trees, maple sap, or horticultural and orchard crops; and the growing of food and crops in connection with the raising, feeding, or management of livestock, poultry, equines, fish farms, or bees for profit.
- Vermont Wetland Rules Section 3.1(a)(3): The farming exemption shall apply to all areas used to grow food or crops in connection with farming activities including areas in ordinary rotation, as of the effective date of these rules. The exemption will expire whenever the area is no longer used to grow food or crops or in ordinary rotation.

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Practical effects

- If a farmer and solar developer decide to install an array in a farmed (and otherwise Class II) wetland, under the VWR the "exemption" disappears and DEC treats the wetland as if it had never been used to grow food/crops.
- At this point, the solar project is subject to all of the same obligations it would have if it were proposed in an undisturbed wetland, including the obligation to avoid the wetland altogether if practicable, along with any requirements for mitigation – even if the conversion to solar production would result in improved wetland function.
- Application of state wetland regulations can reduce the area available for renewable energy generation, constrain a farmer's options for deciding which areas are best suited to conversion, and add significant expense to the design and permitting process for the solar developer, without having prevented any negative impacts to wetland functions and values. In a worst-case scenario, if solar generation is infeasible based on avoidance and mitigation restrictions, farmland could be permanently converted to other uses that don't help us meet our climate and energy goals. Even where solar can eventually be accommodated, it will be more expensive and possibly less productive.
- The affected area also will thereafter meet the statutory definition of a wetland, meaning that future agricultural uses are subject to regulation under the VWR (the current rules include the growing of food/crops as an Allowed Use with minimal restrictions, and statute requires that the rules cannot restrain agricultural activities without consent of AAFM).

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Are there solutions?

- Amend 10 V.S.A. Section 902 to state that construction of a renewable energy facility does not affect the jurisdictional status of any area used to grow food or crops.
- Amend Section 913 to include construction of solar generation facilities in areas used to grow food/crops in list of activities not requiring permits.
- Include provisions that protect wetland functions and the long-term agricultural viability of the soils. For example:
  - Project must receive a CPG (AAFM and ANR are both parties to every review)
  - CPG must include a decommissioning plan approved by AAFM
  - Construction cannot change the topography or hydrology of the affected area

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Contact

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- Ethan Winter, (518) 732-6925
  - American Farmland Trust - https://farmland.org/smart-solar
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  - Alex.DePillis@Vermont.GOV

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Lightning round -- policy suggestions

What are two or three policy ideas to improve the use of farmland for solar in Vermont that could get support from climate, energy, and agriculture coalitions?

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Survey responses (different app, then return to PowerPoint)

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… with some help from our friends…

- Alex:
  - Solar industry: Martha Staskus, Leslie Cadwell, Tom Hand, Chad Ferrell, Shannon Scarbrough, Joey Dorwart-Crane, Jarred Cobb, Adam Crary, Seth Goddard, Dave Carpenter
  - NGOs and gov't: Genevieve Byrne, Drew Watson,Lexi Hain, Allie Webster
  - UVM: Jascha Pick, Amber Reed, Ben Tutko, Kimberly Hagen
  - AAFM: Ari Rockland-Miller, WillyJane Patry, Alison Milbury-Stone, Melanie Kehne
- Ethan:
  - Smart Solar partners and collaborators, including NYSERDA, USDA SARE, NLR-InSPIRE, UMass Amherst, Cornell, Rutgers, CT Working Lands Alliance, ASGA, TNC VT
  - Dan Reicher and Solar Uncommon Dialogue (with SEIA/SI2, TNC)

Extras: agrivoltaic options

Designed to be 100% compatible with crops because the technology does one or more of the following:

- Changes the light spectrum to help plants.
- Allows for conventional cropping practices with an unconventional structure (conventional higher-off-the-ground solar racking is not included).
- Is part of a greenhouse.
- Actively monitors growing conditions and changes the amount of light.

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Extras: agrivoltaic options (a two-part table)

Company	Tracking	Controlled according to agronomic conditions	Greenhouse option	Manipulate light	Description and notes
Sun'Agri	Single-axis[1]	Yes	No	No	Anyone's modules, their controls. Controls optimize for both agronomic factors and energy production. Includes a warranty both that the crops will have enough light or be protected against excess light or heat. Approximately 20 projects since 2018.
Sunzaun	No	No	No	No	Vertical, fence-like structure runs north-south and captures east and west sun. Both sides of the solar panel capture light ("bifacial"). Three US projects as of 2025-04. All portrait format, one panel high.
Next2Sun	No	No	No	No	Vertical, fence-like structure runs north-south and captures east and west sun. Both sides of the solar panel capture light ("bifacial"). Multiple projects. First US project proposed at University of Vermont research farm.
REM TEC	Dual-axis	No	No	No	Guyed structure. Various panel spacings and patterns available. At least five projects: four in Europe, one in China.

[1] Panels move between pointing to the sun, providing shade when needed, and/or to protect plants from hail, depending on conditions.

Company	Tracking	Controlled according to agronomic conditions	Greenhouse option	Manipulate light	Description and notes
Soliculture (LUMO Energy Solutions)	No	No	Exclusively	Yes (shifts green to red)	Gaps between silicon on panel allow light through. Maybe using UbiQD[2] "quantum-dot" film[3] on Heliene[4] panels (see profile in PV Magazine) "…a thin layer of luminescent material …converting green light to red light…" Greenhouse project in Washington and pilot project (2018) in Ontario..
Insolight	No	Yes	Yes	Yes	Linear Fresnel lens layer slides to focus light through gaps in silicon or onto silicon? Or is it a deployable reflector-cum-shading-device? 7-8 projects in Europe, mostly strawberries and raspberries.
DWP Energy Solutions (1/3 down this webpage)	Optional	No	Yes	Yes	Reflects infrared onto silicon (PV) for energy, allows all other wavelengths through. Tested a prototype in US.
Sunseed APV	Optional	Optional	No	Yes	Controlled growing conditions through manipulation of shading devices. Three pilot projects.
TractorSled	Single-axis	No	No	No	Mobile (field-towable) and modular. Much of assembly is off-site. One prototype in US.
Brite Solar	No	No	Yes	No	Two models of PV in glass: 49% and 77% transparency. Two pilot projects.
Longboard Power	Yes	No	No	No	Functions as a snow fence or shelterbelt. Received Colorado Agrivoltaic grant and published results on millet (one season) and microclimate due to the single row of tracked PV.

Others to watch or be aware of:
H2arvester – One prototype. A 12 m x 6 m "car" moves slowly (10 meters per hour) across the field. Contemplating hydrogen and irrigation.
TSE Agri PV – Single-axis, guyed structure, 27 m x 12 m. Promising 11, three-hectare sites, 3 MW each, in 2022.[5] No prototype shown.

[2] New Mexico Inno - UbiQD to develop new type of greenhouse roof with Canadian company (bizjournals.com) (https://www.bizjournals.com/albuquerque/inno/stories/news/2022/03/24/ubiqd-to-develop-new-product.html)