American Farmland Trust
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Smart Solar Siting for New England

Rapidly scaling up New England's solar photovoltaic (PV) resources to meet the region's decarbonization goals will require developing solar projects in a way that minimizes negative impacts on open space, forests and farmlands. Through the Smart Solar Siting Project for New England, American Farmland Trust, Acadia Center, Conservation Law Foundation, Vote Solar, and Vermont Law School have developed research and guidance to reduce conflicts over siting of solar facilities by reaching agreement among multi-stakeholders on smart solar siting principles, policies and programs. Project partners have prepared a number of research summaries and policy analyses, and assembled additional resources that together assess each New England State's potential to meet their climate and solar generation goals while protecting the region's best farm and forest land.

Farmland and Forest Land Use Scenarios

Solar deployment is becoming constrained because of increasing conflict over the pressure that projects, especially large-scale projects, are putting on farms, forests and other land. Flat, open farm fields, often the most productive farmland, are highly desirable for solar siting. This new pressure for solar siting on desirable open land compounds the severe, existing "competition for land" in New England already due to real estate development pressure.

This document illustrates alternative solar siting locations and land-use scenarios, and the corresponding potential solar capacity. These scenarios are not recommendations. Instead, they represent several siting methods and locations that can be used towards meeting the states' clean energy goals. All calculations of megawatt (MW) potential were calculated using a conservative land use area of 5 acres per MW.

According to Acadia Center's Energy Vision 2030, which lays out goals for each New England state's path to meeting emissions reductions of 50% by 2030 and at least 80% by 2050, states are estimated to need significant ground-mounted solar to meet their climate goals. These estimates include community distributed, commercial, and utility scale ground-mounted solar, and are presented in megawatts (MW).

Ground-Mounted Solar Capacity Needed by 2030 to Achieve Emissions Reductions of 50% by 2030*	
CT	1948 MW
ME	2166 MW
MA	5011 MW
NH	771 MW
RI	587 MW
VT	569 MW

*Based on Acadia Center Energy Vision 2030

Farmland Siting – Solar on Non-Agricultural Land

One identified type of farmland that has potential use in solar siting, without displacing active agriculture, is a category of land classified by the USDA Agriculture Census as "other" land. This land is defined as land area on farms that is not actively farmed and may include house lots, farmyards, ponds, wasteland, and roads. Both the number of farms reporting "other" land as part of their property and the total acreage reported are large enough to include in farmland siting scenarios as part of achieving clean energy goals. The table below presents three scenarios for different percentages of farms hosting solar on "other" land, and the respective MW potential under each scenario.

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"Other" Lands by State and MW Potential of Solar on "Other" Lands (and % of 2030 Ground-Mounted Solar Capacity Needs Achieved)					
State	Farms reporting "other" land (#)	Total acres of "other" land	MW Potential*		
			25% of farms host 0.50MW array	15% of farms host 0.50MW array	5% of farms host 0.50MW array
CT	3726	87652	466 (24%)	282 (15%)	94 (5%)
ME	5180	87207	648 (30%)	390 (18%)	130 (6%)
MA	4865	79627	608 (12%)	366 (7%)	122 (2%)
NH	2997	39252	374 (48%)	222 (31%)	74 (10%)
RI	760	7761	96 (16%)	60 (10%)	20 (3%)
VT	4589	73889	574 (100%)	342 (60%)	114 (20%)

*Values in ( ) represent percent of 2030 ground-mounted solar capacity needs achieved with this scenario.

Acreage required for a 0.50MW (500kW) array would be approximately 2.5 acres. This is a reasonable area for development as solar because many farms have "other" land and can host solar without impacting agricultural production. The costs of developing arrays this size pose a challenge, as do variations with respect to whether the "other" land is contiguous, thus the values presented are intended to illustrate the potential. Larger arrays sited on farms with significant "other" land may be more economically feasible. A more significant concern is the feasibility of connecting such arrays to the grid.

Farmland Siting – Dual-Use Solar on Permanent Pasture

In striving to meet renewable energy goals, there has been significant push-back due to the executed and planned conversion of farmland to solar. Employing dual-use solar arrays, which are sited on farmland that continues to be actively farmed or grazed around the panels, can alleviate the concern over the loss of farmland, as the land upon which the arrays are sited can continue to support agriculture while also generating clean energy. While dual-use solar has the potential to be used for commodity crops and vegetables, grazing under solar panels is a well-established and accepted dual-use activity. This scenario presents dual-use on pasture used for grazing. The table below presents three scenarios for different percentages of farms hosting dual-use solar on permanent pasture, and the respective MW potential under each scenario.

Permanent Pasture by State and MW Potential of Dual Use Solar on Permanent Pasture (and % of 2030 Ground-Mounted Solar Capacity Needs Achieved)					
State	Farms reporting permanent pasture (#)	Total acres of permanent pasture	MW Potential of dual use*		
			30% of farms host 1MW dual-use	15% of farms host 1MW dual-use	5% of farms host 1MW dual-use
CT	2574	31923	772 (40%)	386 (20%)	129 (7%)
ME	3410	62369	1023 (47%)	511 (24%)	171 (8%)
MA	3203	46314	961 (19%)	480 (10%)	160 (3%)
NH	1997	28605	599 (78%)	300 (39%)	100 (13%)
RI	440	5914	132 (23%)	66 (11%)	22 (4%)
VT	3756	112348	1127 (198%)	563 (99%)	188 (33%)

*Values in ( ) represent percent of 2030 ground-mounted solar capacity needs achieved with this scenario.

For resources and more information on the New England Smart Solar Siting Partnership please visit:
https://farmland.org/New-England-solar

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Using a conservative dual-use array footprint of 10acres/MW. Distance to substation of these potential arrays is again the limiting factor. It may be most reasonable to assume 5% of farms are within 1 mile of a substation for tie-in to the electrical grid.

Farmland Siting – Solar on Farm Woodlands

There is significant acreage of woodlands reported as part of farmland properties in New England. While woodlands have their own value and role on farms (i.e. timber production, agroforestry, and maple syrup production), owners are often faced with converting woodlands into other land uses to facilitate increased crop production. In addition, woodlands are equally at risk of sale and permanent development as other land on the farm. Therefore, this land type has been included in the solar siting scenarios presented in this document. Scenarios presented in the table below illustrate two different sized arrays on a small percent of farms reporting woodland. The table below presents two scenarios under which 5% of farms with woodlands in each state would clear a portion of their woodland to install solar, and the respective MW generated under each scenario.

Woodlands by State and MW Generated by Solar on 5% of Farms with Woodlands (and % of 2030 Ground-Mounted Solar Capacity Needs Achieved)

State	Farms reporting woodlands (#)	Total acres of woodland on farms	MW generated if 5% of farms hosted 500 KW	MW generated if 5% of farms hosted 1MW
CT	3105	113355	80 (4%)	160 (8%)
ME	5305	685529	130 (6%)	260 (12%)
MA	3911	194189	100 (2%)	200 (4%)
NH	2749	249540	70 (9%)	140 (18%)
RI	546	25535	10 (2%)	20 (4%)
VT	4934	527520	120 (21%)	240 (42%)

*Values in ( ) represent percent of 2030 ground mounted solar goal achieved with this scenario.

Estimated land conversion for a 500kW array is 2.5 acres, and 5 acres for a 1MW array.

Forest Siting – Solar as Percentage of Annual Forest Conversion

Another method of evaluating the potential of a state's forested land for solar development is to review the rate of forest conversion (acres lost) annually. These scenarios look at solar development if it were to be sited on 10% or 5% of current annually converted forest. This forest conversion data comes from the USFS Forest Inventory & Analysis. If conversion rates were to remain steady, and a maximum of 5% of that conversion were allowed for solar, Maine, New Hampshire, and Vermont could meet projected ground-mounted solar capacity requirements by 2030. The table below presents two scenarios for solar siting on different percentages of converted forest land, and the respective MW potential under each scenario.

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Annual Forest Conversion by State and MW Potential of Solar Sited on Converted Land (and % of 2030 Ground-Mounted Solar Capacity Needs Achieved)					
State	**Acres forest converted to non-forest annually**	**10% annual conversion developed - acres**	**10% annual conversion, MW**	**5% of annual conversion developed - acres**	**5% annual conversion, MW**
CT	4122	412	82 (4%)	206	41 (2%)
ME	21442	2144	428 (20%)	1072	214 (10%)
MA	9044	904	181 (4%)	452	90 (2%)
NH	15359	1536	307 (40%)	768	154 (20%)
RI	1128	113	23 (4%)	56	11 (2%)
VT	14207	1421	284 (50%)	710	142 (25%)

*Values in ( ) represent percent of 2030 ground mounted solar goal achieved with this scenario.

Both "Forest Siting" scenarios presented above assume a conservative land use of 5 acres per MW capacity. At larger scales the land requirement can be significantly smaller. This could result in greater generation, or less forest conversion than presented in the above tables. This is not a recommendation for continuing the current rate of forest conversion, but a calculation of what it could mean for solar to play a part of existing development rates.

Data Sources

- Acadia Center Energy Vision 2030: https://2030.acadiacenter.org/
- 2017 USDA Census of Agriculture: https://www.nass.usda.gov/Publications/AgCensus/2017/
- Data from USFS 2018 Forest Inventory & Analysis State Fact Sheets: https://www.fia.fs.fed.us/tools-data/default.asp and https://apps.fs.usda.gov/fia/datamart/datamart_excel.html
- New England Forestry: Foundation Path to Sustainability: https://newenglandforestry.org/wp-content/uploads/2016/04/Path-To-Sustainability.pdf & Keep New England Forested, https://newenglandforestry.org/wpcontent/uploads/2016/04/1._Keep_New_England_Forested_061014.pdf

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