Utility Scale Solar Suitability Analysis

Rappahannock-Rapidan
REGIONAL COMMISSION

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AUG 2018

Purpose & Process

The Purpose of this analysis is to provide the Rappahannock-Rapidan Region with a high-level utility scale solar PV site suitability assessment.

This assessment aims to provide a holistic suitability assessment, combining the wide-ranging land suitability needs and constraints of a utility scale solar installation including the limitations imposed by the existing transmission infrastructure while also incorporating local input on how and where solar development should occur.

This assessment will benefit:

1. Localities within the region in that this assessment can help guide the drafting of local zoning and solar development ordinances by providing:
   - A series of GIS maps showing existing transmission infrastructure's locations
   - A series of GIS maps showing lands not suitable for solar development based on a number of essential technical factors and local input to utility scale solar development.
   - Recommendations at a regional scale that can be included in long range planning efforts including comprehensive planning updates and amendments
   - Providing a general reference guide of suitable land, saving time in identifying suitable sites and recognizing erroneous applications

2. The region as a whole since:
   - The regional commission and local jurisdictions have an interest in protecting and preserving the character of the region and the scale of development as outlined in each localities' comprehensive plans. This includes protecting, among other things:
     - Agricultural and forestal land uses
     - Historic and scenic viewsheds
     - Prime agricultural lands
     - Established residential neighborhoods and property values
     - Available land in industrial and commercial areas
   - Energy and transmission systems work across jurisdictional lines and so solar development in one locality impacts transmission capacity in another- regional cooperation has the potential to guide a more cohesive regional utility scale solar PV development.

3. Property owners and citizens living within the Rappahannock-Rapidan Region as:
   - The assessment provides a high-level resource to help determine "is my site/farm suitable for utility solar energy development?" If so, why? And if not, why not?

The assessment educates citizenry on solar development constraints. A more efficacious citizenry will be better prepared to engage in discussions regarding leasing/selling land and/or siting of solar developments.

Process

The graphic to the right illustrates the GIS overlay analysis process used to extract each data layer of unsuitable lands from the previous remaining suitable land area. The data layers extracted are detailed in the results section of this analysis.

Categories & Constraints

- **Utility Scale > 5 acres**
- **Small Scale < 5 acres**
- **Residential rooftop solar**

- **Suitable Land**
- **Transmission Capacity**
- **Off-site Impacts**

Solar energy installations are categorized for 2 main reasons; purpose and scale.

Scale is often defined in terms of acres dedicated to the installation and/or power generation.

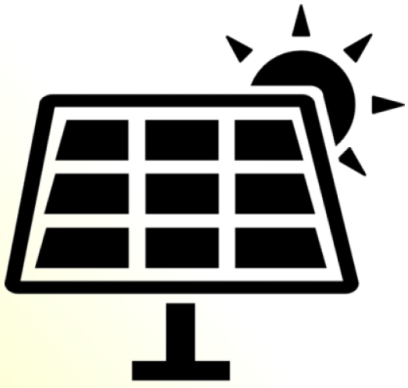
- Utility scale solar projects are focused on maximizing energy output to sell for profit.
- Small scale solar is defined here as focused on offsetting energy costs for the immediate on-site commercial or agricultural uses and synonymous with the term 'solar farm' in most cases.
- Residential rooftop solar installations are dependent on the square footage and pitch of unshaded roof area and usually consist of a few arrays with the primary purpose being offsetting on-site energy costs.

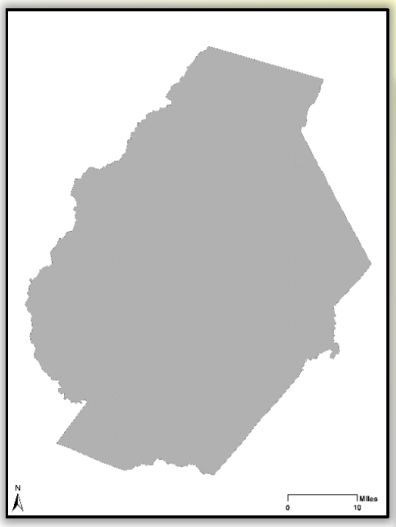
Results

This analysis assessed the amount and general locations of suitable land available for utility scale solar development within the Rappahannock-Rapidan Region. The criteria below defines suitable land. The 7th criteria 'Not on prime agricultural lands' was used to further differentiate highly suitable lands. Agriculture plays an important role in the region's economy and history, and local comprehensive plans outline varying goals and strategies aimed at promoting the continued role of agriculture within the region.

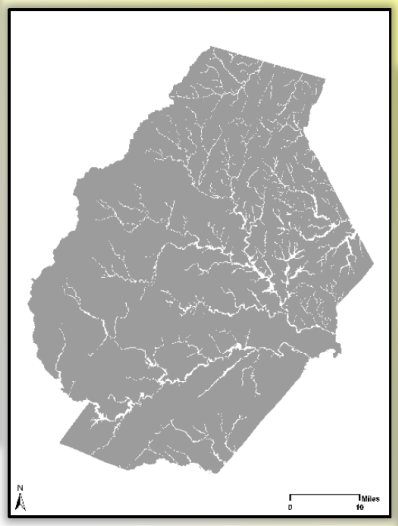
STEP	CRITERIA	SQ. MILES NOT EXCLUDED
0	TOTAL STUDY AREA	1966
1	NOT IN 100-YEAR FLOODPLAIN	1856
2	NOT IN WETLAND	1842
3	NOT IN PROTECTED AREAS	1152
4	SLOPE <5% OR <10% AND SOUTH FACING	1102
5	ADJACENT TO HIGH CAPACITY TRANSMISSION LINE (WITHIN 1 MILE)	490
6	WITHIN 3 MILES OF A SUBSTATION	150
7	NOT ON PRIME AGRICULTURAL LANDS	120

Each step is applied as a filter to the identified areas in order to produce an ideal recommendation set from the broad criteria factors above.

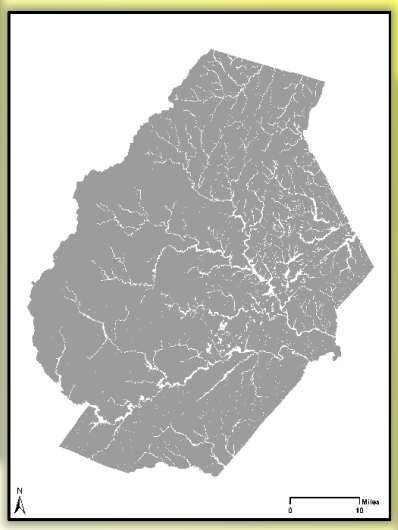




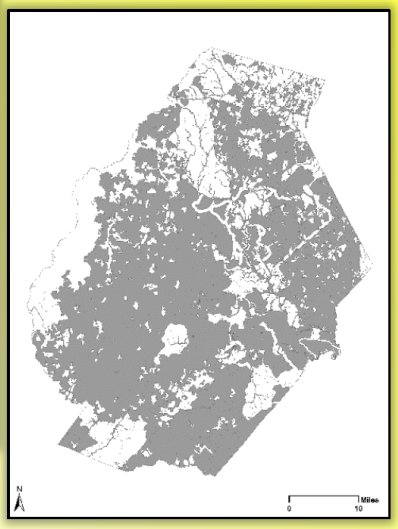
STEP 0



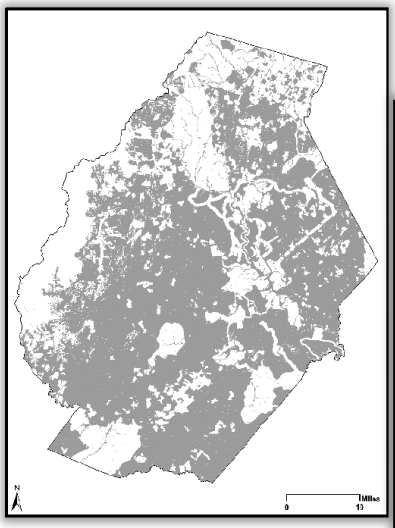
STEP 1



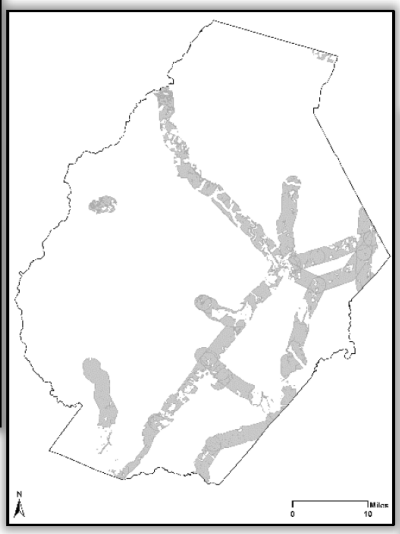
STEP 2



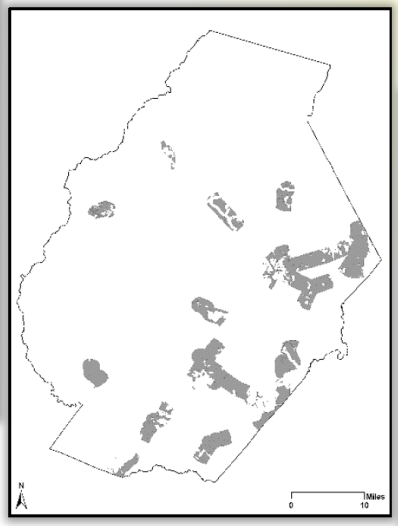
STEP 3



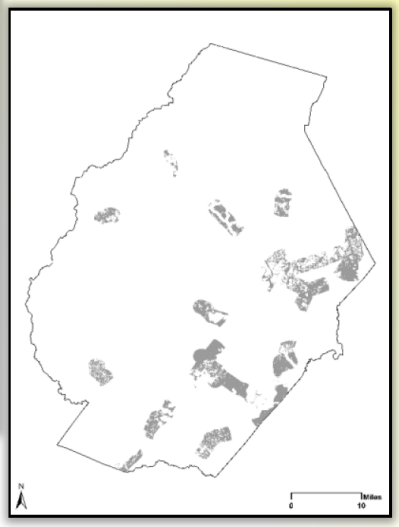
STEP 4



STEP 5



STEP 6



STEP 7

Conclusions

COUNTY	SQ. MILES OF HIGHLY SUITABLE LAND	% OF TOTAL LAND
FAUQUIER	40.2	6.2%
CULPEPER	23.2	6.1%
MADISON	5.4	1.7%
ORANGE	45.5	13.3%
RAPPAHANNOCK	5.1	1.9%
TOTAL:	119.5	6.1%

Rappahannock-Rapidan Region

- Proximity to Substations (step 5) and High Capacity Transmission Lines (Step 6) are the biggest limiting factors for utility scale solar development from a land suitability perspective.
- The available capacity of transmission lines is the big 'unknown' that is an even greater limiting factor than proximity to transmission infrastructure. An interconnected study by the utility provider is required to determine available capacity.
- Most areas of unsuitable slope are also in protected areas (like Shenandoah National Park)
- The most suitable areas for utility scale solar are mostly located in the Eastern part of the region

Protected areas especially:

1. Mine Run Battlefield Study and Core areas in Orange CO.
2. Rappahannock Station, Brandy Station & Kelly's Ford areas in Culpeper & Fauquier CO.

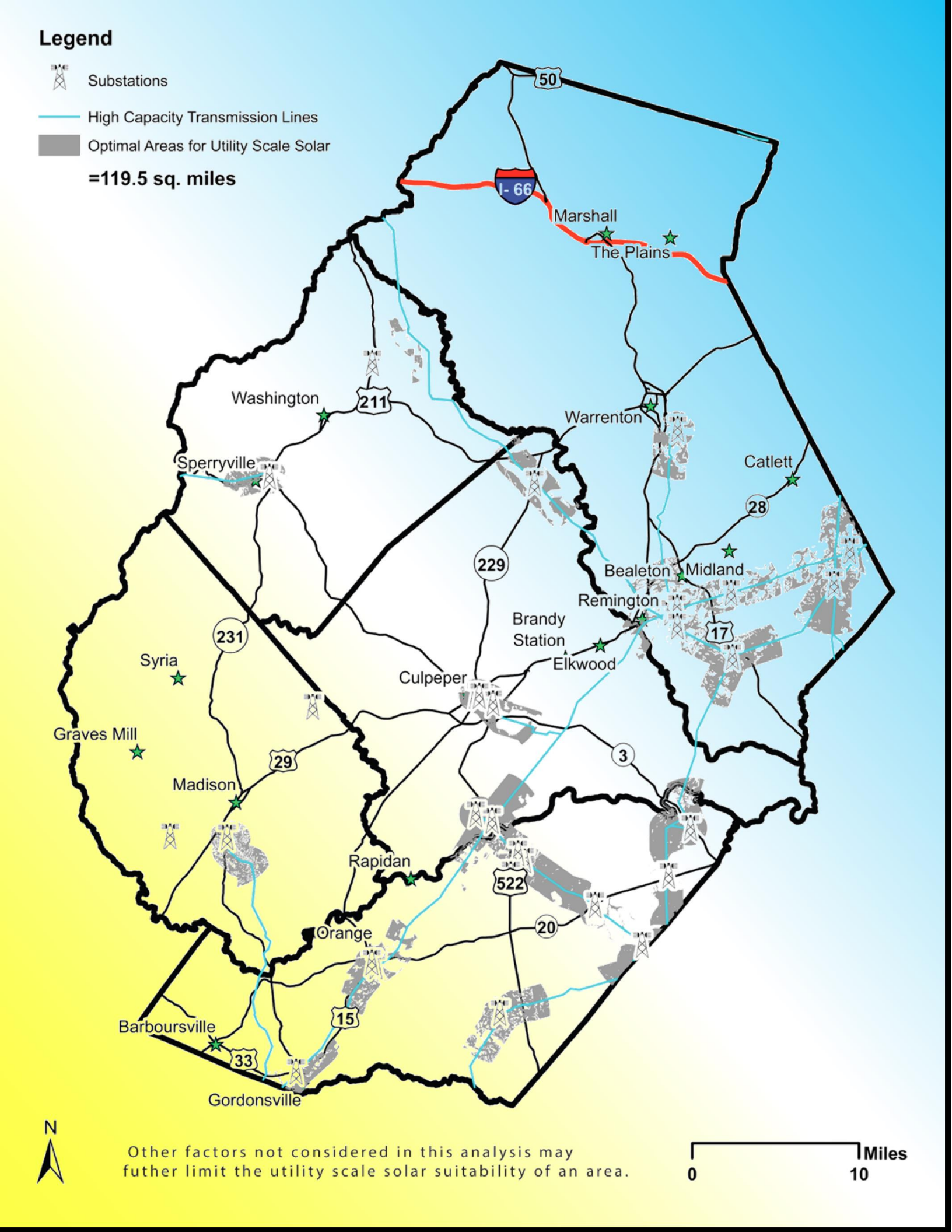
May be susceptible to utility scale solar development interest and applications due to these areas proximity to substations and high capacity transmission lines and being overall exceptionally suitable areas, according to the criteria used, except for being on or near protected areas. Future utility scale solar development applications may target areas nearby these protected areas with potential to impact viewsheds.

Further Research/ Considerations

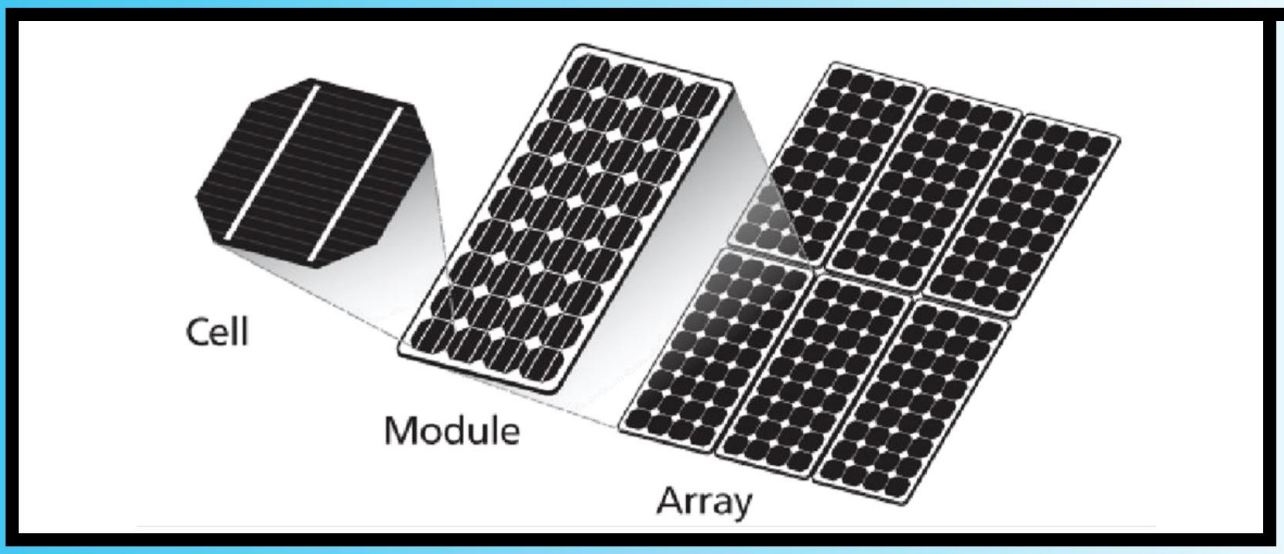
The following data layers could be included in the RRRC's gis overlay analysis to further assess site suitability:

- Land Cover – eg. non-disturbed forests
- DCR Environmentally Protected Areas
- Population Projections/ Future Land Value
- Parcel specific data including viewshed impacts, parcel size, road access and other site specific idiosyncrasies
- A Locality OR site specific/ application-based analysis could build off criteria layers and include:
  1. Local zoning ordinance requirements
  2. Data from a known interconnected study
  3. LIDAR/solar insolation values from NREL or other national sources
  4. Create a sliding scale or heat maps for inputs into the model such as development of floodplain or prime Ag. Lands
  5. Using the PV mapper tool to screen parcels (parcel rather than general area)
  6. Viewshed analysis
  7. Use Sketch-Up to do sun/shade analysis and consider zoning buffer requirements
  8. Parcel specific data

Please reach out to the RRRC for additional information or specific analysis requests.


Legend
Substations
High Capacity Transmission Lines
Optimal Areas for Utility Scale Solar
=119.5 sq. miles
50
I- 66
Marshall
The Plains
Washington
211
Warrenton
Sperryville
Catlett
28
229
Bealeton
Midland
Remington
17
Brandy
Station
231
Elkwood
Syria
Culpeper
Graves Mill
3
29
Madison
Rapidan
522
20
Orange
15
Barboursville
33
Gordonsville
N
Other factors not considered in this analysis may
futher limit the utility scale solar suitability of an area.
Miles
0
10

Additional Resources



LOCAL GOVERNMENT

- DEQ https://www.deq.virginia.gov/Programs/RenewableEnergy/SolarEnergy.aspx

- Solar Power in Virginia http://www.virginiaplaces.org/energy/solar.html

- PV Mapper Tool http://pvmapper.org

- NC Clean Tech Center (https://nccleantech.ncsu.edu/community-solar/)

- Virginia Solar Site Native Plant Finder (http://www.dcr.virginia.gov/natural-heritage/solar-site-native-plants-finder)

- Culpeper County Utility Scale Solar Policy & Example Conditions

(https://web.culpepercounty.gov/Portals/0/Departments/2018%20Solar%20Policy%20%28Signed%29.pdf

HOMEOWNERS

- Solar Energy Leasing Webinar https://vimeo.com/172991201

- Homeowner's Guide to Going Solar https://www.energy.gov/eere/solar/homeowner-s-guide-going-solar

- LEAP (http://leap-va.org/)

- Solarize Piedmont (https://www.pecva.org/our-mission/energy-solutions/solarize-pec)