

## **EPA OSWER Center for Program Analysis Data Guidelines for “Clean and Renewable Energy Generation Potential on EPA Tracked Sites” Maps**

### **Overview**

The U.S. Environmental Protection Agency (EPA) Office of Solid Waste and Emergency Response (OSWER) Center for Program Analysis (OCPA) is encouraging the reuse of contaminated lands for siting clean and renewable energy facilities. In order to ensure domestic energy security and environmental sustainability, hundreds of new power generation facilities will likely need to be constructed, requiring thousands of acres of land. Currently, energy from renewable sources makes up only a small fraction, approximately 2.5 percent<sup>1</sup>, of the energy consumption in the United States. Energy demand projections indicate an estimated 31% growth in demand over the next 25 years<sup>2</sup>. Further, power generation projections indicate an estimated 45% increase over the next 25 years in renewable energy demand, from 357 to 519 billion kilowatt-hours<sup>3</sup>. These demand projections will necessitate significant new energy production.

Contaminated lands are a good fit for siting clean and renewable energy facilities because they: generally have existing transmission capacity and infrastructure in place; take the stress off undeveloped lands for construction of new energy facilities; and clean and renewable energy is an economically viable reuse for sites with significant cleanup costs or low real estate development demand.

In order to demonstrate that contaminated lands have clean and renewable energy potential, OCPA developed geographic information system (GIS)-based maps that demonstrate the viability of siting clean and renewable energy on contaminated lands (i.e., the number of federally-track sites that meet basic clean and renewable energy siting criteria) and generally show what geographical regions have opportunities to reuse contaminated lands for clean and renewable energy development.

While these maps are beneficial as a screening tool to highlight areas with clean and renewable energy potential, they should not be used to identify or prioritize the best EPA sites for developing clean and renewable energy, as EPA tracked site data is dynamic and more detailed site-specific analysis is necessary. Future projects to identify the best sites for clean and renewable energy development may be conducted by the individual cleanup programs, EPA Regions, or other partnerships.

### **Methodology**

EPA developed an inventory of abandoned mine lands, Brownfields, Resource Conservation and Recovery Act (RCRA) sites and Superfund sites (see Datasets section for more detail). From this inventory, EPA extracted sites with acreage and viable latitude and longitude data. This subset of sites was then mapped against nine different clean energy screening criteria groupings, as described below.

The screening criteria used to develop the OCPA clean energy potential maps were approved by OCPA and the National Renewable Energy Laboratory (NREL). Although slope is also a critical factor for siting clean energy facilities, it was not considered in the mapping analysis because site-specific slope information can not be accurately obtained from available electronic data sources. In addition, as many sites cover thousands of acres, the slope may vary widely over the entire site.

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<sup>1</sup> *Annual Energy Review 2006, Table 1.3 Energy Consumption by Primary Energy Source*, Energy Information Administration. Note: Only non-hydroelectric renewable energy sources are represented in this report.

<sup>2</sup> *Annual Energy Outlook 2007 with Projections to 2030*, Energy Information Administration

<sup>3</sup> *Annual Energy Outlook 2007, Overview, Reference Case*, Energy Information Agency

## Clean and Renewable Energy Mapping Screening Criteria

*Please refer to the Data Considerations section for a description of the limitations of this methodology.*

Utility Wind	Utility Solar (CSP)	Biomass
Wind class $\geq 4$	Solar class $\geq 6$ kWh/m <sup>2</sup> /day	Cumulative biomass $\geq 150,000$ residue (biopower) tonnes/year
Distance to transmission lines $\leq 10$ miles	Distance to transmission lines $\leq 10$ miles	Crop biomass residue $\geq 100,000$ (dry mill corn ethanol) tonnes/year
Acreage $\geq 2,000$	Acreage (stirling engine) $\geq 40$	Distance to transmission lines $\leq 10$ miles
Distance to graded road $\leq 25$ miles	Acreage (trough/power tower) $\geq 250$	Acreage $\geq 50$
	Distance to graded road $\leq 25$ miles	Distance to graded road $\leq 50$ miles
Community Wind	Utility Solar (Photovoltaic (PV))	
Wind class $\geq 3$	Solar class $\geq 5$ kWh/m <sup>2</sup> /day	
Distance to transmission lines N/A*	Distance to transmission lines $\leq 10$ miles	
Acreage 100 - 1,999	Acreage $\geq 40$	
Distance to graded road $\leq 25$ miles	Distance to graded road $\leq 25$ miles	
Non-Grid-Connected Wind	Non-Grid-Connected Solar (PV)	
Wind class $\geq 3$ **	There are no formal screening criteria as PV technology can be sited at all properties **	

\* Energy is generally distributed only to the local area, often serving only adjacent properties so transmission is not a screening criterion.  
 \*\* Systems are typically used to power a single property and are not constrained by acreage and distance to power and roads.

### Data Considerations

The following information should be considered when reviewing OCPA's maps:

- Each federally-tracked site was mapped using a single latitude and longitude point obtained from EPA's official cleanup program databases (see Datasets section, below, for more information on program-specific databases). Because site boundary data is not available, these maps do not reflect the total potential for clean energy generation across an entire site. For example, a portion of a site could have a high wind power class due to a ridge line, but if the latitude and longitude recorded in EPA's databases are not along this ridgeline, the site may not meet screening criteria and may not be represented on a map. Similarly, portions of a large site may be close enough to meet screening criteria related to distance to transmission lines, but if the single latitude and longitude point does not meet the distance criteria, the site will not be displayed on the map.
- EPA databases are updated continuously. These maps provide a snapshot in time, as described in the datasets section. The use of site-specific information provided herein should only be used with the understanding that the information changes over time.
- EPA sites that were identified as having potentially incorrect latitude and longitude data (e.g., mapped 10 miles from the state as recorded or no coordinates were provided in EPA databases) are not included in the maps.
- Since acreage is a key screening criteria, EPA sites that do not have acreage information recorded in EPA databases are not included in the maps, except for the non-grid connected wind and non-grid connected PV solar maps as acreage is not a screening criterion for these clean energy types. Acreage is not a screening criterion for non-grid connected wind and non-grid connected PV solar maps because such systems are typically used to power a single property and not constrained by limited acreage. For example, a property owner could install PV panels or "micro" or small-scale wind turbines to supplement the electricity provided to the site from traditional sources, but would not generate power for use off-site.

### Datasets

The following data sources were used to develop the inventory of EPA sites displayed on OCPA's clean energy potential maps. Note: EPA datasets are updated continuously so the maps provide a snapshot in time.

#### ***Abandoned Mine Lands (AML)***

Includes all abandoned hardrock mines and mineral processing sites listed in the Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS) as well as many AMLs with emergency response actions that are not listed in CERCLIS. AML data includes information from the AML inventory dated 2/27/2008 and includes CERCLIS information current of January 2008. Acreage from the AML Inventory was used in most cases. In cases where acreage was not provided in the AML Inventory, CERCLIS acreage was used.

### **Brownfields**

Includes data in the Assessment Cleanup and Redevelopment Exchange (ACRES) database, queried on 3/8/07. Data includes information on properties associated with grants since the inception of the Brownfields Program in 1995, including those associated with Assessment, Cleanup, Revolving Loan Fund (RLF), and Section 128(a) State/Tribal Grants. Some Brownfields properties reported property size in square feet, which was converted to acres for this analysis. Targeted Brownfields Assessment properties were not included on clean energy maps, but their clean energy data is provided in accompanying datasets. A small number of Brownfields properties represented on the clean energy maps may not have benefited from EPA funding as of 3/8/2007, but may be targeted by grantees for future funding.

### **Resource Conservation and Recovery Act (RCRA)**

Includes all sites from the RCRA 2020 Universe Inventory from July 2007. Acreage information was only provided for the 2008 Baseline Inventory sites, but site location was provided for all sites.

### **Superfund**

Includes a site universe from the draft Cross-Program Revitalization Measure (CPRM) dataset developed in March 2008. The list includes: NPL sites (proposed, final and deleted), Superfund Alternative sites, and/or non-time-critical removals (NTRCs). Acreage includes the higher number of Ready for Anticipated Use (RAU) or site wide acres. The CERCLIS data is dynamic and updated on a regular basis. The use of site-specific information provided herein should only be used with the understanding that the information changes over time. Acreage used for mapping includes CERCLIS data as of November 2007. However, in an effort to provide the most current CERCLIS acreage data, a column has been added to the data spreadsheets (“New CERCLIS Acreage (4/2008)”) with CERCLIS data current as of April 2008. Because the maps were created using November 2007 CERCLIS data, some federally-tracked sites displayed on the maps may no longer meet the acreage criteria, while other sites may now meet the criteria but are not displayed on the maps.

In addition, the following GIS data was compiled and used to produce the OCPA clean energy potential maps.

### **National Renewable Energy Laboratory (NREL) Data**

NREL data was downloaded October 12, 2007 (<http://www.nrel.gov/gis/>). Specific information on how the data was collected by NREL is available at: [http://www.nrel.gov/gis/data\\_analysis.html](http://www.nrel.gov/gis/data_analysis.html)

- Concentrating Solar Power (CSP) Solar Potential (L48\_DNI and Lower\_48\_CSP\_Low\_Resolution): Used to determine potential for utility CSP sterling engine system, utility CSP trough and power tower systems, and utility PV solar power.
- PV Solar Potential (L48\_LATILT and Lower\_48\_PV\_Low\_Resolution): Used to determine potential for non-grid-connected PV.
- Biomass (Biomass). Used to determine potential for dry mill corn ethanol and biopower.
- Wind Energy Potential (Lower\_48\_Wind\_Low\_Resolution and 50 meter High Resolution Wind Data, named by state or region for AK, AZ, AR, CA, CO, CT, DE, DC, HI, ID, IL, IN, ME, MD, MA, MI, MO, NV, NE, NH, NJ, NM, NC, ND, MT, OH, OR, PA, RI, SD, UT, VT, VA, WA, WV, and WY): Used to determine potential for utility scale wind, community wind, and non-grid-connected wind. In order to give a sense of what the wind power class means, the following classification information is for utility-scale applications at a 50 meter height.

Power Class	Resource Potential	50 m Wind Power Density (W/m <sup>2</sup> )	Power Class	Resource Potential	50 m Wind Power Density (W/m <sup>2</sup> )
1	Poor	0 - 200	5	Excellent	500 - 600
2	Marginal	200 - 300	6	Outstanding	600 - 800
3	Fair	300 - 400	7	Superb	> 800
4	Good	400 - 500			

- FEMA Transmission Lines (FEMA Electric): Used to determine the distance to transmission lines. Note: there is more accurate transmission line data available from other sources, but due to security concerns it is not publicly available and therefore not used in this analysis.

### **ESRI Data**

ESRI software, copyright 2001-2006

- U.S. Highways (highways.sdc): Used to calculate the approximate distance to the nearest graded road.
- U.S. States (states.sdc): Used to provide state outlines for mapping purposes.

### **Common Attributes**

The following is a description of attributes used in the datasets and provided in the data tables that accompany the OCPA clean energy potential maps:

<b>Attribute Name</b>	<b>Attribute Description</b>
EPA Reg	EPA region where the site is located
Program	EPA Program in which data was obtained
EPA ID/ BF Grant ID	EPA identification code
Site Name	Name of the property
City	City where the site is located
State	State where the site is located
Fed Fac	Indicates whether the site is a federal facility
Acreage	Acreage used for mapping
New CERCLIS Acreage (4/2008)	Updated CERCLIS acreage current as of April 2008
Utility Wind	Indicates sites with utility wind energy generation potential
Cmty Wind	Indicates sites with community wind energy generation potential
Non-Grid Wind	Indicates sites with non-grid connected wind energy generation potential
Utility CSP	Indicates sites with utility stirling engine and/or trough and power tower system Concentrated Solar Power (CSP) energy generation potential
Utility PV	Indicates sites with utility Photovoltaic (PV) solar energy generation potential
Non-Grid PV	Indicates sites with non-grid Photovoltaic (PV) generation potential
Biomass	Indicates sites with biopower (includes residues from crops, forests and mills; methane emissions; urban woodwaste; and dedicated energy crops) or dry mill corn ethanol energy generation potential
Latitude	Latitude in decimal degrees, NAD 27 projection
Longitude	Longitude in decimal degrees, NAD 27 projection
Wind Low Res	Low resolution measurement of the potential wind energy
Wind High Res	High resolution measurement of the potential wind energy, which is only available for some states as described in the NREL data section
CSP/PV Utility	Measurement of the solar potential energy in kWh/m <sup>2</sup> /day for utility scale projects
PV Non-Grid	Measurement of the solar potential energy in kWh/m <sup>2</sup> /day for non-grid connected projects
Total Residue	Cumulative biomass resources (tonnes/year) used to determine biopower potential
Crops	Crop residues (dry tonnes/year) used to determine dry mill corn ethanol potential
Dist Power	Distance to the nearest transmission line in miles
Dist Hwys	Distance to the nearest graded road
* Manure	Methane emissions from manure management (tonnes/year)
* Forest	Forest residues (dry tonnes/year)
* Primmill	Primary mill residues (dry tonnes/year)
* Secmil	Secondary mill residues (dry tonnes/year)
* Urban	Urban wood residues (dry tonnes/year)
* Landfill	Methane emissions from landfills (tonnes/year)
* WWTreat	Methane emissions from domestic wastewater treatment (tonnes/year)
* SwGrass	Energy crops (switchgrass) on Conservation Reserve Program lands (dry tonnes/year)

\* These attributes are available only within electronic versions of the dataset

### **Contact Information**

For more information, please contact EPA's OSWER Center for Program Analysis (OCPA) at [cleanenergy@epa.gov](mailto:cleanenergy@epa.gov).