National Renewable Energy Laboratory
Innovation for Our Energy Future

A national laboratory of the U.S. Department of Energy
Office of Energy Efficiency & Renewable Energy

Renewable Energy Potential for Brownfield Redevelopment Strategies

Renewable energy resources are available throughout the United States. The National Renewable Energy Laboratory (NREL) performs analysis to identify high-potential sites for renewable energy technologies and can help determine those technologies most suitable for a brownfield site.

Renewable Energy Resource Availability

Wind

Wind power can be well-suited to brownfield redevelopment due to the widespread availability of the resource, cost-competitiveness of wind power, and the flexibility in the size and number of turbines that can be installed. The quality of the wind resource varies across the United States. Wind farms typically require class 4 or better wind resource. Generally speaking, the higher-quality wind resource is in the western half of the United States, with some good quality resource around the northern and central Appalachian range, and near the Great Lakes region (see Figure 1).

The criteria that must be met for a brownfield site to be considered as high potential for wind power redevelopment include:

- Class 4 or greater wind resource
- Greater than 50 acres
- Less than 20% slope
- Located within 25 miles to transmission and road

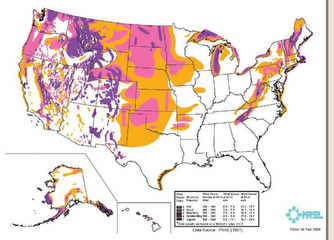

Figure 1. Wind Resource Availability

Concentrating Solar Power (CSP)

Parabolic trough is the type of concentrating solar power (CSP) that is most commercialized and cost-competitive at this time. Parabolic trough CSP is used for grid-connected applications so it is best suited to brownfields that are within a reasonable distance to existing transmission, and to sites that have larger footprints to allow for a sufficient-size system for economic feasibility. The quality of the CSP resource is greatest in the southwestern United States (see Figure 2).

The ideal brownfield for CSP redevelopment must at least meet the below criteria:

- At least 40 acres
- Less than 1% slope
- Located within 25 miles to existing transmission and roads

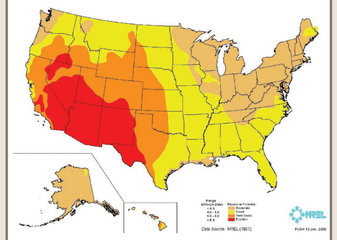

Figure 2. Concentrating Solar Power (CSP) Resource Availability

Photovoltaics (PV)

On-site PV is an ideal candidate for brownfield redevelopment due, in part, to its flexible installment options. State-level incentives for PV system purchase and installation can make on-site PV an even more attractive choice. For a listing of state-level incentives, visit the Database of State Incentives for Renewable Energy and Energy Efficiency (DSIRE) at http://www.dsireusa.org/. The entire United States, with the exception of a portion of the Northwest, has adequate PV resource quality (see Figure 3). Thus, the decision to install a PV system depends on the power requirements at a particular site, as well as site-specific economic considerations, including available incentives. On-site PV can be a particularly financially attractive alternative for remote brownfields that are in an area where grid connection is not feasible because of distance or cost.

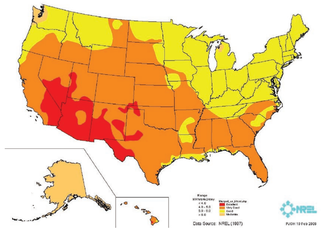

Figure 3. Photovoltaics (PV) Resource Availability

Biomass

Biomass is a broad category of renewable energy that can be well-suited to brownfield redevelopment (see Figure 4). There are multiple biomass applications with varying suitability to brownfields. Given economic and technological considerations, the most suitable at this time are growing biomass, producing corn ethanol, and generating biopower.

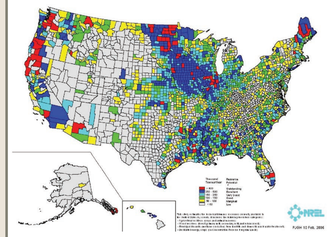

Figure 4. Biomass Resource Availability

The renewable energy technology-specific criteria varies, depending on the particular biomass application under consideration (see table).

Criteria	Growing Biomass for Biofuels	Dry Mill Corn Ethanol Plant or Biopower Plant
Minimum Parcel Size	>= 200 acres	>=50 acres
Resource	Crop residues >=100,000 tonnes/yr	Dry Mill Corn Ethanol Plant: Crop residues >=100,000 tonnes/yr Biopower plant: All residues >=150,000 tonnes/yr
Distance to Road	<= 50 miles	<= 50 miles
Distance to Transmission	NA	<= 10 miles
Distance to existing plant	<= 50 miles	NA

Process to Identify Suitable Renewable Energy Technologies for a Brownfield

1) **Evaluate the Renewable Energy Resource.** Renewable energy resources are widely available throughout the United States. Considering the quality of the resource is the first step in determining the potential for redevelopment using a renewable energy technology.

2) **Consider Renewable Energy Technology-Specific Criteria.** Each renewable energy technology has specific criteria (such as minimum parcel size and slope) that must be met to determine its suitability to a brownfield.

3) **Determine the "Community" Factors.** Considerations such as the economic, environmental, and societal benefits are also key. These can include local revenue, applying non-emitting "green" technologies, and neighborhood revitalization.

Process Illustration

One illustration of this process is an analysis that was conducted in Florida, where NREL looked at applications for both PV and biomass. Although we use this one state as an example, we can apply this process to any area of the United States that has adequate data. The following maps show the results of this one-state evaluation.

Figure 5 shows the location of 119 brownfield sites in Florida.

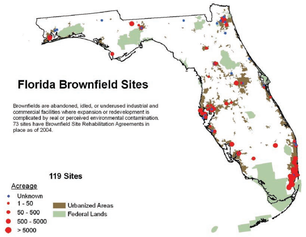

Figure 5. Location of Florida's Brownfield Sites

The PV resource in Florida can support PV applications. Most brownfields with on-site power requirements may be considered as ideal candidates for PV.

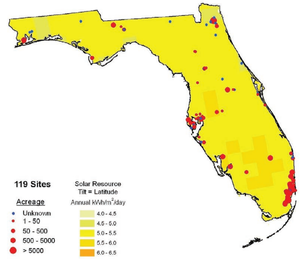

Figure 6. PV Resource Availability with All Brownfield Sites

The available biomass resource makes Florida a promising state for biomass applications. Figure 7 shows the resource availability for all residues.

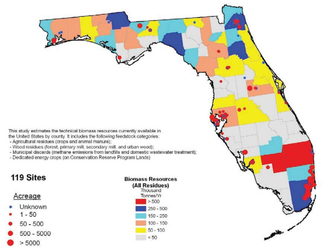

Figure 7. Biomass Resource Availability for All Residues with All Brownfield Sites

Florida has quadrants of crop residue as potential feedstock for biofuel applications.

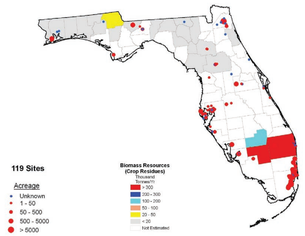

Figure 8. Biomass Resource Availability of Crop Residues with All Brownfield Sites

After applying screening criteria outlined in the biomass table, 25 brownfield sites in Florida may be considered ideal locations for biomass applications.

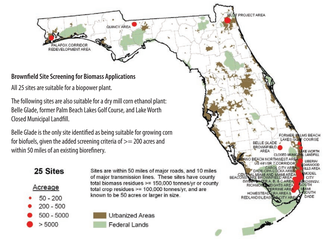

Figure 9. Identification of Suitable Sites for Biomass Applications

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