Redeveloping Brownfields with Solar: Challenges and Opportunities

America's Solar Growth

Utility-scale solar is the third largest source of renewable energy and rapidly growing, powering the equivalent of 13 million homes[1]. Along with clean, solar development accompanies increased local tax revenues, and jobs during the construction of the facility. As solar energy development is also considered a light industrial land use, and does not require personnel onsite full-time to operate, thus many companies are finding ways to deploy solar energy on abandoned mine lands, former industrial sites, and other brownfields.

What is a "brownfield"?

The Environmental Protection Agency (EPA) defines a brownfield as a property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant. More generally, brownfields could be properties that have limited uses due to their past use or conditions. A good example of a "clean brownfield" would be reclaimed surface coal mine lands where the land has been reclaimed and no hazardous substance, pollutant or contamination exists, but due to potential settling may not be suitable for traditional residential, commercial, or industrial development. While reclamation practices have improved since the passage of the Surface Mining Control and Reclamation Act of 1977, these uses, as well as agricultural uses (i.e., row crop farming and timber production) may also be compromised, particularly for mine lands reclaimed in the late 1970s and 1980s.

Conversely, some brownfields may be nearly impossible to reuse. These may include heavily contaminated historic industrial sites or former military properties with unexploded ordinances where the risk to human health and safety is too great to even allow human entry.

There are many variations between these two extremes that include cleaned up Superfund sites, retired landfills, and other less risky contaminated sites.

In general, the cleaner the brownfield, the more potentially favorable for redevelopment.

Brownfields to Brightfields – How might brownfields benefit from solar energy deployment?

Known as "brightfields," deploying solar energy on a brownfield enables a responsible form of industrial redevelopment and clean energy generation. A solar energy facility improves upon a site that would otherwise sit vacant. Furthermore, larger solar facilities can accompany property tax payments or other financial benefits to the local community. The EPA has determined that brownfield redevelopment can increase nearby home property values by 5-15% within roughly a mile of the site[2] transforming blight into clean power may also serve environmental justice, delivering real benefits to a community that was once exposed to harmful industrial operations.

Furthermore, some former industrial sites may also have transmission and other energy infrastructure close by, which means a solar facility can interconnect to the grid and send power to nearby homes and businesses. Some states and localities may also incentivize brownfield development with waived permitting fees, favorable zoning, and / or tax credits.

Despite Potential Benefits, Solar Development on Brownfields Remains Extremely Challenging – and Expensive

Given the benefits listed above, many solar companies actively pursue projects on brownfields, and comb through over 450,000 brownfield sites in the United States for potential development. Unfortunately, despite encouragement from public officials or community members, developers rarely find that these sites can feasibly be developed for solar power. This is due to a variety of factors described below, but largely center on significantly increased cost, permitting complexity, and legal liability. Traditional barriers associated with solar siting – such as transmission access – also factor into these challenges.

Typical challenges associated with solar deployment on brownfields are explored below:

- **Navigating Environmental Risk:** Legal liability underpins many hurdles to brightfield development. A developer must consider how they are held liable under federal statutes, including the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Clean Water Act (CWA), the National Environmental Policy Act (NEPA), and other federal or state regulations. Under CERCLA, parties who only become involved with a property after a major contamination event – such as a solar developer - can still be liable for the full costs of cleanup.[3]
- **Additional Permitting:** Given the potentially severe environmental risk, a brownfield sites may require additional permits from the Environmental Protection Agency to receive approval. Securing necessary permits and approvals may take up to four years before a brownfield development is shovel ready.[4]
- **Environmental Site Assessment:** Before any work proceeds on a brownfield, a developer must perform an extensive environmental site assessment to understand the history of the site, existing contaminants, and the likelihood these contaminants can spread and pollute the nearby environment. An engineering company typically performs this analysis, conducting interviews, and researching the history of the site to assess the level of risk associated with solar development. In some cases, taking soil and/or water samples is needed. Some brownfield sites have incomplete site records; thus, the extensive screening process can include conducting a series of interviews and public record research. A site assessment also considers the risk of other liabilities, such as flooding, earthquakes, and other major threats that could lead to further environmental contamination or soil disturbance.
- **Remediation & Site Preparation:** Based on the results of the assessment, a solar company may need to take steps to remediate the brownfield site, implementing special preparations to minimize pollutant discharge. Remediation can involve extensive procedures such as excavation, soil replacement, solidification, soil recycling, water treatment, bioremediation, or capping.[5]
- **Special Construction Measures:** Disturbing a brownfield site can result in worsening the environmental conditions of the site, including the potential for the migration of pollutants to nearby properties and waterways. Solar construction requires the operation of heavy equipment and machinery to transport components, prepare the ground for infrastructure, secure the panels and racking system to the ground, as well as digging trenches to run conduit underground. In some cases, grading is necessary to prepare the site.

As a result, solar companies may need to use sensitive procedures during construction, operations, and maintenance of the site to minimize the disturbance of contaminants. A developer may install special fences or walls, wheel wash ramps and rubble shaker or grids, and protective layers consisting of crushed rocks to prevent contaminated soil from leaving the brownfield. Site developers may also ensure the weight of the system is appropriately distributed as not to cause significant sinking, which may further disturb the site. Finally, all construction workers must be trained in how to safely operate on site.

Each of these measures comes with an additional cost, and typically adds time to the process.

- **Special Design Features:** Currently, most new ground-mounted, PV solar facilities use a single-axis tracker, which follows the sun over the course of the day to maximize energy generation. However, in some cases, solar developers utilizing brownfields are required to use a fixed tilt, ballasted system to avoid penetrating a landfill cap or disturbing the soil. Given the additional steel, concrete and labor required to build the ballasts, these projects are costlier to build. In addition, because the array does not track the sun, it results in about 15% less energy generation than an array capable of tracking the sun.
- **Traditional Solar Siting Barriers:** Utility-scale electricity generation requires access to high voltage transmission lines, thus brownfields greater than two miles from transmission infrastructure are more difficult to develop for solar. Similarly, unfavorable topography, high gradient, or other engineering or environmental constraints make it challenging to build rows of arrays; flat land is optimal for solar. Other limiting factors may include shading, excessive tree removal, abandoned building demolition, avoidance of groundwater monitoring wells, unstable or unsuitable substrate or geology, presence of sensitive or endangered plants or wildlife species and a host of other factors.

Thus, brownfields will likely represent a small share of land available for solar power – given the industry has a responsibility to provide affordable and reliable electricity as soon as possible to meet our growing demand for energy.

How can policymakers spur greater solar deployment on brownfields?

Many states, as well as the federal government, have sought to incentivize more solar projects on brownfields. The EPA offers loans and grants to support environmental assessments, cleanup, job training, and other activities to advance brownfield developments.[6] Similarly, numerous states have implemented similar policies to ease the challenges described above.[7] While these policies support development, the current patchwork of incentives, coupled with scale of the barriers, if often insufficient to drive rapid deployment.

While every potential site has unique features, below are examples of policies that could serve to address the major barriers to deployment of solar on brownfields.

- **Mitigating Legal Liability for Violations of Environmental Law & Insurance Support**: Legal liability related to federal and state Clean Water Acts violations is the greatest barrier to solar development companies developing projects on known brownfield properties. By taking on the challenge of installing solar panels on a brownfield site, a solar developer is taking on risk for leaking contaminants that were already on the site. Thus, project financiers of the solar facility are hesitant to take on additional risk of holding a potentially dangerous site, leading to increased liability costs.
  A backstop insurance authority could support a project owner in the event a project requires cleanup from its previous industrial use. Additional insurance from the EPA or other public entity could reduce the costs of risk mitigation associated with brownfield development. This could spur greater solar deployment on brownfields without adding considerable costs on a per project basis.

- **Pre-Development Due Diligence**: An environmental site assessment performed by the solar developer poses an early, upfront cost to developing solar on brownfields. It is a challenging business case to make to spend tens of thousands of dollars to study a brownfield site when there is a reasonably high risk the site cannot be feasibly developed, particularly if there are ample "clean" properties in this same area (i.e. near the same transmission line). To ease this barrier, were a public entity to perform due diligence on the brownfield and share the results with interested solar developers, companies can better factor the risks and costs into development, ultimately reducing the costs of deployment. Should the surveys demonstrate the site is feasible for development, the public entity could auction the site to the interested solar developers to maximize cost savings from the private sector.
- **Direct Incentives**: Some states or localities can incentivize brownfield redevelopment with favorable tax incentives, such as reduced property taxes, waived permitting fees, or direct payments to mitigate the additional costs of solar deployment on brownfields. Permitting is typically an extensive and lengthy process for all solar development – especially on brownfields – thus some states have committed to expedite permitting review periods for brownfield projects. Localities may also consider permitting solar on brownfields by-right, to reduce any potential zoning or other permitting challenges. While these direct incentives help ease the burden on solar projects on industrial sites, these policies alone do not transform the market substantially.

The Role of Brownfields in Solar Deployment

The solar industry recognizes the essential value of brownfield redevelopment and will continue to advocate for policies that help facilitate more solar deployment on previously disturbed sites. However, the industry strongly cautions against relying upon on brownfield sites to meet the United States' ambitious clean energy goals. Given the challenges described above, brownfield sites are often not compatible with the competing goal to deploy clean energy rapidly, affordably, and efficiently. Thus, brownfield sites are unlikely to represent a substantial share of future solar generation in the next decade.

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1 American Clean Power Association. Utility-Scale Solar Power Facts | ACP (cleanpower.org)

2 Environmental Protection Agency. Brownfields Program Environmental and Economic Benefits. Accessible: https://www.epa.gov/brownfields/brownfields-program-environmental-and-economic-benefits

3 University of Virginia School of Law. Barriers and Opportunities for Siting Solar Energy Projects on Contaminated Mine Lands in Nevada. 2017. Available: https://www.law.virginia.edu/system/files/Opportunities%20for%20Solar%20Energy%20on%20Contaminated%20Mine%20Lands%20in%20Nevada%20--%20FINAL%20REPORT.pdf

4 Goodbody, Steve. Building Solar Projects on Brownfields Is Hard Work. But There's Massive Upside to Getting It Right. Greentech Media. July 6, 2016. Available: https://www.greentechmedia.com/articles/read/building-solar-projects-on-brownfields-is-hard-work

5 Spiess, T. & De Sousa, C. 2016. Barriers to Renewable Energy Development on Brownfields, Journal of Environmental Policy & Planning, 18:4, 507-534, DOI: 10.1080/1523908X.2016.1146986.

6 Environmental Protection Agency. Brownfields Program Environmental and Economic Benefits. Accessible: https://www.epa.gov/brownfields/brownfields-program-environmental-and-economic-benefits

7 Encore Renewable Energy. Brownfield Redevelopment. Accessible: https://encorerenewableenergy.com/services/brownfields-redevelopment/