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Renewable Energy on Potentially Contaminated Land Webinar Series: Introduction of EPA's RE-Powering America's Land

Sponsored by: U.S. Environmental Protection Agency/Center for Program Analysis

Delivered: October 21, 2010, 3:00 PM - 4:30 PM, EDT (19:00-20:30 GMT)

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- Q&A
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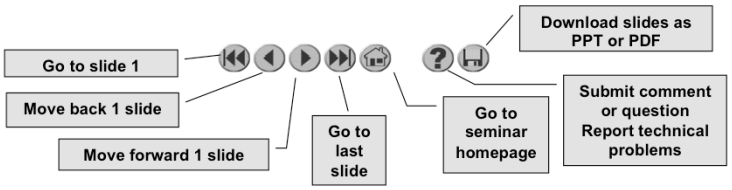

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Although I'm sure that some of you have these rules memorized from previous CLU-IN events, let's run through them quickly for our new participants.

Please mute your phone lines during the seminar to minimize disruption and background noise. If you do not have a mute button, press *6 to mute #6 to unmute your lines at anytime. Also, please do NOT put this call on hold as this may bring delightful, but unwanted background music over the lines and interupt the seminar.

You should note that throughout the seminar, we will ask for your feedback. You do not need to wait for Q&A breaks to ask questions or provide comments. To submit comments/questions and report technical problems, please use the ? Icon at the top of your screen. You can move forward/backward in the slides by using the single arrow buttons (left moves back 1 slide, right moves advances 1 slide). The double arrowed buttons will take you to 1st and last slides respectively. You may also advance to any slide using the numbered links that appear on the left side of your screen. The button with a house icon will take you back to main seminar page which displays our agenda, speaker information, links to the slides and additional resources. Lastly, the button with a computer disc can be used to download and save today's presentation materials.

With that, please move to slide 3.

RE-Powering America's Land:
Renewable Energy on Potentially Contaminated Land and Mining Sites

October 21, 2010

Lura Matthews
OSWER Center for Program Analysis
U.S. Environmental Protection Agency
Matthews.Lura@epa.gov

What Will be Covered Today

- What is RE-Powering America's Land?
- Why Focus on Renewable Energy Generation on Contaminated Sites?
- Existing RE-Powering Tools
- Feasibility Studies
- Next Steps at EPA

RE-Powering America's Land: Renewable Energy on Contaminated Land & Mining Sites

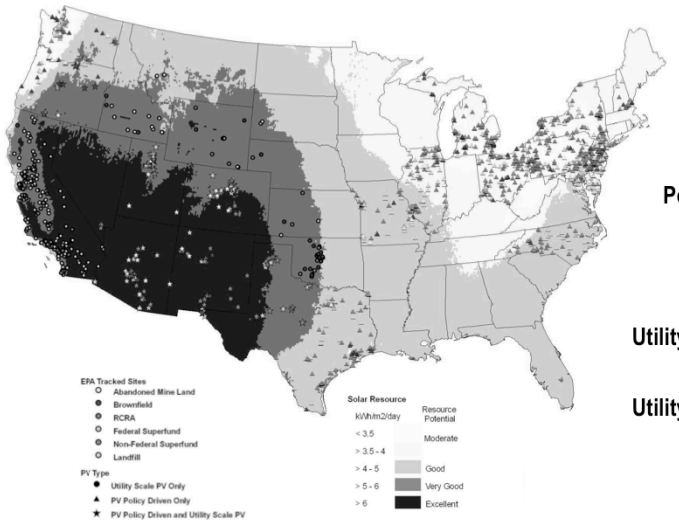
- EPA launched *RE-Powering America's Land* in 2008
- EPA has authority to investigate, assess, and clean up contaminated sites
- Recognized the potential redevelopment opportunities of these EPA tracked sites:
  - Brownfields
  - Superfund
  - Abandoned Mine Lands
  - RCRA – corrective action
  - Landfills

- To date, have mapped over 15 million acres, overlaid with RE potential

Why the Focus on Renewable Energy Development on EPA Tracked Sites?

- **Many of these sites offer:**
  - Existing infrastructure - transmission lines, roads and railway
  - Potentially lower transaction costs
  - Improved Public Support and Faster Permitting/Zoning
- **Siting renewable energy on these sites may:**
  - Increase economic value for the property
  - Further environmental sustainability by maximizing land use
  - Reduce the stress on greenfields
  - Provide clean energy for use on-site, locally, and/or to utility grid
  - Create local jobs

Potential for Solar



Utility PV	470 sites
Policy Driven PV	1,355 sites
Non-grid PV	11,384 sites
Utility CSP (Stirling)	85 sites
Utility CSP (Trough)	60 sites

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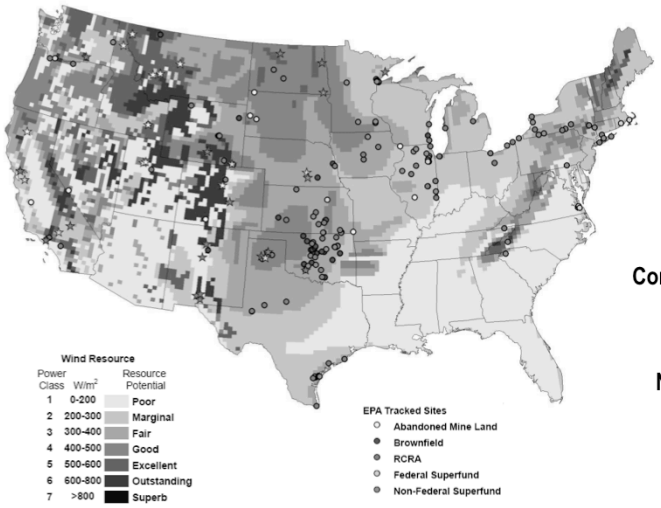
Potential for Wind



Utility Wind **37 sites**

Community Wind **169 sites**

Non-Grid Wind **1,304 sites**

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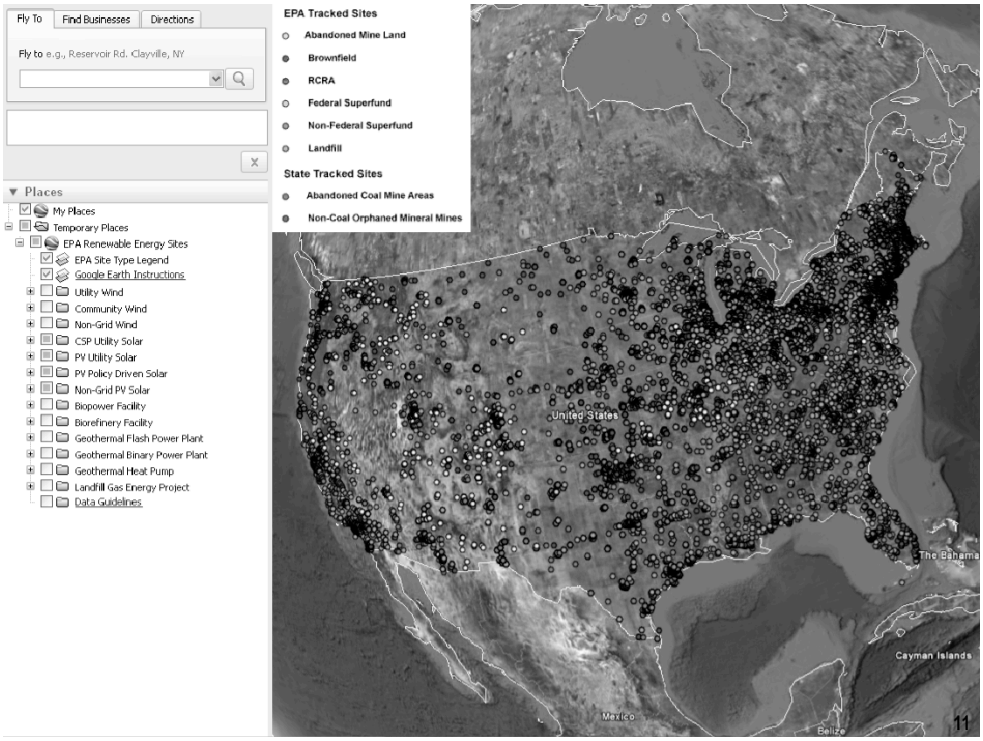
RE-Powering Tools

- **Google Earth Mapping**
  - Joint EPA-NREL venture produced interactive maps
- **Technical Assistance**
- **Success Stories**
  - Identifying and sharing successes
- **Incentives**
  - State-specific maps and financial incentive sheets describing renewable energy and contaminated lands redevelopment incentives in each state

Website: **www.epa.gov/renewableenergyland**

Google Earth Mapping Tool

- **Mapped EPA inventory of EPA tracked sites**
  - Abandoned Mine Lands
  - Brownfields – sites that received a Brownfields grant
  - RCRA
  - Superfund
  - Landfills
- **National Renewable Energy Laboratory (NREL) Data**
  - Wind, Solar, Biomass, and Geothermal Resources
- **Infrastructure Data**
  - U.S. Highways
  - U.S. National Transportation Atlas Railroads
  - Transmission Lines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Places
My Places
Temporary Places
EPA Renewable Energy Sites
EPA Site Type Legend
Google Earth Instructions
Utility Wind
Community Wind
Non-Grid Wind
CSP Utility Solar
PV Utility Solar
PV Policy Driven Solar
Non-Grid PV Solar
Biopower Facility
Biorefinery Facility
Geothermal Flash Power Plant
Geothermal Binary Power Plant
Geothermal Heat Pump
Landfill Gas Energy Project
Data Guidelines
EPA Tracked Sites
Abandoned Mine Land
Brownfield
RCRA
Federal Superfund
Non-Federal Superfund
Landfill
State Tracked Sites
Abandoned Coal Mine Areas
Non-Coal Orphaned Mineral Mines
United States
The Bahamas
Cayman Islands
Mexico
Belize
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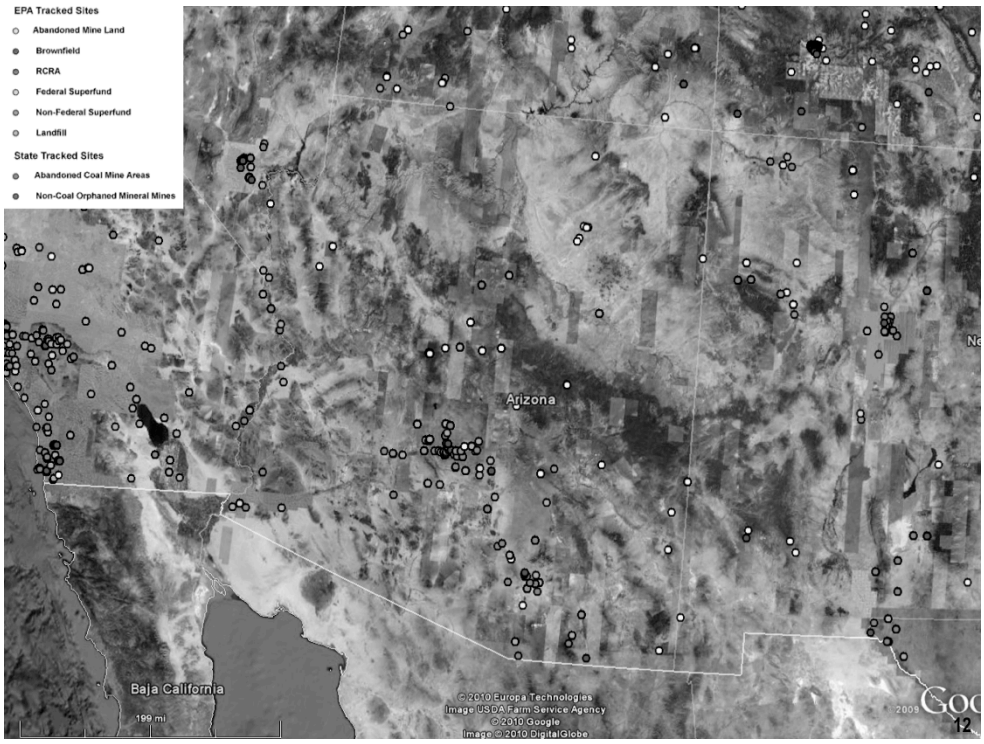
EPA Tracked Sites
Abandoned Mine Land
Brownfield
RCRA
Federal Superfund
Non-Federal Superfund
Landfill
State Tracked Sites
Abandoned Coal Mine Areas
Non-Coal Orphaned Mineral Mines
Arizona
Baja California
199 mi
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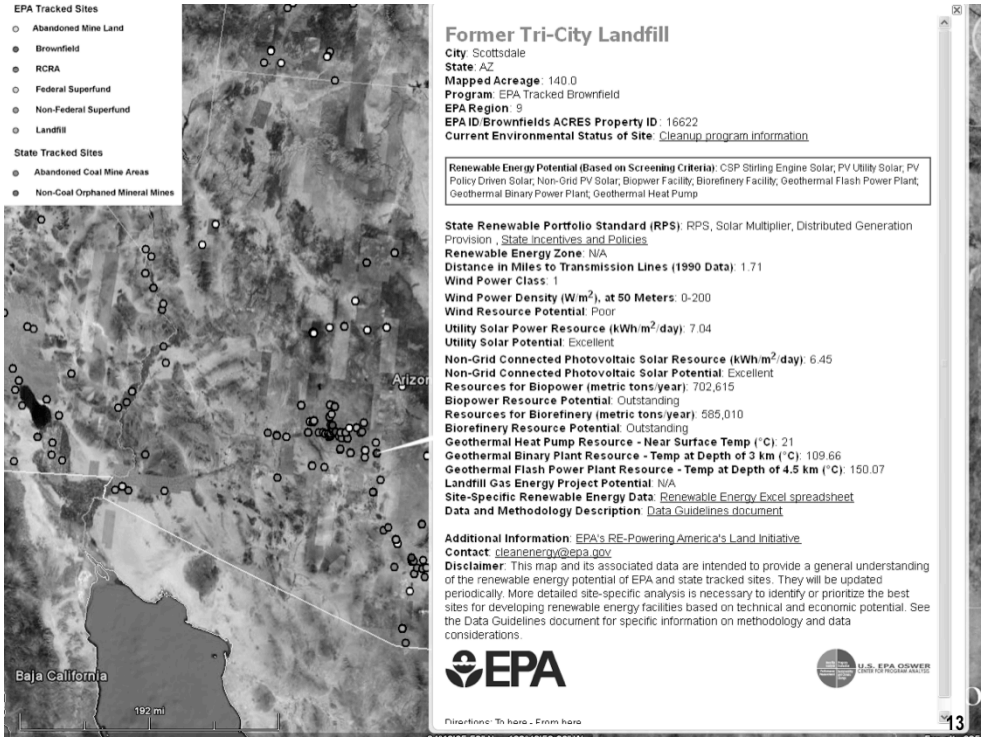
EPA Tracked Sites
Abandoned Mine Land
Brownfield
RCRA
Federal Superfund
Non-Federal Superfund
Landfill
State Tracked Sites
Abandoned Coal Mine Areas
Non-Coal Orphaned Mineral Mines
Baja California
192 mi
Former Tri-City Landfill
City: Scottsdale
State: AZ
Mapped Acreage: 140.0
Program: EPA Tracked Brownfield
EPA Region: 9
EPA ID/Brownfields ACRES Property ID: 16622
Current Environmental Status of Site: Cleanup program information
Renewable Energy Potential (Based on Screening Criteria): CSP Stirling Engine Solar; PV Utility Solar; PV Policy Driven Solar; Non-Grid PV Solar; Biopower Facility; Biorefinery Facility; Geothermal Flash Power Plant; Geothermal Binary Power Plant; Geothermal Heat Pump
State Renewable Portfolio Standard (RPS): RPS, Solar Multiplier, Distributed Generation Provision , State Incentives and Policies
Renewable Energy Zone: N/A
Distance in Miles to Transmission Lines (1990 Data): 1.71
Wind Power Class: 1
Wind Power Density (W/m2), at 50 Meters: 0-200
Wind Resource Potential: Poor
Utility Solar Power Resource (kWh/m2/day): 7.04
Utility Solar Potential: Excellent
Non-Grid Connected Photovoltaic Solar Resource (kWh/m2/day): 6.45
Non-Grid Connected Photovoltaic Solar Potential: Excellent
Resources for Biopower (metric tons/year): 702,615
Biopower Resource Potential: Outstanding
Resources for Biorefinery (metric tons/year): 585,010
Biorefinery Resource Potential: Outstanding
Geothermal Heat Pump Resource - Near Surface Temp (°C): 21
Geothermal Binary Plant Resource - Temp at Depth of 3 km (°C): 109.66
Geothermal Flash Power Plant Resource - Temp at Depth of 4.5 km (°C): 150.07
Landfill Gas Energy Project Potential: N/A
Site-Specific Renewable Energy Data: Renewable Energy Excel spreadsheet
Data and Methodology Description: Data Guidelines document
Additional Information: EPA's RE-Powering America's Land Initiative
Contact: cleanenergy@epa.gov
Disclaimer: This map and its associated data are intended to provide a general understanding of the renewable energy potential of EPA and state tracked sites. They will be updated periodically. More detailed site-specific analysis is necessary to identify or prioritize the best sites for developing renewable energy facilities based on technical and economic potential. See the Data Guidelines document for specific information on methodology and data considerations.
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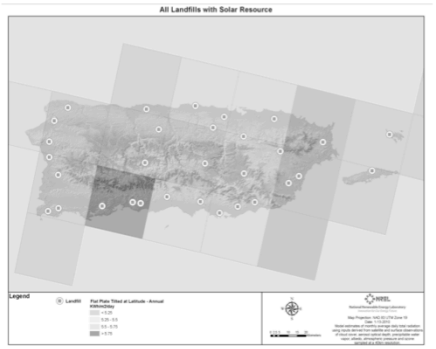
NREL Partnership: Site Specific Analysis

- EPA Partnered with NREL to evaluate the feasibility of siting renewable energy on specific sites
- In 2010, conducting 12 site-specific analyses and one alternative gas station project
- The analysis will include:
  - determining the best renewable energy technology for the site,
  - the optimal location for placement of the renewable energy technology,
  - potential energy generating capacity,
  - the return on the investment, and
  - the economic feasibility of the renewable energy projects.
- Expected Outcome: A tool for the community to use when seeking out developers for the site

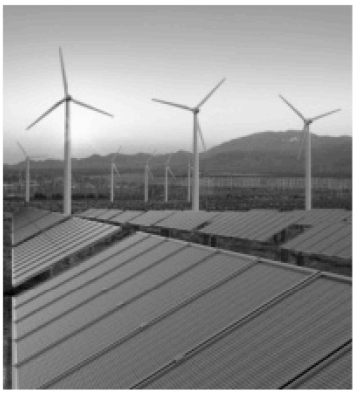
Puerto Rico Landfills

- NREL is analyzing the landfills in PR to determine feasibility for PV solar
- Criteria include:
  - Acreage
  - Slope
  - Distance to roads and transmission lines
  - Landfill closure date
- NREL will identify the highest potential sites and then:
  - Identify possible photovoltaic system size and type for those sites
  - Review the economics of the proposed systems
  - Highlight financing options



Next Steps at EPA

- Expand the toolbox of resources for use by EPA staff, states, and stakeholders
  - Developing guidances
  - Case studies tied to barriers
- Webinar Series
- Clarify Liability Protections
- Adding other sites
- Federal Partners Network
  - Partner with DOE and other Federal Agencies to promote RE-Powering



Thank You!

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» **www.epa.gov/renewableenergyland**

Siting Renewable Energy on Contaminated Lands

Aerojet-General Corp. Superfund Site
Sacramento County, California

Kevin P. Mayer and Gary J. Riley, PE, Superfund Project Managers
U.S. Environmental Protection Agency, Pacific Southwest Region
Renewable Energy on Potentially Contaminated Land Webinar Series:
Introduction of EPA's RE-Powering America's Land. October 21, 2010

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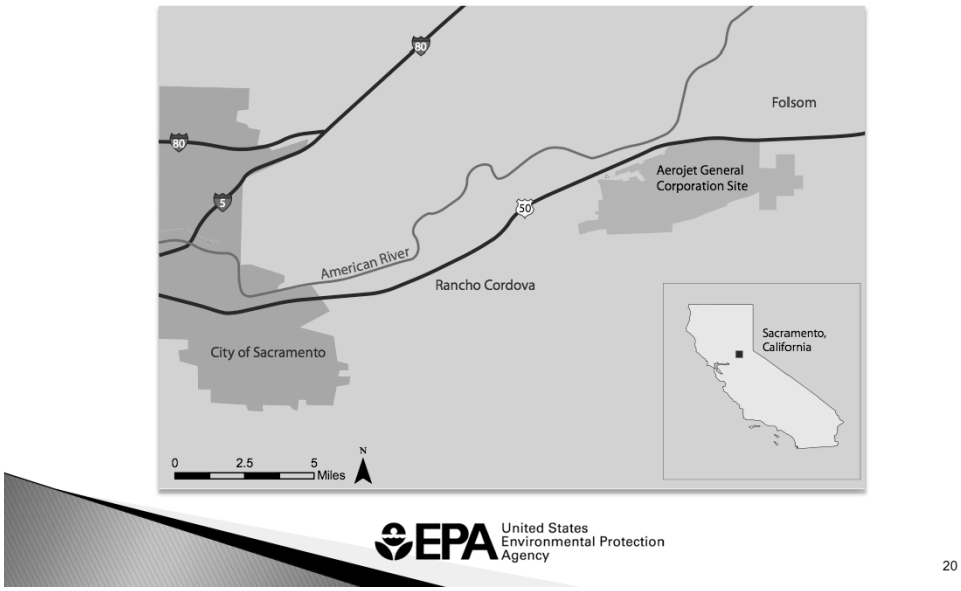
Overview

- Site history
- Cleanup approach and status
- Motivation for sustainability
- The solar energy project
- Making this project work
- Implications for the future

Aerojet Facility Location



Aerojet's facility is located in Sacramento County, about 15 miles east of downtown Sacramento. The site is located between the cities of Rancho Cordova and Folsom in an area that is now firmly in the midst of Sacramento's eastern suburbs. If you travel 100 miles east on Highway 50, you'll end up in South Lake Tahoe.

Aerojet's History in Sacramento

- Operations relocated from Southern California in the early 1950s
- Dredge tailings useful for construction

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Aerojet brought its manufacturing facility north after urban encroachment became an issue in Southern California. The testing of large military and space exploration propulsion systems required a lot of space for safety, noise, and security buffer requirements.

The property they selected in Rancho Cordova had a fairly unique feature: the entire area had been mined for gold in the 1800s using water from the American River and dredging equipment.

The materials dredgers left behind were very useful for Aerojet's needs…

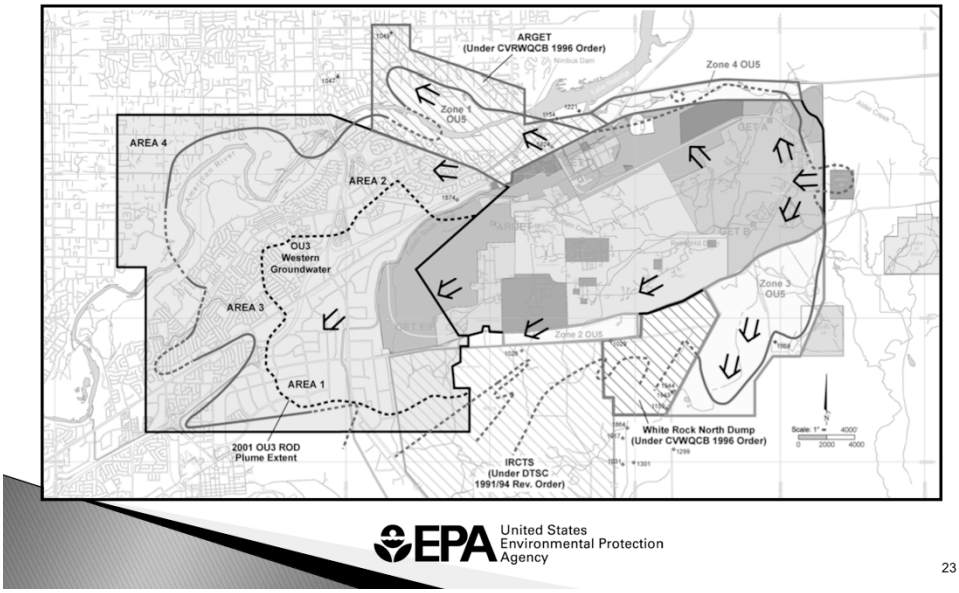
You can see a dredger here on the left, and the patterns they left behind in the aerial photo on the right.

The piles of larger rocks are aligned along the side of the dredger path and are called cobbles. Fine-grained material was deposited along the immediate dredger path (called the “slickens”).

The cobbles were very useful into structuring berms for blast protection and explosive material storage, but also easy to flatten out to create test stands and manufacturing areas.

Many low areas also provided excellent infiltration basins for process wastewater and disposal of cooling water. Unfortunately, the disturbance by dredging also created a subsurface of complex, interbedded fine-grained and course materials.

The cleanup challenge



Research, testing and production has lead to a substantial groundwater plume from the site. The most wide-spread contaminant of concern is perchlorate, a component of rocket fuel. There is also a substantial plume of fuel component NDMA, and also the solvent TCE.

While this figure is quite complicated to take in right now, I hope it can give you an appreciate for the challenge of the ground water remediation task at hand. The red line shows the extent of the roughly 27- square-mile plume. The Aerojet facility is located in the center and right of the figure. Many of the rocket testing areas are to the right (eastern) end of the map, which unfortunately coincides with the recharge area for much of the regional groundwater. You can see this flow represented in the black arrows.

The plume has intersected a number of municipal supply wells and the remedy includes provision of a replacement water supply.

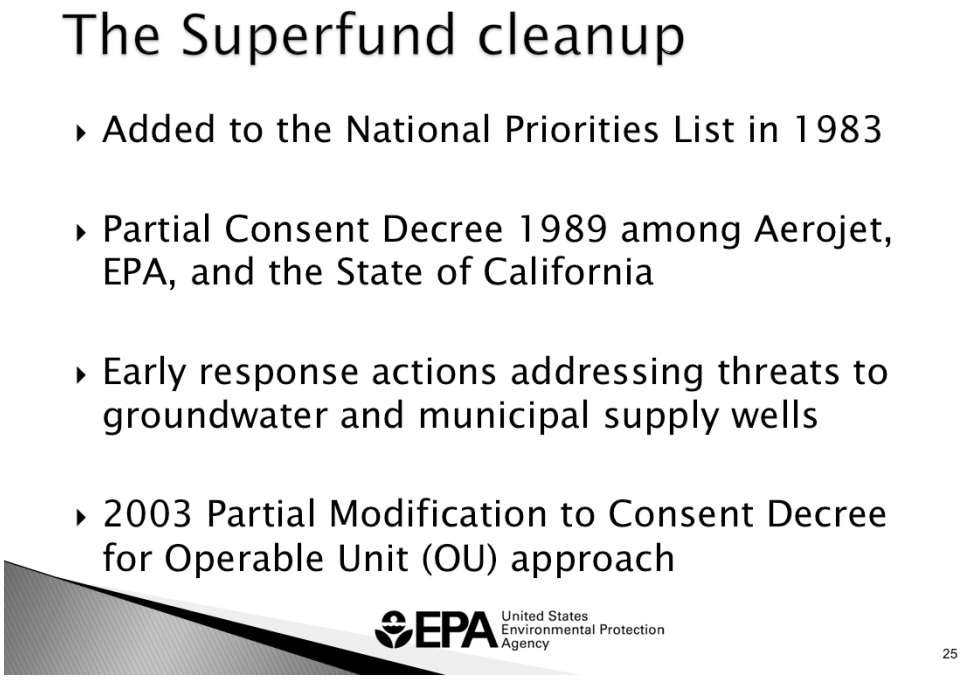
You can no doubt infer that there are many different demands on this Superfund property:

Aerojet is continuing its operation over many of the 5,900 acres of Superfund property and their over 8,000 acres of land holdings. Many of these uses still require buffer zones for security and safety.

Some portions of the Superfund Site are being leased to other users (generally commercial/office tenants). The environmental cleanup itself takes up portions of the site for remediation facilities.

And, some portions of the Site are have been sold to future users and are in use while cleanup proceeds.

Like any type of reuse, planning renewable energy production at this site needs to be compatible with the cleanup and these other considerations. EPA's Superfund Redevelopment Initiative and Green Remediation program have a number of tools to encourage balancing all of these criteria.



Here's a brief history of the Superfund cleanup. The site was added to the Superfund National Priorities List in 1983 after detections of VOCs in private wells and the American River. Perchlorate was found to be a ground water issue in the 1990s. The first cleanup actions to control groundwater pollution were taken in the mid-1980s and continue today.

A 2003 modification to the Partial Consent Decree divided the site into Operable Units, or "OUs", to streamline investigation.

Operable Unit Status

Operable Unit #	Operable Unit Name	Status
1	Overall Site	Study and remedy selection underway.
2	American River GET	Addressed under Perimeter Groundwater Operable Unit (OU 5) and other operable units.
3	Western Groundwater OU	ROD signed in 2001.
4	Area 41 Soil & Groundwater	Study and remedy selection underway.
5	Perimeter Groundwater	Proposed Plan issued for public comment in August 2009; ROD anticipated in Fall 2010. Landfill included in OU 5, with closure overseen by state and county authorities.
6	Boundary OU Groundwater and Soil	Study and remedy selection underway.
7	Islands OU Groundwater and Soil	Study and remedy selection underway.
8	Eastern OU Groundwater and Soil	Study and remedy selection underway.
9	Central OU	Study underway.

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Here is a list of the 9 operable units in more detail.

The on-property, or “Source” OUs are currently in the Remedial Investigation phase to determine the nature and extent of pollution. This information will allow EPA and the State to assess risks from the site and develop appropriate cleanup alternatives.

The groundwater OUs that extend beyond the Aerojet property boundary are known as “Western GW” and “Perimeter GW”. The cleanup decision was finalized in 2001 for Western GW and is expected to be finalized for Perimeter GW later this year.

The Groundwater Remedies

- Over 25 million gallons per day
- More than 100 billion gallons pumped and treated since mid-1980s
- Extraction and treatment consume over 20 MW of electricity

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The groundwater remedies in place for the Western GW and Perimeter GW have a total of nine groundwater extraction and treatment systems, shown here on the map. [The 10th, to the lower left, addresses contamination from operations at the Inactive Rancho Cordova Test Site, a state-lead cleanup site that is not part of the Aerojet Superfund Site.]

The number for this extraction system are impressive: over 25 million gallons of water per day are extracted, with over 102 billion gallons since the first systems began operating.

Lifting all of this water from wells that can be dozens to hundreds of feet deep takes a substantial amount of energy: at least 4.1 MW of electricity.

Extraction and Treatment

- Nine groundwater treatment plants
- >300 extraction wells
- Treatment for TCE, NDMA, and perchlorate

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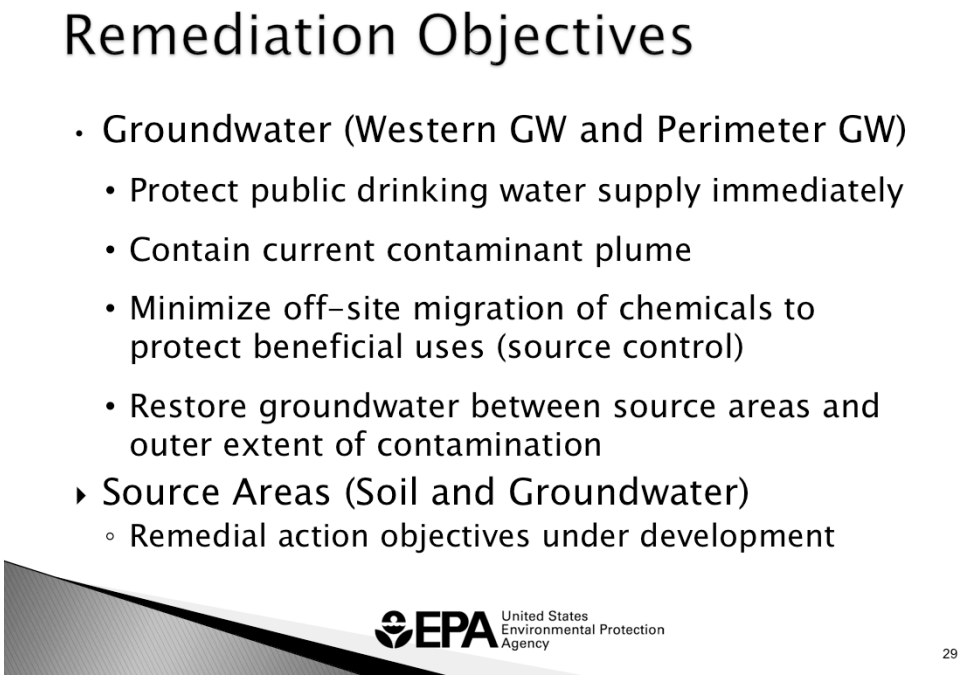
The nine groundwater treatment plants receive water from over 300 extraction wells. This photo shows just a few of the pumps that are need to move all of the water.

TCE is treated using granular activated carbon, while NDMA is broken down with ultraviolet light.

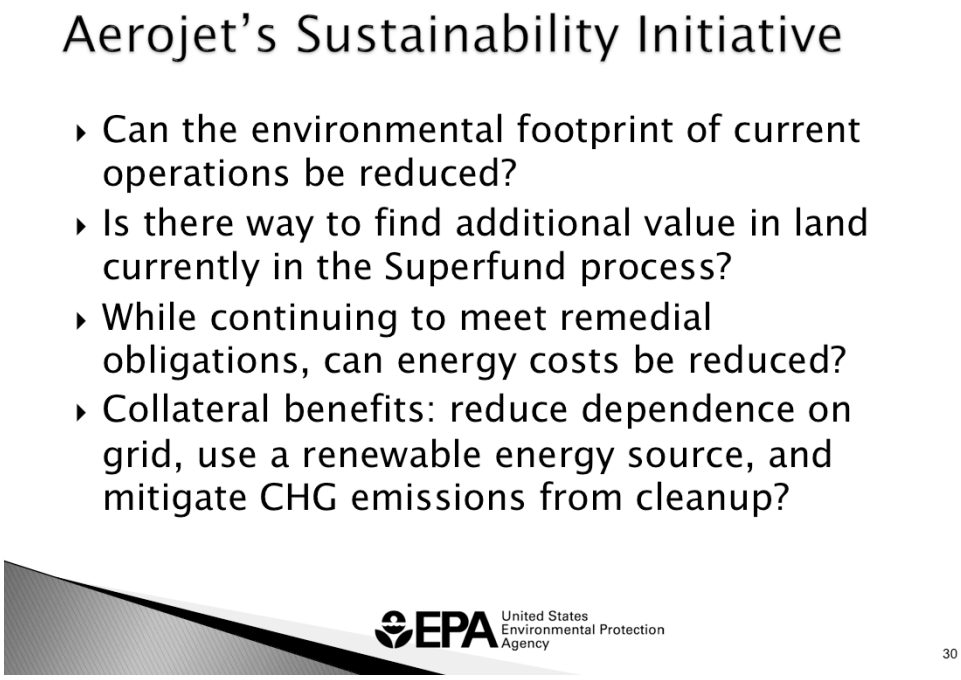
Perchlorate is treated using ion-exchange resins and fluidized bed reactors

Treated groundwater is discharged under an NPDES permit.



The objectives for the groundwater operable unit remediation have been established in the ROD and Proposed Plan.

They are [READ BULLET POINTS]



So, while Aerojet, EPA, and the State of California are working on the cleanup, the company began to ask some of these questions as part of a Corporate Sustainability Initiative.

[READ BULLET POINTS]

The Opportunity

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When it comes to planning a solar energy project, one this is clear: Aerojet has a substantial amount of land in Sacramento County. Even within the 5900 acre Superfund lands, there are areas of opportunity where new uses (and old) can exist with the investigation and cleanup.

EPA has long had a commitment to reuse of Superfund sites through the Superfund Revitalization Initiative, and we were very pleased when Aerojet brought forth a plan for the solar project. But first, let me step back into some of the considerations the company had when planning such a project.

AEROJET
A GenCorp Company

Business Considerations

- Deal structure
- Project funding
- Liability issues (both ways!)
- Future land use
- Project timeline – Aerojet/SPI/SMUD

How would a deal be structure that would ensure viability and sustainability?

Off-take revenue: which entity would own the solar project itself, and how would the land be leased?

The key Power Purchase Agreement (PPA) for any renewable energy project had to allow Aerojet to buy power at acceptable rates for them and the solar project owner.

Of course, the project needed to be funded.

The project used a Federal incentive tax credit/payment

The local utility provided production-based payments

Investors funded the project through a combination of equity and debt financing

Liability issues ran in two directions!

Indemnification (PPA or other agreement) was important for both Aerojet and the project proponents.

Easement Agreement terms contain access provisions that were essential to EPA and the State

Aerojet intends to be in Sacramento county for the long term, and the groundwater cleanup is expected to take decades. Therefore, consideration of the future land use *after* the life of the solar project was essential. The easement agreement describes how the land use reverts back to owner

And, of course, with three partners (Aerojet, Solar Power Inc., and the Sacramento Municipal Utility District), it was essential to have a mutually agreeable Project Timeline.

AEROJET
A GenCorp Company

Business Considerations

- Through its incentive program, Sacramento Municipal Utility District agreed to finance approximately **$13 million** of the project's **$20 million cost** over a 10-year period.
- Other financial and tax considerations…

Of course, the project needed to be funded.

The project used a Federal incentive tax credit/payment

The local utility provided production-based payments

Investors funded the project through a combination of equity and debt financing

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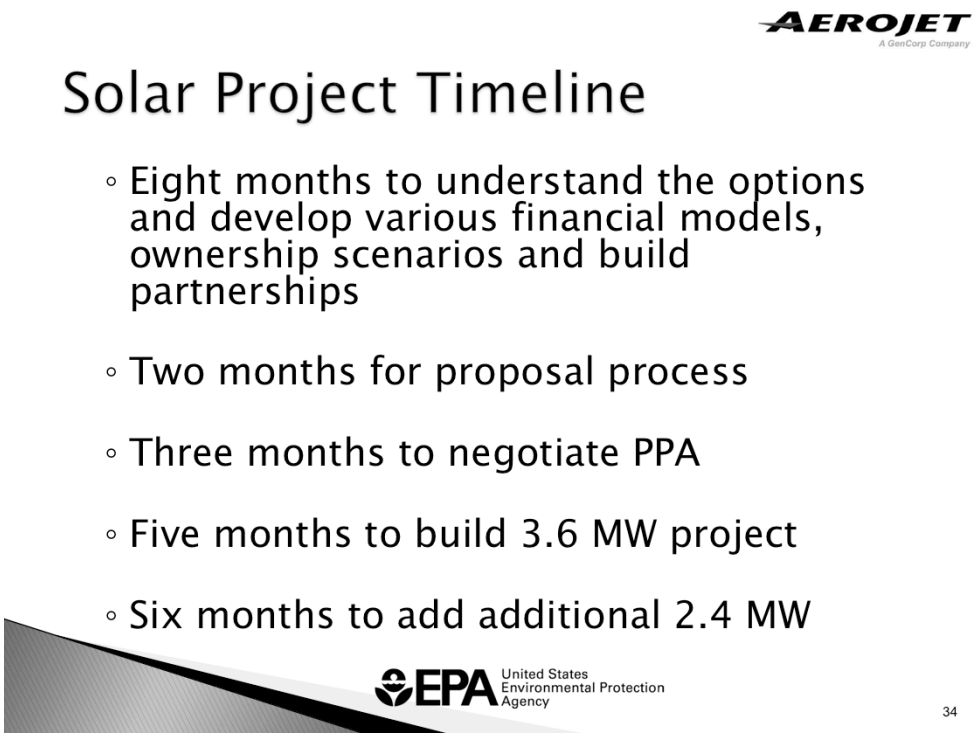

Here is how the timeline for this project worked.

AEROJET
A GenCorp Company

Technical Feasibility

Aerojet Project

- 6 MW
- 40 acres
- 30,000 PV solar panels
- Single axis tracking system

This solar facility is one of the largest single-site industrial installations in the United States.

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This photo shows the solar project as constructed at the Aerojet Superfund Site.

The size of the project was driven by available tax incentives and those provided by the local utility. The initial size of 3.6 MW was based on those incentives; additional incentives drove the expansion to 6 MW.

Potential size and location constraints included not only Aerojet's other needs and the topography, but also avoiding contaminated source areas, wetlands, and protected flora and fauna.

The design was flexible to create a footprint that worked with these issues. As you can see from the photo, the shape does seem unusually complex, but it was the best match to all of the issues. In addition, the location provided access to existing electrical infrastructure on the Aerojet site, which was upgraded for the new source of power.

This location also allows for Aerojet to keep the project within its secure perimeter and minimizes its appearance from off-property as an attractive nuisance to trespassers.

The largest challenge to developing a facility such as this one from the project sponsors' perspective is working through the permitting and approvals process. In this case, Aerojet had permission from the county for industrial use of its property, and notified them prior to issuing their Request for Proposals to potential solar developers.

EPA and the State Agencies were concerned with how the project's construction methods and siting could affect the investigation and cleanup or special status species. These concerns were addressed through communication prior to project approval.

With completion of this project, Aerojet has had positive reaction from the community and their partnership with SPI and SMUD has afforded several high-profile media events.

Solar Project Approval

- How do EPA and State approve this project?
- April 21, 2009 Partial Consent Decree Paragraph 11(e) notice to EPA and State
- April 30, 2009 letter to Aerojet providing EPA approval with some considerations
  - Access corridors
  - Future response actions
  - Right of access (Paragraph 18)

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The specific mechanism for approving this project on a Superfund site was provided by the enforcement agreement for the site, the Partial Consent Decree. Using this process, Aerojet provided formal notice to EPA and the State as required in Paragraph 11(e) of the document. EPA and the State reviewed the proposal and requested clarification on several issues. The parties were able to ensure access corridors would be allowed through the site to accommodate future investigation and cleanup, if needed. The Agencies retain the right of access for cleanup as provided in Paragraph 18 of the Partial Consent Decree.

Project Benefits

- System provides approximately 30% of electricity for groundwater extraction and treatment
- Estimated annual avoidance of 6,000 tons of carbon dioxide, 4 tons of sulphur dioxide, and 5 tons of nitrogen oxide over the project's 25-year design life
- Reuse plans for other portions of the site include residential and commercial/industrial, all of which can benefit from expanded solar energy production.

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[READ BULLET POINTS]

Lessons for Success

- Partnerships are essential
- Involve stakeholders in conceptual phase
- Seek win-win for all stakeholders
- Flexibility
- Timely action and responses

Without the right partners in Solar Power Inc. and the Sacramento Utility District, Aerojet tells me the project simply could not have been a success.

Early involvement of stakeholders helps avoid surprises down the line that could derail a project by causing excessive delays. Communication about the project's siting and design allowed EPA and the State to approve construction. As a "lesson learned", the parties agree that earlier, more informal involvement at a slightly more conceptual stage would have streamlined the process even more, since an earlier site was determined to be not acceptable to EPA.

The solar project partners *and* stakeholders such as EPA and the community all benefit from a project of this type, by powering a greener cleanup and avoiding greenhouse gas emissions.

Other key factors included quick response times from all parties, especially the agencies. Reuse deals very often require fast action because the project proponents – and their capital – could go elsewhere in the face of time uncertainty. Agencies such as EPA need to ensure we can achieve our goal of protection of human health and the environment without being caught up in a position so conservative and deliberative that great projects can't go forward.

Lastly, Aerojet and their solar project partners were willing to make accommodations for siting and design to recognize that this is an ongoing Superfund response.

Acknowledgements

- Aerojet General Corp.
- EPA Superfund Redevelopment Initiative
  - Contacts:
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APEX WIND ENERGY

Development of Renewable Energy Projects on Brownfield and Industrial Properties

Case Study: Steel Winds

October 18, 2010
Apex Wind Energy, Inc. and Axio Power, Inc.

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Agenda

General Introductions

Introduction to Axio Power & Apex Wind

Our Brownfield Goals

Brownfield Renewable Energy Strategy

Experience

Introduction to Wind Energy

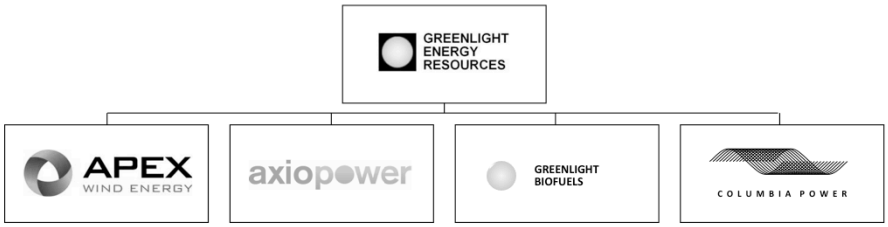
Steel Winds Site Redevelopment

Our Experiences with State and Federal Environmental Agencies

Company Overview

The parent company of Apex Wind Energy and Axio Power is Greenlight Energy Resources, Inc., a private investment company focused on renewable energy

Greenlight has four operating companies in the wind, solar, biofuels and wave energy industries



Apex and Axio have offices in Virginia, California, New York, Pennsylvania, and Ontario, and projects under development throughout the US and Canada

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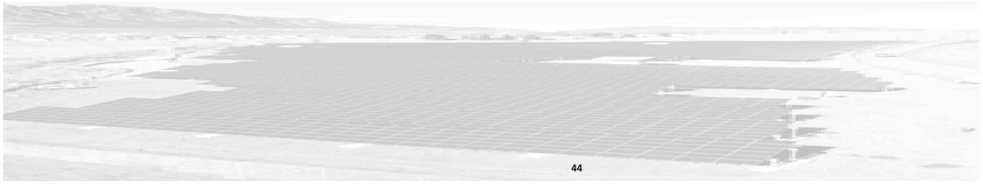
Our Brownfield Goals

1.) **Develop wind and solar projects in months not years**

2.) **Seek out active industrial sites and appropriate brownfield sites such as active or closed mines, refineries, steel mills, oil fields, or similar industry**

3.) **Reduce project costs as compared with conventional sites.**

4.) **Enhance our reputation for environmental stewardship**



Our Brownfield Strategy

1. Do not assume existing environmental liability.
2. Ensure that site remediation occurs to protect our long term stakeholders and employees
3. Work on sites at which renewable redevelopment is appropriate
4. Work on sites which can be built on immediately.
5. Work closely with the community in which we will work
6. Look for sites with existing infrastructure such as power lines and roads
7. Look for sites with large enough tract of available land
8. Work in States that support renewable energy development.
9. Work cooperatively with site owner to ensure that they get PR credit
10. Develop only sites where our activities support the long term environmental status of the community

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Our Experience

Steel Winds
20 MW Wind facility located on an abandoned steel mill in Lackawanna, NY. Numerous energy and environmental awards

Nerefco
23 MW wind facility located inside an operating oil refinery in the Netherlands

Fort Carson Solar
2 MW photovoltaic facility on a landfill property in Colorado

Sunray Windfarm
50 MW wind facility adjacent to an operating oil refinery in the Panhandle region of Texas

And several other similar projects under development…

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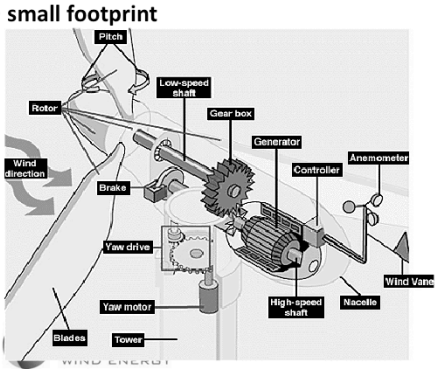
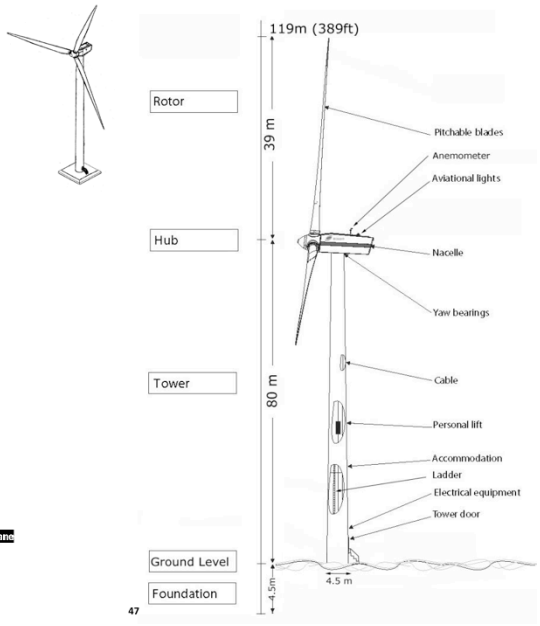
Wind Turbine Components

- **Tall (40 stories to blade tip)**
- **Rotate at 15 – 20 RPM**
- **Nacelle rotates (yaws) to catch the wind**
- **Blades pitch to catch the wind**
- **3-stage gearbox optimizes rotor speed for electrical generation**
- **small footprint**

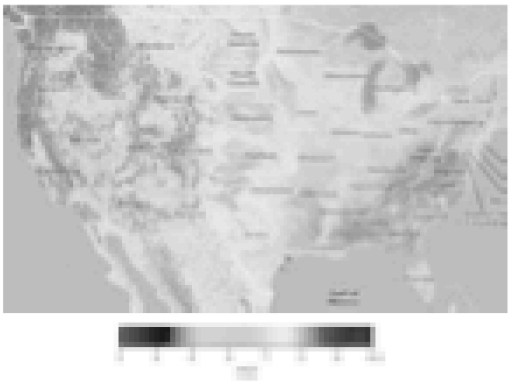




What we look for in a Wind Energy Site

- State mandate for renewable energy
- Clear and cooperative permitting process
- Commercially-viable wind resource
- Robust electricity market
- On-site transmission line/substation
- Location near load
- Access to road, rail, or port
- Local support for renewable energy
- 400+ acres available land

WINDSPEED MAP OF THE UNITED STATES



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Lackawanna, New York

20 MW of Wind Turbines located in Lackawanna, NY; Operational since 2007

30 Acres around the turbines have been remediated through the NYS Brownfield program; the balance of the site is not impacted

Numerous recognitions and awards including *Renewable Energy Project of the Year* from Power Magazine International

- First urban wind facility in US
- Only US wind facility on the Great Lakes
- One of the most visible wind facilities in the US

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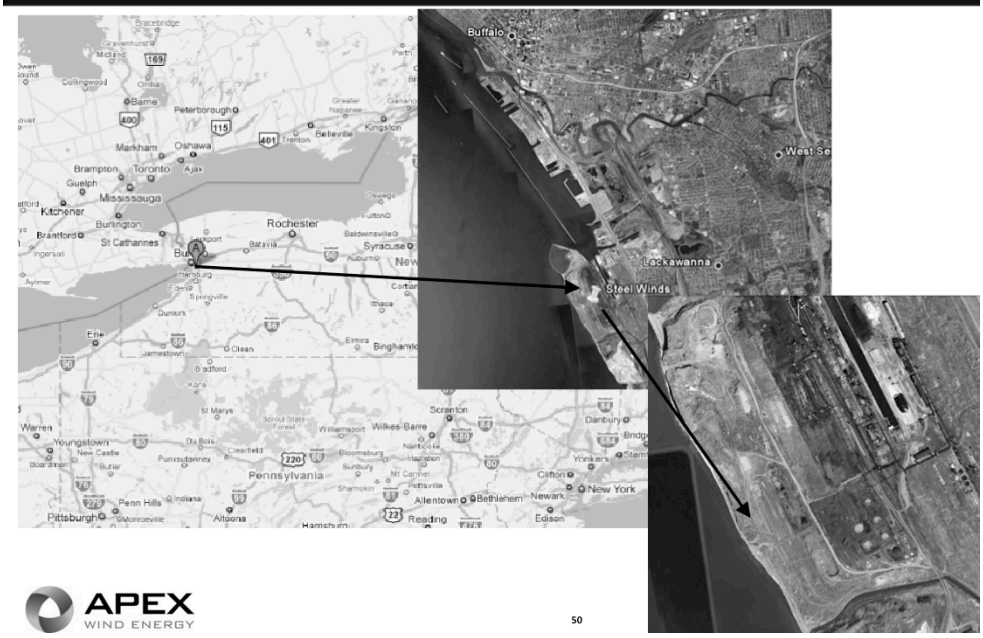
Lackawanna, New York



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Site History

1900: Lackawanna Iron and Steel Company begins construction south of Buffalo, NY

1903: Reorganized Lackawanna Steel Company begins operations

1909: City of Lackawanna, NY formed around the steel plant

1910 – 1921: Lackawanna Steel Works expands to 2 miles of shoreline

1922: Bethlehem Steel Company acquires Lackawanna Steel

1945: 20,000 people employed at Lackawanna Steel Works, the largest integrated steelmaking facility in the world

1970 – 1980: De-investment and foreign competition cause obsolescence of Lackawanna Steelworks and gradual layoffs of works

1982: Bethlehem Steel announces the closing of nearly all production in Lackawanna, NY, laying off 16,000 workers

1988: USEPA declares Lackawanna Steel a superfund site following a RCRA facility assessment

1983 – 2001: Restructuring of Bethlehem Steel and consolidation at Burns Harbor, Sparrows Point, and Pennsylvania Steel

2001: Bethlehem Steel files for bankruptcy

2003: Assets of Bethlehem Steel purchased by International Steel Group (ISG)

2005: ISG merges with Mittal Steel

2006: Mittal Steel merges with Arcelor to form ArcelorMittal, the largest steel company in the world

2009: ArcelorMittal closes remaining steel operations in Lackawanna

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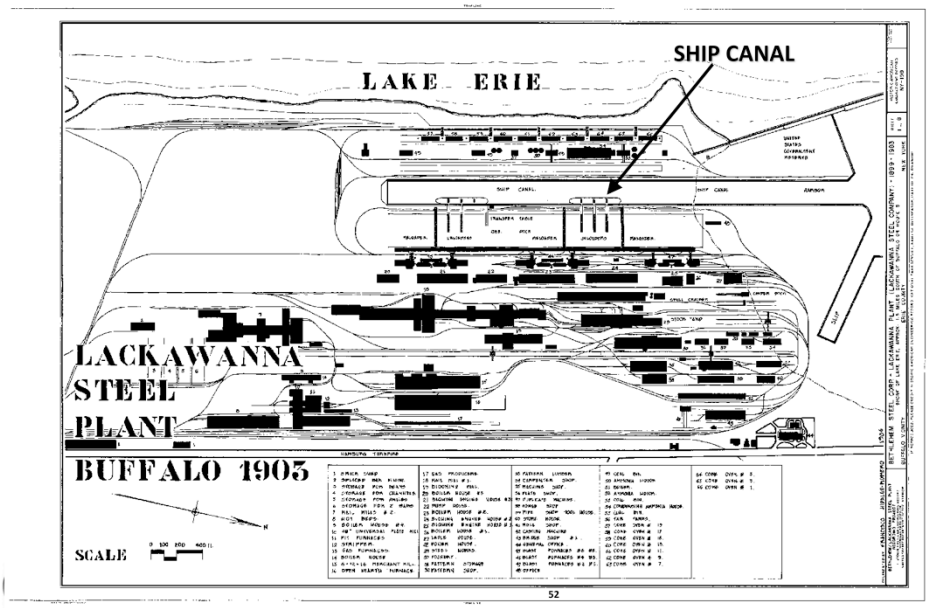
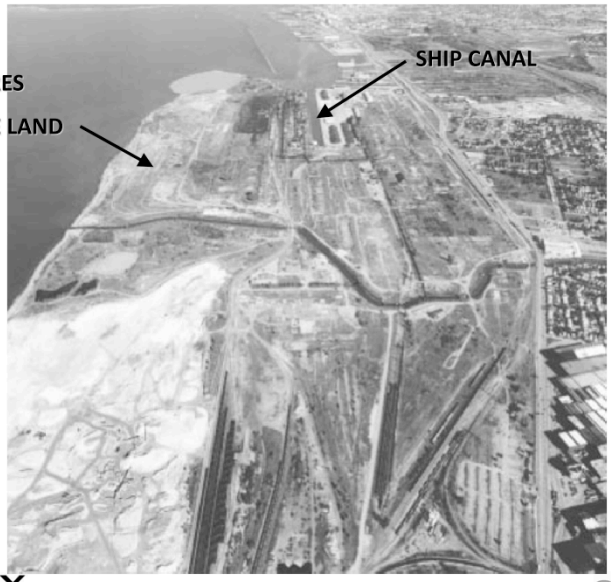
Site History



Site Characteristics



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Site Characteristics

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Site Redevelopment

- Site preparation
  - road construction and surface grading
  - Removal of surface debris
- Dig holes for foundations
  - Removal of sub-surface debris
  - Dynamic compaction
  - 15’ burial depth
- Pour and bury foundations
  - 60’ diameter
  - 15’ above-ground disturbance

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Site Redevelopment

- Grout tower base to foundation
- Attach further tower sections
- Lift nacelle and gearbox
- Attach blades
- Lift Rotor
- Internal wiring and commissioning

- Development Timeline: 2 years
- Construction Timeline: 3-6 months

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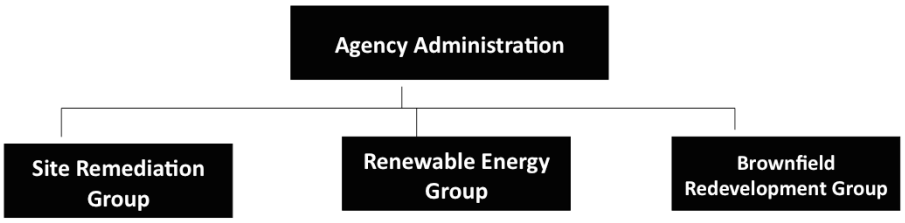
Our Experience with State and Federal Environmental Agencies



The challenge- the three groups on the lower level do not always agree that the near term redevelopment of a brownfield with wind or solar is a priority goal; despite the fact that the top layer generally does.

New York's Solution- Brownfields Cleanup Program offers tax credits for both remediation and redevelopment of brownfield sites. Tying remediation to redevelopment promotes timely reinvestment.

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What are the Impediments?

Site owner prefers to delay expenditures for as long as possible. Fears that allowing some development will raise the site profile and prevent further delay?

Site owner sees no incentive to allow development. Often management of brownfields rests with a remediation department that does see or understand an overall corporate benefit.

Some investors still fear that investment in a brownfield project will leave them open to liability for the existing contamination.

The cost advantage of building on a brownfield vs a greenfield varies by state. At the federal level, the advantage is not always obvious unless there is significant infrastructure savings.

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Suggestions for Regulatory Agency Action

1. Encourage parallel path remediation and renewable development so that the site has a non-interfering use during cleanup
2. Further program to identify locations, assets and willing brownfield owners that are ready for development with wind and solar.
3. Identification of "carrot and stick" incentives which incentivize corporate site owners to allow renewable energy development.
4. Identification of government controlled brownfield sites that can be immediately developed with renewable energy.
5. Creation of interim remediation standards to encourage immediate development of renewable energy prior to completion of cleanup actions

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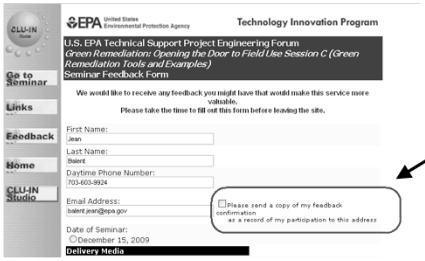
Questions and Discussion

Resources & Feedback

- To view a complete list of resources for this seminar, please visit the **Additional Resources**
- Please complete the **Feedback Form** to help ensure events like this are offered in the future



Need confirmation of your participation today?

Fill out the feedback form and check box for confirmation email.