

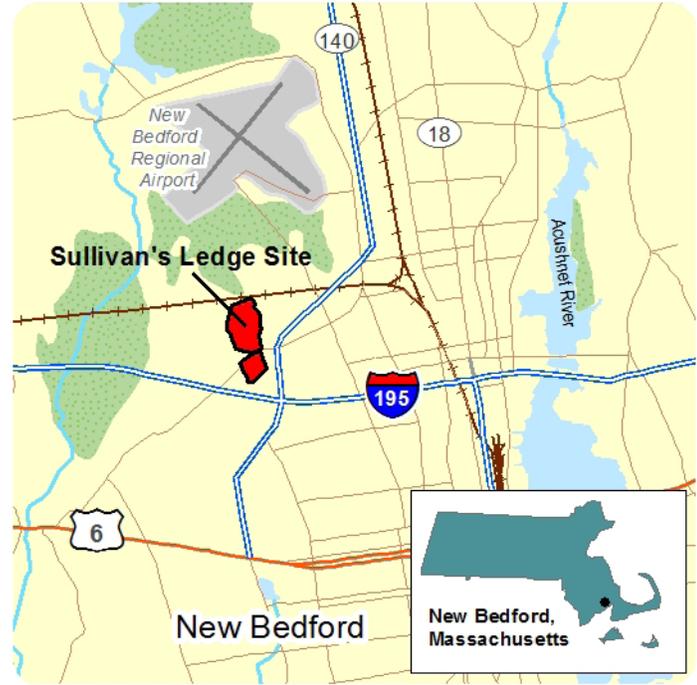
Introduction

The City of New Bedford, Massachusetts, was once known as “the city that lit the world” – its large whaling fleet carried lamp oil back to the mainland in the nineteenth century. Today, the city’s emphasis on renewable energy – and solar energy in particular – has reinvigorated New Bedford’s old moniker. The City of New Bedford’s 16.2-megawatt project, launched in 2011, includes 10 separate solar installations, and one on-shore wind installation. One of these is a national example of how renewable energy projects can revitalize contaminated lands. Located in the northwest part of the city, the Sullivan’s Ledge Solar Project covers 10 acres of the Sullivan’s Ledge Superfund site.

The Sullivan’s Ledge Solar Project is one in a series of renewable energy facilities located on current and former contaminated lands nationwide. Built on an old town landfill affected by soil and groundwater contamination, the facility generates pollution-free energy and has restored a vacant area to beneficial use. The 1.75-megawatt facility includes over 5,000 block-mounted fixed-tilt solar panels. Project financier SunEdison, Inc., leases the site from the city and then sells the solar net metering credits generated by the facility back to the city at a reduced rate under a 20-year power purchase agreement.

The project is the result of innovative planning and cooperation among many parties, including BlueWave Capital, SunEdison, the Massachusetts Department of Environmental Protection (MassDEP), U.S. Environmental Protection Agency (EPA), the City of New Bedford, and the Sullivan’s Ledge Site Group.

In the following pages, the case study discusses the evolution of solar energy reuse efforts at the site from initial planning activities to the solar facility’s construction and operation. The case study provides information and lessons learned from solar reuse at the Sullivan’s Ledge site to companies, local governments, communities, utilities and regulators interested in supporting utility-scale solar development opportunities on contaminated lands.



New Bedford is located in southeastern Massachusetts. About 95,000 people live in the city.



The 1.8-megawatt Sullivan's Ledge solar facility.

Site History, Contamination and Remediation

The 26.5-acre Sullivan's Ledge Superfund site consists of two areas divided by Hathaway Road – a 12-acre landfill area to the south, and a 14.5-acre wooded wetland to the north. The surrounding area is a mix of stores and other businesses, ecological areas, and a golf course.

The 12-acre landfill area was originally a granite quarry that supplied building stone to the New Bedford area in the 1800s. In 1935, the City of New Bedford assumed ownership of the property and used the former quarry as a disposal site for wastes such as electrical transformers, fuel oil, volatile liquids, glass, metal and scrap rubber. These disposal activities led to soil, sediment and groundwater contamination. EPA placed the site on the Superfund program's National Priorities List (NPL) in September 1984. Fourteen businesses and organizations, including the City of New Bedford, were identified as the site's potentially responsible parties (PRPs).

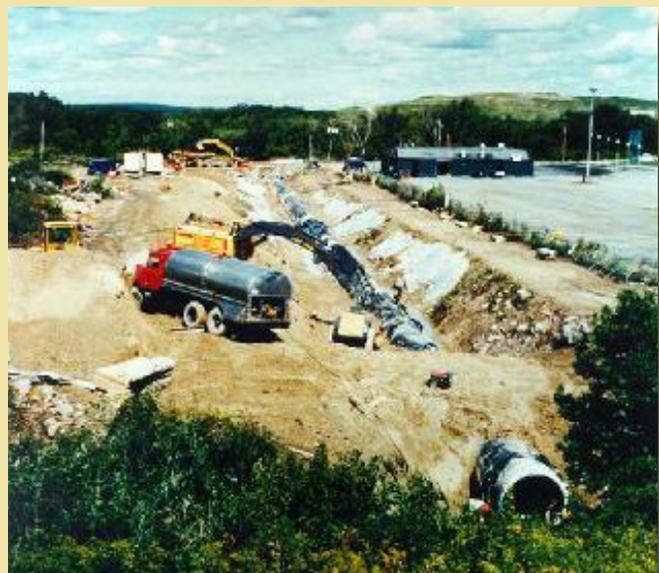
To manage the cleanup, EPA divided the site into two operable units (OUs). Cleanup activities included landfill capping, groundwater extraction and treatment, landfill gas extraction (OU1), and removal of contaminated soil and sediment from the neighboring golf course and 13 acres of impacted wetlands (OU2). In a 1991 agreement, the site's PRPs, known as the Sullivan's Ledge Site Group (Site Group), agreed to pay for the cleanup.

Cleanup began in 1998. Soil and sediment cleanup was completed in 2002. Groundwater treatment and landfill gas extraction are ongoing. The landfill cap includes a geosynthetic clay liner topped with at least 30 inches of clean fill. To ensure the long-term protectiveness of the remedy, a 1991 Consent Decree between EPA, MassDEP and the Site Group prohibits excavation deeper than 6 inches, without a plan approved by EPA in consultation with MassDEP. The Site Group remains responsible for the remedy. The City of New Bedford remains the owner of the landfill area.

Throughout all planning and cleanup activities, EPA and MassDEP staff met regularly with community stakeholders to share information and updates, and to incorporate community feedback into the Superfund process.



Aerial view of the site prior to solar installation.



Construction of stormwater infrastructure near the landfill cap in 1998.

Timeline of Events

<i>1800s – 1921</i>	Quarrying operations
<i>1935</i>	City of New Bedford acquires site property
<i>1930s – early 1970s</i>	Quarry pits used for waste disposal
<i>1982 – 1983</i>	Air and groundwater monitoring
<i>September 21, 1984</i>	EPA places site on NPL
<i>June 1989</i>	OU1 remedy selected
<i>June 1991</i>	OU1 Consent Decree issued
<i>September 1991</i>	OU2 remedy selected
<i>April 1993</i>	OU2 Consent Decree issued
<i>July 1995</i>	OU1 remedy updated
<i>March 1998</i>	Landfill capping begins
<i>April 1999</i>	Soil/sediment removal and stabilization begins
<i>December 1999</i>	Groundwater collection and treatment begins
<i>August 2001</i>	Soil/sediment removal and stabilization completed
<i>March 2002</i>	Landfill capping completed
<i>June 2004</i>	Landfill gas extraction begins
<i>May 2007</i>	New Bedford’s Sustainability Task Force established
<i>January 2010</i>	Massachusetts’ Solar Carve-Out I Program established
<i>February 2010</i>	Energy Office of New Bedford established
<i>October 2011</i>	New Bedford’s Solar Initiative established
<i>November 2011</i>	Massachusetts’ Clean Energy Results Program established
<i>January 2012</i>	Jon Mitchell takes office as Mayor of New Bedford
<i>October 2012</i>	Mitchell administration revised Solar Initiative and established Renewable Energy Power Purchasing Initiative
<i>December 2013</i>	EPA approves installation of 1.75-megawatt solar project
<i>May 2014</i>	MassDEP and the City sign Grant of Environmental Restriction and Easement (GERE)
<i>Spring 2014</i>	Solar installation begins
<i>September 4, 2014</i>	Solar installation activated
<i>September 19, 2014</i>	Commissioning ceremony
<i>December 2014</i>	EPA gives Region 1’s first Excellence in Site Reuse Award to project team
<i>March 2015</i>	Solar Electric Power Association recognizes project team with Photovoltaic (PV) Project of Distinction Award

Project History

Pre-2007

Cleanup and Public Safety Are Project Focus from the Outset

During site investigations and cleanup, protection of public health and the environment was the top priority. According to EPA project manager Dave Lederer, “reuse was not a primary consideration. The focus was on getting design and construction activities underway,” he noted. “There was a thought in people’s minds that once the cap was installed, there might be some basic use for the area, but nothing more than something very limited.” He added that “there were also proposals to use the area for ball fields, but the site has a little slope to it. That would have been difficult.” About four years later, however, everything changed. The City of New Bedford was looking to become a national leader in renewable energy.

2007 – 2008

Renewable Energy Becomes a City-Wide Priority

Early in his administration, New Bedford Mayor Scott W. Lang endorsed the U.S. Mayor’s Climate Protection Agreement, resolving to take a proactive approach to addressing climate change. In May 2007, the City established its Renewable Energy Initiative, spearheaded by a Sustainability Task Force led by the Mayor. This group of community members was tasked with recommending ways to improve municipal energy resources and reduce greenhouse gas emissions. Most energy resources in New Bedford were fossil fuel-based and brought in from faraway sources. The Task Force met over the course of a year to formulate a renewable energy plan for



The landfill area prior to solar project construction.

Terms to Understand

Kilowatt (kW): Unit of measure for the amount of electricity needed to operate given equipment.

Kilowatt-hour (kWh): Unit of measure indicating the amount of electricity produced or consumed over time. One kWh means one kilowatt of electricity supplied for one hour.

Megawatt (MW): 1,000 kW or 1,000,000 watts.

New Bedford. In September 2008, the Task Force released a Sustainability Report outlining the City’s renewable energy goals. Task Force Chairman John K. Bullard stated, “the most basic building block for a sustainable future for New Bedford is an active and informed citizenry.” He added, “this plan points the way to a city with a restored environment, increased economic opportunity, all equitably shared.”

2009 – 2012

Building Capacities

With the community committed to pursuing renewable energy opportunities, the next step was to make projects happen. Following the 2008 financial crisis, the 2009 American Recovery and Reinvestment Act made stimulus money available to localities for innovative projects. Funded by an \$800,000 grant from the Act, the City established the New Bedford Energy Office. Under Energy Office Director Scott Durkee, the City worked to establish a plan in 2010, that operationalized the Sustainability Task Force’s original report on producing clean energy. The reduction plan contained three goals:

- Reduce kilowatt-hours consumed per capita by 20 percent by 2020.
- Reduce fossil fuel products sold by 20 percent per capita.
- Obtain 20 percent of the community’s energy from renewable sources.

As a result of the reduction plan, the City moved forward with a series of small-scale solar projects on city-owned buildings that provided power to municipal facilities, ultimately reducing public utility costs. State incentives such as the Green Communities Act and the Solar Carve-Out Program, assisted the City’s Energy Office with funding for these projects.

In 2008, Massachusetts Governor Deval Patrick helped pass the Green Communities Act, which allowed for legislation to boost energy efficiency and encourage investment in renewable energy. The law provided the Department of Energy Resources (DOER) with a means to structure the Solar Carve-Out Program, a market-based incentive program designed to

encourage the development of solar photovoltaic capacity throughout Massachusetts. Launched in 2010, the Solar Carve-Out Program requires that Massachusetts retail electric suppliers buy solar renewable energy certificates (SRECs) for some of the electricity they produce each year. A solar array generates SRECs, which are owned by the developer of the array. The developer then sells these SRECs to the electric utilities, which in turn sell power to the buyer of the energy – in this case, the City of New Bedford. The program played a vital role in fostering the start of solar projects across the state.

Another important component of the Green Communities Act, was the provision for net metering, which allows a solar project host to offset its electricity usage with electricity generated on site. The act increased the allowable capacity of net metering facilities that use renewable resources such as solar power, to create energy up to 2 megawatts. The act also increased the value of electricity credits to nearly the retail rate. With net metering, the cost of electricity from the utility can be offset by the credits generated at another location. It also made solar projects more attractive to developers. New Bedford Energy Office Director Scott Durkee stated, “Net metering was a key instrument in financial modeling. It provided an incentive for companies wishing to develop solar facilities.” Net metering, in conjunction with the Solar Carve-Out Program, provided financial incentives, regulatory and permitting assistance, and coordinated outreach programs, to help Massachusetts become a national leader in renewable energy.

With support from the federal grant and both state programs, the City of New Bedford kicked off their Solar Initiative in October 2011. The goal: to host up to 10 megawatts of solar energy generation projects by 2013, enough to generate electricity for about 1,500 homes. The City also announced a partnership with renewable energy developer ConEdison Solutions to install solar panels on city-owned properties, including schools, community centers and other public facilities. The Solar Initiative was the first of its kind in Massachusetts, and would be a driving force in reaching the goals set out by the Energy Office’s reduction plan. Reflecting on the effort, Mayor Lang noted that “our Solar Initiative is only the most recent innovative program in New Bedford’s drive to become a national leader in energy efficiency and renewable energy.” The first year of the Solar Initiative resulted in the production of 500 kilowatts of solar power for the City.

New Bedford’s focus on becoming a nationwide model for renewable energy projects remained a priority across City administrations. In January 2012, New Bedford native Jon Mitchell took office as New Bedford’s 38th mayor. Mayor Mitchell saw the positive results from the Solar Initiative in place and wished to expand on them. In October 2012, the Mitchell administration revised the Solar Initiative and established the Renewable Energy Power Purchasing Initiative. This initiative called for the production of 16 megawatts of solar energy--equivalent to 2/3 of the energy used by the City. Mitchell

Renewable Energy Initiatives in Massachusetts

Solar Carve-Out I & II programs

Financial incentives for solar developers to maintain and expand solar facilities. The SREC-II program currently in place is designed to sustain the market until 1,600 megawatts of solar capacity have been installed statewide.

Net Metering

Due to the Green Communities Act of 2008, customers of electric distribution companies can generate their own electricity to offset their electricity usage. A special net metering device monitors energy usage and generation.

Commonwealth Wind

Program offers communities and developers assistance with wind power assessments, feasibility studies and development grants.

Energy Storage Initiative

Effort to establish an energy storage market and build partnerships to support large-scale energy storage projects.

Administration Chief of Staff Neil Mello stated, “Building on the Sustainability Task Force’s report and the Energy Office’s reduction plan, Mayor Mitchell set out to make New Bedford a national leader in solar energy. The goals set forth by Mayor Mitchell would help the state achieve its energy goals to produce 1,600 megawatts of renewable energy by 2020.”

In addition to continuing solar-based projects already underway across the community, the Mitchell administration replaced all 10,000 of the city’s street lights with energy efficient LED bulbs, replaced windows, heating and cooling systems in 100 city buildings, and converted trash trucks to run on natural gas. Many of the first small-scale solar projects of the initiative were installed on the rooftops of city-owned buildings.

2013 – Early 2014

Closing in on Solar Opportunities at Sullivan’s Ledge...

As the City evaluated ways to increase energy efficiency and use renewable energy at municipally owned facilities, it also began to explore a larger-scale option: developing a utility-scale solar facility. “The Sullivan’s Ledge site was a leading candidate from the start,” explained Neil Mello. “It was a good size, well located and vacant. We had a well-known Superfund site in the city. How could we turn the area into something positive for the community?”

EPA was no stranger to the idea of solar arrays located on cleaned-up landfill areas. At several Superfund sites across the country, solar arrays had been installed on the flat, open

landscapes of former landfills. In 2012, EPA worked with developers to construct a utility-scale solar array at the Iron Horse Park Superfund site, just over 70 miles away from Sullivan’s Ledge in Billerica, Massachusetts. EPA attorney Ruthann Sherman had worked at the Iron Horse Park site before she worked at Sullivan’s Ledge, and knew that a project like this could be feasible. “Everyone at EPA was interested in solar projects. They seem to work well on Superfund sites,” Sherman remarked. “At every turn, EPA was interested in making this happen at Sullivan’s Ledge,” she added.

Building a Project Team...

The City’s first step was to look for a partner that could effectively coordinate the project, assist with negotiations between the City and the Site Group, and ultimately make sure that the project would benefit all parties involved. “We knew that a project like this required expertise,” said Neil Mello. “And we knew we would need to work closely with EPA and the State.”

New Bedford selected Boston-based renewable energy project development company BlueWave Capital for several reasons. The City had previously collaborated with the firm on other solar projects. The company also had extensive experience with contaminated lands – former EPA Region 1 Regional Administrator John DeVillars was part of the team as founder of the company. DeVillars was familiar with federal Superfund regulations and brought a wealth of knowledge to the project team. According to Neil Mello, “DeVillars’ hands-on approach was instrumental in moving the project forward.”

Project financing was the next step. Experience and proven track records again played a key role in the selection process. BlueWave initially looked to ConEdison Solutions because of an established working relationship and their experience financing other renewable energy projects in New Bedford. However, the company had not often worked at brownfields or Superfund sites.

EPA and Site Reuse: Renewable Energy

Since the inception of the Superfund program, EPA has been building on its expertise in conducting site characterization and remediation to ensure that contamination is not a barrier to the reuse of property. Today, consideration of future use is an integral part of EPA’s cleanup programs, from initial site investigations and remedy selection through to the design, implementation, and operation and maintenance of a site’s remedy. For example, EPA is working nationwide with public and private partners such as SunEdison to encourage solar and other renewable energy development opportunities on current and formerly contaminated lands.

Region 1 Energy and Climate Unit provides information, technical assistance and training on energy efficiency, renewable energy, energy use and transmission, greenhouse gas reduction programs, climate impacts, adaptation, resilience and preparedness.

The Green Power Partnership is a voluntary EPA program that supports the organizational procurement of green power – electricity produced from renewable resources – by offering expert advice, technical support, tools and resources. Partnering with EPA helps organizations lower the transaction costs of buying green power, reduce their carbon footprints and communicate their environmental leadership to stakeholders. To date, more than 1,300 organizations have joined the partnership, using more than 28 billion kilowatt-hours of green power annually. Leading municipalities are also partnering with EPA to become Green Power Communities.

EPA’s Superfund Redevelopment Initiative (SRI) provides stakeholders at Superfund sites and other contaminated lands with tools and information to consider reuse opportunities, including renewable energy projects.

The RE-Powering America’s Land Initiative identifies the renewable energy potential of contaminated lands and serves as a resource for parties interested in reusing these lands for renewable energy development. Through this initiative, EPA and its federal, state, tribal, local, utility, community and private-sector partners are exploring how new renewable energy facilities can be developed on these properties.

EPA’s Green Remediation Strategy fosters the use of best management practices for green remediation at contaminated sites. “Green remediation” is the practice of considering all environmental effects of remedy implementation and incorporating options to maximize the environmental benefits of cleanups. By incorporating the use of renewable energy sources, EPA and its partners are maintaining the effectiveness of remediation methods while reducing greenhouse gas emissions from conventional power sources.

Please see the ***Sources and Resources*** section for more information.

BlueWave next turned to solar development company SunEdison. BlueWave and SunEdison were already developing a large portfolio of solar projects in other locations. Erin Sweet, the company's senior manager of commercial operations, recalled that "the BlueWave Capital/SunEdison team together made a really good fit for this ambitious project. We had financing experience to leverage tax equity from our work on similar projects across the country, and BlueWave had strong staff with landfill experience ready to take on the project."

As part of the project agreement, SunEdison would own and operate the array and sell the net metering credits generated back to the City at a discount, effectively reducing their monthly electricity bill. But turning concepts and engineering designs into an operating solar system sitting atop a capped landfill takes a unique partnership between the land owner and developer. "My team immediately gelled with Neil Mello, Scott Durkee and Mayor Mitchell's entire exec staff. Structuring a deal that works for both parties when a superfund site is involved requires trust and genuine alignment. We had both of those things with the City from start to finish," said Steve Raeder, SunEdison's general manager of its eastern United States commercial and industrial business.

Coordinating with Site Agencies, Addressing Stakeholder Concerns...

With SunEdison on board, the City and its development partners started working with EPA, MassDEP and the Project Management Committee (PMC), which represented the Site Group. BlueWave, SunEdison, the City, EPA, MassDEP and the PMC met several times in 2013 to discuss technical, regulatory and liability issues associated with the project. EPA site project manager Kimberly White noted that "SunEdison has done a lot of these projects. Their experience helped everything move along well."

EPA's role, according to site attorney Ruthann Sherman, "was to help facilitate the project, while making sure the remedy remained protective." The parties communicated face-to-face, via conference calls and over email over the course of several months. According to EPA project manager Dave Lederer, "sometimes BlueWave led the meetings. Sometimes, EPA and BlueWave co-chaired them. It depended on the subject matter."

The main concern of regulators and the PMC was making sure that the solar facility's design would be compatible with the remedy and not disturb the landfill cap. As EPA's Kimberly White put it, "the cap had to be in the same condition after installation as it was before." Another concern was guaranteeing ongoing access to groundwater sampling and recovery wells. The Site Group is responsible for groundwater monitoring, and needed to be sure the solar panels would not interfere with monitoring activities or other components of the remedy. Trenching of cables for the solar installation also presented a challenge; the site's Consent Decree prohibited digging past 6

Federal Liability Protections for Tenants at Superfund Sites

In part to encourage development of renewable energy facilities at Superfund and brownfield sites, EPA issued guidance in 2012 to clarify liability protections for tenants at these sites who meet certain criteria.

The 2002 CERCLA "Brownfields" Amendments had defined criteria for bona fide prospective purchasers, or BFPPs, and clarified some potential environmental risks for prospective owners and tenants. However, BFPP status and associated protections applied to a prospective tenant only if the property owner qualified as a BFPP. Under the 2012 guidance, EPA can provide liability protections to tenants through the Agency's use of enforcement discretion. A tenant can obtain BFPP status in different ways, deriving it from an owner who meets BFPP criteria, meeting BFPP criteria on its own when the landowner has lost its BFPP status, and meeting BFPP criteria even if the owner never had BFPP status.

BFPP protection is self-implementing. EPA generally will not participate in site-specific determinations of BFPP status or application of its enforcement discretion guidance. In limited circumstances, however, EPA may issue a comfort letter or status letter to a tenant to address concerns at a particular property.

See the *Sources and Resources* section for more information.

inches or disturbing the liner. Finally, EPA, MassDEP, the City and the PMC were concerned about how the solar panels might affect vegetation growth on the cap after installation.

To address these technical issues, EPA and MassDEP required that the City submit a work plan with detailed engineering drawings, an operations and maintenance plan, and the written opinion of a licensed site professional stating that the construction, operation and maintenance of a solar facility would not negatively impact the landfill cap. The work plan replaced the standard post-closure due diligence use permit typically required by the State. BlueWave's Aidan Foley explained that "the work plan had extensive requirements, including limitations on vehicle traffic on the cap and limitations on damage to the ground surface." The requirements were highly detailed. The tire pressure of work vehicles, for example, had to be below a certain pressure.

BlueWave worked with environmental engineering and consulting company TRC Solutions to draft plans for the solar facility. They submitted them to EPA in July 2013. The original plan called for 5,500 photovoltaic (PV) modules mounted on

275 aboveground racks covering 18,207 square feet. Each rack would be stabilized by concrete ballast blocks with low bearing pressure to avoid damaging the cap. The panels would be connected by cables above and below ground. The design also called for a temporary access road across the cap during installation. The design made sure that access to gas recovery and monitoring wells remained unobstructed. Plans were also drawn up to address any possible erosion of the cap during construction and after installation, and to ensure that the panels were adequately spaced to allow for operation and maintenance activities.

The City, MassDEP and the PMC also reviewed the work plan and noted several ways to further ensure the protectiveness of the site's remedy. In November 2013, BlueWave and TRC submitted an amended work plan to EPA:

- A total of 5,490 PV modules would be installed on 1,220 concrete ballast blocks.
- Rack and ballast block sizes were made smaller (1,500 to 2,550 pounds instead of 4,000 pounds) to reduce the potential for settlement and associated impacts on underlying cap layers.
- The type of rack was changed so that fewer concrete ballasts were needed.
- Any trenches where excavation would exceed 18 inches required hand-excavated test pits in advance.
- Excavation could not exceed 24 inches below grade.

As part of the work plan review process, site agencies asked BlueWave and TRC to conduct a geotechnical review of potential impacts of the ballasts on the cap. EPA project manager Dave Lederer recalled that "we reviewed it and found the project wouldn't have an impact. The State also reviewed the findings and agreed." EPA and MassDEP approved the project's updated work plan in December 2013, after minor revisions.

Clarifying Site Requirements, Addressing Liability Concerns...

While stakeholders were working through these technical considerations, EPA staff reviewed the site's Consent Decree and related requirements. The Consent Decree serves as the legally binding agreement between EPA, MassDEP and the Site Group. One impediment of the Consent Decree was a restriction that prohibited excavation deeper than 6 inches. "The developers needed to go down considerably deeper to satisfy the electrical requirements," EPA project manager Dave Lederer noted. "Fortunately, in many places, the fill was over two feet deep so that excavation could be deepened." The key concept, according to Lederer, was that "the solar project could not interfere with the existing remedy." Ultimately, EPA and the State determined that the project could be carried out under the existing Consent Decree, but the agencies would need to modify the site's institutional control requirements.

At the time of project discussions, institutional controls for the site were still in draft form, in the form of a Grant of Environmental Restriction and Easement (GERE). Because the GERE was not finalized, EPA was able to add language pertaining to the solar project to the document. As EPA project

Innovations in Solar Panel Mounting System Design

Technological advances in panel mounting and framing systems mean that solar panel systems can have minimal impact on the integrity of landfill covers and avoid placement of undue weight on landfilled areas. At the Sullivan's Ledge site, SunEdison used an aboveground system mounted on concrete pads, rather than the in-ground ballast system commonly used at landfills. The concrete pads provide stability for the solar panels and framing while avoiding soil excavation.



The panel mounting system installed as part of the Sullivan's Ledge solar array. The system consists of panels and ballast blocks mounted to concrete pads (see concrete pads without ballast blocks in the foreground). The pads allow the landfill cap to remain undisturbed.

Power Purchase Agreements

A power purchase agreement (PPA) allows interested parties to save on upfront costs and facility maintenance, while still saving money on energy costs. At Sullivan’s Ledge, SunEdison owns the solar array and the City purchases the energy from them. Over 20 years, the agreement is estimated to save the City about \$2.7 million.

manager Dave Lederer noted, “we were fortunate that the restrictions had not been finalized yet. When this particular use came up, we didn’t have to change any preexisting restrictions.” EPA, MassDEP and the PMC worked together on the institutional controls. MassDEP and the City signed the restriction in May 2014. In addition, EPA prepared a comfort letter for the PMC. The letter clarified the status of EPA’s involvement at the site, as well as the Site Group’s ongoing remedy responsibilities. According to EPA’s Ruthann Sherman, “this was very important to the PRP group.”

During this time, the City also finalized an agreement with the PMC to address potential project liabilities and other concerns caused by the solar project. The City also established an escrow account that the PMC could access to repair any damages if necessary.

Maintenance of vegetation outside of the solar footprint is part of the City’s operation and maintenance responsibilities. As former city water superintendent Jim Ricci stated, “the City and its partners wanted to make sure that all adequate guarantees and protections were in place.” PMC representative Steve Wood added, “I think the PRP group in general saw the benefit in reusing the site. As long as the project would not result in future costs or liabilities for members of the PMC, the group thought it was a good thing to do.”

As part of the pre-construction negotiations between parties, BlueWave, SunEdison and the City signed a power purchase agreement (PPA) in September 2013. Under the terms of the agreement, SunEdison owns and operates the solar facility and sells the energy to the City. The City purchases net metering credits from SunEdison for a period of 20 years after construction of the facility. The credits are set at a fixed price of about 11 cents per kilowatt hour. If the price of electricity goes up, the City continues to pay the same rate. The credits are a type of coupon that can be applied to the City’s energy bills. If for some reason, the facility does not produce its estimated kilowatt hours during a given period, SunEdison will pay the City the difference between the average net metering credit price and the average net energy price. Net metering was a key part of the project’s appeal to the City since Sullivan’s Ledge “has a lot of capacity but not much load,” explained BlueWave senior project developer Aidan Foley.

SunEdison owns, operates and maintains the net metering device that tracks the amount of energy the facility sends to NStar, the local electric utility. After the 20-year contract period, both parties can renew the PPA for additional years. SunEdison’s remote monitoring system links to an operations center that is staffed 24 hours a day. Automated diagnostic checks of the system take place every 15 minutes; any anomaly triggers an alert to send an employee to the site for review. As part of the agreement, SunEdison is also responsible for most operation and maintenance activities at the facility, including mowing the grass in between the solar panels nine times per year and completing monthly landfill integrity inspections. Inspection reports are shared with EPA, MassDEP, the PMC and the City.

Looking back, each of these agreements was vitally important to the project’s success. Consent decree amendment agreements, the PPA, and operation and maintenance agreements all needed to be in place. BlueWave’s John DeVillars noted that addressing site and project complexities took time. “The permitting and pre-construction part of the project took much longer than other solar projects, primarily due to the number and complexity of agreements required to move forward,” he noted. “MassDEP, SunEdison, BlueWave, the City and the PMC collectively had to agree on each of those elements.”

Applying for Additional Project Approvals...

The project’s developers also tackled the lengthy pre-construction permitting process that often accompanies renewable energy projects. BlueWave’s John DeVillars led the way. “He knew his way around Superfund sites and helped us in a big way with how to navigate the challenge of permitting the project,” said SunEdison’s Raeder. The project team also needed a federal stormwater permit from EPA. Due to the site’s proximity to wetlands, developers also had to submit a “Request



Unloading concrete ballast blocks at the site.

for Determination of Applicability” to the Conservation Commission of Massachusetts to learn if the state’s Wetlands Protection Act would apply to their project. The Commission determined that the Act would not apply to the project.

With the development team relying on state incentives for project funding, construction and building permits had to be secured by January 2014. BlueWave worked with the City to get the required permits in place on time. “We needed a permit by a certain day or the project wouldn’t have funding from the state,” John DeVillars recalled. “We were scrambling and the mayor’s chief of staff worked with the City’s building department to act in time. Fortunately, we succeeded. It was a good example of how the City’s support helped make the project happen.”

Spring 2014 – Fall 2014

Breaking Ground

Project construction began in the early spring of 2014. BlueWave subcontracted with Beaumont Solar, a New Bedford-based engineering, procurement and construction company, and Pro-Tech Energy Solutions to manage the engineering and construction services.

EPA project manager Kimberly White participated in regular meetings with contractors and stakeholders throughout construction to make sure activities did not negatively impact the remedy or surrounding areas. “The State, the City and all contractors were involved,” she noted. “Everything was very positive. Everyone was responsive to requests from EPA.”

While the construction process mostly went smoothly, there were a few bumps along the way. Lingering New England winter weather set the project back by a few weeks. According to EPA’s Kimberly White, “we had a tough winter. The development team had thought they would start by late fall 2013, but the project was delayed due to the weather and getting contractors on site.” Minor trenching adjustments were also needed due to shallow bedrock near the western part of the site. The project engineers at TRC provided full-time oversight of the construction process to make sure the landfill cap was not impacted. Beaumont Solar, Pro-Tech Energy Solutions and TRC worked together over the course of the spring and summer to complete construction. The goal was for the solar array to be ready to go online in September.

Generating Power, Generating Benefits

The project’s development team met the deadline. The solar array was activated on September 4, 2014. On September 19, 2014, EPA Administrator Gina McCarthy visited the site along with other local, state and federal leaders for the commissioning ceremony. McCarthy remarked, “I applaud the City of New Bedford for using the property to make clean, sustainable power – Sullivan’s Ledge will now add two megawatts of



Figures (top to bottom):

1. The site during construction of the array.
2. Spacing between the panels allows for cap maintenance.
3. A contractor mows between the panels.

clean power to the grid – and for heeding our moral obligation to act on climate change and invest in renewable, local energy. This is the kind of leadership that we need in cities and towns across the country.”

New Bedford Mayor Jon Mitchell echoed McCarthy’s sentiments. “Just a few years ago, this site was regarded as a problem with no good solution. Today, what we once thought of here as a problem is now a source of pride,” he said. “And what was once a modest local effort has turned into one of the nation’s most ambitious moves to adopt solar. New Bedford’s leadership position has other communities asking how we managed to achieve so much so quickly.”

With the 1.8-MW solar array online and producing energy, the City of New Bedford now saves about 30 percent on its municipal electricity bills – about \$135,000 per year, or \$2.7 million over the course of the 20-year term of the PPA. The solar array will also produce enough electricity to offset carbon dioxide emissions from the electricity use of over 226 average American homes, equivalent to taking 345 automobiles off the road – 1,641 metric tons of carbon dioxide per year.



Installed solar panels at Sullivan’s Ledge.

In addition to environmental benefits and fiscal savings for the community, the project also supports local jobs. Construction contractor Beaumont Solar actively recruits graduates from New Bedford’s technical high school. Beaumont Solar employed 12 New Bedford residents during construction of the facility.

Lessons Learned

A combination of significant factors contributed to the redevelopment of a large part of the site into a utility-scale solar facility.

- The site’s location, topography and public ownership made the area a strong candidate for reuse as a utility-scale solar farm.
- Regular coordination and communication among site stakeholders were critically important to the project’s success. As BlueWave’s John DeVillars noted, “there was the City, the parties that make up the PRP group, the development team, site agencies, contractors – all building common purpose and making it a collaborative effort where everyone shared the same objective. That was the key ingredient.”
- The City’s leadership and role as a cooperative PRP and property owner made the project possible. EPA project manager Kimberly White reflected that “the City was a strong partner. There was strong political support because of the public benefit associated with the reuse of the site. Working with them directly as the property owner made a big difference.”
- The Commonwealth of Massachusetts’ leadership in supporting renewable energy resources statewide through incentive programs and technical assistance enabled the project to move forward. As Department of Energy Resources deputy commissioner Dan Burgess stated, “we are committed to securing our clean energy future and reclaiming economic opportunity for the Commonwealth’s cities and towns through investments in renewable energy.”
- SunEdison and BlueWave’s experience and technical expertise made possible the project’s innovative design approach, which addressed remedy compatibility concerns and resulted in a minimally invasive construction approach that avoided the need for large-scale excavation and earthmoving. This adaptive approach can guide similar renewable energy projects where contamination remains at sites after cleanup.
- EPA and MassDEP were active partners who understood the project’s redevelopment priorities in the context of the site’s remedy. The agencies’ willingness and flexibility to work through potential reuse barriers while ensuring long-term protectiveness were critically important.
- All parties involved continue to be patient and flexible, recognizing that remedy maintenance and facility operations are

complex processes reliant on available resources, multiple partners, cleanup requirements, market conditions and other factors. John DeVillars remarked, “All of the people representing the project’s partners were focused and highly talented individuals. It was in the interest of each party to achieve the outcome that we sought.”

The Bigger Picture

While these conditions created an ideal climate for the successful reuse of the site, there are also a range of broader lessons learned that can help guide similar projects at contaminated lands across the country.

Renewable energy projects at Superfund sites and other contaminated lands can provide significant benefits.

Projects such as the Sullivan’s Ledge solar array can make use of infrastructure already in place, create local jobs, spur local investment, create benefits for landowners in the form of lease payments, and help hedge against energy price and supply volatility. These projects also reduce pressure to redevelop greenfields, as many states incentivize redeveloping on brownfields. As Mayor Jon Mitchell noted, “The New Bedford approach to being a smart city is to find ways to turn our environmental challenges and liabilities into green assets.”

EPA and state agencies work closely with communities, site owners and other stakeholders to support reuse outcomes that are compatible with site cleanups.

The Agency places a high priority on supporting renewable energy opportunities at contaminated lands. At the Sullivan’s Ledge site, EPA and MassDEP’s coordination with the City of New Bedford, the Site Group and the project’s development team enabled the siting of the solar array in an appropriate location and with a design that ensured the long-term protectiveness of the remedy.

While EPA provides tools and resources to support Superfund reuse, communities and public- and private-sector organizations make it happen.

EPA’s mission is to protect human health and the environment. EPA relies on engaged community stakeholders to bring their land use goals and priorities to the table to evaluate them in light of any constraints posed by the site. At Sullivan’s Ledge, the City of New Bedford, the Site Group and its development team worked to make sure their solar facility plans would be compatible with the site’s remedy.

Utility-scale renewable energy projects are complex undertakings requiring diverse expertise.

For the Sullivan’s Ledge solar array, SunEdison and BlueWave Capital’s experience with utility-scale solar projects meant they could effectively manage the overall process and bring in cost-effective, specialized expertise – permitting expertise, financing partners, contractors with system design capabilities – as needed, as well as benefit from existing site and institutional knowledge.

While utility-scale solar energy projects provide significant environmental benefits, they are often higher cost than conventional energy projects. Partnerships, incentives and supportive state and federal policies are essential to help address this cost differential.

The City of New Bedford and its development team were able to access diverse state and federal resources that were vital to the project’s success. These included incentives available through the State’s SREC and net metering programs, the federal stimulus act grant, and the federal solar investment tax credit, which provides a tax credit equal to 30 percent of the cost of a solar project.



Installed solar panels at Sullivan’s Ledge.

Recognize the leadership role of local governments.

As the organizations responsible for their communities' general welfare, local governments are particularly well-positioned to host redevelopment projects, bring together diverse stakeholders to discuss site reuse opportunities, and use planning tools and incentives to foster positive site outcomes. In New Bedford, the City started by working on small-scale renewable energy projects, building its capacities, and convened its Sustainability Task Force to bring stakeholders together and plan for the future.

The Superfund remedial process can provide information to fulfill environmental permitting and other regulatory requirements for renewable energy projects like solar farms.

Superfund sites are among the most comprehensively documented and evaluated areas of land in the United States. At most sites, a remedial investigation/feasibility study, proposed plan or record of decision will provide property owners and prospective purchasers with extensive site information.

PV solar systems can be located in many places, at many scales.

The City of New Bedford was looking to install a utility-scale solar farm to maximize the community's renewable energy resources. Other PV power systems can be as small as a few solar cells on the roof of a building, do not need to be connected to the electrical grid and can function in locations with average sun exposure. At many remote contaminated sites like abandoned mine lands, for example, PV systems provide power for green remediation efforts.

Conclusion

The transformation of the Sullivan's Ledge Superfund site into a 12-acre utility-scale solar facility illustrates how community leadership, collaborative working relationships among local governments, EPA, state agencies, the Site Group and other parties, and detailed, flexible long-term planning can result in the protection of human health and the environment and economic benefits for communities. The City of New Bedford, its solar development partners and the Site Group worked with state and federal agencies to minimize disturbance of the landfill cap while maximizing solar panel capacities. Operating at capacity since September 2014, the solar facility produces about 2.4 million kilowatt hours of electricity annually, based upon an adjusted year estimate. Today, the 1.8-megawatt solar facility at the Sullivan's Ledge site is a leading example of how Superfund sites can support renewable energy development.



Aerial view of the solar facility.

Utility-Scale Solar Energy Development

THE SULLIVAN'S LEDGE SUPERFUND SITE IN NEW BEDFORD, MASSACHUSETTS

Sources and Resources

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Images for this case study came from EPA, the City of New Bedford and BlueWave Capital.

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