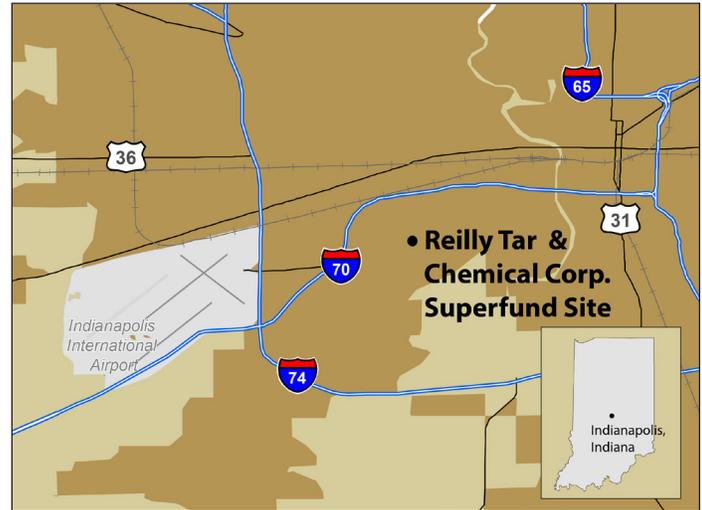


Introduction

Central Indiana has become a hub for renewable energy projects. In and around Indianapolis, at least five utility-scale solar facilities are currently operating or are under development, with a total combined generating capacity of more than 50 megawatts. One of these facilities is a national example of how renewable energy projects are revitalizing contaminated lands. Located a few miles east of Indianapolis International Airport and named for a historic neighborhood nearby, Maywood Solar Farm covers 43 acres of the Reilly Tar & Chemical Corp. (Indianapolis Plant) Superfund site. The U.S. Environmental Protection Agency (EPA) listed the site on the Superfund program's National Priorities List (NPL) in 1984.

Maywood Solar Farm is one in a series of renewable energy facilities sited on current and former contaminated lands nationwide. Built on an old industrial property affected by soil and ground water contamination, the facility generates pollution-free energy and has restored a mostly vacant area to beneficial use. The 10.8-megawatt facility includes over 36,000 ground-mounted, fixed-tilt solar panels. Project developer Hanwha Q CELLS subleases the site property from Vertellus Agriculture & Nutrition Specialties LLC (Vertellus), a wholly-owned subsidiary of Vertellus Specialties Inc., and sells the solar power to Indianapolis Power & Light Company (IPL), a local utility, under a 15-year power purchase agreement.

The project was a result of innovative thinking, planning and cooperation among many parties, including Vertellus, Vertellus' environmental consultant, Hanwha Q CELLS and its contractors, IPL, EPA, and the Indiana Department of Environmental Management (IDEM). In addition to being the first utility-scale



The site is located in the southwestern part of Indianapolis. About 820,000 people live in the city.

solar facility on a Superfund site in EPA Region 5, it is one of the largest solar facilities ever built on a Superfund site in the United States.

In the following pages, the case study discusses the evolution of solar energy reuse efforts at the site from initial planning activities in 2010 to the solar farm's construction, operation, grid connection and operation. The case study is intended to provide information and lessons learned from solar reuse at the Reilly Tar & Chemical Corp. site to companies, local governments, communities, utilities and regulators interested in supporting utility-scale solar development opportunities on contaminated lands.



Maywood Solar Farm.

Site History, Contamination and Remediation

The 120-acre Reilly Tar & Chemical Corp. (Indianapolis Plant) Superfund site is located on two parcels divided by Minnesota Street in Indianapolis, Indiana. The Oak Park property, occupying about 40 acres, is located north of Minnesota Street. The Maywood property, occupying about 80 acres, is located south of Minnesota Street. The surrounding area is a mix of residential, industrial and commercial properties.

Beginning in 1921, the Republic Creosote Company used the southern part of the site to distill coal tar and treat wood. Wood treating operations ended in 1972. In 1941, several chemical plants began operating on the northern part of the site. In the 1950s, Reilly Tar & Chemical Corporation (Reilly) started producing specialty chemicals on the northern part of the site. Reilly eventually expanded its operations to include parts of the Maywood property. Site operations contaminated soil and ground water with volatile organic contaminants (VOCs), semi-VOCs, and carcinogenic polynuclear aromatic hydrocarbons (CPAHs). Following site investigations, EPA placed the site on the NPL in September 1984.

To clean up the site effectively and phase activities to allow for continued use and reuse, EPA divided the site into five operable units, or OUs. Most of Reilly's operating facilities – aboveground storage tanks, distillation towers and utilities – were located on the northern part of the site. The Maywood property included operating facilities and areas used for chemical processing and wood preserving. Four areas – an abandoned railway trench, a sludge treatment pit, a drainage ditch, a landfill and the fire pond – were used for disposal of hazardous materials.

Throughout all planning and cleanup activities, EPA and IDEM staff met regularly with community stakeholders to share information and updates, and bring community feedback into the Superfund process. Cleanup began in 1994; most activities (see table) finished in the late 1990s. Reilly led site investigations and cleanup, with EPA and IDEM providing oversight. Vertellus formed in 2006 as the result of a merger between Reilly and Rutherford Chemicals. Today, Vertellus continues to manufacture chemicals on site. Until recently, the company also used part of the site for truck-trailer parking and storage. Institutional controls ensure the site's remedies remain protective over the long term.

Reilly put an environmental restrictive covenant in place for the site in 1998. Vertellus updated the covenant in February 2012. The covenant limits use of on-site ground water to industrial operations only, prohibits the interference with required remedial activities without prior written approval from EPA, and prohibits residential use of the site. In addition, the covenant prohibits excavation, installation, construction, removal or use of any buildings, wells, pipes, roads, ditches or any other structures within on-site areas previously used for hazardous waste disposal without prior written approval from EPA.



Detailed site map prior to solar farm installation.

OU#	Remedy	Status
1	Perimeter ground water containment system	Ongoing
2	Solidification of contaminated materials in south landfill on Maywood property followed by placement of soil cover; thermal desorption of soils from other dumping areas on Maywood property	Complete
3	Permeable cover over wood treatment area on Maywood property	Complete
4	Concrete cover over parts of northern area. Soil vapor extraction for other parts of northern area	Complete
5	Monitored natural attenuation of ground water	Ongoing

Project History

2010 – July 2012

Fostering an Idea, Coordinating with EPA

In the late 1990s, after the completion of most cleanup activities, 40 acres on the southern half of the Maywood property were unused or underused as a trailer storage area. John Jones, Director of Regulatory Management for Vertellus, explained that the company had considered other uses for the area, including a warehouse, but had not moved beyond initial brainstorming. Then, around 2010, he recalled, “we were approached by a firm looking to do solar work. We talked with them and realized there could be an opportunity for the entire 40 acres.” The large amount of available land coupled with the local utility’s new solar incentive program peaked interest. Jones and company officials expanded discussions to include several solar development companies. “With the development restrictions in place at the site, we knew we would need EPA’s involvement and approval before going further,” he recalled. EPA Region 5 Project Manager Dion Novak was his point of contact. Novak explained, “EPA supports safe and appropriate site reuse. In particular, the Agency views renewable energy as a great reuse for Superfund sites and other impaired properties.” Novak began coordinating with his counterpart at IDEM to discuss the potential approvals process and the steps needed to determine whether a solar facility would remain protective of the site’s remedy.

The project’s timing was partly spurred by a new initiative, the Rate Renewable Energy Production (REP) pilot program sponsored by local utility Indianapolis Power & Light Company (IPL). Under this voluntary “feed-in tariff” (FIT) incentive program, utility customers owning a qualifying renewable electricity generation facility such as a solar energy system could receive a set price from IPL for the electricity



The 45-acre part of the Maywood property identified as the potential location for a solar farm.

and all environmental attributes generated. IPL agreed to pay above-market rates to producers of renewable energy. The Rate REP program initially allowed customers to enter into a long-term power purchase contract with IPL for up to 10 years; it later extended the maximum length to 15 years to encourage participation. IPL also modified the definition of qualifying facilities to enable utility customers to contract with third parties (e.g., solar developers) to own and operate renewable energy facilities located on the utility customer’s property. These changes in 2012 served as the catalyst for the development of Maywood Solar Farm.

August 2012 – March 2013

Getting to a Purchase Agreement, Forming a New Solar Partnership

IPL evaluated candidate projects for the Rate REP program on a first-come, first-served basis. Vertellus, in partnership with Inovateus Solar (Inovateus), submitted an application to IPL in August 2012. IPL approved the application a few months later. After undertaking an interconnection study, IPL, Vertellus and Inovateus signed interconnection and power purchase agreements in February 2013 and submitted them to the Indiana Utility Regulatory Commission (IURC) for final approval. IURC approved the agreements in March 2013, the same month the opportunity to participate in IPL’s incentive program ended.

Partnering with Inovateus helped in navigating the IPL application process, according to Vertellus’ John Jones, and led to the site’s selection for IPL’s pilot incentive program. However, Vertellus also realized it needed an energy developer that could offer a turn-key approach to designing and building a solar facility as well as provide access to the financial resources and backing necessary to get a large solar project built.

Consequently, Vertellus started a competitive process to identify an energy developer capable of meeting its project development interests. Vertellus ultimately selected Hanwha Q CELLS, an integrated company with experience building



Location of the Maywood Solar Farm on site.

large solar facilities. According to Jones, “based on their work at installations elsewhere, they were the most capable candidate.” In addition to Hanwha Q CELLS’ on-the-ground experience with solar projects, the company’s project staff had considerable experience with contaminated sites and cleanup. “Hanwha Q CELLS was excited for the opportunity to be one of the first companies to construct a utility-scale solar facility on a Superfund site,” remarked Hanwha Q CELLS’s Solar Project Developer Geoffrey Underwood. However, given the anticipated scale of the project and the complexities of building on a Superfund site, Hanwha Q CELLS understood there would be new challenges to overcome to maintain the project’s commercial viability.

Following the selection process, Hanwha Q CELLS began managing the project; Vertellus and the company then worked with IPL to update the power purchase agreement to reflect each organization’s roles. At the same time, Hanwha Q CELLS



Field testing of pile installation.

began working on the challenge of designing a solar facility tailored to an area that was part of a Superfund site.

April 2013 – September 2013

Designing the Project, Addressing Liability Concerns

From the project’s outset, Hanwha Q CELLS recognized the importance of coordinating closely with Vertellus, EPA and IDEM to make sure its solar facility design would be compatible with the Superfund remedy in place on the Maywood property and not trigger Superfund liability. Hanwha Q CELLS, EPA, IDEM and Vertellus staff met several times. The parties also brought in August Mack Environmental (August Mack) as an additional resource and consultant – the remedial contractor had led the site’s cleanup in the 1990s and authored the site’s Operations and Maintenance Plan. August Mack helped Hanwha Q CELLS more fully understand the information about the site that EPA was providing to Hanwha Q CELLS.

EPA Region 5 Project Manager Dion Novak noted that “since this was a Superfund site where cleanup work was complete, the company could not do anything that would affect the site’s protectiveness.” Moreover, he added, “Hanwha Q CELLS would need to minimize any exposure to underground waste, take all appropriate safety precautions during the work, and repair any damage done to capped portions of the site during construction.” After a few meetings, the agencies requested that the company prepare a soil management plan demonstrating its intended approach to designing the facility in a way that would minimize disturbance of impaired soil remaining on site. The company submitted this plan to EPA, IDEM and Vertellus in summer 2013. “The end result was that plans for a typical solar facility were modified to make a solar facility work on the Maywood property,” explained Novak. He added that “Hanwha Q CELLS went from an initial project design that relied mostly on soil trenching to one that minimized or eliminated intrusive work or contact with any contaminated soils below the Superfund remedy covers.”

Solar module mounting systems and related infrastructure installed at utility-scale solar facilities usually require extensive

Feed-in-Tariffs: A Key Renewable Energy Incentive

Feed-in tariffs (FITs) are an energy policy mechanism used to encourage deployment of renewable electricity technologies. Commonly used in Europe to boost renewable energy generation, FITs have historically been associated with a German model in which the government mandates that utilities enter into long-term contracts with generators at specified rates, typically above the retail price of electricity. In the United States, FITs are comparatively new. They are voluntary programs established by utilities or mandated through state law.

FIT policies can be understood as a production-based incentive (PBI), where payment is awarded for the actual electricity produced by a system (\$/kilowatt-hour). PBIs differ from investment or capacity-based incentives such as rebates, where a payment is awarded on the basis of the size of an installed system (\$/Watt). FITs offer a guarantee of access to the grid and payments to anyone who produces electricity from a renewable energy source. Payments can be composed of electricity alone or bundled with renewable energy certificates. These payments are typically awarded as long-term contracts set over a period of 15 to 20 years.

A key element of an FIT is to set a price that reflects the cost of generating the energy. In general, FIT rates need to be set above the retail cost of electricity to generate significant additional renewable energy investment. The premium level may depend on the underlying program motivation and goals: interest in a specific renewable energy technology; meeting a capacity target or a certain level of renewable energy credits; facilitating local renewable energy investment; or diversifying an energy portfolio.

trenching. Hanwha Q CELLS's proposed approach called for a driven, pile-based solar module mounting system that would mitigate the need for extensive soil excavation and earthmoving during construction activities. The company's plan would also keep facility infrastructure (e.g., panel wiring and inverter pads) above ground and minimize regrading by designing the facility to fit well with the site's existing topography. "These were the most innovative parts of the project's design," explained Novak.

While reviewing the soil management plan, EPA and IDEM approved Hanwha Q CELLS's request to begin initial site preparation work, which consisted primarily of clearing and grubbing to meet IPL program deadlines. The agencies also agreed to allow the company to test its proposed piling installation system to confirm it would support the panels and not expose any underlying contaminated material. Hanwha Q CELLS used its findings from the tests to refine the system's design as well as to demonstrate that disruption to the underlying contaminated material would be kept to a minimum. EPA issued a letter with input from IDEM stating that the company's proposed design did not affect the protectiveness of the site remedies in July 2013.

Addressing Superfund Liability

According to Hanwha Q CELLS's Solar Project Developer Geoffrey Underwood, "there was a fair amount of legal work among the various parties to understand risk profiles and potential legal liabilities, and how to mitigate those risks to make sure the project could be responsibly developed." EPA's July 2013 letter provided Hanwha Q CELLS with some certainty that its solar facility design would not affect the protectiveness of the site's remedy and trigger Superfund liability. Vertellus further clarified that the company had not transferred its obligations established

Solar Panel-Mounting System Design to Minimize Disturbance of Impaired Soil

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. Hanwha Q CELLS proposed a driven pile-based solar module mounting system rather than the concrete ballast system commonly used at landfills. The driven pile system provides stability for the solar panels and framing while avoiding soil excavation or adding weight. In a few locations where piles could not be driven to proper depth to achieve engineering goals, the design used ballast foundations.

The project also included an innovative wire management approach; use of aboveground cable trays enabled the project to avoid digging trenches between each row of panels and burying wire below ground. These design choices helped Hanwha Q CELLS minimize soil cover disruption during construction.



Panel mounting system installed at Maywood Solar Farm. The system includes an innovative above-ground wire management approach.

Federal Liability Protections for Tenants at Superfund Sites

In response to concerns that liability protection for tenants at formerly contaminated sites was not sufficiently clear to encourage development of renewable energy on Superfund and brownfield sites, EPA issued a guidance document in 2012 to broaden protections of tenants who meet certain criteria, even if a site owner does not qualify for protection as a bona fide prospective purchaser, or BFPP. Although prompted by concern about protection of tenants at sites hosting renewable energy facilities, the guidance applies across all types of sites and potential site uses.

The passage of the Superfund "Brownfields Amendments" in 2002 provided the BFPP definition and clarified some potential environmental risks to prospective owners and tenants. However, BFPP status and derivative protections were considered to only apply to a prospective tenant if the underlying 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 under which certain tenants will be treated as BFPPs. A tenant can obtain BFPP status in different ways, including deriving it from an owner who satisfies and maintains compliance with the BFPP criteria, meeting BFPP criteria on its own when the landowner has lost its BFPP status, and meeting BFPP criteria even though 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.

under existing Superfund legal agreements between the company and EPA, with the exception that Hanwha Q CELLS abide by the site's restrictive covenant. The company dealt with this through their ground sublease agreement with Vertellus.

Hanwha Q CELLS decided to take additional steps to ensure it would not become liable for the site's contamination under Superfund. First, the company made sure it qualified as a bona fide prospective purchaser under the 2002 Brownfields law and regulations. Hanwha Q CELLS then worked with EPA and IDEM to obtain comfort letters clarifying that EPA and IDEM did not have an interest in the company as a potentially responsible party at the site. Finally, Hanwha Q CELLS purchased an environmental insurance policy to protect against any additional costs for cleanup associated with the site.

Securing Additional Approvals, Completing Site Preparation

Hanwha Q CELLS's additional site preparation work included demolishing existing on-site structures as needed, filling in underground vaults, and upgrading and widening access roads to make them suitable for project construction work.



Site preparation.

The company and its contractors also had to obtain additional approvals and undertake final site preparation in advance of facility construction. This work included securing drainage permits, demolition permits, electrical permits and building permits. The City of Indianapolis also required construction plans, stormwater management plans and erosion control plans for site construction.

Given August Mack's experience in working with the city, the remedial contractor took the lead securing most of the permits. The firm also provided civil engineering design for site work, and developed the project's health and safety plan for construction activities. According to Jones, "the expertise of both Hanwha Q CELLS and August Mack resulted in a smooth permitting and planning process for the project."

October 2013 – January 2014

Building the Solar Facility

After site preparation, Hanwha Q CELLS and its contractors began installing piles and mounting systems, panels and related infrastructure. During construction, the only excavations were for utility poles to transfer power off site to the electrical grid. August Mack coordinated with the structural engineers and installation contractors once construction was underway. Vertellus routinely had staff on site to observe the construction process.

According to Tim Dewitt, a Senior Technical Engineer with August Mack, the primary issue Hanwha Q CELLS and its contractors faced during construction activities was how to do the work in a way that would limit impacts to surface soils. Hanwha Q CELLS's contractors took several interim erosion control measures during construction, including the use of silt fences, application of a gravel cover, periodic erosion inspections, and placing straw on areas where vegetative cover was not growing. They also repaired surface ruts and other areas where construction activities damaged cover soils. In addition, Hanwha Q CELLS's contractors seeded and mulched the area. Given that the construction and seeding cover work took place in the fall, outside of the peak growing season, August Mack inspected the site in spring 2014. Hanwha Q CELLS's contractors will also replant areas as needed to reestablish the vegetative cover and finish repairing damaged cover soils.

There were also concerns, according to Dewitt, about encountering subsurface coal tar from past operations when installing piles in certain areas, including the landfill. However, crews did not encounter any tar during construction. In addition, settlement, particularly in the landfill area, was also initially a concern. "However, once we refined the project's design, it was no longer an issue," Dewitt noted, "because of the piling system and the very limited use of concrete ballasts." Summing up the project, Dewitt added, "Hanwha Q CELLS did a good job of managing the overall process and leveraging or bringing in specialized expertise valuable to the project. This included permitting expertise and contractors with electric design capabilities, and relying on August Mack's site and institutional knowledge."

In total, Hanwha Q CELLS and its contractors installed several thousand piles. In the few places where Hanwha Q CELLS could not drive piles to the design depth, the company used



Pile installation.



Mounting rack installation.



Solar panel installation.

poured-form ballast-support systems, enabled by the selected adaptive racking system. The company’s plans for minimizing soil disturbance proved successful. According to Hanwha Q CELLS’s Geoffrey Underwood, “normally an entire site would be graded to level for a typical solar facility, and there would be excavations for wire runs and inverter placement. We recognized the greatest potential for ensuring the protectiveness of the remedy was to eliminate all sub-surface intrusions. We were able to reduce soil movement by an estimated 93 percent over conventional solar construction methods.” Vertellus’ John Jones echoed this point, commenting that “the only excavations that took place were the setting of on-site utility poles. Otherwise, everything Hanwha Q CELLS did out there was above ground. That has been quite an accomplishment. It also eliminated any potential exposures to workers, which was important.”

February 2014 – Current

Generating Power, Generating Benefits

Hanwha Q CELLS brought the entire facility online in February 2014. The finished solar facility includes 4,549 piles, 1,400 solar panel racking tables, 36,556 polycrystalline, fixed-tilt solar panels, and eight inverters covering nearly the full 43 acres of the site’s Maywood property.

Under the terms of the power purchase agreement with IPL, Hanwha Q CELLS will sell electricity and environmental attributes from Maywood Solar Farm for 15 years. IPL will purchase 100 percent of the output from the facility over the length of the power purchase agreement at 20 cents per kilowatt hour. IPL will also retain ownership of project renewable energy credits over that time.¹



Utility pole installation.

¹ A renewable energy credit represents the environmental and renewable attributes of renewable electricity. Renewable energy credits, and their associated attributes, can be sold separately from the underlying physical electricity associated with a renewable-based generation source. IPL is currently selling the environmental attributes associated with the solar energy from Maywood Solar Farm in the form of renewable energy credits. IPL uses the revenue from sales of these credits first to reduce the cost of the Maywood Solar Farm power purchase agreement and then to adjust the price of electricity to consumers through IPL’s fuel adjustment clause.

Hanwha Q CELLS signed a land-lease agreement with Vertellus for 15 years, with an option to extend that lease up to 35 years. Under the lease agreement, the company will provide annual lease payments to Vertellus. In addition, Hanwha Q CELLS agreed to maintain the vegetative cover and grounds where the solar facility is located for the duration of the lease to maintain the protectiveness of the Superfund remedy covers and prevent any impacts.

Project outcomes are striking. Hanwha Q CELLS estimates that electricity generated from Maywood Solar Farm will help reduce carbon dioxide equivalent emissions by 13,235 metric tons per year – equal to the amount of annual carbon produced for energy use in more than 1,800 residential homes. The total cost of the project was about \$30 million. Of that amount, about

\$4 to \$6 million was invested in the local economy in the form of labor, construction costs and materials. The project created around 75 to 100 jobs during construction and will continue to have a positive impact on the economy through ongoing contracts for equipment and labor with local firms during the 15 to 35 year operating period tied to operation of the facility.

EPA Project Manager Dion Novak found the project’s timeline and outcomes remarkable. “Hanwha Q CELLS understood from the early stages EPA’s desire to protect the remedies in place at the site. However, clear communication of constraints and barriers by all parties, and intense, back-and-forth discussions, led to decisions that made sense for most parties. All of this cooperation and coordination resulted in a truly extraordinary start-to-finish timeline, which is not typically the



Ribbon-cutting ceremony at Maywood Solar Farm in April 2014. (from left: Rich Preziotti, President and CEO, Vertellus Specialties Inc.; Susan Hedman, EPA Region 5 Administrator; Moon Hwan Cha, President, Hanwha Q CELLS USA; Tom Easterly, Commissioner, IDEM; Justin Moed, Indiana State Representative, 97th District)

Renewable Energy Initiatives in Indiana

Indiana Office of Energy Development

The Indiana Office of Energy Development (IOED) promotes the use of renewable energy as well as the manufacturing of renewable energy production materials. IOED suggests considering solar energy to offset traditional electricity use for heating, cooling and water and offers incentives to lower project start-up costs.

In 2011, the state set a voluntary goal of 10 percent clean energy by 2025 under its Clean Energy Portfolio Standard.

Renewable Energy Incentives

While IPL’s Rate REP incentive program is no longer accepting applications, other renewable energy initiatives and incentives are in place in Indiana.

The state of Indiana offers a renewable energy property tax exemption. This tax exemption applies to any solar thermal, photovoltaic, and other solar energy systems installed after December 31, 2011. The assessed value of the system will be exempt from property taxes.



Timeline of Events

1921	Republic Creosote Company begins distilling coal tar and treating wood on site
1941	Chemical plant operations begin on site
1950s	Reilly begins producing specialty chemicals on site
1964	Investigations detect site chemicals in off-site ground water and on-site surface water samples
1972	Wood treatment operations end
1975	State investigations identify on-site ground water contamination
1980	Sampling finds elevated levels of contaminants in site soils
1984	EPA places site on NPL
1987	Site operators spill 60,000 gallons of waste fuel on site; Reilly begins remedial investigations
1992	EPA selects remedy for OU1
1993	EPA selects remedy for OU2
1996	EPA selects remedy for OU3 and OU4
1997	EPA updates remedy to include off-site thermal treatment at OU2; EPA selects OU5 remedy
1998	Remedial workers complete off-site shipment of soil for thermal treatment for OU2
2003	Remedial workers complete permeable cover installations for OU3
2005	Remedial workers complete soil vapor extraction operations for OU4
2006	Vertellus forms from Reilly Industries and Rutherford Chemicals merger
2008	Alternative remedial technology pilot tests for OU1
2012	Vertellus approaches EPA to discuss potential solar facility
Mar. 2013	Vertellus and solar developer Hanwha Q CELLS join IPL's renewable energy incentive program
Jul. 2013	EPA and IDEM approve solar facility installation plans Project site work begins
Feb. 2014	Solar facility completed; power provided to IPL
Apr. 2014	Maywood Solar Farm ribbon-cutting ceremony held EPA Region 5 presents Hanwha Q CELLS with its Renew Award



way business gets done,” he said. “Hanwha Q CELLS’s ability to tailor the facility’s design to match the site’s constraints as well as the willingness exhibited by all parties made the project work.” Hanwha Q CELLS’s Geoffrey Underwood was equally enthusiastic. “In my mind it was a really big deal,” he reflected. “We were able to bring solar development to a corporate entity that was open to building on a Superfund site.” Vertellus is similarly pleased with the project. “The land is now put to a higher and better use, and within the overall original 80 acres, we still have quite a bit of unused or underutilized land available for expansion,” reflected John Jones, Vertellus’ Director of Regulatory Management.

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 size, relatively flat topography, and proximity to the power grid coupled with the availability of a significant local renewable energy production incentive, made the site appealing for a utility-scale solar farm.
- Regular coordination and communication among site stakeholders was critically important to the project’s success, particularly given the tight timeframes and deadlines required to get the facility built and up and running.
- EPA and IDEM’s willingness to work through potential reuse barriers while ensuring the long-term protectiveness of the site’s remedy helped move the project from the drawing board to completion in less than a year.
- Hanwha Q CELLS’s ability to develop a solar facility project approach that addressed remedy compatibility concerns resulted in a minimally invasive construction approach that mitigated the need for large-scale excavation and earthmoving. This adaptive approach can guide similar renewable energy projects at other sites where contamination remains on site following cleanup.

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 important benefits.

Projects such as the Maywood Solar Farm can reduce pressure to redevelop greenfields, make use of infrastructure already in place, create local jobs, spur local investment, create benefits for landowners in the form of land lease or right-of-way payments, and help



hedge against energy price and supply volatility. IPL created the Rate REP incentive pilot program in part to help diversify its energy generation resources.

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

As Hanwha Q CELLS’s Solar Project Developer Geoffrey Underwood explained, “when you get into the specifics of building solar projects on Superfund sites and brownfields, they can be difficult to complete without the right skills and expertise.” Legal or contamination concerns may drive away interested parties; site conditions may make reuse efforts seem too expensive.

For the Maywood Solar Farm, Hanwha Q CELLS’s experience with utility-scale solar projects as well as with contaminated sites meant it 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. “The bottom line made sense. We were able to accurately estimate project costs and liabilities,” Underwood noted. “And we had someone on staff – Project Manager Robert Stoeber with experience in brownfield construction – who could develop a cost-effective approach to construction.”

Partnerships, incentives, programs and policies are important elements of viable renewable energy projects.

Vertellus’ capacity as an IPL customer to partner with a solar developer and still participate in IPL’s Rate REP incentive

program helped make the project financially viable.

While EPA provides tools and resources to support Superfund redevelopment, public and private sector organizations and site stakeholders make it happen.

EPA’s mission is to protect human health and the environment. EPA relies on engaged stakeholders to bring their future land use goals and priorities to the table so this information can be evaluated in the context of site cleanup and long-term stewardship. In Indianapolis, the ongoing working relationship between EPA’s project manager and Vertellus enabled regular communication about reuse opportunities. It also established a foundation for ongoing discussions among EPA, IDEM, Vertellus and Hanwha Q CELLS about project design, remedy compatibility and potential liability considerations.

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

Superfund sites are among the most comprehensively documented and evaluated areas of land in the United States. Vertellus relied on this documentation as well as the experience of the site’s remedial contractor to clarify remedy considerations and areas of potential concern. Hanwha Q CELLS also relied on this information during its project design work.

Conclusion

The 43-acre Maywood Solar Farm shows how cooperation and collaboration among site agencies and local stakeholders can lead to innovative, utility-scale renewable energy projects at Superfund sites and other contaminated lands. Vertellus and solar developer Hanwha Q CELLS's work with EPA and IDEM clarified how the solar facility's design could take the site's remedy into account and remain protective of human health and the environment. In turn, EPA and IDEM's commitment to supporting the project's fast-moving schedule meant Hanwha Q CELLS could meet key project deadlines. For its part, Hanwha Q CELLS and the site's remedial contractor designed a solar facility that accounted for contaminated soil remaining on site, resulting in minimal excavations and soil disturbance during construction. The project has been fully operational since February 2014. Today, the 10.8-megawatt Maywood Solar Farm is a leading example of how Superfund sites can support renewable energy development.

"This innovative solar project demonstrates that Superfund sites can be redeveloped to generate economic benefits for the local community and clean renewable energy for homes and businesses."

- EPA R5 Administrator Susan Hedman

"This project is a big deal for everyone involved....the partners' combination of vision, innovation and determination is what has made this a successful solar energy project in Indianapolis."

- Greg Fennig, VP Public Affairs, IPL

"This project signifies rebirth through new industry and is a visible symbol to the local community of the opportunities for and commitment to revitalization and economic development in Indianapolis' southwest industrial corridor."

- Justin Moed, Indiana State Representative, 97th District

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 consumed over time. One kWh means one kilowatt of electricity supplied for one hour.

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



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 the 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 Vertellus to encourage solar and other renewable energy development opportunities on current and formerly contaminated lands.

EPA Region 5 Renewable Energy Assessments enable stakeholders to evaluate renewable energy opportunities at Superfund sites. EPA Region 5 provides a spreadsheet with summarized results of National Renewable Energy Laboratory assessments for siting renewable energy projects at Region 5 sites. Region 5 also provides maps identifying sites with potential renewable energy resources.

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. SRI is celebrating its 15th anniversary in 2014.

EPA's 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.

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

Utility-Scale Solar Energy Development

THE REILLY TAR & CHEMICAL CORP. (INDIANAPOLIS PLANT) SITE IN INDIANAPOLIS, INDIANA

Sources: Images and maps for this case study came from EPA and Hanwha Q CELLS.

Resources

Site-Specific

EPA site progress profile:
cumulis.epa.gov/supercpad/cursites/csinfo.cfm?id=0501215

Maywood Solar Farm:
maywoodsolar.com

IDEM Virtual File Cabinet:
vfc.idem.in.gov/Pages/Public/Search.aspx

General

EPA Superfund Redevelopment Initiative:
www.epa.gov/superfund/programs/recycle

Vertellus Specialties:
www.vertellus.com/company.aspx

EPA's RE-Powering America's Land Initiative:
www.epa.gov/renewableenergyland/

Hanwha Q Cells USA:
www.q-cells.us

Renewable Energy Assessments in EPA Region 5:
www.epa.gov/region5/renewableenergy

Indiana Office of Energy Development – Solar Energy:
www.in.gov/oed/2412.htm

EPA Region 5 Renewable Energy Maps:
www.epa.gov/region5/renewableenergy/pdfs/r5maps-20110913.pdf

Indianapolis Power & Light Company (IPL):
www.iplpower.com



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