



TYPICAL PROJECT QUESTIONS AND ANSWERS

Provided are answers to typical questions that students, parents, teachers, school and community stakeholders may have about the upcoming Amphitheater solar project.

Q: How many solar projects are being undertaken at District sites?

A: Currently 24 District sites are slated for solar systems, with a majority of sites being schools and a smaller number being District support facilities. Through ongoing technical evaluations, the number of sites and sizes of systems may change but not significantly.

Q: Are we talking about generating electricity or heating water?

All of the systems will utilize solar panels to convert sunlight into electricity. The solar panels will be mostly installed on tall shade structures covering play areas and parking lots, and roof tops for a small number of sites. When the solar panels are not producing power, for example at night, the school's electricity will be supplied by TEP as usual.

Q: How is Amphi paying for the solar projects?

A: Amphi is taking advantage of a financing arrangement called a Solar Services Agreement (SSA). Instead of owning the solar systems, Amphi will simply pay for the clean solar power the systems produce every month. The solar rate is set in advance and is lower than the TEP rate the District would pay otherwise. This means the District will start saving money right away. The District has negotiated this SSA purchase rate to remain constant for the 25-year term of the SSA. The SSA provides a hedge against energy inflation and is expected to save the District millions of dollars over the term of the Agreement.

Q: How tested are SSAs? Are SSAs 'sub-prime mortgages' waiting to happen?

A: SSAs are an extremely well vetted method for schools to obtain solar systems, as evidenced by many Arizona-school districts (for example Tanque Verde, TUSD and Marana School Districts) that have gone solar via an SSA. An SSA is simply an agreement whereby a system owner pays to construct a solar system and maintain / service it over time, in exchange for a long term agreement to sell the energy produced by the system. Typically school districts enter into SSA contracts to reduce energy costs (vs. their electric utilities) and since the inception of school SSAs in Arizona (around 2009), best practices have been developed for schools to follow when exploring the feasibility of a solar system contract. The System Owner for the Amphi project is part of a Fortune 100 company which will not sell its ownership of the systems to anyone else, and is a stable long-term partner in the business of owning and operating energy generation assets including solar systems.

Q: Who are the parties involved in the solar projects? How experienced and qualified are they?

A: There are three main parties supporting the District solar projects and each has a different role and responsibility, as follows:



1. Natural Power and Energy (NPE): NPE is a leading solar ‘Developer’ in Arizona, with considerable experience in Tucson including projects for National Bank of Arizona and the new, innovative system at Tucson International Airport. Amphi competitively awarded the solar projects to NPE to facilitate the project’s development and management, arrange SSA financing, oversee design/engineering, and the procurement of system components. NPE is currently evaluating top-tier Arizona based and licensed general contractors to install the systems and ensure all sites are managed in the safest and least disruptive way during installation.

2. Constellation: Constellation will function as the ‘Owner’ of the Amphi solar systems, and is responsible for system performance, operations and maintenance. Constellation will benefit from federal tax credits associated with the project, as well as the revenue stream provided by Amphi’s energy purchases from the solar systems during the term of the SSA. Constellation is a unit of Exelon Corporation, a Fortune 100 company a national energy leader with operations in 47 states with over 26,000 employees and revenues of \$27.4 billion in 2014. Constellation has deployed solar across 10 Arizona School Districts (over 100 sites), and counts among its marquee solar customers electric utilities (such as Southern California Edison), US States (State of Maryland), companies (General Motors) and US Federal Agencies.

3. Amphitheater Public Schools: Amphi is considered the ‘Host’ of the solar systems and in this capacity is not responsible for the operations and maintenance of the systems but has contractually agreed to purchase all the energy generated by the systems over the 25-year term of the SSA. If you didn’t already know, Amphi has been serving Tucson’s youth, families and community since 1893. Amphi was recently ranked the 3rd top District in the State of Arizona and the decision to go solar will have a profoundly positive effect on advancing the District’s sustainability objectives.

Q: What about Tucson Electric Power (TEP)? What is their role in the solar projects?

A: All District solar systems will be sized, designed, installed and interconnected in compliance with TEP rules and regulations. However, unlike other Tucson-area school districts that have gone solar to date, no TEP incentives are available to subsidize the projects. The reason for this is that TEP incentives in support of privately developed school solar projects ended in 2012-13 per plans approved by the Arizona Corporation Commission. As a result, the District will retain the rights to all ‘Renewable Energy Credits’ (RECs) association with the systems. This means as a result of this project’s solar energy generation, the District may claim a true offset of its carbon footprint.

Q: How will safety be maintained on the school campuses during the time contractors will be onsite? Are the solar systems themselves safe?

A: NPE and its team has extensive experience in school solar installations and is well versed in the challenges of managing construction projects at educational facilities. NPE has developed a comprehensive construction plan and will be able to meet and exceed the rigorous safety requirements (ex. trade background checks, fencing, hazard awareness, daily coordination with school authorities) required to complete the installations with minimal disruption to the schools while in session.

As for the systems themselves, all components used in the Amphi systems are UL listed and installed in a safe code-compliant manner in accordance with City of Tucson, Town of Oro Valley, Pima County (as applicable by jurisdiction) and TEP requirements. Because the solar panels will be located on tall shade structures, they will be very difficult to tamper with. Additionally, the major electrical connection to each site’s electrical gear will be further protected with fences and/or padlocks.



Q: What goes into the decision to place the solar shade structures in certain areas of each site's campus versus other locations?

A: The solar shade structures need to be installed in areas at each site that make the most economical sense and comply with key design considerations such as distance to the site's electrical gear, solar panel orientation, shading and easements. Additionally, considerations such as preserving large play areas (such as baseball fields) and avoiding the need to remove trees and landscaping are important factors that play into the system locations. Final placement of the solar shade structures is subject to change.

Q: How will the systems benefit the students? Are the systems being installed just to create District savings or is there an educational component?

A: In addition to providing shaded play areas for students and/or covered parking, all installed solar systems will feature online data monitoring. This data monitoring will allow students and teachers to view the performance of the systems instantly as well as scrutinize it for more detailed analysis. The information supplied by the data monitoring will also be integrated into the school curriculum to help students learn about how solar electricity works and the benefits of renewable energy and energy efficiency. This applies to subject areas such as science, social studies, math, language arts and technology.

Q: What is the time span of the solar project? When will all sites be completed?

A: The project has been organized into 3 groups, with each organized according to geographic proximity, system size and TEP interconnection coordination. While the project is already underway in the design phase, installation of the first group of systems will begin in the last quarter of 2015. The follow-on group of sites will be initiated every three months or so with completion of all the installations expected by the third quarter of 2016.

Q: Will solar shade structures installed in locations where the students currently play (adjacent to and on the perimeter of play fields and courts) **become off-limit areas?**

A: During construction, impacted areas are fenced off to ensure students and staff are kept safe. Fences are brought down as quickly as possible following completion of construction. Sometimes, however, work appears to be complete but fences remain up. When this happens it is almost always because the construction team is waiting for either the permitting authority, or the utility, to inspect the systems prior to issuing final approvals and permits. As soon as those approvals are received, the fences will be brought down. After construction, the areas underneath the shade structures will remain completely accessible to the students. It has been the experience of other Arizona school districts with solar shade structures that the shade provided by the systems become popular areas for the students to play during the hot months of the year, providing a shady respite from the hot sun. Additionally, the size of the structures allows for many physical activities underneath them; each structure provides 8.6' clearance on its low side and 17' clearance on its high side. Spacing among the columns supporting the structures is on average 27'.

Q: Shouldn't the solar shade structures be permanently fenced off and made inaccessible to any student or school staff for safety purposes?



A: The authorities having jurisdiction (AHJ) in Tucson, such as the City of Tucson or Pima County, have permitted and inspected solar shade structure installations, confirming that the designs meet all applicable safety standards/code requirements and do not require fencing. Of note, solar shade structures of the same general design as those being installed with the Amphi solar project have been deployed across a large number of school sites across Arizona, and hundreds of sites across the U.S., all without the need for permanent fencing. Solar systems are typically only fenced in situations where they are located far closer to the ground (these are known as 'ground mounted' systems) than those being deployed at Amphi.

Q: Is the required equipment (e.g. baseball/softball backstops) for physical education being retained at each school, per required Arizona School Facilities Board Rules and Policies?

A: All school sites with systems being installed will remain in compliance with the Arizona School Facilities Board rules *R7-6-249.A. and R7-6-250. Equipment List for Physical Education*. At some school sites, system design considerations have resulted in the relocation of backstops. All schools will retain the required equipment and fixtures for physical education.

Q: If there is construction of the systems during school hours what safeguards have been implemented to ensure student and school staff safety?

A: Weeks prior to construction activities beginning at any site, the Amphi solar project team and school principal/key representatives will meet, with the planning of construction safety and logistics among the primary topics reviewed and signed-off on. This process is called 'site coordination', and for each school an extensive checklist is reviewed for fencing placement, identification of daily school ingress and egress, bus and parent pick-up zones, among other items. As such, when construction is initiated there is a plan to be followed in implementing safeguards as well minimizing disruption to the school's normal daily flow.

Q: Is there a risk of electric shock or electrocution from the solar shade structures to the students and school staff?

A: It is not possible to be electrocuted simply by touching a solar panel. The risk of electric shock and electrocution from the systems is prevented by multiple safeguards. Design and installation is of course carried out in accordance with the National Electrical Code. All equipment is properly sized and fused to prevent over-current conditions. Equipment is specifically UL-listed and utilized in accordance with these listings. Any equipment or installation accessible to the public is specifically designed to be located in these areas such that no live energized buses or conductors can be accessed by non-qualified personnel.

Q: Do these systems pose an electromagnetic radiation risk to the children?

A: No. The strength of power frequency magnetic fields resulting from the systems designed and constructed for Amphi (verified by field observations) do not come close to the threshold for acute exposure for the general public established by the ICNIRP (<1% of these levels at 1 ft distance). To put it in context, being 1 ft away from an inverter yields less electromagnetic radiation exposure than the midpoint of the typical range for televisions (also at 1 ft distance), according to the California Department of Health Services, and less than the entire range given for a vacuum cleaner.

Q: With the heavy rainfall and flooding that occurred over the last few years, are the systems and associated electrical gear susceptible to flood conditions at the low-lying schools?



A: All the systems are reviewed by the City of Tucson, town of Oro Valley or Pima County permitting departments, depending on jurisdiction, including the flood control department and when flood plains are an issue, we provide heightened concrete pads for any relevant electrical gear to mitigate 100-year floodplain risks. All of the designs and installations are thoroughly reviewed, permitted and inspected by the City of Tucson, Town of Oro Valley or Pima County engineering/building departments depending on jurisdiction, again with attention to safety and code-compliance.

Q: How much noise do the solar shade structures make and will any noise be a distraction to the students and school staff?

A: It is actually the system's inverters that make noise, rather than the solar panels or structures, and the volume of noise emitted is considered minimal. Per the inverter manufacturer's information on acoustic emission levels, the inverters are listed at 51 decibels. If one were to stand directly below the inverter, a faint electronic whine would be heard similar to how a running desktop computer might sound.

Q: Shouldn't the columns of the shade structures be padded to prevent injuries that may occur if collided with?

A: The solar shade structure columns, like any other shade structure column or basketball pole in the District, are not padded. Constellation owns solar systems at 10 other school districts (since 2012) and has received no reports of injuries.

Q: What health risks do chemicals used in solar panels and other devices used in solar PV arrays pose if they are released into the environment, for example in a fire?

A: Virtually none. All solar panel materials, including chemicals in the solar cells, are contained in a solid matrix, insoluble and non-volatile at ambient conditions, and enclosed. Researchers conclude that the potential for emissions derived from PV components during typical fires is limited given the relatively short-duration of most fires and the high melting point of PV materials (>1000 degrees Celsius). In the rare instance where a solar panel might be subject to higher temperatures, the silicon and other chemicals that comprise the solar panel would likely bind to the glass that covers the PV cells and be retained there.

Q: Can the solar panel glass shatter if struck, endangering children with glass fragments?

A: No. PV panels are made of strong tempered glass. They pass hail tests, and are regularly installed in Arctic and Antarctic conditions. They are not expected to be broken by impacts from footballs, kick balls or soccer balls. A direct hit from a projectile (unlikely due to the height and slope of the panels) may break the glass but the glass would remain inside the frame.