

# Border Environment Cooperation Commission ASTROSOL First Light Solar Tucson, Arizona

## 1. General Criteria

### 1.a Project Type

**Project Name:** ASTROSOL First Light Solar (“Project”)

**Project Sector:** Clean and efficient energy

### 1.b Project Category

**Category:** Private-sector environmental infrastructure project

### 1.c Project Location and Community Profile

**Communities:** Pima County, Arizona

**Location:** Pima County, in the south-central region of Arizona, borders Cochise County to the east, Yuma County to the west, Maricopa and Pinal counties to the north, and the state of Sonora in Mexico to the south. The county has a total land area of approximately 9,186 square miles. The City of Tucson is the county seat.

The project is located in a region with some of the highest levels of solar insolation in the continental US, according to the National Renewable Energy Laboratory (NREL), as seen in the figure below.

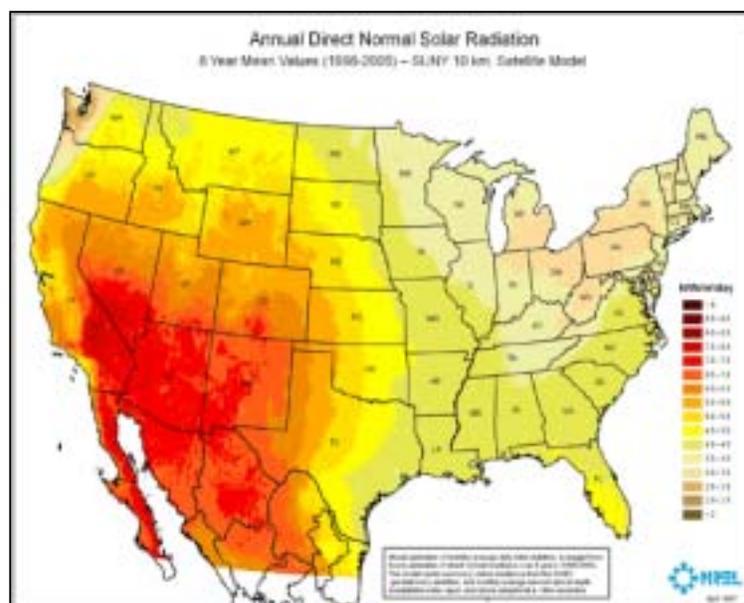


Figure 1. Annual Direct Normal Solar Radiation

**Location within the Border:**

The project will be located within the University of Arizona Science and Technology Park (“UASTP”), in a 355 acre parcel devoted to solar installations by the University. The property is located partially in the City of Tucson and partially in unincorporated Pima County, all within the 100 km border region.



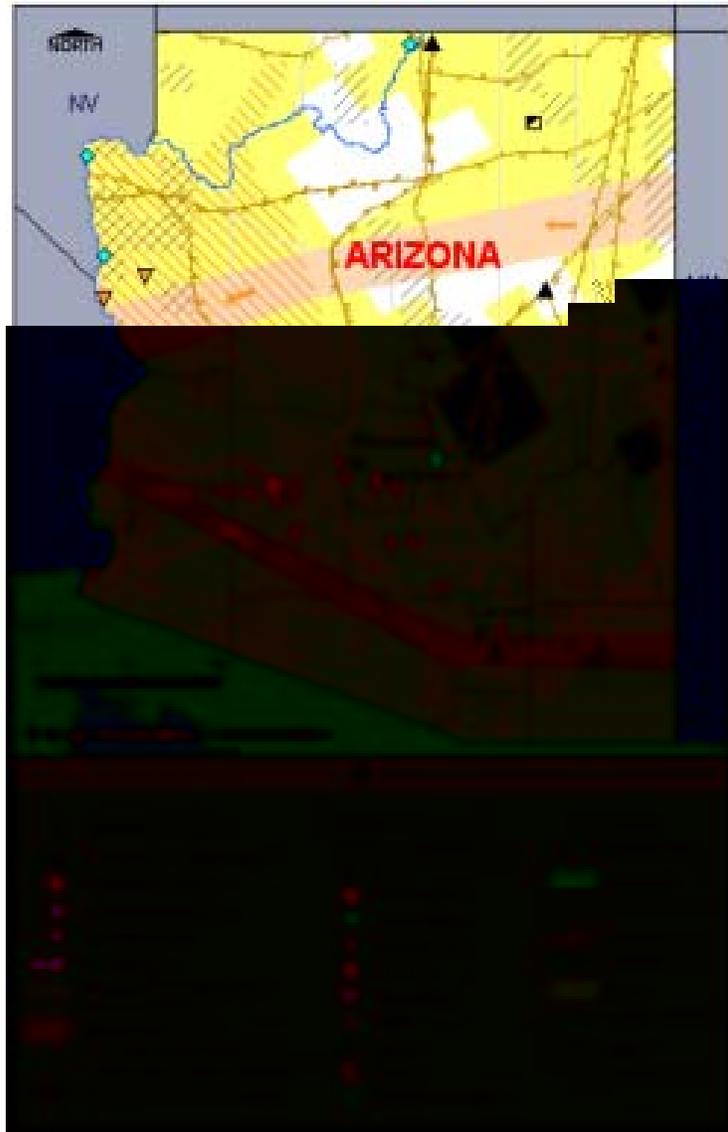
**Figure 2. Project Location.**

**Demographics:**

<b>Current Population:</b>	980,263 (2010 Pima County Population)
<b>Growth Rate:</b>	1.6 % annually from 2000 to 2010 (2010)
<b>Primary Economic Activities:</b>	Government; professional and business services; manufacturing; leisure; trade, transportation, and utilities (Pima Association of Governments 2010)
<b>Labor Force:</b>	477,578 (2005-2009 5-year estimate)
<b>Per Capita Income:</b>	\$24,556 (2009 Inflation-adjusted)
<b>Median Household Income:</b>	\$45,885 (2009 Inflation-adjusted)
<b>Occupied Housing Units:</b>	370,264 (2005-2009 5-year estimate)
<b>Total Housing Units:</b>	419,647 (2005-2009 5-year estimate)
<b>Average Household Size:</b>	2.62 persons per household (2005-2009 5-year estimate) <sup>1</sup>
<b>Energy Generation &amp; Consumption</b>	Figure 3 shows the locations of Arizona’s electrical plants, renewable energy potential, and energy sources. <sup>2</sup>

<sup>1</sup> U.S. Census Bureau 2010. State and County Quick Facts. Pima County; 2005-2009. American Community Survey 5-Year Estimates. Pima County.

<sup>2</sup> U.S. DOE, Energy Information Administration (EIA) 2009a. State Energy Profiles – Arizona.



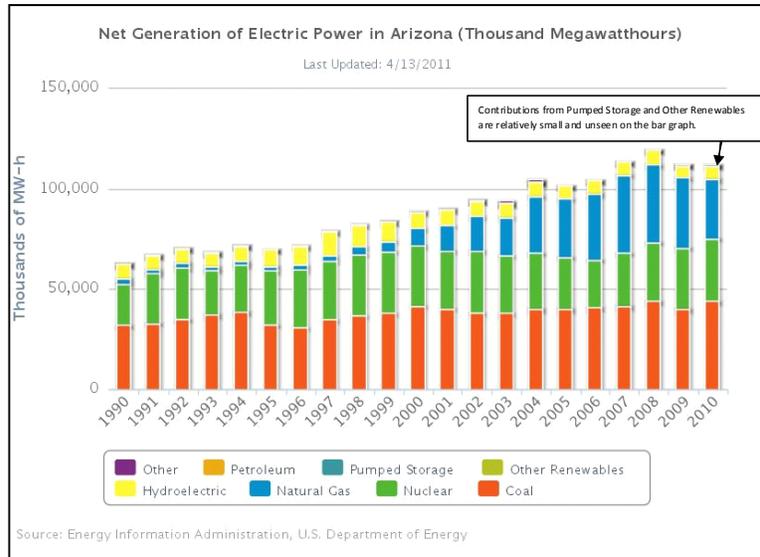
**Figure 3. Location of electrical plants and potential renewable energy sites in the State of Arizona.**

As of 2010, Arizona had more than 95 megawatts (MW) of solar generation<sup>3</sup>. It ranked fourth in the US in terms of solar installations and it was only one of five states that installed more than 50MW in 2010. Additionally, it ranked third in concentrated solar power (CSP) installations in 2010, with 1.5 MW installed.<sup>4</sup>

<sup>3</sup> “2010 SEPA Utility Solar Rankings”; Solar Electric Power Association (SEPA), June 2011

<sup>4</sup> “US Solar Market Insight: 2010 Year in Review”; Solar Energy Industries Association & GTM Research, June 2011

The following table shows the net electricity generation for Arizona.



**Figure 4. Arizona’s Electrical Energy Generation.**  
**Source: Arizona Indicators.**

### 1.d Legal Authorities

<b>Project applicant:</b>	AstroSol Inc. (“AstroSol”)
<b>Legal representative:</b>	Michael Volz, President and CEO
<b>Legal instrument to demonstrate legal authority:</b>	Articles of Incorporation of the Project’s LLC registered in the State of Arizona.
<b>Date of instrument:</b>	September 2, 2009, as reassigned in November 2011.
<b>International Treaties and Agreements:</b>	Not in conflict of any international treaties and agreements

### 1.e Project Summary

<b>Project Description and Scope:</b>	The project consists of clean energy generated by solar photovoltaic (PV) panels. The project will be located in an unincorporated area of Pima County, Arizona on a 355 acre property available for solar installation as part of the University of Arizona Science and Technology Park (UASTP). The Project is expected to include approximately 48,384 thin film amorphous silicon panels on a fixed-tilted rack. The PV modules, which convert sunlight into low voltage electricity, have a rated capacity of 5.1 MW alternating current (or AC) with a potential annual electricity output of approximately 12,126 megawatt-hours (MWh) in the first year of operation. The electricity generated by the plant will be sold to Tucson Electric Power (TEP) under a 20-year fixed price Power
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Purchase Agreement (PPA). The voltage will be stepped up by an integrated inverter/transformer, and the energy will be sent to an on-site transformer station which will further step up the voltage to 13.8 kV. The interconnection point with TEP line is on site with the entire infrastructure already installed.

The production of clean and emissions free electricity from the project is expected to result in a displacement of over 7,700 metric tons of carbon dioxide (CO<sub>2</sub>), 44 metric tons of nitrogen oxide (NO<sub>x</sub>) and 28 metric tons of sulfur dioxide (SO<sub>2</sub>) emissions per year<sup>5</sup>.

**Population Benefited:** 980,263 (Pima County).

**Project Map:** The project site is located on a 355 acre technology park property owned by the University of Arizona, for which 38.5 acres is leased to First Light LLC<sup>6</sup> pursuant to a 20-year site lease executed in October 10, 2010 as amended. The following figures show the location of the project:



**Figure 5. University of Arizona Science and Technology Park.**

**Project Justification:** There is a need for affordable and environmentally beneficial alternatives to conventional fossil fuel-derived energy sources. Additionally, renewable energy projects create an opportunity to generate electricity without the same atmospheric emissions generated by fossil fuel fired plants or the use of scarce water resources for electricity production.

The project provides an opportunity to displace GHGs and other pollutants produced by traditional fossil-fuel based energy

<sup>5</sup> Factors used for the calculation of annual CO<sub>2</sub>, NO<sub>x</sub>, and SO<sub>2</sub> emissions were obtained from PV FAQs; The National Renewable Energy Laboratory for the U.S. Department of Energy; January 2004.

<sup>6</sup> The legal documents related to the lease agreement to First Light LLC are expected to be amended to reflect AstroSol, Inc LLC, the entity created for the purposes of this project.

generation, while providing the residents of Pima County with a safe and reliable energy alternative. **The aggregated environmental impact for the expected life of the project over the next 25 years is estimated to be equivalent to a reduction of nearly 176,000 metric tons of CO<sub>2</sub>.**

**Project Need or Consequences of No Action or Alternative:**

**In 2001, Arizona passed a renewable portfolio standard, known as the Environmental Portfolio Standard (EPS), which was designed to increase the delivery of renewable electricity with associated environmental benefits to the people of Arizona. The EPS initially required utilities to obtain about 1.1% of their energy sales from renewable resources, of which 60% was required to be supplied by solar energy.<sup>7</sup> In 2006, the Arizona Corporation Commission (ACC), as established by Title 40 Chapter 2 Article 1 Parts 201-209, approved the much more aggressive Renewable Energy Standard and Tariff (REST). The REST changed and expanded the EPS program by setting a higher renewable requirement and eliminating the specific solar energy supply requirements.**

**Under current regulations, the regulated public utilities must derive 15% of their energy sold from renewable resources by 2025.<sup>8</sup> At present just less than 11% of the electricity generated in Arizona is supplied by renewable sources including biomass, geothermal, hydroelectric, solar, and wind resources<sup>9</sup>. Of this mix, the primary renewable energy source is conventional hydroelectric energy. The project will contribute to the fulfillment of Arizona's EPS, and specifically TEP's requirement to comply with the renewable energy supply percentage.**

**Pending Issues:**

None.

**Criterion Summary:**

The project meets all of the general requirements of the criterion.

<sup>7</sup> Arizona Corporation Commission 2006. "Commissioners Approve Rules Requiring 15 Percent of Energy From Renewables by 2025."

<sup>8</sup> Database of State Incentives for Renewables & Efficiency: [www.dsireusa.org](http://www.dsireusa.org)

<sup>9</sup> U.S. Energy Information Administration for Arizona

## 2. Human Health and Environment

### 2.a Compliance with Applicable Environmental and Cultural Resource Laws and Regulations

#### Environmental and Public Health Needs Addressed by the Proposed Project:

Historically the United States has depended to a great extent on fossil fuels for the generation of energy. This conventional energy development can affect the natural environment due to the harmful emissions related to the generation process, including the release of greenhouse gases (GHG) as well as other pollutants such as sulfur dioxide (SO<sub>2</sub>) and nitrogen oxides (NO<sub>x</sub>).

**The current generation of electricity for the residents of Arizona relies on a mix of energy production technologies with the largest source being coal (42.38%), nuclear (37.86%), hydroelectric (10.22%), natural gas (9.06%), other renewables (0.41%), and petroleum (0.07%).** For TEP, energy production comes primarily from coal, at nearly 70%, natural gas (30%), and less than 1% from renewables.

One crucial way to protect the natural environment and mitigate climate change is to develop energy from renewable resources, and thereby displace generation from GHG-intensive sources. According to the Appendix D of the Greenhouse Gas Emissions Inventory and Reference Case Projections, 1990-2020 (Center for Climate Strategies 2006), **combustion of fossil fuels in producing electricity and in transportation accounted for 80% of Arizona's greenhouse gas emissions during 2000.** 11% of GHG emissions originated from the remaining uses of fossil fuels – natural gas, oil products, and coal in the residential, commercial, and industrial sectors (pg 44, 2007 AQ Report); see figure 6.

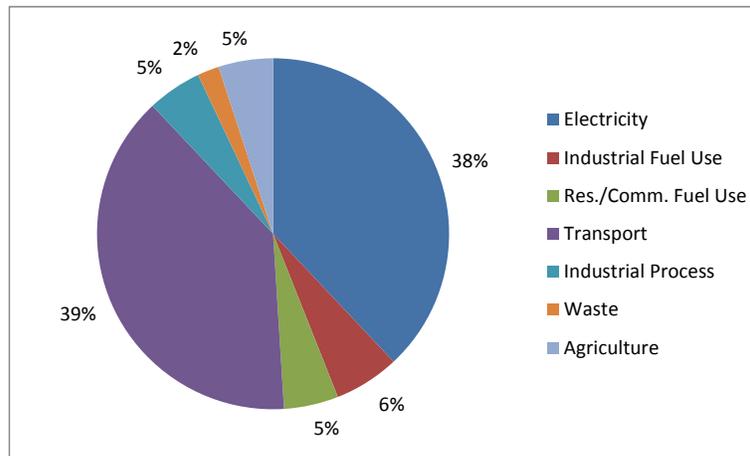
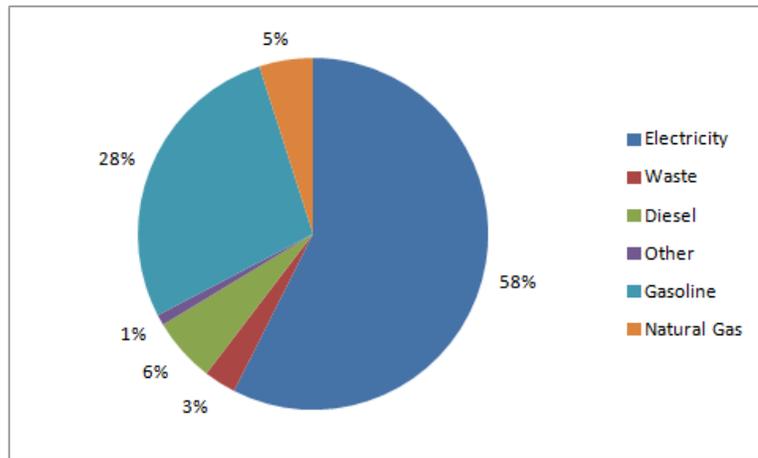


Figure 6. Arizona Greenhouse Gas Emissions by Source, 2000.  
Source: Pima Association of Governments: Air Quality Report 2007.

In April 2011, the Pima Association of Governments (PAG) published a Regional Greenhouse Gas Inventory for Eastern Pima County, City of Tucson, Pima County Government Operations and City of Tucson Government Operations. **This study concluded that there are two major sources of greenhouse emissions: energy use and transportation sectors. Approximately 57% of the energy emissions were from electricity use, since local energy generation is predominantly from coal-fired power plants (PAG 2011, pg 37).**

Total carbon dioxide production was estimated and allotted to six sources; see figure 7.



**Figure 7. Tucson Greenhouse Gas Emissions by Source, 2008.**  
Source: Pima Association of Governments: Regional GHG Inventory, April 2011.

As provided in Table 1, below, **based on nearly 112 million MWh net generation of electricity for 2009 in Arizona, more than 53 million metric tons of CO<sub>2</sub>, 33 thousand metric tons of SO<sub>2</sub>, and 62 thousand metric tons of NO<sub>x</sub> were emitted.** As shown in this table, the majority of carbon dioxide emissions are attributed to coal, almost 94% of nitrogen dioxide emissions are attributed to coal and all of the sulfur dioxide emissions come from coal burning.

<b>2009 Arizona Electric Power Industry Emissions Estimates (Thousand Metric Tons)</b>			
	SO <sub>2</sub>	NOx	CO <sub>2</sub>
Coal	33	58	39,203
Petroleum	*	*	51
Natural Gas	*	3	14,270
Other Gases	-	-	-
Other Renewables <sup>1</sup>	*	1	-
Other <sup>2</sup>	-	*	-
<b>Total</b>	<b>33</b>	<b>62</b>	<b>53,524</b>
<sup>1</sup> Other Renewables includes biogenic municipal solid waste, wood, black liquor, other wood waste, landfill gas, sludge waste, agriculture byproducts, and other biomass.			
<sup>2</sup> Other includes non-biogenic municipal solid waste, tire-derived fuels, and miscellaneous technologies.			
* = Value is less than half of the smallest unit of measure (e.g., for values with no decimals, the smallest unit is 1 and values under 0.5 are shown as *).			
-(dash) = Data not available.			
Sources: Calculations made by the Electric Power Systems and Reliability Team; Office of Electricity, Renewables, and Uranium Statistics; U.S. Energy Information Administration.			

**Table 1. 2009 Arizona Electric Power Industry Emissions Estimates**

The project will reduce the demand for fossil fuel fired electricity, and thus displace related harmful emissions. **For the next 25 years, the production capacity of 5.1 MW of zero-carbon generation will contribute to avoid CO<sub>2</sub> emissions of nearly 176,000 metric tons into the atmosphere as compared to the current CO<sub>2</sub> intensity of the Arizona electricity mix.** In addition, solar energy requires minimal water for energy production, while fossil fuel-fired generation is generally more water intensive. Increasing the mix of renewables will have a positive impact on water conservation in a state with scarce water resources.

**Public Health**

The project will positively impact the regional airshed by reducing pollutants which may help contain the severity of respiratory and other diseases aggravated or caused by air pollution. In addition, the reduction of GHG emissions is expected to mitigate climate effects that create more vulnerable conditions for human health.

**The project meets the following applicable environmental laws and regulations:**

All environmental permits have been obtained and are managed for the overall technology park including state and federal permits for waste management, drinking water, wastewater disposal, and stormwater discharges by UASTP. A list of the existing environmental permits is available in the Phase I Environmental Site Assessment reported for the project on July 16, 2010. A local Conditional Use Permit is not necessary for this project, as it is compatible with the use already determined and registered for the UASTP.

**The State of Arizona does not have a formal environmental authorization process for this project type.**

## 2.b Human Health and Environmental Impacts

**Health statistics:**

Epidemiological research has shown that both, chronic and acute exposure to harmful emissions associated with fossil-fuel based energy production, can lead to serious respiratory problems. It is estimated that, at very least, prolonged exposure to excessive levels of pollutants can deteriorate the respiratory capacity of humans and greatly contribute to the increase incidence of cardiopulmonary diseases such as asthma, heart ailments, and lung cancer. The following table lists some of the human health and environmental impacts associated with pollutant emissions.

Emission	Problems	Impacts
SO <sub>2</sub> , NO <sub>x</sub>	Fine Particulates	- regional haze - lung and heart disease
NO <sub>x</sub> , VOCs	Ozone Smog	- respiratory disease, permanent lung damage
CO <sub>2</sub>	Climate Change	- increases in global temperature - extreme weather
SO <sub>2</sub> , NO <sub>x</sub>	Acid Rain	- degradation of soil, foliage and water bodies

**Table 2. Health and Environmental Impacts Associated with Pollutants.**

In summary, by substituting the demands of electrical power generation from conventional fossil fuel sources with renewable resources, the project could help improve air quality and the general environmental conditions affecting the health of residents, not just in the specific project location, but within the region and beyond.

Although there are some environmental, health and safety hazards associated with the manufacture and disposal of solar cells, according to the US Department of Energy, few power-generating technologies have as little environmental impact as PV solar panels.<sup>10</sup>

**Direct and Indirect Benefits:**

The project will provide a clean energy alternative to the area by constructing a solar energy site, displacing emissions associated with conventional electricity generation. The electricity provider for the region and project off-taker is working toward increasing the share of energy they derive from renewable sources; the energy added by the project would further reduce the carbon intensity of the fuel mix, increase the diversity of renewable sources, and lessen the strain on production and transmission as demand grows during peak hours.

**Environmental Impacts:**

In the United States, greenhouse gas emissions come primarily from the combustion of fossil fuels in energy use. Energy-related carbon dioxide (CO<sub>2</sub>) emissions, resulting from the combustion of petroleum, coal, and natural gas, for 2008 were measured at a total of 5,735.5 million metric tons of CO<sub>2</sub>eq emissions. This represented close to 82 percent of the total U.S. anthropogenic (human-caused) GHG emissions in 2008.

Fossil fuels supply 85 percent of the primary energy consumed in the United States and are responsible for 98 percent of emissions of carbon dioxide.

**Climate Change**

When power plants burn fossil fuels to generate energy, emitted CO<sub>2</sub> accumulates in the atmosphere, trapping increasing amounts of heat on the Earth. Consequently, this contributes to potential climate warming conditions. In computer-based models, rising concentrations of GHGs produce an increase in the average surface temperature of the earth over time. Rising temperatures may, in turn, produce changes in precipitation patterns, storm severity, and sea level commonly referred to as “climate change.”

The actual reduction in GHG emissions could be greater than the calculated average since solar production generally displaces peak energy, which is generally more GHG intensive than the average mix. The proposed project will decrease the amount of CO<sub>2</sub> and combat the rising global warming trends caused by CO<sub>2</sub> emissions produced during energy generation.

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<sup>10</sup> U.S. Dept. of Energy (2010). “Photovoltaic Basics.” Accessed January 5, 2010 at [http://www1.eere.energy.gov/solar/pv\\_basics.html](http://www1.eere.energy.gov/solar/pv_basics.html).

### **Acid Rain**

Acid deposition, or acid rain, results from emissions of sulfur dioxide (SO<sub>2</sub>) and nitrogen oxides (NO<sub>x</sub>), primarily from power plants, vehicles and industry. Further, acid rain created by increased levels of SO<sub>2</sub> and NO<sub>x</sub> in atmospheric precipitation can have harmful effects on crops and livestock, further endangering human populations.

### **Water Use**

Water conservation will also be a benefit of the project, as the water used in large quantities for conventional energy production is not necessary for solar derived energy. The solar PV facility will use a limited amount of water during the construction period of the project, and will be limited to dust suppression and soil conditioning. Water use for long-term operations of the facility will be for PV module washing and domestic (potable) water uses.

### **Environmental Assessment**

A Phase I Environmental Site Assessment was performed for the entire 355-acre UASTP site. The assessment objective was to recognize environmental conditions with the site. The study revealed no evidence of recognized environmental conditions in connection with the property.

Documentation related to specific consultations or studies are available related to the following:

- Pima Pineapple Cactus (PPC) Survey determining that no PPC were found on the property
- Preliminary Archeological Data Recovery Report and related letter from the State Historic Preservation Office, which recommends to proceed with the planned development
- Western Burrowing Owl Survey finding no sign of the species on the property

The study describes that the majority of the property consists of undeveloped, naturally vegetated land. Existing land development at the property is generally limited to monitoring wells, constructed drainage facilities, a railroad spur, roadways, and utilities which cross the property to service adjoining properties. Surface storm water generally flows across the site from southeast to northwest as sheet flow. Four significant drainage features cross the area including the Julian Wash which is immediately north, entering at the northwest corner; and three drainages originating from industrial development within the UASTP. All drainage features on or in the vicinity of

the property are ephemeral; there are no perennial or intermittent drainage systems, springs, wetlands, or any other special aquatic sites on the property.

**Mitigation Measures:**

The intent of the Sponsor is to construct and operate the project in compliance with all applicable environmental standards by applying mitigation measures aimed at preventing the creation of significant adverse impacts.

The environmental impact resulting from the project will be positive overall; since the project will aid in the reduction of harmful atmospheric emissions generated by fossil fuel fired electrical plants. Some temporary impacts will be produced during the construction and operation of the plant. Some of these impacts include elevated noise levels, vibration, visual intrusion, and dust. The impacts would be managed accordingly.

Since Solar Photovoltaic (PV) energy power produces negligible carbon dioxide emissions, when compared to conventional fossil fuel derived methods, and since solar generated electricity is accomplished without the effects of emissions of NO<sub>x</sub>, and SO<sub>x</sub> during its production, the project can help decrease the associated harmful effects of these emissions by providing clean solar electrical power. In fact, most of the GHG emissions associated with a PV system lifespan are concentrated with the construction and installation phase of the components.

Generally speaking, it will also conserve water resources as solar energy production requires minimal use of water if compared with other sources. In summary, solar power is one of the cleanest forms of energy and the implementation of the project in Pima County will benefit the region for years to come.

**Transboundary Impacts:**

No negative transboundary impacts are anticipated as a result of the development of the solar energy project, on the contrary, a beneficial effect is anticipated on the air quality due to the decreased demand on fossil fuel fired electrical plants. The project could benefit the communities contiguous to the project area, as the potential reduction in pollutants made possible by the project helps to improve the air quality across the airshed. Furthermore, the project will aid in addressing and solving the larger environmental concerns about greenhouse gases and global warming targeted by international agendas.

**Pending Issues**

None.

**Criterion Summary:**

The project addresses human health and environmental issues.

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<sup>11</sup> Baseline reflects th

## 3. Technical Feasibility

### 3.a Technical Aspects

#### Project Development Criteria

**Design Criteria:**

The scope of the project is to design, build and operate a 5.1 MW<sub>AC</sub> solar photovoltaic energy generation plant. The electricity generated will be consumed by TEP via a 20-year PPA. The electricity will be delivered to the TEP distribution network at an interconnection point located on site. The project design has been created using the appropriate standards for projects of this type and size, as well as by current industry design practices for engineering and construction of similar renewable energy infrastructure projects.

The general design criteria establishes that the plant design life will be 25 years, have an installed capacity of 5.1 MW<sub>AC</sub>, be designed for unmanned operation during operating hours and able to accommodate the requirements for interconnection and transmission with TEP.

**Project Components:**

**PV System Components**

PV modules are the basic building blocks of solar electric power systems. The technology employed is from market leaders in the industry, like Astronery/Chint Solar (modules), SMA (inverters), Schletter (racking system). The technology selected for the solar panels is thin film amorphous silicon manufactured by Astronergy. The modules range in power output from 110W to 145W at Standard Test Conditions (STC) and are 1.43 square meters in area each. The modules will be installed on fixed-tilt racking structure. The arrays are composed of parallel rows of modules which are spaced to provide the optimum output considering shading and other generation loss influences.



Figure 8. ASTROSOL 5.1 MW Solar Site

**Other Design Criteria:**

TEP has precise interconnection design and operational guidelines regarding the connection to the utility's system. The project's interconnection requirements are established by TEP's Distributed Generation Interconnection Requirements (DGIR). In order to connect to the offered transmission line, all the equipment and installation must comply with existing IEEE design standards and testing procedures, including UL requirements and performance testing.

**Appropriate Technology**

**Assessment of Alternatives:**

As described by its website, the Solar Zone at the UASTP seeks to provide the solar industry with a supportive and competitive environment with a unique solar-centric research park which includes:

- Power generation by multiple technologies;
- Research and development;
- Materials and supplies;
- Manufacturing and distribution of solar equipment and hardware;
- Green-job and workforce training;
- Educational outreach;

- Public demonstration and awareness hub.

All solar power generated in the Solar Zone will be used by TEP to expand its renewable energy resources in Southern Arizona. The Solar Zone is in the largest multi-technology solar evaluation site in the United States. This enables various technologies to perform side by side, under identical operating conditions, so developers may determine when systems are most efficient and economical for the company and Southern Arizona.

The proposed project will install thin film amorphous silicon solar panels manufactured by Astronergy. In contrast to traditional crystalline silicon PV that is cut from solid crystalline material, amorphous silicon thin film panels are composed of thin layers of semiconductor materials topped by both an amorphous silicon layer and microcrystalline silicon layer that work in tandem.<sup>12</sup> Astronergy maintains that its thin film technology has several performance advantages over, primary among them: (i) higher module energy yield, (ii) better performance at high temperatures, (iii) improved performance in low light, and (iv) superior shading tolerance.<sup>13</sup>

#### **Solar Resource Assessment**

A specific solar assessment was not conducted for the proposed project. Irradiance data was supported by an existing solar resource dataset, Tucson TMY2, for the Independent Engineer's (IE) evaluation of the project. The Tucson TMY2 data is considered appropriate because it is based on a location within 8 miles of the project site and has a long historical basis.

Using the PV simulation software program PVSYST, developed by the University of Geneva and used recognized across the PV industry for its robustness and accuracy, the IE developed a model that captures the configuration of the proposed system including the expected losses attributable to parameters such as module quality, module mismatch, module soiling, temperature or inverter efficiency. The result of the PVSYSTS simulation helps to substantiate the anticipated generation of the facility based on the solar resource and system design.

In the case of this project, the energy production for the first year has been estimated at nearly 12,126 MWh.

#### **Property and Right of Way Requirements**

The project will be installed on approximately 38.5 acres of unimproved land located in Pima County. More particularly the site is located on a parcel of land which includes portions of Sections 21 and 28, Township 15 South, Range 15 East, Gila and

<sup>12</sup> Astronergy. [http://www.astronergy.com/technologies\\_pv.php](http://www.astronergy.com/technologies_pv.php)

<sup>13</sup> Section 9.1, Black and Veatch "Thin Film Silicon Solar Module Due Diligence", September 2011.

Salt River Meridian in Pima County. Rights-of-way are established and available to the project for implementation and on-going operations from the UASTP.



Figure 9. UASTP Site Map

### Project Tasks and Timelines

#### Project Timeline

- PPA and Lease agreement signed
- Project construction is scheduled to start before the end of 2011
- Major equipment components to be ordered before the end of 2011
- Expected project completion no later than May 2012.

### 3.b Management and Operations

#### Project Management

##### Resources:

The project sponsor is AstroSol Inc, which is a joint venture between solar panel manufacturer Astronergy Solar, Inc. and project developer Solmotion. Astronergy focuses on the mass production of crystalline silicon and amorphous silicon solar panels. Solmotion is a German solar developer that, together with German co-developer Vis Solis, has completed more than 25 MW of solar capacity in Europe (primarily Germany and Italy) and North America; Solmotion also has an additional 20 megawatts under development. Solmotion and Vis Solis senior management have more than 20 years of combined experience in solar power.

**Operation and Maintenance**

**Operation Plan:** Local contractors will be employed under the supervision of experienced project managers. The operation of the project will be subcontracted by the Sponsor to an experienced firm with ample experience and capacity in solar projects.

**Permits, licenses, and other regulatory requirements:** On November 14, 2006, the ACC adopted the new Renewable Energy Standard and Tariff (REST) rules (AAC R14-2-1801-1815), which were published in the Arizona Administrative Register. The REST rules require that public utilities satisfy an annual renewable energy requirement by obtaining renewable energy credits (RECs) from eligible renewable energy resources, as defined in the rules. The annual renewable production requirement is calculated by applying the required annual percentage to the kilowatt-hours (KWh) sold by the utility. The energy requirement for 2011 is established at 3.0% of the total portfolio and will increase gradually to 15% by 2025.<sup>14</sup>

The electricity produced by all solar installations located at the UASTP will be sold to TEP. TEP in turn will report the energy purchased under the requirements to meet its REST requirements.

**Reviewing Agencies:** Formal review requirements for the construction of solar energy

## 4. Financial Feasibility

4.a Proof of Financial Feasibility	
<b>Financial Conditions</b>	
<b>Information Submitted:</b>	Tucson Electric Power Financial Statements (TEP), Sponsor and First Light LLC ownership information, and project's cash flow forecasts.
<b>Financial Analysis Results:</b>	The project's expected revenue from the sale of electricity, based on the credit risk analysis performed by NADB, will be sufficient to cover: a) scheduled O&M expenses, b) funding of any reserve accounts, c) payment of debt service and, d) return to equity. Therefore the project is deemed financially feasible.
<b>Project Scope</b>	
<b>Item:</b>	The scope of the project is to design, build and operate an approximately 5.1 MW <sub>AC</sub> solar energy generation park. The electricity generated will be bought by TEP.
<b>NADB Loan Amount:</b>	Up to \$13.1 million dollars.
<b>Dedicated Revenue Source</b>	
<b>Source of Income:</b>	Revenues from the sale of electricity, through the Power Purchase Agreement signed with TEP.
<b>4.b Legal Considerations</b>	
<b>Project Management:</b>	AstroSol Inc. will manage the project through its wholly owned subsidiary, the special purpose corporation (SPC) created for the implementation of the project, AstroSol Tech Park AZ LLC. AstroSol Tech Park AZ LLC has the legal authority to contract loan obligations.

**Pending Issues:**

None.
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**Criterion Summary:**

The project meets all applicable financial feasibility criteria.
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## 5. Public Participation

### 5.a Private-sector Environmental Infrastructure Project

**Project Classification:** The project is classified as a private sector environmental infrastructure project with exclusive impact. This category includes projects that intend to provide an environmental service. The impact of these projects is generally exclusive to the facilities, processes or services of the Sponsor, although an indirect benefit for the community may exist. This project is not expected to require increased revenue generation to be supported by the community-at-large for the project's implementation or operation and maintenance.

**Public Access to Project Information:** For this project category, the *General Public Comment Period* shall apply as a minimum requirement to satisfy this criterion. BECC will release the Project Certification Document (PCD) for a 30-day public comment period beginning November 22, 2011.

**Additional Outreach Activities:** Although a broad public participation effort was not required for the project, the off-taker's activities related to acquiring solar energy production has received attention in local media, which includes the partnership for purchasing solar power generation from the UASTP Solar Zone installations. UASTP Solar Zone has been widely published by both TEP and the University of Arizona through the internet ([www.uatechpark.org](http://www.uatechpark.org)), media, brochures and industry sector publications and expositions. The Solar Zone has been designed to present a visible showcase for solar energy, expediting the acceptance and usage of renewable energy region-wide. In addition, it is designed to leverage the University of Arizona Research Institute for Solar Energy for investigation and development of next generation solar technology.

This project was selected through a formal Request for Proposal process initiated in September 2009 by TEP, which requires a formal publication and public approval process. In addition, the project is mentioned on TEP's and UASTP's websites. Articles are available upon request.

**Pending Issues:**

None.

**Criterion Summary:**

The project meets the Public Participation requirements for certification of a private sector environmental infrastructure project with exclusive impact.

## 6. Sustainable Development

### 6.a Human and Institutional Capacity Building

**Project Operation and Maintenance:**

The project's technical requirements, including design, appropriate operation and maintenance of the program systems will be overseen by AstroSol, Inc. The project will generate power that will be sold to TEP under a 20-year, fixed price PPA.

**Human and Institutional Capacity Building:**

The project contributes to institutional and human capacity building through:

- Utility-scale demonstration of new solar technology.
- Local labor to be employed to perform routine maintenance and site security.
- Technical training to be provided as required.
- As needed, external specialized contractors to be employed for expert services.

### 6.b Conformance to applicable Local, State, and Regional Regulations and Conservation and Development Plans

**Local and Regional Plans Addressed by the Project:**

In 2006 the ACC approved final rules to the REST, which expanded the program by setting a higher renewable requirement and dropping the solar energy requirements. The new requirement states that regulated public utilities must generate 15% of their energy production from renewable resources by 2025. The project will help meet the new ruling.

**Laws and Regulations Addressed by the Project:**

The UASTP is responsible for managing land use and other environmental permits required for the project.

**Impacts to Neighboring Communities in the U.S. and/or Mexico:**

The project will benefit neighboring communities in the U.S. and Mexico by improving regional air quality and avoiding GHG emissions which cause broader effects to the region and beyond.

### 6.c Natural Resource Conservation

The project will reduce the problem of atmospheric emissions generated by fossil fuel fired electrical plants since solar electricity is generated without the emissions of CO<sub>2</sub>, NO<sub>x</sub>, and SO<sub>2</sub>. It will also save water resources as solar energy does not use water for its operation.

### 6.d Community Development

The completion of this project will help in the development of the community. The project will provide social and economic

benefits to the county residents through investment, job creation and environmental improvement.

The project will create jobs during its installation and operation.

**Pending Issues:**

None.

**Criterion Summary:**

The project meets sustainable development principles for certification.