CITY OF SAN DIEGO

PURCHASING & CONTRACTING DEPT.
1200 Third Avenue, Suite 200
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REQUEST FOR INFORMATION (RFI) COVER SHEET
PROGRAM(S) TO MEET CITY'S 100% RENEWABLE ENERGY GOALS

Subject: **Solutions to Support the City of San Diego's Goal of 100% Renewable Energy**

Date Issued: **September 23, 2016**

Response Date and Time (Closing Date): **October 21, 2016 at 3:00 p.m.**

Questions/Comments Due Date: **September 30, 2016 at 5:00 p.m.**

City Contact Name and Information: **Maureen Medvedyev, Principal Procurement Specialist, Mmedvedyev@sandiego.gov**

Respondent's Information:

Respondent Name: Skywalker Energy

Address: 1041 Market St. Suite 153, San Diego, CA 92101

Telephone No. and E-Mail Address: (310) 270-5961 jknight@skywalkerenergy.com

Website: www.skywalkerenergy.com

Authorized Representative Name and Title: Jamaal Knight, CEO & Principal

Representative's Original Signature: _____

Date Signed: October 20, 2016

TO BE CONSIDERED, RESPONDENT MUST :

1) **Provide all requested information identified in this Cover Sheet.**
2) **Submit all requested information described in the RFI.**
3) **Submit all requested information on or before the Closing Date.**

Roadside Sun Diego:

SOLUTION TO SUPPORT THE CITY OF SAN DIEGO'S OF GOAL OF 100% RENEWABLE ENERGY
RFI No. 10079755-17-A

Submitted by:
Skywalker Energy
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EXECUTIVE SUMMARY:

'Roadside Sun Diego': A public/private solar photovoltaic (PV) infrastructure project that will generate clean energy along San Diego transit and highway right-of-way's and help the city of San Diego meet its Climate Action Plan goal of 100% renewable goal. This two-phase, triple bottom line project will be the first and only 'roadside' solar project in California.

This project is aimed at directly addressing the City's 100 percent renewable electricity goal by 2035 by introducing additional generation from PV arrays sited along city transit lines and highway right of ways. Additionally, the project achieves the following goals:

- Helping the city expand its energy portfolio and lower emissions to levels below what is required per California SB 350 and the State's Renewable Portfolio Standard;
- Introduces an innovative energy/infrastructure upgrade opportunity to supply electricity and/or reduce greenhouse gas emissions;
- Ensuring reliable and sustainable energy services for both the near- and long-term;
- Spurring new renewable energy development;
- Considering social and environmental equity in efforts to meet the City's 100 percent renewable electricity goal;
- Increasing resources dedicated to local investment and economic development; and
- Creating green jobs in San Diego.

Introduction to 'Roadside' Solar

The most common highway application for solar technology included call boxes, traffic signals, flashing beacons, weather information systems and traffic counters.

The decision to use these technologies had little to do with the debates about energy policy or environmental protection and was driven primarily by convenience and savings.

Land Requirements' & 'Access to Transmission'

Traditionally, both CSP and PV utility scale projects required substantial tracts of land, in climates with limited cloud cover to be cost effective. To meet this requirement, these solutions are often sited far from cities, creating further costs and logistics issues with transmitting the energy created.

'Roadside' PV arrays can be built seamlessly into the existing infrastructure of metropolitan areas where the electricity it generates is needed most.

International Applications

'PV Soundless' Project – Freising, Germany

The world's largest PV sound barrier with a capacity of 500 kWp (at a length of approximately 1 km) was installed at Freising in Germany, next to the Munich airport and has been operational since September 2003.

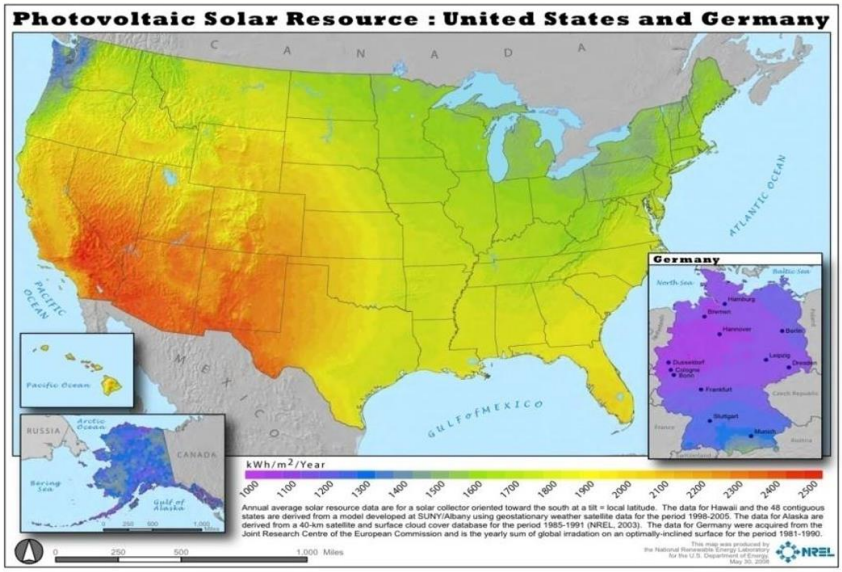
Solar Tunnel – Antwerp, Belgium

The tunnel on the Paris-to-Amsterdam line topped with 16,000 solar panels went on line in June 2011 and generates enough electricity to power the Antwerp station and Belgian train network.

- Cost: $22.8M
- Size: 2.6 miles
- Output: 3,300 MW

Domestic Capacity

Most parts of the U.S. receive substantially more solar radiation than Germany, ranked first in the world for cumulative installed solar capacity.



The U.S. southwest, note Southern California specifically, has nearly double the amount. Local projects exist as proof-of-concept in the U.S.

Domestic Applications

Massachusetts Route 44 project: In August 2012, the first solar project (99-kilowatt) built along a major highway right-of-way on the East Coast has begun producing energy to power the town of Carver's water-treatment plant

Domestic Applications (cont.)

In 2008, the Oregon Solar Highway Demonstration Project, a 104 kilowatt system located at the interchange of I-5 and I-205 near Portland Oregon, was initiated as a proof-of-concept project.

The Baldock Solar Station, adjacent to a highway safety rest area, the Baldock Solar Station is a 1.75 MW array . The 6,994 panel array sits on approximately seven acres of ODOT property, producing appx. 1.97 million kW/hrs of clean, renewable energy annually. Construction began in early August 2011 and the project was placed into service – connected to the grid – on January 17, 2012.

Roadside Solar: Plans for Local Applications

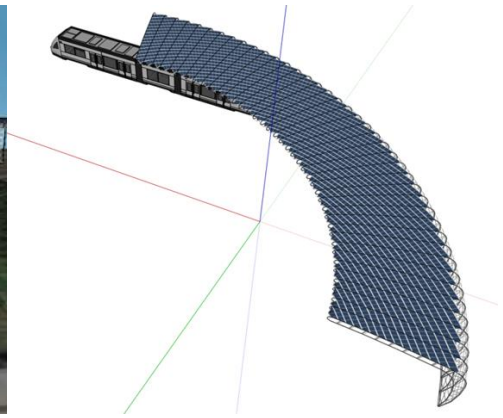
Phase 1 – Trolley-Line

State and local agencies (site property holders) can partner with private utilities (off-takers) and solar developers (engineering, procurement, construction) to leverage portions of San Diego's 65 miles of trolley line to site this solution.

Assuming that 1 mile equals 1 MW of solar capacity, Phase 1 alone could potentially contribute a 15MW of new generation for the City.

Phase 1A: Pilot project - 5 miles along expansion route to UTC/UCSD

- Aims to create enough electricity to power a substantial percentage of the existing trolley line.
    - Less invasive to traffic.



Phase 1B: Expansion to an additional 10 miles of trolley line

- Transfer excess power back to the grid.
    - Opportunity to lease ad space to generate additional revenue throughout the life of the project.

Roadside Solar: Plans for Local Applications Phase 2 - Highway

State and local agencies can also partner with private utilities and solar developers to leverage portions of San Diego's 300 miles of highway to site this solution.

Again assuming that 1 mile equals 1 MW of solar capacity, Phase 2 could potentially contribute a 50MW of new generation for the City.

Phase 2: San Diego highway walls, medians and right of ways.

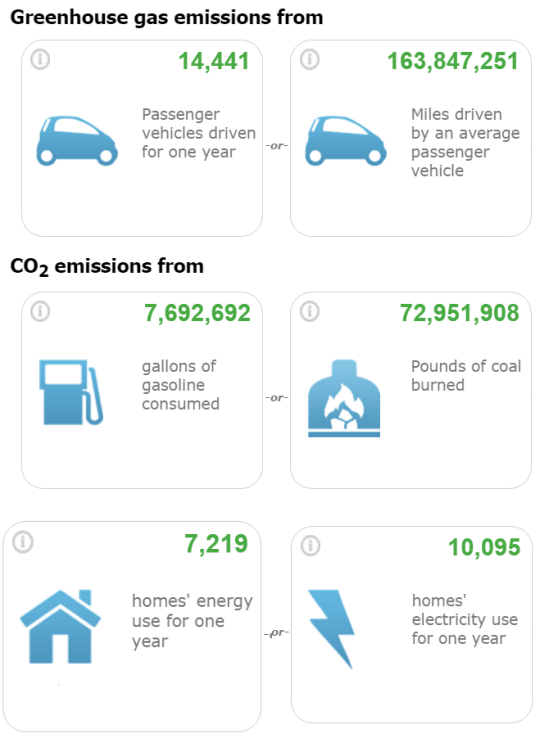
This phase would be a series of PV systems, covering a proposed 50 miles and would aim to power lighting and signage along highways, while transferring excess power to the grid.

Project Benefits

A 1 MW power plant produces 1000 kilowatts of power as long as it's operating at full capacity, producing 1000 kilowatt-hours of power each hour it operates, or 24,000 kilowatt-hours per day, or 8,670,000 kilowatt-hours per year. When calculating solar generation, one has to consider the fact that the sun does not always shine and sometimes obstructions limit generation.

Once fully installed, assuming 80% efficiency and 5.68 hours of average daily solar generation in San Diego:

System Size: 65MW
Annual Generation[1]: 97,278,442 kWh
Annual Emissions Reduction (CO2 equivalent)[2]: 68,365 MT
Potential Jobs: 75 – 100 construction jobs; 10 – 15 permanent maintenance jobs



Timeframe

It is difficult to predict the amount of time it may take to advance a project from concept to reality, as circumstances will inevitably vary on implementation.

At a minimum, prospective project managers should expect to six to twelve months assessing region-specific political context, evaluating available incentives and business/financing models, assembling a project team, identifying suitable project sites and selecting a solar developer.

This timeline, of course can be delayed by complications with permitting. Once these initial steps are completed and project agreements are executed, construction and project commissioning can typically happen in less than six months, depending on the complexities involved with the site development.[3]

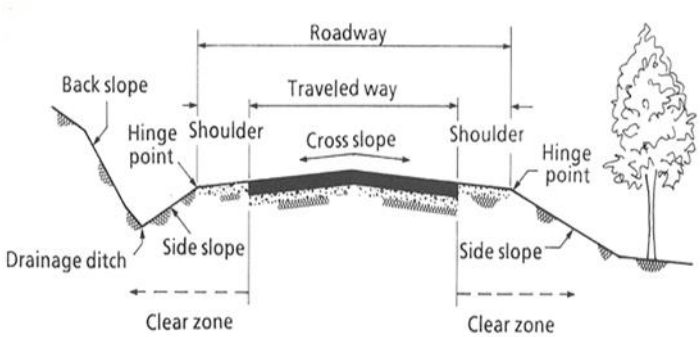
[1] http://pvwatts.nrel.gov/
[2] https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator
[3] ODOT Solar Highway Program: From Concept to Reality

Impact: Assessing Site Feasibility

'Roadside Sun Diego' will require the following site specific, impact studies and evaluations:

- ❑ **Preliminary environmental screening**
  - ❑ Biodiversity and habitat
  - ❑ Water resources
  - ❑ Hazardous materials
  - ❑ Noise
  - ❑ Geology
  - ❑ Local Land use and Parks
  - ❑ Scenic and visual resources
  - ❑ Socioeconomics
- ❑ **On-site solar resource evaluation**
  - ❑ Total Solar Resource Fraction (TSRF)
  - ❑ Requirements for grid connection
  - ❑ Site properties
  - ❑ Estimate of system size and cost
- ❑ **Trees versus Solar**
- ❑ **Context sensitivity screening**
- ❑ **Carbon footprint analysis**

To evaluate the potential impacts to scenic and visual resources for the proposed solar PV project renderings can be produced to illustrate the before and after effects of the project.



The clear zone is the traversable area that starts at the edge of the traffic lane and extends laterally a sufficient distance to allow a driver to stop or return to the road before encountering a hazard or overturning. Any potential project is best accommodated outside of the highway clear zone for safety reasons.

Costs

Total Estimated Project Cost: $97.5M *(Assuming $1.50 per watt)*

Financing

Through a public/private partnership and a Power Purchase Agreement (PPA) a host agency (i.e. City of San Diego, MTS) could avoid upfront capital investment and ongoing operating and maintenance responsibilities while securing a long-term, predictable price for electricity, often initially at a price lower than current utility rates.

Through a Solar License Agreement (SLA) a private sector partner would build, own and operate the solar PV system and would receive revenue from electricity sales to the host agency and capture the tax benefits and financial incentives made available from developing the project.

Because public agencies are generally precluded from owning equity in a private enterprise, the host agency typically does not own the system assets. However, there are means for ultimately transferring ownership to the agency if desired.

While innovative public-private partnerships may allow public agencies to avoid the upfront capital cost of the solar PV system, there will likely be some programmatic costs local agencies must fund. Some of these costs are associated with internal agency staff time, while others may be costs for external consulting services such as external legal counsel and professional or technical services.

Well-Established Federal and State Incentives

Investment tax credits (ITC): ITC's provide a tax credit to taxpayers equal to 30% of qualified expenditures for investments in solar PV systems.

Modified Accelerated Cost-Recovery System (MACRS): MACRS is the method for calculating federal accelerated depreciation of business equipment.

Proposed Program Participants	
SKYWALKER ENERGY CONSULTING SERVICES	Project Developer, Consultant
SDGE A Sempra Energy utility	Off-taker
MTS, SANDAG	Land Rights/Usage
TBD	Finance Partner (PPA)

Project's Novelty

'Roadside Sun Diego' will be the first of its kind in state of California and will be a high profile testament to the City's commitment to achieving its Climate Action Plan goal. The project will generate clean and abundant energy on previously unused land controlled by the City, County or State.

The staggered phases of development will allow the project to seamlessly integrated with existing or future energy projects or programs.

Potential Obstacles

There are several practical, technical and regulatory issues to consider for an ambitious project like this. Each deserves detailed consideration:

- Long, Skinny Roadside Arrays: First, Roadside solar may involve long, skinny arrays. This may require thicker wires and/or transformers to boost voltages between strings of panels, their combiners, and inverters.

- Access for Construction and Maintenance: Closely related is access during construction and maintenance. Highway Roadside developers have been restricted in terms of special access, and more so, if it involves limiting motorists' unimpeded use of rights of ways. Rail access requires rail safety classes, certification, and installation protocols.

- Interconnection: The solar system will need to interconnect to the local utility. This can be complicated. What loads are nearby? What is the structure of utility interconnection for solar, exclusively net energy metered? Suitably priced feed-in tariffs might work well. Crossing under or over federal highways may make a system cost prohibitive given expensive trenching, tunneling, or overhead transmission.

- Clear Zones: For highway solar deployment in America, adhering to clear zone restrictions can negate opportunities. AASHTO's Roadside Design Guide defines a clear zone "as the total roadside boarder area, starting at the edge of the travelled way, available for safe use by errant vehicles." Highways also have "recoverable slopes" that must be kept clear of solar systems.

- Theft and Vandalism: The location of solar arrays along Roadsides may make them susceptible to vandalism and/or theft. Each panel is worth hundreds of dollars; copper wires are attractive to thieves. While highways, railways, and busways are restricted – it is illegal to enter on foot -- care must be taken to locate arrays in areas where such activity is least likely. There are also theft-proof solutions such as sealed conduits, pedestal-mounted, theft-proof boxes, etc., but these add costs.

- Glint and Glare: Experts claim that glint and glare is less of an issue than many would think. Harvesting solar inherently involves capturing photons, not letting them bounce off the panel surface. For the Sacramento Roadside Solar project presented later in this report, an Initial Study and Mitigated Negative Declaration was prepared that found that the project "would be implemented without causing a significant adverse impact on the environment."

- Federal Regulations on the Lease of Public Goods: Perhaps most complex is federal regulation of land and air-space leases. Many highway rights of ways and land is controlled by the federal government, much is state controlled. In each instance, how projects are defined is essential, especially when private ownership is involved. This is discussed in some detail in two ensuing case studies from Oregon and California.

State and Federal Regulations

- Highway rights of ways are regulated in the United States at the federal level by the Federal Highway Administration (FHWA). It maintains regional offices that work with state agencies, such as Caltrans in California. An influential trade association, the American Association of State Highway Transportation Officials (AASHTO) has working committees and develops guidelines. It is a "standard-setting body" that publishes guidelines for bridge clearances and the "Green Book" (Roadside Design Guide) that is a frequently updated repository defines specifications for roadway and highway design consistency.

- In the United States, highway regulations rule out PV systems mounted on guard rails and noise barriers such as those built in Europe. Experts claim that in the U.S., this type of installation would be limited by the AASHTO Green Book. It states that no structures of any sort are allowed to be placed on top of or directly behind guardrails or median barriers unless the barrier is specifically designed to be crash-worthy. The FHWA Office of Infrastructure's Clear Zone and Horizontal Clearance also maintains specifications for embankments. Clearances vary and depend on the average motorist speed, curvature, whether or not there are guardrails, and slopes.

- In California, light rail system safety and security is regulated in California by the Public Utilities Commission (CPUC). Its Rail Transit Safety Section has authority of all Rail Transit Agencies in the State and works in close cooperation with the Federal Transit Administration. The CPUC publishes regulations for light rail systems including clearances that pertain to solar systems.

- The CPUC's "Regulations Governing Clearances on Railroads and Street Railroad with Reference to Side and Overhead Structures, Parallel Tracks, Crossing of Public Roads, Highways and Streets" was originally adopted January 19, 1948. It has been amended as recently as 1981. Section 9 defines overhead and side clearances for rails carrying freight cars and those not designed for freight. Overhead clearances drop from 22' above the rail, to 14' without freight.

- Minimum clearances – except for stations – drops to as little as 30 inches from the side of the largest equipment operated, and even less in tunnels. Further study and potentially special accommodation may be needed to allow for innovative alignment pilot projects. This may be an opportunity for Metro to demonstrate leadership among transit agencies nationwide.

- Generally, light rail has less rigorous regulation than heavy rail systems. Light rail systems have lighter equipment, and operate at slower speeds. Note that "streetcars" are closely related, but transit planners reserve the light trail designation for systems on tracks generally separated from city streets. Light rail also often features articulated cars to achieve tight turning radiuses.