Financial Analysis of Solar Project Options for UCLA[1]

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Executive Summary

The goal of this study is to assess potential feasibility of installing a solar energy generation system on the UCLA campus that would meet certain criteria. UCLA Luskin Center researchers used the following criteria for the purpose of our analysis:

- **Cost**: minimize or eliminate upfront costs as well as minimize operational expenses for UCLA, ideally to achieve cost neutrality or generate revenue.
- **Ownership**: per above criteria to minimize or eliminate upfront costs, UCLA would want to enter into a lease arrangement with a third party provider/solar provider. Solar leases are often for a 20 year period but the term could be negotiated. In addition, UCLA could structure the contract so that the solar leaser/third party would transfer asset ownership to UCLA at the end of the lease period.
- **Availability of power**: the project site would need to reliably generate solar power. UCLA could collect (or partner with a solar provider to collect) 15-minute interval data to provide critical information about the solar capacity factor for the site.
- **Standards conformity**: solar provider would need to adhere to UCLA's building, installation and maintenance standards.
- **Visibility**: a project site that would be visible on campus could provide educational and public relations benefits.
- **Environmental benefits**: ideally UCLA would count the solar installation towards reducing its greenhouse gas emissions.

Of these criteria, cost is paramount for the purpose of this study.

[1] The University of California does not support or disavow the findings in this document. It does not represent the official views of the University of California, Los Angeles nor indicate any action that the university may or may not take. The UCLA Luskin Center for Innovation is a research center and this memo represents the research findings of this center only. The Luskin Center has a research history of analyzing solar programs with implications for policy versus individual projects. The assumptions used in this study were informed, but have not been verified, by other parties. This financial analysis of this study is a starting point for assessing solar project options.

UCLA Luskin Center researchers created a project finance model to assess a variety of hypothetical financial scenarios, estimating costs and benefits of the project options. Main drivers of solar project costs are the following:

1. **System performance**: the solar capacity factor will be affected by **location**; unobstructed areas will produce more solar energy than shaded or partially shaded areas.
2. **Installation cost**: cost per watt could be negotiated with or bid upon by the solar system leaser but is influenced by **size of the system and type of installation**.
3. **Financing terms**: the interest that UCLA would pay the solar system leaser could also be negotiated but the industry standard is currently about 4%.
4. **Utility program**: what the Los Angeles Department of Water and Power (LADWP) could offer UCLA to generate solar power on campus, specifically with a **Feed-in Tariff**, over a specified **period of time/duration.**

These four cost drivers will be explained in the preceding sections. The analysis leads to the finding that a solar installation on a medium-sized rooftop such as the Wooden Center could be nominally revenue generating under the following conditions:

1. The site location has a high solar capacity of .22.
2. The installation cost is $3.25 per watt or lower.
3. The interest rate UCLA would pay the solar leaser/third party is 4% or lower.
4. UCLA enters into a 20 year contract with LADWP in which LADWP agrees to pay UCLA a fixed price of either $.17 or $.16 per kWh.

The finances of a solar project are only one of a myriad of considerations that would be important to UCLA. It is beyond the scope of this memo to analyze these other considerations but we do note that under the potentially cost effective strategy outlined above and described in more detail below, UCLA would forfeit all environmental attributes of the solar installation to LADWP, including the greenhouse gas reduction credits.

1. System Performance and Location

System performance is critical when considering the cost of electricity produced. If the same photovoltaic (PV) system is installed in two different locations–one with unobstructed, high quality sunlight and the other with shading–the PV system in the unobstructed location will produce more electricity than the one in the shaded location. Assuming the installation costs are the same for both, the electricity produced in the second (shaded) location will be more expensive because less electricity will be produced for the same cost. This difference in performance is particularly relevant when the goal of the installation is to remain cost neutral.

Given the cost criteria listed above, a number of locations were identified as potential installation sites. Of these sites, the rooftop of the Wooden Center and the top of Parking Structure

8 stood out as prime construction sites due to the quality of the sunlight striking these structures,[2] their central location on campus, and the high visibility of these locations to stakeholders at UCLA, such as students, as well as the general public.

Given the size of the roof on the Wooden Center, there is a maximum *solar capacity*[3] of approximately 290 kW. The *solar capacity factor*[4] for this site would need to be determined. Solar providers have the expertise to run these site tests.

Parking Structure 8, if completely covered, has a maximum solar capacity of approximately 1.6 MW, though an installation no greater than 1 MW is most likely given the need for cars to maneuver on the roof under and around the shaded solar canopy. Parking Structure 8 is the largest, high quality site for solar on campus. It would provide visibility for a solar installation to the public and student body. Lot 8, however, would require the PVs to be part of a shaded parking structure canopy, a more costly type of solar installation than a typical rooftop installation. As will be described in the sections that follow, thereby Structure 8 would not be cost neutral for UCLA under the FiT. Instead, this site might be an ideal candidate to take advantage of potential state incentives via Proposition 39 funds that will be available sometime after July, 2013. Specific details are currently being determined through enabling legislation.

2. Installation Costs, System Size, and System Type

Another main project cost driver is installation cost. Not including any tax incentives or rebates, the installation cost of a solar system is based on the size of the system and the type of installation.

System size and cost per watt are inversely related. Given the high fixed costs associated with the design and installation of a solar system, a small roof-top system (50 kW) can cost upwards of $7.00-7.50 per watt installed, whereas a much larger system (1 MW) may only cost $2.50-3.00 per watt. Operation and maintenance costs are also lower on a per watt basis for larger systems as these set costs are amortized over more wattage.

Another consideration is the type of installation. A building rooftop installation will be less expensive than a shaded parking structure of the same size due to the fact that additional design and construction must be done to erect the supporting structure for a shaded parking lot. This is a consideration at UCLA where the largest spaces appropriate for a solar installation are on parking lots that would necessitate a shaded parking structure.

[2] Luskin Center researchers estimated solar potential for several sites at UCLA by utilizing geographic information from the County of Los Angeles along with physical analysis during site visits.
[3] Solar capacity is actual output and is expressed in kilowatt (kW) or mega-watt (MWh).
[4] The solar capacity factor is determined by dividing the actual output with the maximum possible output.

3. Financing Considerations

We benchmarked what had been done by other non-profit institutions that had installed a solar installation(s) on their property, hoping to learn best practices and lessons learned from other institutions in a similar financing situation as UCLA. UCLA and other non-profits are unable to take advantage of the investment tax credit (ITC) when installing solar. By using the ITC, for-profit institutions and individuals get a one-time tax credit equal to 30% of the cost of the solar installation. Non-profits, since they do not pay taxes, cannot take advantage of this cost savings. As a result, non-profits must seek alternative financing in order to reduce project costs.

UCLA does have access to a financing instrument called a Tax-Exempt Lease (TELP). TELP financing is available to government and non-profit institutions, and it provides a low interest financing option for obtaining equipment. Typically at the end of a TELP, ownership is transferred from the lessor to the lessee. Interest rates for these arrangements are low because the financier does not pay taxes on the interest income. Currently, a 20 year TELP is available with interest payments around 3.75 – 4%. Since interest rates are near all-time lows, we expect the interest payments for a TELP to increase in the future.

4. Utility Programs

Feed-in Tariff

A Feed-In Tariff (FiT) establishes a set rate (tariff) that a utility, like the Los Angeles Department of Water and Power (LADWP), will pay for solar energy produced by property owners within the utility's territory. Under such an arrangement, a long-term contract between the energy producer and the utility is established in which the energy producer is paid per kWh produced.

LADWP recently approved a FiT program for 100 MWs that will be phased in with offerings of 20 MW each 6 months starting in February of 2013. DWP will offer a 17 cent tariff/Base Price of Energy[5] for the first 20 MW reserved, on a first come first serve basis for qualifying projects. The tariff will decrease by 1 cent after that, per the below schedule. Therefore, timing will affect the finances of a project. UCLA could maximize returns from the FiT by submitting an application as early as possible.

FiT Pricing Table			
Tier Level	**Total MW Capacity Reserved**	**Small Project MW Capacity Reserved**	**Pricing (per kWh)**
1	0-20	0-4	$ 0.17
2	20-40	4-8	$ 0.16
3	40-60	8-12	$ 0.15
4	60-80	12-16	$ 0.14
5	80-100	16-20	$ 0.13

[5] LADWP defines "Base Price of Energy" as the base price (in dollars per kilo-watt hours) to be paid to the Participant (of the FiT Program) for energy delivered to the LADWP. This memo uses the term "tariff" to mean BPE as defined by LADWP.

The solar energy produced at UCLA via this project would be connected directly to the utility's grid with a separate meter for auditing purposes, and the FiT program would be independent of UCLA's energy consumption from LADWP. As such, UCLA would forgo its rights to the renewable energy credits (RECs) and environmental benefits, including greenhouse gas reduction credits, associated with the production of electricity from the solar system. These rights would transfer to LADWP. (LADWP is offering this program as a way to meet its required Renewable Portfolio Standard requirements.) By slightly increasing the renewables percentage within LADWP's portfolio, however, the project would an effect of UCLA GHG footprint albeit very nominally and indirectly. The transfer of GHG credits to LADWP could be seen as a significant disadvantage of the FiT Program for UCLA.

FiT Program Guidelines include but are not limited to:

- Eligible Projects must have a total nameplate capacity ranging from 30 kW to 3 MW.
- The 100 MW FiT Program will be distributed into five (5) semi-annual allocations of 20 MW.
- Each 20 MW allocation will have a 4 MW set aside for the small Projects ranging from 30 kW to 150 kW.
- Unused capacity from each allocation will not be added onto future allocations.
- Applicants must meet all eligibility and minimum technical requirements.
- Applications will be accepted on a first come, first served basis.
- An interconnection study will be conducted. The Applicant will be responsible for all interconnection costs.
- Applicants must enter into a Standard Offer Power Purchase Agreement (SOPPA), in duration of not more than 20 years in length, and an Interconnection Agreement.

The full guidelines and more information about LADWP's Solar FiT Program can be found here.

Net Metering

An alternative to a Feed-in Tariff, "Net Metering enables customers to use their own generation from on-site renewable energy systems to offset their electricity consumption over a billing period by allowing their electric meters to turn backwards when they generate electricity in excess of their demand." [6] Unlike FiTs in which energy generators receives a price per kW that is typically above retail in order to incentivize solar installations, net metering enables customers to receive retail prices for the excess electricity they generate.

In many situations, Net Metering is a cost effective option; however, for UCLA, that is not the case. In part because UCLA produces most of its electricity at a co-gen natural gas plant on campus, LADWP has set a rate structure for the university with high fixed costs (see Appendix). And since solar is a non-dispatchable energy source with availability less than 100%, the cost reduction under a Net Metering arrangement is most likely $0.04 per kWh produced. Even under the best case scenario, Net Metering would only produce savings of $0.10 per kWh produced, compared to the FiT which is priced at $.17 - $.13 (depending on time of participation in the FiT Program). However,

[6] U.S. Department of Energy. http://apps3.eere.energy.gov/greenpower/markets/netmetering.shtml

one major positive under a Net Metering arrangement would be that UCLA would still own the claims for the RECs associated with the solar project as well as the other environmental attributes including the greenhouse gas reduction credits.

Summary of Findings and Example Cases

Finding #1: Net Metering is Better Option than FiT to Maximize Greenhouse Gas Reduction Credits for UCLA

Under the FIT, UCLA would not retain the environmental attributes of the solar power produced on campus. Net Metering, in contrast, would allow UCLA to maximize the greenhouse gas (GHG) reduction credits associated with a solar installation. GHG reduction credits affect UCLA's progress as part of its Climate Action Plan.

Finding #2: FiT is a Better Financial Option for UCLA than Net Metering

We will highlight the project finance differences under the FiT Program compared to Net Metering, using the following project assumptions:

- System size: 275 kW
- Capacity Factor: 0.22
- Cost per watt installed: $3.25

Scenario #1under a FiT: $0.16 per kWh produced
Under FiT: this hypothetical project would generate revenue of $23,450 over 20 year FiT arrangement

Scenario #2 under Net Metering: $0.10 saved per kWh not purchased (best case)
Under Net Metering: project would cost UCLA $583,618 over 20 year net metering arrangement (under the aforementioned scenario).

Clearly, a FiT would be the best economic choice. As previously explained, however, there is a trade-off between cost savings and ownership of the greenhouse gas reduction credits and the Renewable Energy Credits. In other words, owning the rights to the RECs and GHG reduction credits under a Net Metering arrangement could cost UCLA over $600,000 over a 20 year period.

Finding #3: A Rooftop Project Would Be More Economical than a Parking Lot Canopy Project

We will now highlight the cost differences between project types under a FiT. To do so, we set the following assumptions:

- Capacity factor: 0.22
- FiT tariff, per kWh: $.17
- Interest rate UCLA pays to third party provider: 4%

System Scenario #1:

- System size: 275 kW
- Type: PVs on building rooftop (Wooden Center)
- Cost per watt: $3.25

= $ 124,630: estimated revenue that UCLA would generate over 20 year FiT contract period under favorable but feasible assumptions for hypothetical System 1

System Scenario #2:

- System size: 1.25 MW
- Type of installation: Solar canopy on a parking facility (Parking Lot 8)
- Cost per watt: $4.25

= ($ 203,498): estimated cost that UCLA would have to pay for hypothetical System 2

The main reason for the cost difference between System 1 and System 2 is due to the system type, building rooftop compared to parking lot canopy. A rooftop installation on the Wooden Center with a capacity of between 275-290 kW could be feasible and the most cost effective for UCLA.

Finding #3: Entering into a FiT Contract Early, in the Winter or Spring of 2013, would Yield the Best Financial Proposition under the FiT Program

The following assumptions apply to each of the below 3 scenarios:

- System size: 275 kW
- Cost per watt: $3.25
- Capacity factor: 0.22
- Interest rate UCLA pays to third party provider: 4%

Scenario #1: Submitting in Early 2013 to Reserve a Portion of First 20 MWs: Tier I Rate

$.17 tariff per kWh, over a 20 year contract term

= $ 124,630

Scenario #2: Tier 2 Rate

$.16 tariff for kWh, over for a 20 year contract term

= $ 23,451.32

Scenario #3: Tier 3 Rate

$.15 tariff per kWh, over a 20 year contract term

= $ (77,727.00)

This analysis finds that the best financial proposition for UCLA would be to take advantage of the $.17 tariff/BPE by applying to the FiT Program as soon as possible after LADWP begins accepting applications in February of 2013.

Finding #5: Maximizing Contract Term Could also Support Best Financial Proposition for UCLA|

Twenty years is the maximum contract duration that LADWP is offering. While intuitive, we underscore that it makes financial sense for UCLA to take advantage of the maximum duration, so that UCLA could receive revenue from LADWP for longer, thereby recouping the costs of the solar installation. Going back to the Scenario #1 example in Finding #3, a solar project could generate revenue of approximately $125,000 over a 20 year term. Anything less than 18 years would likely put the project in the red for UCLA, even under favorable conditions including a $.17 tariff.

Conclusion

Based on our analysis, UCLA could hypothetically benefit from taking advantage of the FiT in the near term to capitalize on a relatively high tariff available on a first come first serve basis. Luskin Center researchers assessed that a rooftop installation on the Wooden Center, with a capacity of between 275-290 kW, could be nominally revenue generating under these conditions:

1. The site location has a high solar capacity of .22.
2. The installation cost is $3.25 per watt or lower.
3. The interest rate UCLA would pay the solar leaser/third party is 4% or lower.
4. UCLA enters into a 20 year contract with LADWP in which LADWP agrees to pay a fixed price of either $.17 or $.16 per kWh.

These are favorable but feasible assumptions. Variables could change over time and the project finance model that the UCLA Luskin Center created does allow for easy modification should any parameters need to be adjusted.

This study focused on a financial analysis of project options under existing LADWP program. The analysis would shift should non-financial variables, such as retaining ownership of the power and the associated greenhouse gas reduction credits are of top consideration, be of top concern.

UCLA may want to monitor Proposition 39 as another potential opportunity to receive funding incentives to install renewable energy as well as energy efficiency projects on campus. Proposition 39 funds will be available sometime after July, 2013. Incentives will likely come in the form of grants and low or no interest loans. Specific details are currently being determined through enabling legislation.