Engineering Evaluation & Feasibility Study

Needles Solar Energy Sites Evaluation

Prepared for

City of Needles, CA

For the benefit of the

Needles Public Utility Authority

by

Arlen Barksdale, PhD
Chief Technology Officer
UniSol Solar

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August 12, 2024

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Rainie Torrance
Utilities PUA Manager
City of Needles
817 Third Street
Needles, CA 92363

Re: ***City of Needles Solar Engineering Evaluation &Feasibility Study***

Dear Ms. Torrance:

Thank you for the opportunity to perform an Engineering Evaluation and Feasibility Study (EEFS) on the City of Needles's solar infrastructure development opportunities and multiple site surveys pursuant to your RFP award of April 12 last. Attached please find our report for your review.

In furtherance of implementing the ultimate needs of solar development, we feel strongly that our industry experience, engineering and energy conservation expertise, and superior value will make us the clear choice for your future utility scale solar energy and RECs requirements, whether via a PPA or turn-key utility design-build projects.

We hope to continue to serve you as you move forward to address your energy purchase and/or facility needs.

Sincerely,

Arlen Barksdale, PhD
Physicist and Engineer
UniSol Solar, a division of Arborvitae Enterprises, LLC
in cooperation with
UCSD Jacobs School of Engineering

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Engineering Solar Feasibility Study – City of Needles

EXECUTIVE SUMMARY ABSTRACT

The goal of this solar engineering feasibility study is to analyze possible solar energy sites to supply power to the City's utility via a Power Purchase agreement or a city-owned design-build solar field. The primary focus is photovoltaic (PV) system installations as a ground-mount array on one or more of ten (10) possible sites on or near the 69KV transmission service line for the Needles Public Utility Authority utility provider.

The annual projected alternative energy requirement per the California Air Resources Board (CARB) is used to establish the minimum size project of 3 MW for efficient solar placement. Electrical services extensions required to interconnect the potential array location the existing grid were evaluated to determine the estimated interconnection cost. Other financial impacts such as the current design-build cost per MW dc as well as anticipated extraordinary civil engineering costs and land-related studies (e.g, CEQA, biological, archeological, seismic, SWPP, etc.) were considered to estimate the overall cost of the facility and its effective power purchase agreement (PPA) rate.

This analysis can be used to determine if investing in its own solar electric energy generating plant (financed via grant or bond) will meet the City's long-term goals. Additionally, a PPA with a contract-end ownership flip to the City option is explored to tailor an optimum project to the City's utility generation goals. The output of this Feasibility Study includes a detailed spreadsheet of each site analysis report on installation costs and expected PPA rates with array sizing and a conceptual one-line electrical design.

The conclusion of this study demonstrates that meaningful immediate short-term electrical power purchase savings (avoided costs) under current WAPA wholesale pricing, plus renewable energy certificates (RECs) and greenhouse gas emissions offsets (GHGs) avoided costs, is obtainable within the current municipal budget with an additional advantage of a 30 year long-term savings (avoided costs) over WAPA power purchase costs and the benefit of CARB compliance for renewable energy generation 30% goal. Additionally, an ownership flip at a significantly reduced price (e.g. scrap cost) can be obtained at contract endpoint for a PPA approach.

Engineering Solar Feasibility Study – City of Needles

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Introduction

Needles is a city in eastern San Bernardino County, California, in the Mojave Desert region of Southern California. Situated on the western banks of the Colorado River, Needles is located near the California border with Arizona and Nevada. The city is accessible via Interstate 40 and U.S. Route 95. The population was 4,959 at the 2020 census, up from 4,844 at the 2010census.

Needles was founded in May 1883 during the construction of the Atchison, Topeka and Santa Fe Railway, which originally crossed the Colorado River at Eastbridge, Arizona three miles southeast of modern Needles. Needles was named after "The Needles", a group of pinnacles in the Mohave Mountains on the Arizona side of the river.

Needles was a major stop on the historic U.S. Route 66 highway from the 1920s through the 1960s. For migrants from the Midwest Dust Bowl in the 1930s, it was the town that marked their arrival in California. The city is lined with motels and other shops from that era. Needles is now a tourism and recreation center. The city is the eastern gateway to the Mojave National Preserve, a scenic desert area.

The City of Needles has currently engaged Arborvitae Enterprises LLC through a public awarded consultation to achieve the following:

- Evaluate feasibility of ten (10) potential solar sites
- Rate these sites as to least-to-most feasible
- Estimate design build costs and PPA rates

The audit field team focused on these 10 Sites with the audit concentrating on deriving feasibility ratings for potential solar projects that can be employed to reduce costs, improve reliability and achieve CARB standards in the most economical way. Below is a map of those ten potential solar sites which are under consideration and were investigated (the corresponding information gathered and evaluated is listed in Appendix D).

Needles Community with 10 potential solar Sites under consideration:

Project Description and Analysis

Site #1 – Old treatment Plant 10 ac

Option A and B compare 3rd party PPA w/ ownership flip with Municipal bond financing with outright ownership as to PPA rates and desirability ratings:

Option A (Site 1)- This 10 ac tract is fenced and can easily be repurposed as a solar field,

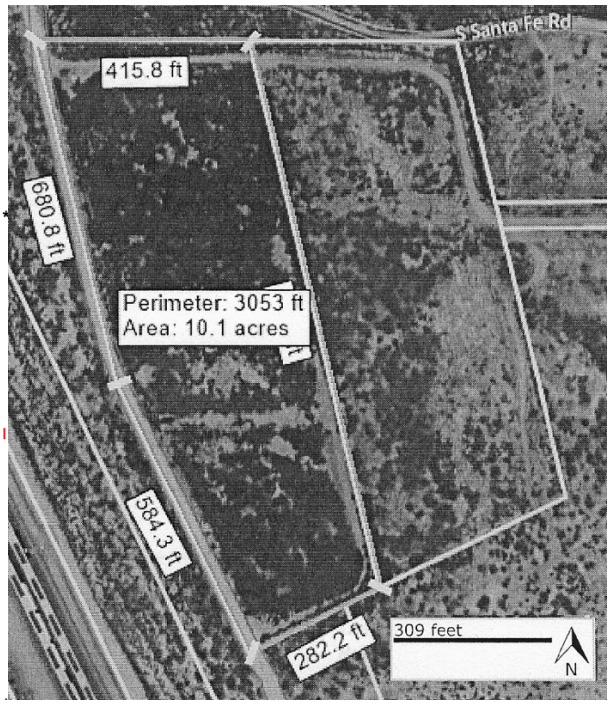
- Proposed ownership: 3rd party PPA structure with ownership flip to Needles at 30 yr
- Site Capacity: 3MW dc furnishing 2.499 MWac plate
- Production: outputting 6,894 MWhr in year 1
- Permitting: CEQA and study reports would be negligible cost
- Interconnect cost: minimal with 69kv line connection only .04 mi away
- Civil: flat already used land with negligible site prep cost
- Project estimated cost: $5,025,000
- Project effective PPA rate: $0.0518/kwhr
- Site desirability rating (scale 1 to 10): ***7.02***

Engineering site review and analysis report sheet for Site #1-A

Project Assumptions		
General		
Plate Capacity (MWac):		2.500
DC-AC derate	1.20	83.33%
Total Capacity (MWdc)		**3.00**
Annual Production Yr 1 MWhr		**6,894**
Yield kwhr/yr/kwdc	bifacial	2,298

Cash Flow Assumptions		
Revenues	1st Full year	$357,094
	Monthly	$29,757.81
Effective Price per kWh*	**30 year lease/PPA**	$0.0518
PPA escalation rate		1.50%
Expenses		31
O&AM (annual)		$35,000
Insurance w/ decrs	5%	$7,395
Utility maint fee SCE	0.0%	$0
Land Lease (plus RE tax)		$9
	tot ann exp init	$42,404
Increases by inflation-begin in year…		2
	CFADS - 1st year	$314,690
Annual Expenses Escalation (%)		1.75%

CAPEX		
EPC turnkey	1.450	$4,350,000
misc(intrcn,civil, mitig)	0	$0
Dvp, commission include	0.2250	$675,000
unallocated reserve		$0
Total project costs		**$5,025,000**
	Cost per watt	***2.010***
Construction period max (months)		10



Option B (Site 1) - This 10 ac tract is fenced and can easily be repurposed as a solar field,

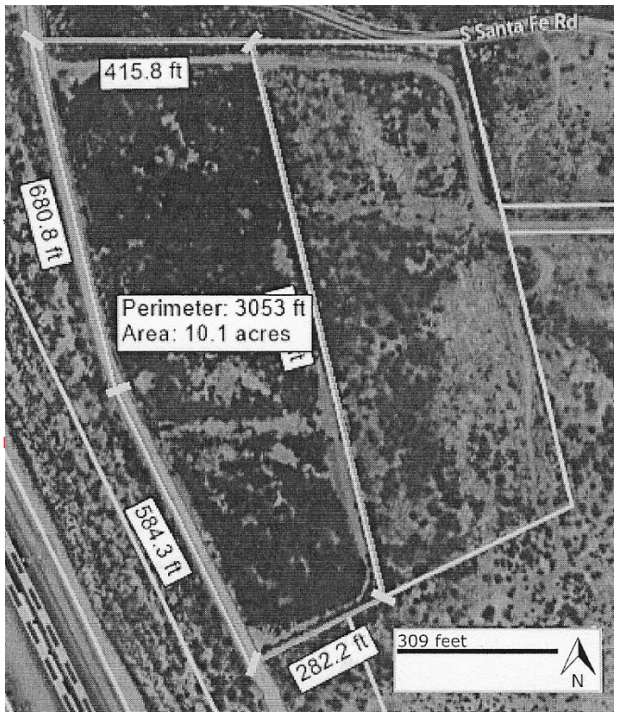
- Proposed ownership: direct Needles ownership at outset
- Site Capacity: 3MW dc furnishing 2.499 MWac plate
- Production: outputting 6,894 MWhr in year 1
- Permitting: CEQA and study reports would be negligible cost
- Interconnect cost: minimal with 69kv line connection only .04 mi away
- Civil: flat already used land with negligible site prep cost
- Project estimated cost: $5,025,000
- Project effective PPA rate: $0.0364/kwhr
- Site desirability rating (scale 1 to 10): ***10.0*** (highest)

Engineering site review and analysis report sheet for Site #1-B

Project Assumptions			
General			
Plate Capacity (MWac):			2.500
DC-AC derate		1.20	83.33%
Total Capacity (MWdc)			**3.00**
Annual Production Yr 1 MWhr			**6,894**
Yield kwhr/yr/kwdc	bifacial		2,298

Cash Flow Assumptions			
Revenues	1st Full year		$250,655
		Monthly	$20,887.91
Effective Price per kWh*	**30 year lease/PPA**		$0.0364
PPA escalation rate			1.50%
Expenses			31
O&AM (annual)			$35,000
Insurance w/ decrs	5%		$7,395
Utility maint fee SCE	0.0%		$0
Land Lease (plus RE tax)			$9
	tot ann exp init		$42,404
Increases by inflation-begin in year…			2
	CFADS - 1st year		$208,251
Annual Expenses Escalation (%)			1.75%

CAPEX		
EPC turnkey	1.450	$4,350,000
misc(intrcn,civil, mitig)	0	$0
Dvp, commission include	0.2250	$675,000
unallocated reserve		$0
Total project costs		**$5,025,000**
	Cost per watt	***2.010***
Construction period max (months)		12



Project Description and Analysis

Site #2 – Landfill near airport 120 ac

This 120 ac tract is former landfill and can easily be repurposed as a solar field,

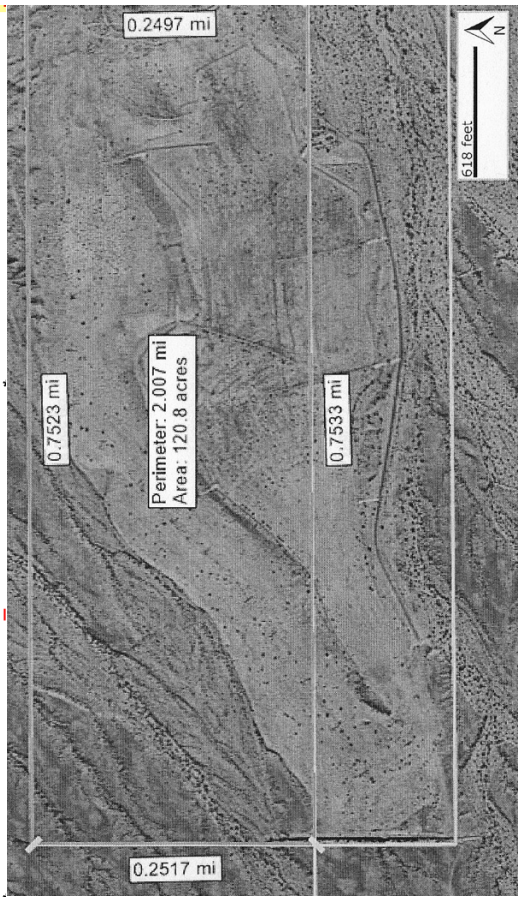
- Proposed ownership: direct Needles ownership at outset
- Site Capacity: CARB guidelines 30%: 3MW dc furnishing 2.499 MWac plate
- Production: outputting 6,894 MWhr in year 1
- Permitting: CEQA and study reports would be negligible cost
- Interconnect cost: approx. $2M with 69kv line connection 2 mi away
- Civil: flat already used land with negligible site prep cost. Question of depth of piling penetration.
- Project estimated cost: $7,125,000
- Project effective PPA rate: $0.04877/kwhr
- Site desirability rating (scale 1 to 10): ***7.46*** (moderately high)

Engineering site review and analysis report sheet for Site #2

Project Assumptions		
General		
Plate Capacity (MWac):		2.500
DC-AC derate	1.20	83.33%
Total Capacity (MWdc)		**3.00**
Annual Production Yr 1 MWhr		**6,894**
Yield kwhr/yr/kwdc	bifacial	2,298

Cash Flow Assumptions		
Revenues	1st Full year	$336,206
	Monthly	$28,017.15
Effective Price per kWh*	**30 year lease/PPA**	$0.0488
PPA escalation rate		1.50%
Expenses		31
O&AM (annual)		$35,000
Insurance w/ decrs	5%	$7,395
Utility maint fee SCE	0.0%	$0
Land Lease (plus RE tax)		$9
	tot ann exp init	$42,404
Increases by inflation-begin in year…		2
	CFADS - 1st year	$293,802
Annual Expenses Escalation (%)		1.75%

CAPEX		
EPC turnkey	1.450	$4,350,000
Interconnection	666667	$2,000,001
Dvp, commission include	0.2250	$675,000
site & civil		$100,000
Total project costs		**$7,125,001**
	Cost per watt	***2.850***
Construction period max (months)		12



Project Description and Analysis

Site #3 – PPA offer near airport 120 ac

This 120 ac tract is reasonably level and can be repurposed as a solar field,

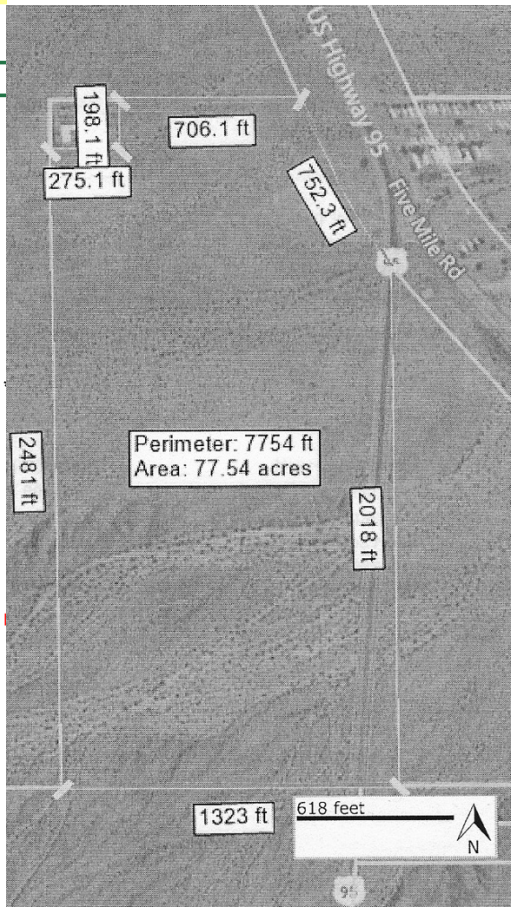
- Proposed ownership: 3rd party PPA structure with no indication yet of any ownership flip terms
- Site Capacity: CARB guidelines 30%: 3MW dc furnishing 2.499 MWac plate
- Production: outputting 6,894 MWhr in year 1
- Permitting: CEQA and study reports would be modest cost
- Interconnect cost: approx. $4M with 69kv line connection 4 mi away
- Civil: reasonably flat land with low site prep cost
- Project estimated cost: $9,050,000
- Project effective PPA rate: $0.0882/kwhr
- Site desirability rating (scale 1 to 10): ***4.12*** (moderately low)

Engineering site review and analysis report sheet for Site #3

Project Assumptions			
General			
Plate Capacity (MWac):			2.500
DC-AC derate		1.20	83.33%
Total Capacity (MWdc)			**3.00**
Annual Production Yr 1 MWhr			**6,894**
Yield kwhr/yr/kwdc	bifacial		2,298

Cash Flow Assumptions			
Revenues	1st Full year		$608,024
	Monthly	$50,668.70	
Effective Price per kWh*	**30 year lease/PPA**		$0.0882
PPA escalation rate			1.50%
Expenses			31
O&AM (annual)			$35,000
Insurance w/ decrs	5%		$7,395
Utility maint fee SCE	0.0%		$0
Land Lease (plus RE tax)			$9
	tot ann exp init		$42,404
Increases by inflation-begin in year…			2
	CFADS - 1st year		$565,620
Annual Expenses Escalation (%)			1.75%

CAPEX		
EPC turnkey	1.450	$4,350,000
Interconnection	1333334	$4,000,002
Dvp, commission include	0.2250	$675,000
site & civil		$25,000
Total project costs		**$9,050,002**
	Cost per watt	***3.620***
Construction period max (months)		12



Project Description and Analysis

Site #4 – West side 38 ac

This 38 ac tract is raw land with rolling flood wash and cannot be easily developed as a solar field,

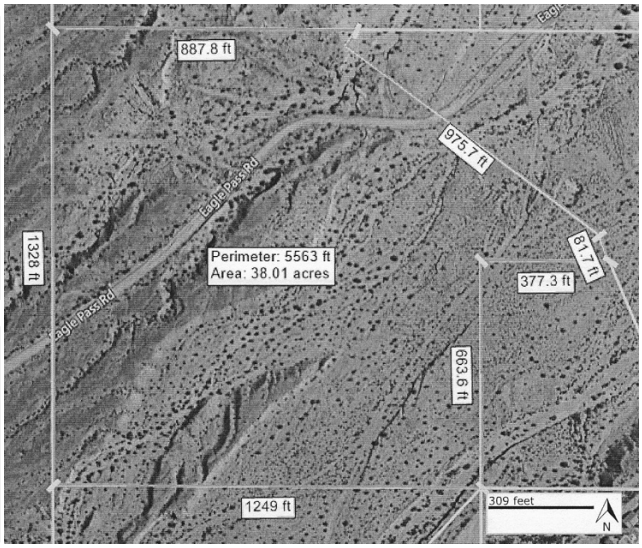
- Proposed ownership: direct Needles ownership at outset
- Site Capacity: CARB guidelines 30%: 3MW dc furnishing 2.499 MWac plate
- Production: outputting 6,894 MWhr in year 1
- Permitting: CEQA and study reports would be moderate cost
- Interconnect cost: approx. $1M with 69kv line connection 1 mi away
- Civil: raw land with rolling flood wash est $2M cost to remediate
- Project estimated cost: $8,050,000
- Project effective PPA rate: $0.05423/kwhr
- Site desirability rating (scale 1 to 10): ***6.71*** (moderate)

Engineering site review and analysis report sheet for Site #4

Project Assumptions			
General			
Plate Capacity (MWac):			2.500
DC-AC derate		1.20	83.33%
Total Capacity (MWdc)			**3.00**
Annual Production Yr 1 MWhr			**6,894**
Yield kwhr/yr/kwdc	bifacial		2,298

Cash Flow Assumptions			
Revenues	1st Full year		$373,845
		Monthly	$31,153.78
Effective Price per kWh*	**30 year lease/PPA**		$0.0542
PPA escalation rate			1.50%
Expenses			31
O&AM (annual)			$35,000
Insurance w/ decrs	5%		$7,395
Utility maint fee SCE	0.0%		$0
Land Lease (plus RE tax)			$9
	tot ann exp init		$42,404
Increases by inflation-begin in year…			2
	CFADS - 1st year		$331,441
Annual Expenses Escalation (%)			1.75%

CAPEX		
EPC turnkey	1.450	$4,350,000
Interconnection	333334	$1,000,002
Dvp, commission include	0.2250	$675,000
site & civil		$2,025,000
Total project costs		**$8,050,002**
	Cost per watt	***3.220***
Construction period max (months)		12



Project Description and Analysis

Site #5 – West side 23 ac

This 23.79 ac tract is raw land with rolling flood wash and cannot be easily developed as a solar field,

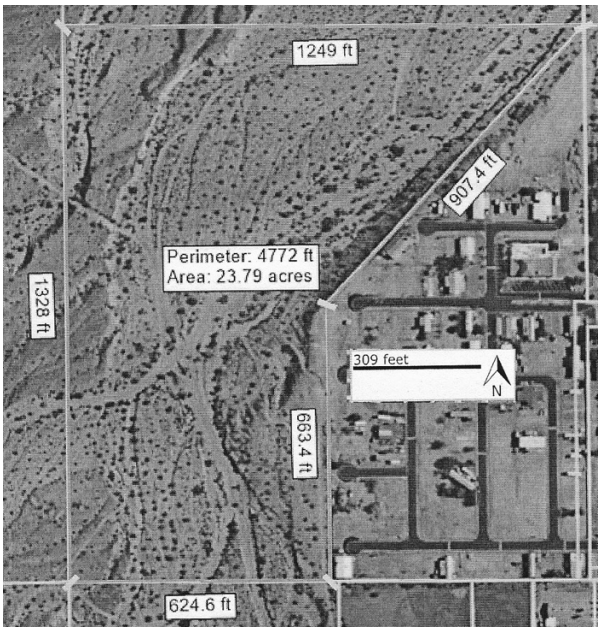
- Proposed ownership: direct Needles ownership at outset
- Site Capacity: CARB guidelines 30%: 3MW dc furnishing 2.499 MWac plate
- Production: outputting 6,894 MWhr in year 1
- Permitting: CEQA and study reports would be moderate cost
- Interconnect cost: approx. $1M with 69kv line connection 1 mi away
- Civil: raw land with rolling flood wash est $2M cost to remediate
- Project estimated cost: $8,050,000
- Project effective PPA rate: $0.05422/kwhr
- Site desirability rating (scale 1 to 10): ***6.71*** (moderate)

Engineering site review and analysis report sheet for Site #5

Project Assumptions			
General			
Plate Capacity (MWac):			2.500
DC-AC derate		1.20	83.33%
Total Capacity (MWdc)			**3.00**
Annual Production Yr 1 MWhr			**6,894**
Yield kwhr/yr/kwdc	bifacial		2,298

Cash Flow Assumptions			
Revenues	1st Full year		$373,776
		Monthly	$31,148.03
Effective Price per kWh*	**30 year lease/PPA**		$0.0542
PPA escalation rate			1.50%
Expenses			31
O&AM (annual)			$35,000
Insurance w/ decrs	5%		$7,395
Utility maint fee SCE	0.0%		$0
Land Lease (plus RE tax)			$9
	tot ann exp init		$42,404
Increases by inflation-begin in year…			2
	CFADS - 1st year		$331,372
Annual Expenses Escalation (%)			1.75%

CAPEX		
EPC turnkey	1.450	$4,350,000
Interconnection	333334	$1,000,002
Dvp, commission include	0.2250	$675,000
site & civil		$2,025,000
Total project costs		**$8,050,002**
	Cost per watt	***3.220***
Construction period max (months)		12



Project Description and Analysis

Site #6 – SW corner off residential 25 ac

This 24.91 ac tract is raw land with rolling flood wash with small acreage usable as a solar field,

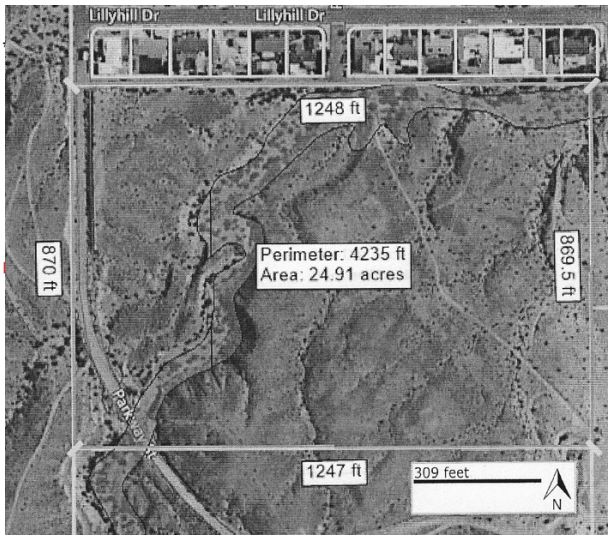
- Proposed ownership: direct Needles ownership at outset
- Site Capacity: CARB guidelines 30%: 3MW dc furnishing 2.499 MWac plate
- Production: outputting 6,894 MWhr in year 1
- Permitting: CEQA and study reports would be moderate cost appr $35K
- Interconnect cost: approx. $1M with 69kv line connection 1 mi away
- Civil: raw land with rolling flood wash but some flat est $100K cost to remediate
- Project estimated cost: $6,160,000
- Project effective PPA rate: $0.0431/kwhr
- Site desirability rating (scale 1 to 10): ***8.44*** (high)

Engineering site review and analysis report sheet for Site #6

Project Assumptions			
General			
Plate Capacity (MWac):			2.500
DC-AC derate		1.20	83.33%
Total Capacity (MWdc)			**3.00**
Annual Production Yr 1 MWhr			**6,894**
Yield kwhr/yr/kwdc	bifacial		2,298

Cash Flow Assumptions			
Revenues	1st Full year		$296,912
		Monthly	$24,742.64
Effective Price per kWh*	**30 year lease/PPA**		$0.0431
PPA escalation rate			1.50%
Expenses			31
O&AM (annual)			$35,000
Insurance w/ decrs	5%		$7,395
Utility maint fee SCE	0.0%		$0
Land Lease (plus RE tax)			$9
	tot ann exp init		$42,404
Increases by inflation-begin in year…			2
	CFADS - 1st year		$254,508
Annual Expenses Escalation (%)			1.75%

CAPEX		
EPC turnkey	1.450	$4,350,000
Interconnection	333333.4	$1,000,000
Dvp, commission include	0.2250	$675,000
site & civil		$135,000
Total project costs		**$6,160,000**
	Cost per watt	***2.464***
Construction period max (months)		12



Project Description and Analysis

Site #7 – Switch Station 2 ac

This 2 ac tract is clean flat land within switch yard premises- small acreage usable as a small solar field,

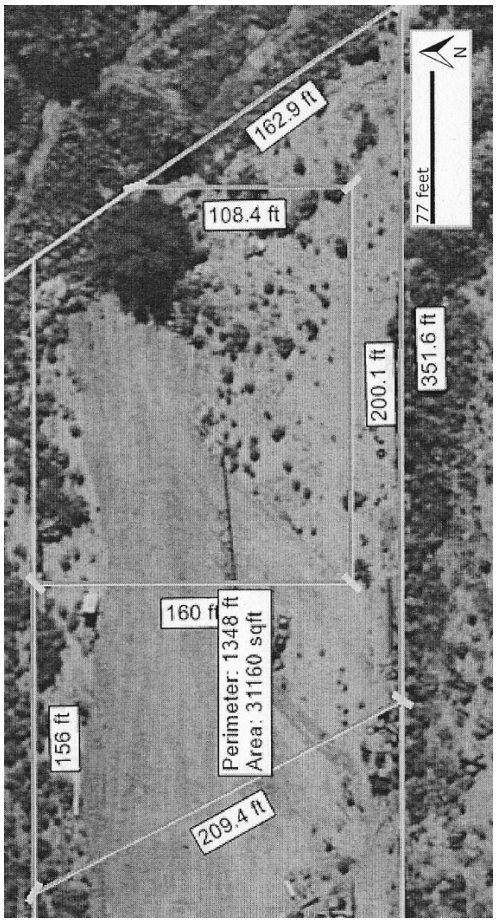
- Proposed ownership: direct Needles ownership at outset (some BLM overlap to resolve)
- Site Capacity: 500kw dc furnishing 417 KWac plate
- Production: outputting 1149 MWhr in year 1 (small operation may not be worth the effort)
- Permitting: CEQA and study reports would be minimal to no cost
- Interconnect cost: approx. negligible with 69kv line connection on site apprx $50k
- Civil: flat developed commercial utility company switch yard land – minimal to no cost
- Project estimated cost: $887,500
- Project effective PPA rate: $0.06575/kwhr
- Site desirability rating (scale 1 to 10): ***5.53*** (moderate)

Engineering site review and analysis report sheet for Site #7

Project Assumptions			
General			
Plate Capacity (MWac):			0.417
DC-AC derate		1.20	83.33%
Total Capacity (MWdc)			**0.50**
Annual Production Yr 1 MWhr			**1,149**
Yield kwhr/yr/kwdc	bifacial		2,298

Cash Flow Assumptions			
Revenues	1st Full year		$75,543
		Monthly	$6,295.29
Effective Price per kWh*	**30 year lease/PPA**		$0.0658
PPA escalation rate			1.50%
Expenses			31
O&AM (annual)			$35,000
Insurance w/ decrs	5%		$1,233
Utility maint fee SCE	0.0%		$0
Land Lease (plus RE tax)			$2
	tot ann exp init		$36,234
Increases by inflation-begin in year…			2
	CFADS - 1st year		$39,309
Annual Expenses Escalation (%)			1.75%

CAPEX		
EPC turnkey	1.450	$725,000
Interconnection	100000	$50,000
Dvp, commission include	0.2250	$112,500
site & civil		$0
Total project costs		**$887,500**
	Cost per watt	***2.130***
Construction period max (months)		6



Project Description and Analysis

Site #8 – Near new treatment plant 4 ac

This 3.589 ac tract is raw land with small acreage usable as a solar field,

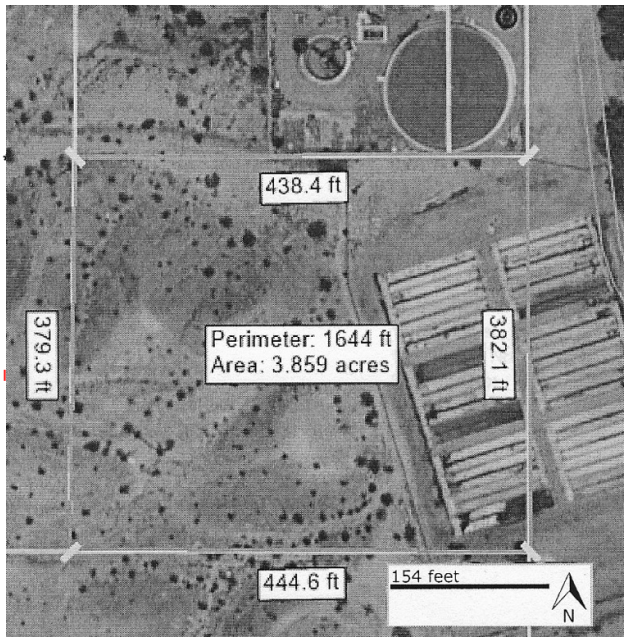
- Proposed ownership: direct Needles ownership at outset
- Site Capacity: 2MW dc furnishing 1.667 MWac plate
- Production: outputting 4,596 MWhr in year 1
- Permitting: CEQA and study reports would be moderate cost
- Interconnect cost: approx. $150K with 69kv line connection nearby
- Civil: raw land est $117K cost to remediate
- Project estimated cost: $3,617,000
- Project effective PPA rate: $0.1015/kwhr
- Site desirability rating (scale 1 to 10): ***3.58*** (low)

Engineering site review and analysis report sheet for Site #8

Project Assumptions		
General		
Plate Capacity (MWac):		1.667
DC-AC derate	1.20	83.33%
Total Capacity (MWdc)		**2.00**
Annual Production Yr 1 MWhr		**4,596**
Yield kwhr/yr/kwdc	bifacial	2,298

Cash Flow Assumptions		
Revenues	1st Full year	$190,680
	Monthly	$15,889.98
Effective Price per kWh*	**30 year lease/PPA**	$0.0415
PPA escalation rate		1.50%
Expenses		31
O&AM (annual)		$35,000
Insurance w/ decrs	5%	$4,930
Utility maint fee SCE	0.0%	$0
Land Lease (plus RE tax)		$6
	tot ann exp init	$39,936
Increases by inflation-begin in year…		2
	CFADS - 1st year	$150,744
Annual Expenses Escalation (%)		1.75%

CAPEX		
EPC turnkey	1.450	$2,900,000
Interconnection	75000	$150,000
Dvp, commission include	0.2250	$450,000
site & civil		$117,000
Total project costs		**$3,617,000**
	Cost per watt	***2.170***
Construction period max (months)		7



Project Description and Analysis

Site #9 – Old ice plant near RR 50 ac

This 50 ac tract is rough land, some heavily treed, some steep slopes, with only small acreage usable as a solar field,

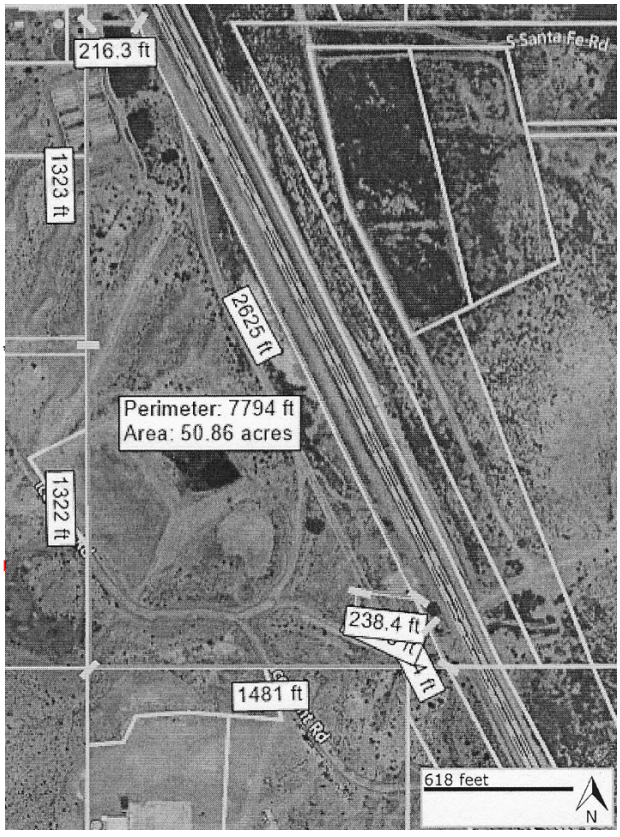
- Proposed ownership: direct Needles ownership at outset
- Site Capacity: 1MW dc furnishing 833 KWac plate
- Production: outputting 2298 MWhr in year 1
- Permitting: CEQA and study reports would be moderate cost as repurposed commercial
- Interconnect cost: approx. $375K with 69kv line connection nearby up the hill
- Civil: rough land est $117K cost to remediate
- Project estimated cost: $2,167,000
- Project effective PPA rate: $0.0561/kwhr
- Site desirability rating (scale 1 to 10): ***6.48*** (moderate)

Engineering site review and analysis report sheet for Site #9

Project Assumptions		
General		
Plate Capacity (MWac):		0.833
DC-AC derate	1.20	83.33%
Total Capacity (MWdc)		**1.00**
Annual Production Yr 1 MWhr		**2,298**
Yield kwhr/yr/kwdc	bifacial	2,298

Cash Flow Assumptions		
Revenues	1st Full year	$128,958
	Monthly	$10,746.51
Effective Price per kWh*	**30 year lease/PPA**	$0.0561
PPA escalation rate		1.50%
Expenses		31
O&AM (annual)		$35,000
Insurance w/ decrs	5%	$2,465
Utility maint fee SCE	0.0%	$0
Land Lease (plus RE tax)		$3
	tot ann exp init	$37,468
Increases by inflation-begin in year…		2
	CFADS - 1st year	$91,490
Annual Expenses Escalation (%)		1.75%

CAPEX		
EPC turnkey	1.450	$1,450,000
Interconnection	375000	$375,000
Dvp, commission include	0.2250	$225,000
site & civil		$117,000
Total project costs		**$2,167,000**
	Cost per watt	***2.600***
Construction period max (months)		12



Project Description and Analysis

Site #10 – Bureau reclamation land 14 ac

This 13.75 ac tract is commercial BOR land flat acreage all usable as a solar field,

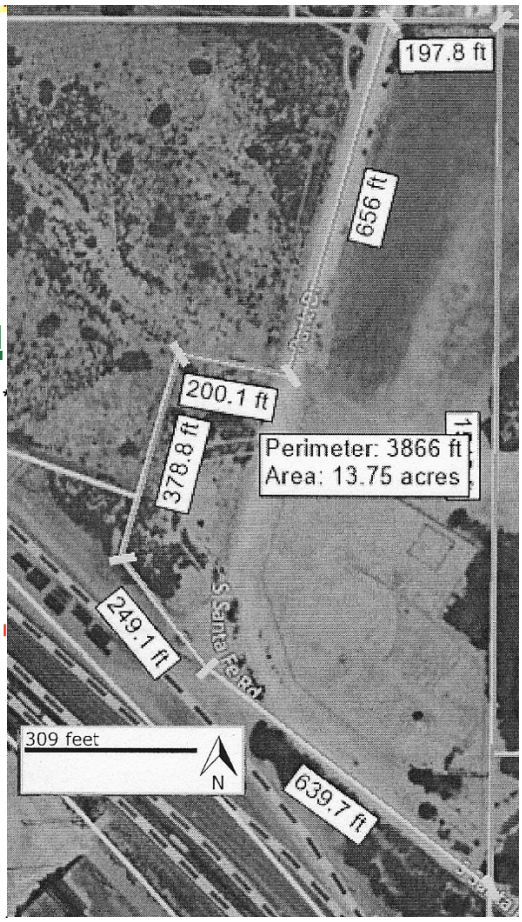
- Proposed ownership: direct Needles ownership at outset (requires arrangement with BOR)
- Site Capacity: CARB guidelines 30%: 3MW dc furnishing 2.499 MWac plate
- Production: outputting 6,894 MWhr in year 1
- Permitting: CEQA and study reports should be negligible as repurposing commercially used cleared land approx. $17K
- Interconnect cost: approx. $150K with 69kv line connection across rail road
- Civil: raw land all flat and usable est $100K cost to clean up stored gravel and rock piles
- Project estimated cost: $5,292,000
- Project effective PPA rate: $0.0379/kwhr
- Site desirability rating (scale 1 to 10): ***9.58*** (very high)

Engineering site review and analysis report sheet for Site #10

Project Assumptions		
General		
Plate Capacity (MWac):		2.500
DC-AC derate	1.20	83.33%
Total Capacity (MWdc)		**3.00**
Annual Production Yr 1 MWhr		**6,894**
Yield kwhr/yr/kwdc	bifacial	2,298

Cash Flow Assumptions		
Revenues	1st Full year	$261,547
	Monthly	$21,795.58
Effective Price per kWh*	**30 year lease/PPA**	$0.0379
PPA escalation rate		1.50%
Expenses		31
O&AM (annual)		$35,000
Insurance w/ decrs	5%	$7,395
Utility maint fee SCE	0.0%	$0
Land Lease (plus RE tax)		$9
	tot ann exp init	$42,404
Increases by inflation-begin in year…		2
	CFADS - 1st year	$219,143
Annual Expenses Escalation (%)		1.75%

CAPEX		
EPC turnkey	1.450	$4,350,000
Interconnection	50000	$150,000
Dvp, commission include	0.2250	$675,000
site & civil		$117,000
Total project costs		**$5,292,000**
	Cost per watt	***2.117***
Construction period max (months)		12



Engineering Solar Feasibility Study – City of Needles

Summary & Conclusions

The goal of this feasibility study was to analyze ten (10) site locations for potential photovoltaic (PV) electrical generation systems for direct consumption by City of Needles Public Utility Authority and compute avoided costs.

Location Summary: The designated potential locations on various sites in and about Needles, San Bernardino County, California were evaluated for cost of installation including costs of design-build, interconnection, site preparation, studies for permitting and the expected effective power purchase costs per kwhr. The results were tabulated and rated as to desirability on a scale of 1 to 10, with 10 being the best. See individual project descriptions above and detail of the data compilation on the relevant sites in Appendix D. A summary of the key data is tabulated below in Table 1. Of note is that approximately five of the ten Sites rated 7 or above which are potentially desirable locations for a utility-owned solar electric generation plant that would satisfy the coming CARB requirements for 30% renewable mix in the utility's community power needs.

Table 1 Site Summary

City of Needles Potential Solar Sites Analysis

item	description	land size	location: lat-long	Total estim project cost	probable financing	net effective PPA rate cost incl infrastucture	Comparative Desirablity Rating - 0-10 (10 best)
1-b	old treatment plant	10 ac	34.82820 N -114.58794 W	$ 5,025,001	city bond	0.03636	10.00
10	BOR land	14 ac	34.83512 N -114.59254 W	$ 5,292,000	city bond	0.03794	9.58
6	SW corner off residential	25 ac	34.82703 N -114.62482 W	$ 5,660,000	city bond	0.04307	8.44
2	landfill near airport	120 ac	34.79494 N -114.61343 W	$ 7,125,000	city bond	0.04877	7.46
1-a	old treatment plant	10 ac	34.82820 N -114.58794 W	$ 5,025,000	PPA	0.0518	7.02
5	west side	23 ac	34.83342 N -114.62757 W	$ 8,050,000	city bond	0.05422	6.71
4	west side	35 ac	34.84189 N -114.62461 W	$ 8,050,000	city bond	0.05423	6.71
9	old ice plant by RR	50 ac	34.82687 N -114.59047 W	$ 2,167,000	city bond	0.05612	6.48
7	switch station	2-3 ac	34.8569 N -114.62501 W	$ 887,500	city bond	0.06575	5.53
3	PPA offer by airport Hwy 95	25 ac mol	34.76761 N -114.60018 W	$ 9,050,000	PPA	0.0882	4.12
8	near new trtmt plant	4ac	34.8286 N -114.59276 W	$ 3,617,000	city bond	0.1015	3.58

Avoided Costs (savings) summary:

a) **From reduced PPA costs:** Note that a preponderance of the Sites could produce power for the municipal utility below the current WAPA wholesale price creating a near-term savings, and with the savings amortized over a 30 year lifespan of the alternative energy plant, a further avoided cost advantage of some **$15,891,866** is obtainable. An additional advantage is an emergency reliability backup of at least 30% of the demand load in the event of outages from WAPA deliveries of electricity due to natural or man-made disasters.

b) **From reduced REC purchases:** The utility is currently purchasing 50,000 RECs (renewable energy certificates 1 REC = 1 mwhr retail power usage) annually to satisfy statutory Renewable Portfolio Standards (RPS) requirements (AB2514 Public Owned Utility responsibility and CA Pub Util Code Sec 399.11 et seq.) from a 3rd party (3Degrees Group, Inc.) to compensate for non-renewable generation at $412,500 cost per year ($8.25/REC currently in a 10 year contract). With the installation of 3 MW solar power generation (producing some 6894 RECs per year or 192,494 over 30 yr), the utility will benefit an additional minimum avoided costs of **$2,476,556** over the initial 30 year operation cycle of the generating facility.

c) **From reduced GHG purchases:** Additionally, the Needles Public Utility Authority currently has mandatory GHG (greenhouse gas emissions – carbon dioxide) reporting requirements as an Electric Power Entity (EPE) under AB-32 (GHG reporting). The current annual CO2e source includes power imports e-tagged from WAPA (Western Area Power Administration) delivery point of 23,130.26 metric tons as verified by WZI Inc. (independent 3rd party consultant in conformance with AB-104462). Accounting for a 30% free allowance, the net 70% responsibility for the utility computes to 15,491.18 metric tons. Currently the annual bill payment requirement to purchase offsetting DEBs (Direct Environmental Benefits) stands at $1.138M, paid in triannual installments. With the installation of 3 MW solar power generation (producing some 30% of power purchases, the conservative estimate of annual GHG savings is $ 341,400 in year1). In sum the additional avoided costs for GHG reduced emissions over the 30 year life cycle of the solar generating plant at a 2.5% CPI is approximately $**14,970.922**.

d) **Total avoided costs:** Appendix C summarizes all of the avoided costs totaling some **$ 33,339,243** with the development and operation of its own renewable energy generating plant. Note that with a proposed 3MW solar plant costing about $5,025,000 that the avoided costs alone pay back this capital expense in 7 years.

APPENDICES

Attached as:

A. Award Letter
B. Solar Meteo and Production Analysis
C. Calculation of Avoided Cost
D. Needles Solar Site Data Analysis Chart
E. Base Line Assumptions
F. Arborvitae Company Info
G. Resume of Key Staff
H. Certification

Appendix A

Award Letter

City of Needles
817 Third Street, Needles, California 92363
(760) 326-2113 • FAX (760) 326-6765
www.cityofneedles.com

April 12, 2024

Arborvitae Enterprises, LLC
1968 Circle Park
Encinitas, CA 92024

Attn: Arlen Barksdale

RE: **AWARD of the SOLAR PHOTOVOLTAIC FEASIBILITY STUDY**

Congratulations !!!, Arborvitae Enterprises. you have been awarded as the low bidder for the above-mentioned RFP and approved at the **04/09/2024** City Council Meeting.

I have attached the Professional Services Agreement for the project. Please print out and sign page 12 attached. If you could please scan and/or **return only the signature page 12 identified in the document** that would be great. Once the City signs all documents, I will send you a complete original copy. A Meeting will be scheduled, please send availability dates in order to set up a goals meeting.

Other documents to submit:

- Insurance required.
- Business License application

Should you have any questions, please give me a call at (760) 326-5740 Ext. 130 all documents can be forwarded to Tammy Ellmore at tellmore@cityofneedles.com

Thank you again for your participation in our RFP.

Rainie Torrance
Utilities Manager
(760) 326-5740 x 140
rtorrance@cityofneedles.com

Appendix B

Data Analysis Detail

TECHNICAL: Meteorological and Production data

Climate data for Needles Airport, California (1991–2020 normals,[a] extremes 1888–present) [hide]													
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Record high °F (°C)	85 (29)	92 (33)	99 (37)	107 (42)	118 (48)	125 (52)	125 (52)	123 (51)	120 (49)	112 (44)	92 (33)	83 (28)	125 (52)
Mean maximum °F (°C)	75.4 (24.1)	80.7 (27.1)	91.3 (32.9)	100.8 (38.2)	108.0 (42.2)	115.6 (46.4)	118.4 (48.0)	116.7 (47.1)	111.5 (44.2)	101.3 (38.5)	87.4 (30.8)	74.6 (23.7)	119.6 (48.7)
Mean daily maximum °F (°C)	66.4 (19.1)	71.0 (21.7)	79.1 (26.2)	86.6 (30.3)	96.2 (35.7)	106.4 (41.3)	110.5 (43.6)	109.3 (42.9)	102.6 (39.2)	89.5 (31.9)	75.1 (23.9)	64.5 (18.1)	88.1 (31.2)
Daily mean °F (°C)	56.2 (13.4)	59.9 (15.5)	66.6 (19.2)	73.7 (23.2)	83.1 (28.4)	93.0 (33.9)	98.5 (36.9)	97.4 (36.3)	90.0 (32.2)	77.0 (25.0)	63.8 (17.7)	54.7 (12.6)	76.2 (24.6)
Mean daily minimum °F (°C)	46.0 (7.8)	48.8 (9.3)	54.1 (12.3)	60.8 (16.0)	70.0 (21.1)	79.6 (26.4)	86.6 (30.3)	85.4 (29.7)	77.3 (25.2)	64.6 (18.1)	52.5 (11.4)	45.0 (7.2)	64.2 (17.9)
Mean minimum °F (°C)	34.0 (1.1)	37.1 (2.8)	41.9 (5.5)	48.6 (9.2)	56.5 (13.6)	66.2 (19.0)	75.6 (24.2)	74.9 (23.8)	65.0 (18.3)	51.5 (10.8)	39.7 (4.3)	33.4 (0.8)	31.8 (−0.1)
Record low °F (°C)	18 (−8)	22 (−6)	29 (−2)	33 (1)	39 (4)	46 (8)	57 (14)	60 (16)	40 (4)	34 (1)	25 (−4)	20 (−7)	18 (−8)
Average precipitation inches (mm)	0.73 (19)	0.79 (20)	0.51 (13)	0.18 (4.6)	0.07 (1.8)	0.04 (1.0)	0.27 (6.9)	0.39 (9.9)	0.34 (8.6)	0.22 (5.6)	0.34 (8.6)	0.44 (11)	4.32 (110)
Average precipitation days (≥ 0.01 in)	3.3	3.7	2.9	1.3	0.7	0.3	1.8	1.9	1.8	1.6	1.5	2.3	23.1
Mean monthly sunshine hours	248	254.3	310	360	403	420	403	372	330	310	240	248	3,898.3
Mean daily sunshine hours	8	9	10	12	13	14	13	12	11	10	8	8	11
Percent possible sunshine	79	82	83	92	93	97	92	90	89	88	78	81	87
Average ultraviolet index	3	4	6	8	9	10	11	10	8	5	4	2	7
Source 1: NOAA[16][17] WRCC[19]													
Source 2: Weather Atlas (sun and uv)[20]													

SYSTEM INFO

Modify the inputs below to run the simulation.

DC System Size (kW):	3000
Module Type:	Standard
Array Type:	1-Axis Tracking
System Losses (%):	9.58
Tilt (deg):	0
Azimuth (deg):	180

PVWatts® Calculator

NREL NATIONAL RENEWABLE ENERGY LABORATORY

My Location | NEEDLES CA » Change Location | English Español Українська | HELP | FEEDBACK

RESOURCE DATA | SYSTEM INFO | RESULTS

Go to system info

RESULTS

Print Results

6,893,607 kWh/Year*

System output may range from 6,502,739 to 7,102,483 kWh per year near this location.
Click HERE for more information.

Month	Solar Radiation (kWh / m^2 / day)	AC Energy (kWh)
January	4.69	371,413
February	5.95	423,790
March	7.81	596,675
April	9.66	701,041
May	10.77	785,561
June	11.40	786,483
July	9.97	705,768
August	9.69	689,456
September	8.71	616,335
October	6.71	506,598
November	4.94	372,725
December	4.20	337,762
Annual	7.88	6,893,607

Location and Station Identification

Requested Location	NEEDLES CA
Weather Data Source	Lat, Lng: 34.85, -114.62 1.2 mi
Latitude	34.85° N
Longitude	114.62° W

PV System Specifications

DC System Size	3000 kW
Module Type	Premium
Array Type	1-Axis Tracking
System Losses	9.58%
Array Tilt	0°
Array Azimuth	180°
DC to AC Size Ratio	1.2
Inverter Efficiency	96%
Ground Coverage Ratio	0.4
Albedo	*From weather file*
Bifacial	Yes (0.7)
Monthly Irradiance Loss	Jan 0% Feb 0% Mar 0% Apr 0% May 0% June 0% July 0% Aug 0% Sept 0% Oct 0% Nov 0% Dec 0%
Ground Coverage Ratio	0.4

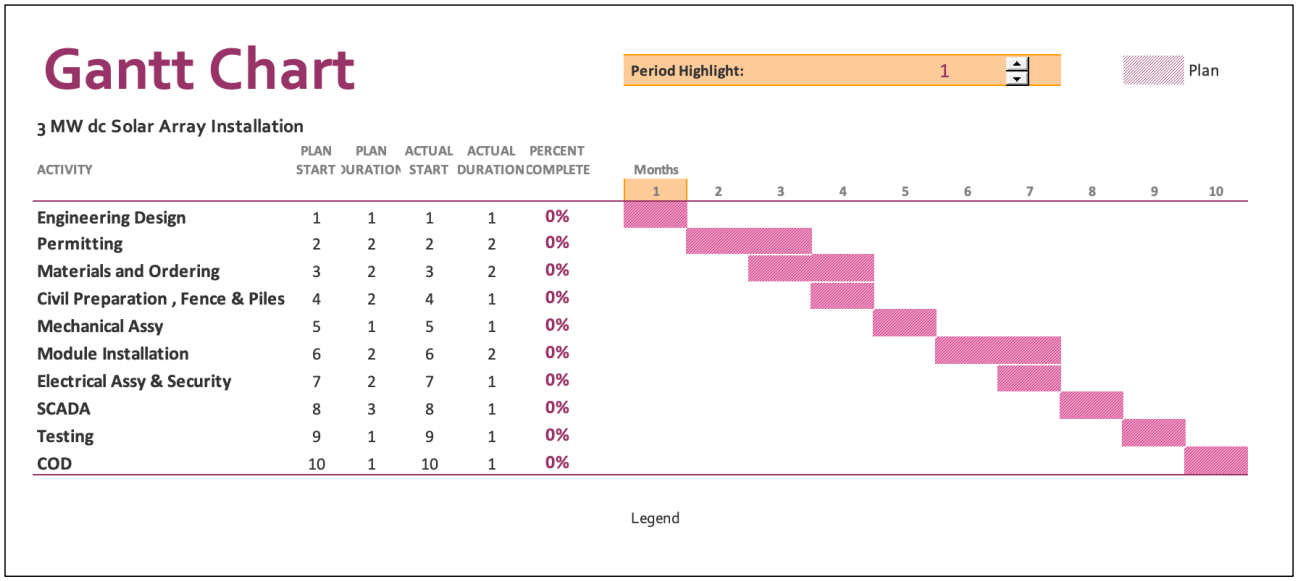
Performance Metrics

DC Capacity Factor	26.2%

Givens: single axis tracker, bifacial solar modules, and azimuth 180 deg (south).

Calculation for Yield: = 6,642,891 kwhr/yr / 3MWdc solar array = **2297.9 kwhr/kwdcp** installed. Calculations include compensating for random shadowing, slight variations in tilt and direction, and electrical line losses. This yield number is used in the financial modeling for each site to obtain build-design cost and effective 30 year PPA rate for comparisons with standardized variables.

Project Schedule (TIMELINE GUIDANCE): The Engineering, Procurement and Construction (EPC) timeline for design-build approximately covers 10 months following Notice to Proceed with an anticipated schedule below:



COST guidance:

Due to the government administration effecting tariffs against imports of silicon solar panels, aluminum and steel, there is a current cost driver of commodities to the upside:

CHART OF COMMODITIES AFFECTED:

- Aluminum
- Copper
- Steel
- Silicon

Comment on incentives:

- Federal tax credit (ITC) is currently 30%, decreasing thereafter.
- Although depreciation may be taken all in year 1, we utilize a 6 year MACRS model.
- The depreciation is diminished by ½ of the ITC (15%), so the effective depreciation is 85% of the EPC (engineering, procurement, construction) costs.
- The new tax law commercial federal tax rate of 20% is applied.
- The ITC will also apply to the battery charging systems powered by solar.
- Certain Municipal financial repayment structures can be taken as tax exempt but at the sacrifice of the ITC and depreciation.

Appendix C

Calculations of Avoided Costs

Needles PUA Stack-Up

AVOIDED LIFETIME COSTS and VALUE ADDED:

Avoided PPA WAPA purchases	$15,891,866
Avoided future RECs purchases	$ 2,476,576
Avoided GHG DEBs purchases	$14,970,822
	$33,339,243

Needles Owned 3 MW project - Avoided Costs (30 years)

year	solar production kwhr/yr	WAPA purch cost per kwhr	WAPA annual cost of this solar production	Utility owned Bond Cost per yr	Utility owned Bond Cost per kwhr	Avoided cost of power purchasing	Avoided costs of RECs purch	Avoided costs of GHG cap-trade purch	Total avoided costs per year	Cummulative savings/ avoided costs
1	6,893,607	$ 0.0800	$ 551,489	$ 270,774	$ 0.0393	$ 280,715	$ 56,872	$ 341,000	$ 678,587	$ 678,587
2	6,890,160	$ 0.0820	$ 564,993	$ 270,774	$ 0.0393	$ 294,219	$ 58,265	$ 349,525	$ 702,009	$ 1,380,596
3	6,886,715	$ 0.0841	$ 578,828	$ 270,774	$ 0.0393	$ 308,054	$ 59,692	$ 358,263	$ 726,009	$ 2,106,605
4	6,883,272	$ 0.0862	$ 593,002	$ 270,774	$ 0.0393	$ 322,228	$ 61,153	$ 367,220	$ 750,602	$ 2,857,207
5	6,879,830	$ 0.0883	$ 607,524	$ 270,774	$ 0.0394	$ 336,750	$ 62,651	$ 376,400	$ 775,801	$ 3,633,007
6	6,876,390	$ 0.0905	$ 622,400	$ 270,774	$ 0.0394	$ 351,626	$ 64,185	$ 385,810	$ 801,622	$ 4,434,629
7	6,872,952	$ 0.0928	$ 637,641	$ 270,774	$ 0.0394	$ 366,867	$ 65,757	$ 395,455	$ 828,080	$ 5,262,708
8	6,869,516	$ 0.0951	$ 653,256	$ 270,774	$ 0.0394	$ 382,482	$ 67,367	$ 405,342	$ 855,190	$ 6,117,899
9	6,866,081	$ 0.0975	$ 669,252	$ 270,774	$ 0.0394	$ 398,478	$ 69,017	$ 415,475	$ 882,970	$ 7,000,869
10	6,862,648	$ 0.0999	$ 685,641	$ 270,774	$ 0.0395	$ 414,867	$ 70,707	$ 425,862	$ 911,435	$ 7,912,305
11	6,859,216	$ 0.1024	$ 702,430	$ 270,774	$ 0.0395	$ 431,656	$ 72,438	$ 436,509	$ 940,603	$ 8,852,908
12	6,855,787	$ 0.1050	$ 719,631	$ 270,774	$ 0.0395	$ 448,857	$ 74,212	$ 447,422	$ 970,490	$ 9,823,398
13	6,852,359	$ 0.1076	$ 737,253	$ 270,774	$ 0.0395	$ 466,479	$ 76,029	$ 458,607	$ 1,001,115	$ 10,824,513
14	6,848,933	$ 0.1103	$ 755,306	$ 270,774	$ 0.0395	$ 484,532	$ 77,891	$ 470,072	$ 1,032,496	$ 11,857,009
15	6,845,508	$ 0.1130	$ 773,802	$ 270,774	$ 0.0396	$ 503,028	$ 79,798	$ 481,824	$ 1,064,650	$ 12,921,659
16	6,842,086	$ 0.1159	$ 792,750	$ 270,774	$ 0.0396	$ 521,976	$ 81,752	$ 493,870	$ 1,097,598	$ 14,019,258
17	6,838,664	$ 0.1188	$ 812,163	$ 270,774	$ 0.0396	$ 541,389	$ 83,754	$ 506,216	$ 1,131,360	$ 15,150,617
18	6,835,245	$ 0.1217	$ 832,051	$ 270,774	$ 0.0396	$ 561,277	$ 85,805	$ 518,872	$ 1,165,954	$ 16,316,571
19	6,831,828	$ 0.1248	$ 852,426	$ 270,774	$ 0.0396	$ 581,652	$ 87,906	$ 531,844	$ 1,201,402	$ 17,517,973
20	6,828,412	$ 0.1279	$ 873,299	$ 270,774	$ 0.0397	$ 602,525	$ 90,059	$ 545,140	$ 1,237,724	$ 18,755,697
21	6,824,997	$ 0.1311	$ 894,684	$ 270,774	$ 0.0397	$ 623,910	$ 92,264	$ 558,768	$ 1,274,943	$ 20,030,639
22	6,821,585	$ 0.1344	$ 916,593	$ 270,774	$ 0.0397	$ 645,819	$ 94,524	$ 572,737	$ 1,313,080	$ 21,343,719
23	6,818,174	$ 0.1377	$ 939,038	$ 270,774	$ 0.0397	$ 668,264	$ 96,838	$ 587,056	$ 1,352,158	$ 22,695,877
24	6,814,765	$ 0.1412	$ 962,033	$ 270,774	$ 0.0397	$ 691,259	$ 99,210	$ 601,732	$ 1,392,200	$ 24,088,078
25	6,811,358	$ 0.1447	$ 985,590	$ 270,774	$ 0.0398	$ 714,816	$ 101,639	$ 616,776	$ 1,433,231	$ 25,521,309
26	6,807,952	$ 0.1483	$ 1,009,725	$ 270,774	$ 0.0398	$ 738,951	$ 104,128	$ 632,195	$ 1,475,274	$ 26,996,582
27	6,804,548	$ 0.1520	$ 1,034,451	$ 270,774	$ 0.0398	$ 763,677	$ 106,678	$ 648,000	$ 1,518,354	$ 28,514,937
28	6,801,146	$ 0.1558	$ 1,059,782	$ 270,774	$ 0.0398	$ 789,008	$ 109,290	$ 664,200	$ 1,562,498	$ 30,077,434
29	6,797,745	$ 0.1597	$ 1,085,733	$ 270,774	$ 0.0398	$ 814,959	$ 111,966	$ 680,805	$ 1,607,730	$ 31,685,164
30	6,794,346	$ 0.1637	$ 1,112,320	$ 270,774	$ 0.0399	$ 841,546	$ 114,708	$ 697,825	$ 1,654,079	$ 33,339,243
	205,315,824		$ 24,015,086	$8,123,220		$15,891,866	$ 2,476,556	$14,970,822	$33,339,243	cksum

solar panel degradation	0.05%
WAPA CPI escl	2.50%
bond amount	$5,025,000
bond interest rate	3.50%
bond term	30 yr
initial REC price	$8.25

If PPA approach is preferable over bond financing, using the EPC guidance costs from Appendix E, it appears for Site 1-A a 30 year PPA rate of $0.0518/kwhr (initially) would result in a favorable investor IRR (internal rate of return) of 8.29% from a current project cost of $5,025,000 which should provide a financially viable opportunity for typical investor/lender. The PPA model reduces Needles risk and indebtedness and still provides a significant avoided costs over WAPA/REC/GHG expenses. See model below for assumptions rollout for PPA calculation and estimated project costs (Site 1-A exemplar):

unisol SOLAR ENERGY SOLUTIONS

strictly confidential for UniSol use only and none other

Ground Mount tracking 1X

Pro-Forma Estimates

ESTIMATE subject to revision

(scalable model)

MW dcp in bundle= 3

Indicative Solar Financial Modeling

Project Name: Needles I

Project Location: Needles, CA

Start Year Construction 2024

Commissioning Year 2025

Project Assumptions

General		
Plate Capacity (MWac):		2.500
DC-AC derate	1.20	83.33%
Total Capacity (MWdc)		**3.00**
Annual Production Yr 1 MWhr		**6,894**
Yield kwhr/yr/kwdc	bifacial	2,298

Cash Flow Assumptions

Revenues	1st Full year	$357,094	
	Monthly	$29,757.81	
Effective Price per kWh*	**30 year lease/PPA**	$0.0518	
PPA escalation rate		1.50%	
Expenses		31	
O&AM (annual)		$35,000	
Insurance w/ decrs	5%	$7,395	
Utility maint fee SCE	0.0%	$0	
Land Lease (plus RE tax)		$9	
	tot ann exp init	$42,404	11.87%
Increases by inflation-begin in year…		2	
	CFADS - 1st year	$314,690	
Annual Expenses Escalation (%)		1.75%	

*net effective based on cost amortization

Financing Assumptions

Debt	*none at this time*	
Debt		$0
% Financed with debt (LTV)		0.0%
Debt interest rate		4.75%
Debt term (yrs)		20
Annual debt payment		$0
DSCR avg=	*#DIV/0!*	
Equity		
Sponsor Equity (sweat equity, incl tax eqty, jr debt & ITC)		$5,025,000
% equity provided		100%
Discount Rate		5.00%

Incentives and Tax Assumptions (if monetized)

Incentives	income approach: *ITC + 8 yrs ebitdaX1.32X30%*		**$957,363**
Federal ITC (30%) pre-approved 1603		85%	**$1,281,375**
% of project costs depreciable with ITC	(less 15%)		85%
			$4,271,250
Taxes			
Tax rate	20%	8.85%	28.9%

Indian nation and Public entities can't use depr or ITC, so lease purchase or PPA contract most viable financing model.

After-Tax IRR 30 yr **8.29%**

Operating Expenses

General				
Land tax	rate%	0.00%	$0	by city
Lease Rate/ac /yr typ			$1	by city
Insur rate per MW w/ incm rider		.17 per $100	$0.17	
Acreage of Site	(ac per Mw)	3	9.00	ac per segment
O&AM/maint/opr asset mgmt/MW/yr			$11,667	per mw dc
Panel Derate/yr			0.500%	

off-taker **Needles, CA** ownership flip 30yr

owner **SPV: Needles I**

interconnection agmt tbd - IC to Needles post

Permits - City will expedite

time to shovel-ready - approx 1 month overall COD 2025

site control by Developer

EPC quoted but no selection yet

major technology selected

engineering single lines comp'l

engineering field layout comp'l

CAPEX

EPC turnkey	1.450	$4,350,000	1.740
misc(intrcn,civil, mitig)	0	$0	
Dvp, commission include	0.2250	$675,000	
unallocated reserve		$0	
Total project costs		**$5,025,000**	
	Cost per watt	***2.010***	2.010
Construction period max (months)		10	

*DEPRECIATION (std, no bonus assumed, ITC basis)

1	20.00%	854,250
2	32.00%	1,366,800
3	19.20%	820,080
4	11.50%	491,194
5	11.50%	491,194
6	5.80%	247,733
	100.00%	4,271,250

EPC stackup 2024 (taxes incl)	
panels 412W	0.275
invert/trsf-batt read	0.325
BOS	0.450
mtg/track/etc	0.350
other	0.050
	1.450

ITC subject to Treasury/IRS AUP analysis/review

*using MACRS depreciation although new tax law allows 100% in year 1-we use 6 years here

project valuation w/ depr/ITC/SGIP: **$5,025,000** **total CFBT** **$10,739,021**

Disclaimer: the figures cited herein are for discussion purposes only on a proforma basis. UniSol is not responsible for accuracy or veracity of stated figures. The reviewer is responsible for verifying and calculating their own financial modeling and drawing their own conclusions.

7/5/24

Appendix D

Needles Solar Site Data Analysis Chart

The following 10 projects have been evaluated and assigned a feasibility rating (from 1 to 10) based on optimal cost, infrastructure development and effective resultant PPA rate:

City of Needles Potential Solar Sites Analysis

item	description	land size	location: lat-long	flood plain issues	estim land studies	IP dist	est IP Cost	est site prep cost	site capacity	solar design size DC	plate size AC	project ownership	depr & tax credits?	Total estim project cost	financing	net effective PPA rate cost incl infrastucture	Feasibility issues?	Comparative Desirability Rating - 0-10 (10 best)
1-a	old treatment plant	10 ac	34.82820 N -114.58794 W		-0-	.04 mi	-0-	-0-	4-5MW	3	2.499	3rd party PPA with ownership flip	yes	$ 5,025,000	PPA	0.0518	good - flat-repurposed	7.02
1-b	old treatment plant	10 ac	34.82820 N -114.58794 W		-0-	.04 mi	-0-	-0-	4-5MW	3	2.499	City Utility	yes	$ 5,025,001	city bond	0.03636	good - flat-repurposed	10.00
2	landfill near airport	120 ac	34.79494 N -114.61343 W		-0-	2 mi	$2M	$100k	30 MW	3	2.499	City Utility	no	$ 7,125,000	city bond	0.04877	City-no tax credits or depr	7.46
3	PPA offer by airport Hwy 95	25 ac mol	34.76761 N -114.60018 W		$25k	4 mi	$4M	n/a	12MW	8	6.664	3rd party PPA with ownership flip	yes	$ 9,050,000	PPA	0.0882	need prod schd & profile & PPA details - interconnect issue - FAA glare restriction	4.12
4	west side	35 ac	34.84189 N -114.62461 W	yes	$25k	1 mi	$1M	$2M	15MW	3	2.499	City Utility	no	$ 8,050,000	city bond	0.05423	questionable - flood & prep - no tax credits or depr	6.71
5	west side	23 ac	34.83342 N -114.62757 W	yes	$25k	1 mi	$1M	$2M	12MW	3	2.499	City Utility	no	$ 8,050,000	city bond	0.05422	questionable - flood & prep - no tax credits or depr	6.71
6	SW corner off residential	25 ac	34.82703 N -114.62482 W		$35k	2 mi	$1M	$100k	15MW	3	2.499	City Utility	no	$ 5,560,000	city bond	0.04307	residential zoning - no tax credits or depr	8.44
7	switch station	2-3 ac	34.8569 N -114.62501 W		-0-	on site	$50k	-0-	500kw	0.5	0.4165	City Utility	no	$ 887,500	city bond	0.06575	usability-part BLM - small - no tax credits or depr	5.53
8	near new trtmt plant	4ac	34.8286 N -114.59276 W		$17k	at road	$150k	$100k	2 mw	2	1.666	City Utility	no	$ 3,617,000	city bond	0.1015	very rough-small - no tax credits or depr	3.58
9	old ice plant by RR	50 ac	34.82687 N -114.59047 W		$17k	up the hill	$375k	$100k	lMW	1	0.833	City Utility	no	$ 2,167,000	city bond	0.05612	rough-tree stripping - small - no tax credits or depr	6.48
10	Bureau Reclam land	14 ac	34.83512 N -114.59254 W		$17k	across road	$150k	$100k	5mw	3	2.499	City Utility	no	$ 5,292,000	city bond	0.03794	need lease or purchase - no tax credits or depr	9.58

Appendix E

Base-line Assumptions

1. **O&M scope elements required**

For the solar installations, these ongoing elements are required for Operations & Maintenance (O&M) and have been budgeted in the various Sites analysis as initially $11,667 per MW dc:

   a. SCADA Monitoring
   b. Reporting annual performance
   c. Ongoing Maintenance as needed
   d. Repair service calls
   e. Cleaning
   f. Replacement inverters as needed
   g. Replacement solar panels as needed

2. **EPC current benchmark (design-build turnkey array)**
   a. $1.45+/- per watt dc installed
3. **Investor Owned Considerations**
   a. Internal Rate of Return at 8.3%,
   b. ITC and depreciation applicable,
   c. no debt, 100% equity contribution
   d. tax base fed 20%, state 8.85%,
   e. favorable lease rate on municipal property at $1/ac/yr
4. **Municipal Owned considerations**
   a. -0- % return (breakeven)
   b. 3.5% municipal bond financing, 100% debt from bond
   c. no ITC and no depreciation applicable,
   d. no tax consequences,
   e. site control no cost
5. **PPA considerations**
   a. 30 year, 1.5% escalation. PPA calculated for each site
   b. 1.75% labor increase annually
   c. CapEx calculated for each site
6. **Solar Insurance**
   a. decreasing term, $0.17/$100 on capex depreciable amount
   b. 1.75% insurance rate increase annually
7. **Project Development costs**
   a. Industry standard average at $0.225/watt

Appendix F

Arborvitae Enterprises LLC

In the 50+ years since the Barksdale family engaged in the solar silicon cell business, we've seen unimaginable changes and major breakthroughs in technologies and roll-outs – both in our company and in the renewable energy sector. We are excited to share more of the great projects we have completed in recent years. These projects will continue to prove our dedication to high quality and customer service.

From computerized electronic monitoring and power management systems to complex charge controllers, battery storage and conventional generation integration, we are doing more interesting and challenging projects every day.

We continue to add to our highly skilled workforce to handle the growing demand for our solar solutions and we continue to train and educate our team which is improving our ability to deliver ever larger and more complex projects on-time and on-budget. We remain committed to excellence in customer service --whether it's helping you process a CUP or rebate or going the extra mile to find that perfect solution for your unique site and energy complement of design-build storage, substation, transmission, distribution, interconnection, O&M, SCADA or operations management requirements.

Our team members are each and every one committed to social and environmental responsibility in everything we do from working with educational organizations, ecological foundations, deserving charities and to promoting volunteerism among our employees, we will leave our planet earth a better place than we found it.

Further we endeavor to support our commitment to serve our customers in the ways we always have, with honesty and integrity. We look forward to addressing your needs and exceeding your expectations.

Appendix G

Resume of Key Staff

CHIEF EXECUTIVE OFFICER
UniSol Solar & Storage
Arlen Barksdale, Ph.D.

CSLB C-46 Solar license #1119501

Dr. Barksdale, of Cherokee extraction, from 1975 to the present he is the President and CEO of Hytec Engineering & Design, a firm specializing in solar engineering design, telecommunications data transmission, technical publications and printing, and customer computer application development.

Additionally he is CEO/CTO of UniSol Solar, LLC (*a unified solar-storage systems development company*). Dr. Barksdale is solidly experienced in the silicon industry since 1973 with his debut with Texas Instruments. He has been instrumental in the rollout of 2GW+ silicon-based solar/storage projects and counting. He has held numerous executive level positions in high technology companies. Chairman-emeritus of the Green Government Commission of Lake City/Hinsdale County, Colorado, he is also the primary strategist and project developer for commercial as well as utility scale solar projects since 2004. Dr. Barksdale is a senior Computer Science and Engineering mentor at the Jacobs School of Engineering of UCSD in California. In 2002-03 Dr. Barksdale as Chief Technology Officer headed up the Technology Divisions of two start-up high tech companies – All Optical Networks and Interphotonics, Inc. – both in the optical telecommunications field.

An avid inventor, he is the owner of the Solar Collector Core Technology (patent pending), the Programmable Photonic Integrated Circuit (patent pending), an Adjustable Single Axis Solar Tracker (patent pending), Thermoelectrically Cooled 65GHz LNA (patent pending), and the Business-card-size CD (patent issued). He has over 50 years experience in electronic and silicon semiconductor technology development-to-manufacturing. Prior to 1991, Dr. Barksdale held positions within the academic community, including National University's Computer Science and Engineering department, where he variously held the positions of Dean, Department Chair and Professor, and at Rice University where he was a research fellow working with X-Band microwave studies of II-VI and III-V semiconductors at cryogenic temperatures. From 1973 to1977, he served as Director of Operations for Texas Instruments' Calculator and computer products, PCB assembly, CMOS, and silicon material divisions. At TI, Dr. Barksdale received significant recognition for his groundbreaking work in advanced silicon growth manufacturing technology pioneered for the RAM products which launched the present day personal computer industry.

A veteran of the United States Air Force during the Vietnam era, he was a member of the Intelligence Corps (Russian language translator, cryptographic and electronics). Dr. Barksdale is a National Science Foundation fellow, Welch Foundation fellow, and Atomic Energy Commission special fellow in Nuclear Science & Engineering. Dr. Barksdale holds a Ph.D. and M.A. in Solid State Physics from Rice University, a B.S. Physics/Math/Chemistry from the University of Texas, and A.A. Biology/Math from Weatherford College. He also has conducted Postdoctoral research at the M.D. Anderson Cancer Research Institute in Houston.

Appendix G

Certification

Pursuant to your request, I hereby submit this solar electric generation feasibility study report in its entirety as to form and content and attest to the best efforts to provide a true and comprehensive technical analysis of the subject matter herein. Results accuracy is expected to be +/-5%. Calculations based on premises of current financial and commodities markets and are subject to as-built drawings and City plan review of permits.

Dated this the 12th day of August, 2024.

Attest,

Arlen Barksdale, PhD

Chief technology Officer
Physicist and Engineer
UniSol Solar & Storage
CSLB C-46 Solar license #1119501
a division of Arborvitae Enterprises LLC
in cooperation with
UCSD Jacobs School of Engineering

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