Blue Sky CONSULTING GROUP

MEMORANDUM

To: Interested Parties

From: The Blue Sky Consulting Group

Date: May 14, 2024

Re: Economic Impact of Proposed Solar Electric Generation Facility in Solano County

Executive Summary

This memorandum presents an analysis of the economic impact of a solar electric generation facility in Solano County as proposed by California Forever. The proposed project consists of a solar electric generation facility of 2,000 MW and an accompanying battery energy storage system (BESS) of 5,000 MW. We estimate that the project will result in the following economic impacts:

- The build-out of the generation facility and BESS would deliver to Solano County $281 million of total economic activity and 1,383 new full-time jobs which would last for the duration of the phased construction period, estimated at 10 years. In other counties, this work would deliver to California $397 million of economic activity and 1,817 new jobs each year during this period. Across all California, the project would generate $677 million in annual economic activity and would support 3,200 new jobs during this period.
- Once fully constructed, the facility would create 426 full-time permanent jobs for operations and maintenance. Of these jobs, 295 would be in Solano County and an additional 131 jobs would be located elsewhere in California.

Economic Impact Overview

Constructing a solar generation facility will require hiring construction workers, engineers, and other workers, and purchasing the materials and equipment needed to build the proposed facility. Our analysis of the economic impact assesses both (1) the total dollar value of any economic activity in Solano County and California as the result of this construction; and (2) the total number of jobs—for both Solano County and California residents—likely to be created by this activity.

Most of the economic activity generated by the construction and installation of the solar and battery systems would benefit Solano County residents. In addition, because some portion of the labor force and suppliers necessary for this activity reside within California (but outside of Solano County), the project would also provide economic benefits to California.

Following the construction period, this project will also create new *permanent* Solano County jobs, since Solano County workers and firms will be needed to operate and maintain the new power plant.

Overview of Economic Analysis Approach

Economic effects were calculated using the IMPLAN model. Planners and regional economists use input-output models such as IMPLAN to measure and project the impacts of local economic changes, including the construction of new power plants. Input-output models estimate the effects of changes in one

industry on other, related industries based on purchases made in these related industries, allowing researchers to estimate the total economic impact of proposed projects deriving from three types or stages of spending:

- *Direct effects* refer to the share of a project's budget that is allocated to paying local worker wages or purchasing local firms' goods or services. For example, the portion of the project budget allocated to labor costs for electrical workers or for purchasing steel and concrete would be direct effects of the project.
- *Indirect effects*: Constructing new solar generation facilities requires inputs from firms in other industries such as those that provide raw materials and supplies and from associated services, such as engineering, design, and consulting. These upstream transactions conducted by the solar industry's linked suppliers of goods and services comprise indirect effects.
- *Induced effects*: The workers employed by firms that are directly or indirectly impacted by the planned work spend their incomes in the local region, which creates additional demand for goods and services from local firms. For example, construction workers and workers employed in supplier firms spend part of their paychecks on groceries and clothing. These employee consumption activities are known as induced effects.

IMPLAN provides the detailed data necessary to estimate the indirect and induced impacts within a defined study area, given a defined amount of direct spending. Including indirect and induced effects shows that a project's total economic impact is greater than the amount of direct spending; in other words, these effects are what account for a project's economic "multiplier" (i.e., the incremental increase in economic activity across all included industries that is caused by a change in demand from one or more specific industries).

The IMPLAN model further provides estimates of the number of new private sector jobs created in the study region as a result of the construction activity and the new spending by the employees and contractors working on these projects or working for the project's suppliers.

Project Budgets and Adjustments to Account for Out of Region Suppliers

The total *direct* economic effect, within a defined study area, of any proposed project is equal to the proportion of the project's total budget that is spent within that area; indirect and induced effects are proportional to this initial direct effect. Projects sited in Solano County typically draw on labor and suppliers living or headquartered in the County, and as a result, a project's indirect and induced effects would occur largely within the County as well. In addition, California Forever's proposed project will rely on labor and supplies sourced from elsewhere in California as well as from outside of the region. It is therefore necessary to adjust the total budget to determine the direct effects within the County and state.

To develop estimates for a solar plant and co-located battery storage costs, we analyzed datasets from the United States Energy Information Administration (EIA),[1] National Renewable Energy Laboratory (NREL),[2] and Berkeley Energy Lab (BEL).[3] These sources broadly align on the typical per-MW cost of

[1] https://www.eia.gov/todayinenergy/detail.php?id=48736; https://www.eia.gov/outlooks/aeo/assumptions/pdf/table_8.2.pdf

[2] https://www.nrel.gov/news/program/2021/documenting-a-decade-of-cost-declines-for-pv-systems.html

[3] https://emp.lbl.gov/sites/default/files/utility_scale_solar_2021_edition_slides.pdf

constructing solar plants with co-located storage. As NREL's accounting of these costs was most complete, and allowed more precise estimates of the cost of solar and battery storage when the two are co-located, their estimates were ultimately used for our analysis.

We estimate the total cost of building-out the proposed solar generation facility and BESS will be $9.4 billion based on cost estimates for construction of new photovoltaic and BESS systems produced by the NREL. Specifically, NREL estimates current costs for such systems as well as expected future costs based on declining production costs over time as the technologies mature. The results presented in this memorandum reflect the NREL's estimated utility scale PV system costs for the period 2024 to 2033 (i.e. a 10-year period corresponding to a phased 10-year construction timeline).[4] According to the NREL estimates, PV system capital costs will average $1,101 per kW over this period. BESS system capital costs are expected to be $1,402 per kW over the same period.[5] Estimated costs for the proposed system are presented below.

Figure 1 – Total Estimated System Cost (2024 $)

	Expected Capital Cost	System Size (MW)	Total Cost
Solar (per kW)	$1,182	2,000	$ 2,363,640,047
BESS (per kW)	$1,402	5,000	$ 7,007,520,401
Total			**$9,371,160,449**

Isolating the total direct economic impact to Solano County and to California flowing from this work requires first allocating this total to Solano and California workers and firms. We estimate that the *direct* effects comprise a Solano County component of $2.17 billion ($217 million annually) in addition to $1.67 billion ($167 million annually) attributable to other California counties, for a California total of $3.84 billion ($384 million annually). The remainder of the direct effect is accounted for by firms and shareholders outside the state.

To allocate the total project budgets across Solano, California, and all other regions, we first consulted NREL's solar plant and battery storage cost model, which allocates the total cost of an installation to several categories, including the cost of the photovoltaic (PV) module, solar and battery inverters, batteries, other materials and equipment, and the labor cost (paid to those who install the panels and batteries). Next, we estimated the proportion of each spending category that would likely be directed to Solano or California firms.

Because most solar panels and grid-scale battery systems are produced outside of California, for purposes of this analysis, we have assumed that these components would be produced by out of state suppliers. [6] The economic impact results presented in this memo would be considerably larger to the

[4] https://atb.nrel.gov/electricity/2023/utility-scale_pv and https://atb.nrel.gov/electricity/2023/utility-scale_battery_storage.

[5] BESS costs assume a 4-hr battery system.

[6] Approximately 80% of the panels that are installed annually are supplied by foreign firms (see for example, https://www.wsj.com/articles/can-americas-solar-power-industry-compete-with-chinas-one-firm-tries-11624295249; https://news.energysage.com/u-s-solar-panel-manufacturers-list-american-made-solar-panels/). Of the remaining 20% of panels manufactured domestically, a large share is manufactured in states other than California (https://www.solarpowerworldonline.com/u-s-solar-panel-manufacturers/).

extent either or both of these components are manufactured within the region.

Economic Impact for Solano and California

The proposed project is estimated to cost $9.4 billion, with $2.17 billion spent on Solano County firms and workers, and $1.67 billion spent on firms and workers in other counties. As shown in Figure 2, given a 10-year construction period, annual direct effects are $217 million in the County and $167 million across the remainder of the state. Within Solano County, this direct spending would generate an additional $26 million of indirect economic activity (i.e., purchases of goods and services from Solano County suppliers) and $38 million of induced activity (i.e., new worker spending within the County), for a total $281 million in economic impacts. Across all of California and including all three types of impacts, the project would generate $677 million in annual economic activity (or $6.77 billion over 10 years).

Figure 2 – Annual Economic Impacts in Solano County and California (mil 2024 $)

	Solano County	Other California Counties	All California
Direct	$217	$167	**$384**
Indirect	$26	$113	**$139**
Induced	$38	$117	**$154**
Total Economic Impact	**$281**	**$397**	**$677**

Employment Detail

As shown in *Figure 3*, we estimate that during the construction period, this project would support 1,383 new jobs for Solano residents and an additional 1,817 new jobs for Californians outside the County.

Figure 3 presents information on the 15 sectors most impacted by the employment growth projected to result from this project. In Solano County, the project would directly create more than 1,000 jobs in the construction of new power and communications structures sector. Indirect and induced spending would create jobs across a range of industries, including at retail and restaurant establishments, real estate services, architectural and engineering services, and building materials and equipment suppliers.

Figure 3 – New Jobs Supported Annually by Sector During Construction Phase

Job Sector	Solano County	Other California Counties	All California
Construction of new power and communication structures	1,043	909	1,952
Limited-service restaurants	18	31	48
Employment services	14	33	47
Other real estate	12	34	45
Full-service restaurants	12	31	44
Architectural, engineering, and related services	17	25	42
Retail - Building material and garden equipment and supplies	21	21	42
Individual and family services	16	23	39
Wholesale - Other durable goods merchant wholesalers	7	21	28
Hospitals	8	19	27
Truck transportation	2	24	26
Automotive repair and maintenance, except car washes	8	15	23
Couriers and messengers	6	17	23
Commercial and industrial machinery and equipment rental	12	11	22
All other food and drinking places	6	15	21
All Other Sectors	182	588	770
Total Jobs, All Sectors	**1,383**	**1,817**	**3,200**
Increase in County Employment	**0.7%**		
Increase in County Construction Employment	**6.1%**		

Most of the jobs created by the new facility will be related to the construction itself. Specifically, 1,043 of the new jobs in Solano County will be in the Construction of New Power and Communications Structures sector. Within this sector, there are a variety of job classifications, including construction trades workers, powerline installers and repairer, construction supervisors, and others. Figure 4 presents additional detail on the jobs that are expected to be created within the Construction of New Power and Communications Structures sector.

Figure 4 – Construction Sector Jobs – Detail

Occupation Title	Employed
Construction Laborers	171
Electrical Power-Line Installers and Repairers	169
First-Line Supervisors of Construction Trades and Extraction Workers	73
Telecommunications Line Installers and Repairers	73
Operating Engineers and Other Construction Equipment Operators	69
First-Line Supervisors of Mechanics, Installers, and Repairers	63
Electricians	37
Construction Managers	32
General and Operations Managers	26
Project Management Specialists	25
All Other	304
TOTAL - Construction of new power and communication structures	**1,043**

Ongoing Economic Impacts for Solano and California

In addition to the construction-phase results presented above, the ongoing operations and maintenance (O&M) of the proposed facility will result in economic impacts on Solano County and California. These ongoing operations and maintenance costs were estimated based on information provided by NREL and total $20.11 per kW for solar PV maintenance and $35.04 per kW for the BESS each year. In total, these costs are expected to total an estimated $200.7 million annually when the facility is fully constructed. Because some portion of these costs will be for materials and equipment that are not available locally, the total O&M costs were adjusted to reflect the portion that is likely to be spent in Solano County.

Figure 5 – Annual Ongoing Economic Impacts in Solano County and California

Impact Type	Solano County	Other California Counties	All California
Direct	$129	$0	**$129**
Indirect	$20	$25	**$45**
Induced	$14	$14	**$28**
Total Economic Impact	**$162**	**$39**	**$201**
Total Jobs, All Sectors	**295**	**131**	**426**

As shown in Figure 5, total ongoing economic impacts of the new facility are estimated at $201 million annually, of which $162 million will accrue to Solano County and $39 million to other counties in California. These economic impacts are expected to generate 426 jobs each year, of which 295 will be in Solano and 131 in the rest of the state.