Renewable Resource Development

Due Diligence Summary
NextEra – Genesis

2 x 125 MW Concentrating Solar Thermal
Blythe, CA Riverside County

April 8, 2009
Prepared by Alan Williams

Confidential – Contains Proprietary Information

Executive Summary

1.1 Recommendation

The Genesis Project is feasible and viable. Cost and performance data are reasonable with known, controllable and manageable risks. There are no fatal flaws in the site or technology. There are some factors that could increase the project's capital cost. PG&E will want to determine how possible cost increases would be handled as part of any commercial deal it would entertain with NextEra.

1.2 Project Description

Two 125 MW steam turbine generating units and separate concentrating, parabolic trough solar fields located approximately 24 miles west of Blythe, California near Interstate 10. Transmission interconnection would be via a tie-in to the newly constructed 67 mile 230 kV line between Blythe and the Julian-Hinds substation. PG&E would have a one half interest in 250 MW of solar generation.

1.3 Capital Cost

The base capital cost for 125 MW (one of two units) is $470 Million.

1.4 Project Technical Due Diligence (Summary)

The proposed parabolic trough solar thermal technology has been operational since the early 1980's and may be considered the most mature of all the solar-thermal technologies in the contemporary market.

NextEra brings their experience in operating and developing similar, concentrating solar trough power plants to the Genesis project. The project, and PG&E, would benefit from this being the third or fourth project by NextEra using nearly identical technology and development by essentially the same internal team. Overall, both the solar technology and the steam turbine based electrical power generation are well known.

1.5 Technology & Engineering

The concentrated solar trough (CST) technology is widely considered to be the most mature and cost effective solar technology for development of large, utility-scale solar electric power generation facilities.

NextEra is an experienced developer and project manager. They have successfully developed and constructed several other major projects of this magnitude including solar thermal, solar photovoltaic, wind, and fossil fuel plants.

1.6 Transmission

The project would interconnect via a new 4 – 8 mile 230 kV gen-tie line to the new, 67 mile Blythe-Julian Hind 230 kV transmission line now under construction by NextEra.

The point of interconnection for CAISO purposes would be the Julian-Hind substation.

1.7 Environmental Assessment

The project site is well suited for this application. However, the Next Era environmental team has not demonstrated a high level of understanding of the California Energy Commission's permitting processes for solar facilities. Although not a fatal flaw their inexperience could cause delays in permit approvals and a subsequent delay in starting construction. Final commercial operation date would slip accordingly.

1.8 Project Schedule

California Energy Commission filing and Bureau of Land Management filing: In preparation throughout 2009. **Filing Date: October 2009**

Date Adequacy: **December 2009**

Reviews and approvals will occur through 2010.

CEC Permit: **October 2010**

BLM ROW Permit: **December 2010**

Receive Transmission Upgrades Approval **Uncertain**

Construction start: **December 2011**

Project Completion: **February 2014**

Commercial Operation Date: **June 2014**

1.9 Other Energy & Environmental Policy Considerations

NextEra has based this project on the assumption that it will be able to use wet cooling tower technology. Present Energy Commission sentiment may favor dry cooling.

Additionally, concerns about evaporation ponds attracting birds which in turn prey on desert tortoises require the installation of a zero liquid discharge system instead of evaporation ponds. This is a $20 Million per unit impact to capital costs and $2 - $3

Million in annual operating costs

Technical Due Diligence

2.1 Technical Project Description, Technology, Engineering

The project consists of two separate 125 MW power blocks and associated solar fields. Solar energy is collected and transformed into steam by parabolic trough type solar collector assemblies. NextEra has assumed the site will have adequate well water supplies to support mechanical draft wet cooling towers as the primary heat sink to condense steam from the steam turbine. See additional discussion and possible impacts in section 2.11 Water Resources.

NextEra has not identified an engineering firm for supporting the present, preliminary design and configuration efforts. They are relying on prior work prepared by Worley Parsons and NextEra staff from their Beacon Solar Project's Application for Certification (AFC) submitted to the California Energy Commission in March of 2008[1]. Solar performance has been estimated by scaling up data available to them from the 80 MW SEGS 8 & 9 solar plants near Kramer Junction, CA.

2.2 Site Location, Plan, and Access

The Genesis project will be sited on Federal land near Blythe, CA in eastern Riverside County. NextEra has two sites identified in this area and is presently moving forward on a 4,640 acre parcel known as Ford Dry Lake. They are also planning to develop a nearby site, the McCoy site, in the future but is not a part of the Genesis project as presently contemplated between NextEra and PG&E.

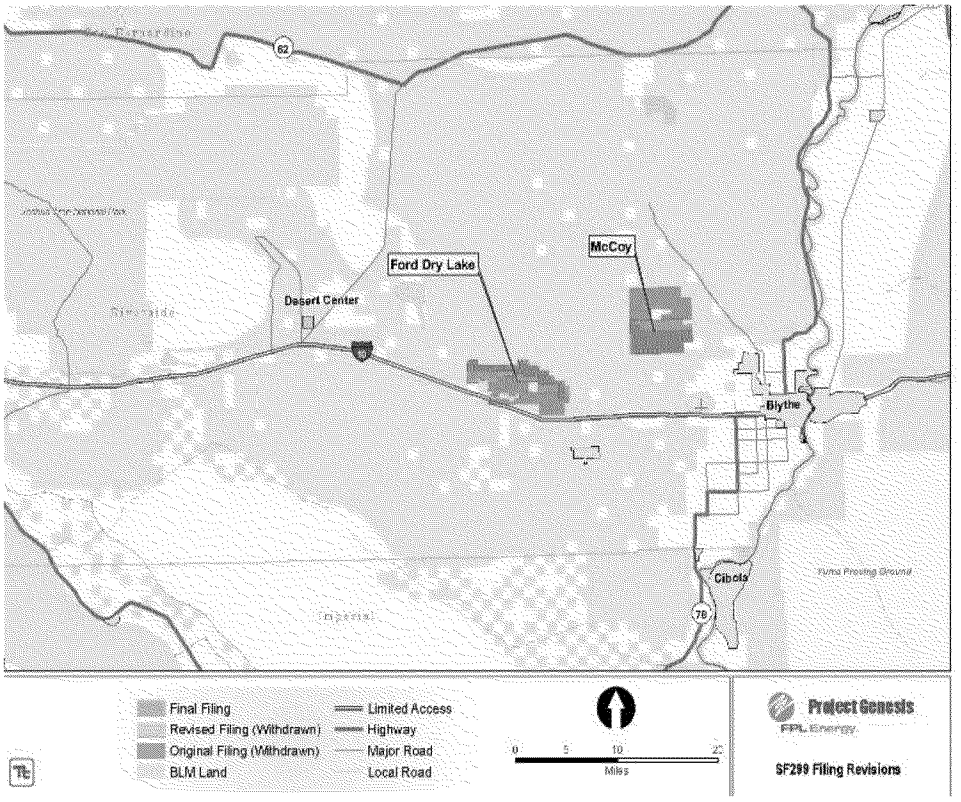
NextEra has chosen to develop the Ford Dry Lake site ahead of the McCoy site because it provides a better water supply, and has shorter transmission line and natural gas line interconnections.

Access to the site would be from Interstate 10 via a new access road approximately 4 miles long. A new transmission line tying the project into the Blythe – Julian Hinds 67 mile 230 kV line, also owned by NextEra, would parallel the access road.

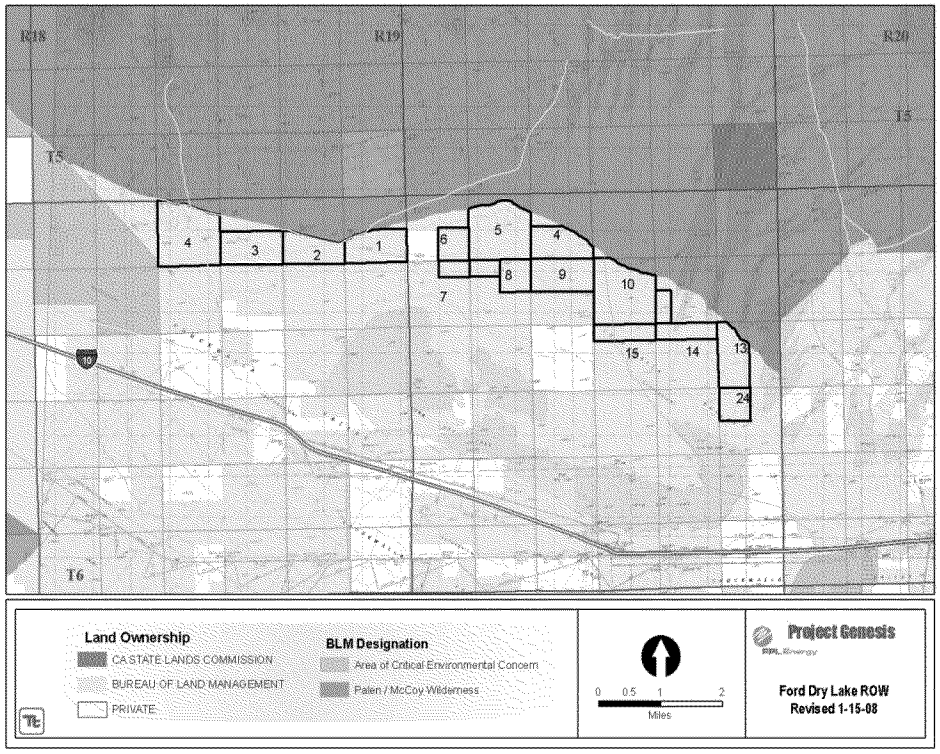
The preferred ROW for the access road and transmission line is a straight line due south from the site. Unresolved issues for biological, land ownership, and flooding potential across a dry lake bed may result in a longer, more costly, routing.

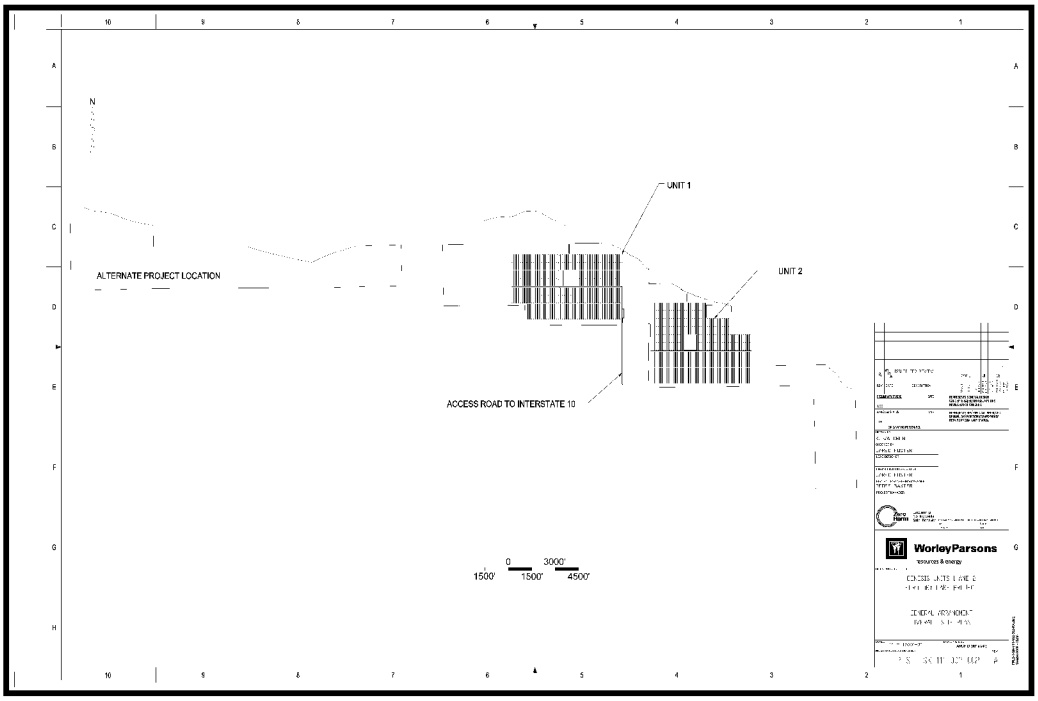
See figures below for site location and Solar Field arrangements within the Ford Dry Lake site.

[1] Beacon Solar Energy Project is a single unit 250 MW parabolic trough based solar facility planned near California City (Kern County). Construction scheduled to start 3Q 2009 with commercial operation in 3Q 2011. Source: California Energy Commission http://www.energy.ca.gov/sitingcases/beacon/index.html



Ford Dry Lake Site.





Location of Units 1 & 2 (125 MW each) on the Ford Dry Lake site.

2.3 Site Description & Solar Resource Assessment

NextEra notes that the solar resource at this site is slightly lower than their plant at Kramer Junction (SEGS 8-9) but has similar characteristics. B&V's analysis supports this, indicating that with a direct normal insolation (DNI) level of 7.4 kWhr/m^2 the site's solar resource is "excellent". The SEGS 8-9 site has a DNI of 7.7 kWhr/m^2

Solar metering has been installed on the site to collect actual data that will be used for final design.

2.4 Geotechnical Investigations

NextEra says Geophysical work will be conducted as part of the test well program. This is not expected to occur before the end of April 2009.

2.5 Site Topography

B&V's review considers the site to be generally suitable, recognizing that NextEra has chosen the flattest parcels available for the solar field and power generation facilities.

Based on USGS topographical maps however they note that the slope on the site exceeds 1% which indicates that some terracing will be necessary

2.6 Plant Arrangement

Two, physically separate solar fields and power blocks of 125 MW each are planned with a common administration building and warehouse.

2.7 Solar Technology, resources & experience

NextEra is relying on its SEGS operation and retrofit experience as the baseline for multiple solar projects it is undertaking in California, Florida and an undisclosed site. It is using this experience for establishing technology, design specifications and procurement policies for all of its solar thermal projects.

The company claims that because of these earlier projects they are well versed in the solar equipment market. They have used this experience to develop their own views on price trends and technology improvements and have incorporated these into this project's forecast for price and performance.

NextEra indicated that rather than select a sole-source supplier now they preferred to stay current with multiple technologies for assuring procurement of the critical parts of the supply chain and allow flexibility to meet their various project schedules. This includes using blanket contracts that can move delivery between projects. It is their intention to maintain detailed discussions with every trough and mirror supplier in order to take advantages of changes in technology and commercial aspects of a number of suppliers.

NextEra has not yet prepared a site specific analysis of solar characteristics and associated annual electrical production performance. They are using scale-up calculations instead, based on the SEGS 8 & 9 facilities.

To predict and verify site performance Black & Veatch prepared an independent analysis of the expected performance at the Ford Dry Lake site using the National Renewable Energy Lab (NREL) Solar Advisor Model (SAM). The B&V work suggests that NextEra is more aggressive in its assumptions for solar collector performance and is using pricing estimates for solar collector equipment that are significantly less than the present market benchmarks. This is in line with NextEra's view of their experience and market position. Two potential risk areas are possible because of this.

First, if NextEra's forecasted pricing is off target the project cost will increase directly.

Second, if the solar collector assumptions are incorrect the project can either accept a lower annual generation level which is a cost increase on a dollar per MW-hour basis. Or, if additional land area is available, it can increase the solar collector area to

compensate for lower collector efficiencies. The timing on when each of these factors is known to change will also have an impact on the options available for correction.

These risk issues are presented graphically in Table 2.2. The approximate magnitude for the 125 MW plant is 38,000 MW hours per year of generation and a cost impact of roughly $23 - $53 Million. The result of the lower annual generation if the solar field area could not be increased to compensate would be a reduction of the net capacity factor from 26.5% to 23%.

Solar Field:
The solar field generally includes:

- *Parabolic trough concentrator*. This is the reflective surfacing (mirror) on some type of rigid support – a metallic, glass, or plastic plate.
- *Absorber tubes*. Two concentric tubes that lie along the parabolic trough's focal point. An outer tube made of glass provides insulation via a vacuum layer to the inner tube made of metal. A working fluid (heat transfer fluid or HTF) is circulated inside of the metal tube where it absorbs the solar radiation energy.
- *Working Fluid (HTF)*. A synthetic oil with a high boiling point is used as the heat absorption and transfer mechanism.
- *Solar tracking system*. This rotates the trough to track the sun and obtain the most efficient solar flux as the sun moves from east to west during the day.
- *Support structure*. A rigid metallic support structure that holds and supports the entire parabolic trough system. This structure is mounted on a pile-based foundation system generally provided by others. It must be capable of withstanding moderate wind loads without distorting the parabolic trough mirrors and losing solar efficiency. It must also support the system in higher wind loads and sustain design base seismic loads.

NextEra has not identified specific vendors for the solar field components. B&V has observed that the dimensions and preliminary performance data used by NextEra corresponds to a Eurotrough/Flagsol system. The company has repeatedly indicated that they are at least two years away from any decision on selecting suppliers. Solel Solar Systems or Schott Glass are the likely suppliers of the heat collector elements (HCE).

Next Era has not described any of the other components, such as the supply and return header piping for the heat transfer fluid, pumps, and heat exchangers. Nor have they indicated who might be contracted for any of the civil site preparation work.

Figure 2.1 indicates a typical concentrating solar trough system.

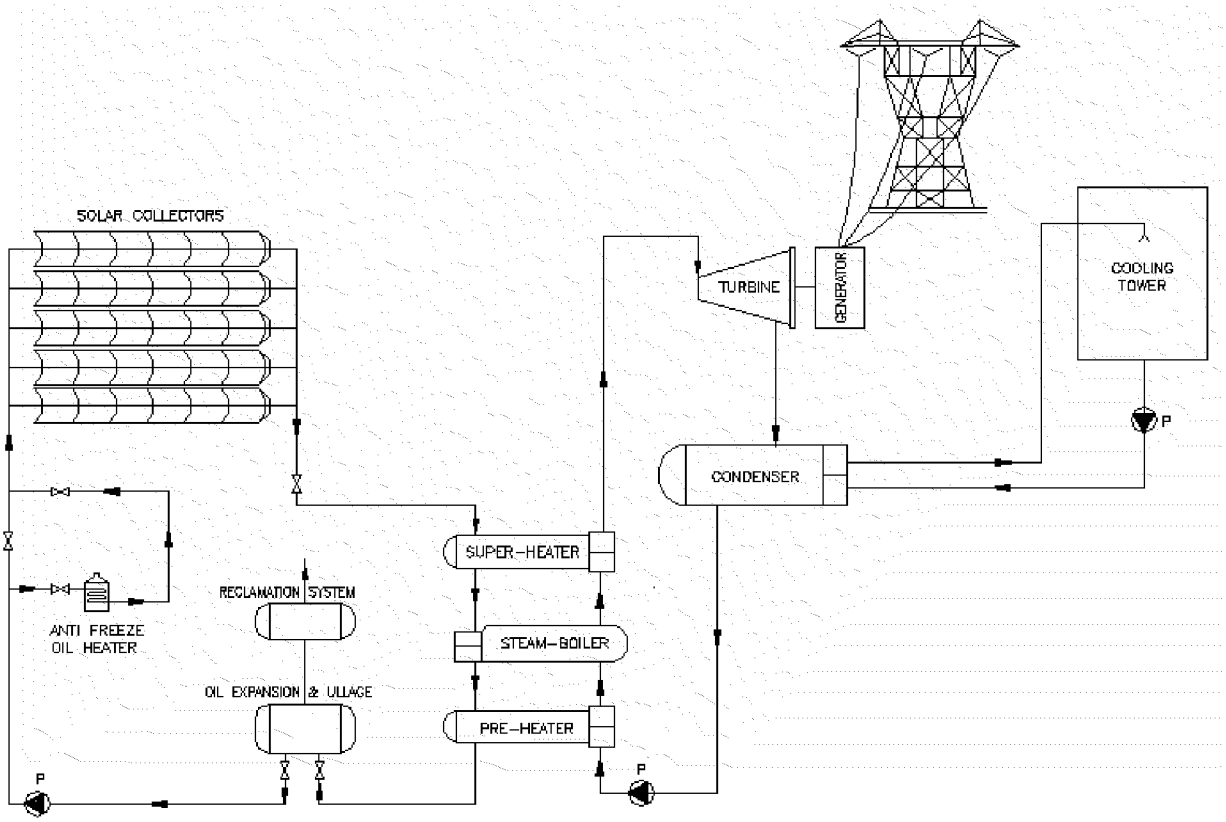
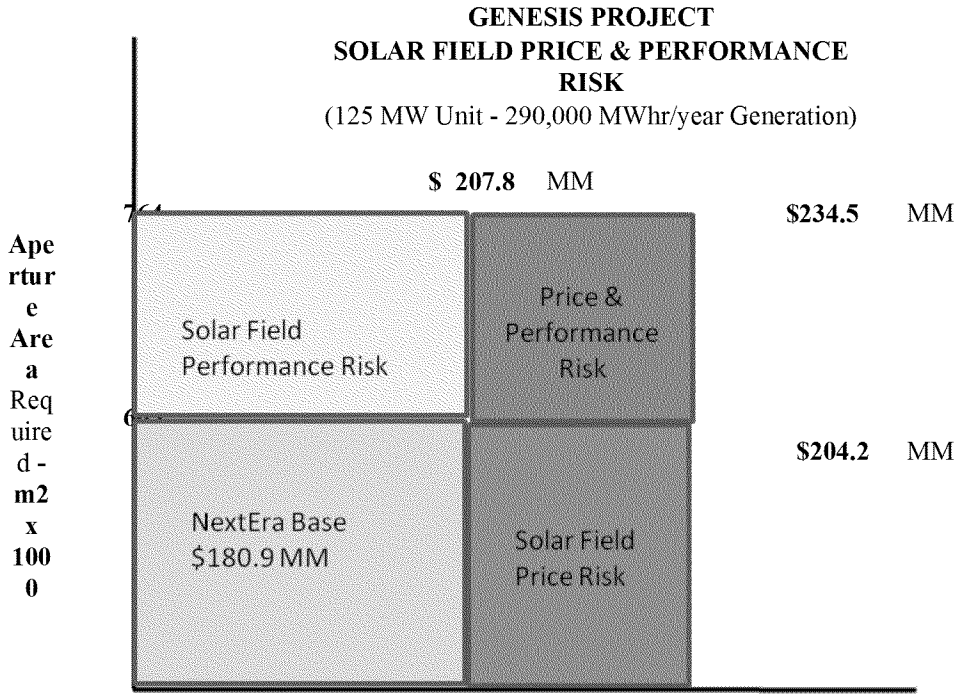


Figure 2.1: Typical Solar Trough System



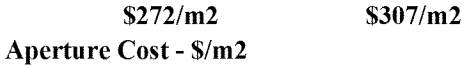


Figure 2.2: Solar Field Aperture Area Risk Matrix

2.8 Power Generation (Steam Cycle)

Steam Turbine: NextEra confirmed that they have recent performance, heat balance and pricing information from at least one major turbine supplier for a 125 MW net/140 MW gross steam turbine. However they have declined to provide that information to PG&E because they have not actually chosen a specific vendor and will not for approximately two more years.

In general they have based the 125 MW system on the existing 80 MW ST at SEGS with adjustments for size and efficiency improvements. Black & Veatch, for other PG&E projects, has determined that there are at least three turbine vendors active in the solar steam turbines in this size range. They are: Siemens, Toshiba, Alstom and perhaps Hitachi. General Electric has also recently indicated that they will be pursuing the solar turbine market in this size.

Cooling Technology: Wet, mechanical draft cooling towers are planned. No specifics as to size, number of cells, or layout have been provided by NextEra.

The Ford Dry Lake site is preferred by NextEra over an adjacent site (McCoy) because of its water supply. A full geophysical and test well program is being developed for permitting but NextEra will not be starting that program until April 2009 or later.

Actual water requirements have not been determined by NextEra pending test well results. An estimate of 2000 – 2500 acre-ft/year for 250 MW was used in the Plan of Development application submitted in 2007.

NextEra expects adequate water quantities will be available to support the project without causing significant impact to basin groundwater levels or impact to Colorado River water. In order to be considered by the CEC and BLM as acceptable for cooling uses the quality of the water must be non-potable.

Balance of Plant: No further details regarding balance of plant have been provided. NextEra says additional work for process flow diagrams and equipment details will be developed later in 2009.

2.9 Power Plant Operation

Actual plant operation is very similar to a conventional steam turbine based plant with the obvious difference being the solar field is replacing a fired, high pressure steam boiler. Because this solar boiler's output is dependent on the sun actual output will vary by time of day and time of year. Peak output generally occurs around mid day during the summer solstice in June. Each unit will be designed to produce a peak net output of 125 MW during this period. In the winter months daily generation will drop to about 25% of the peak summertime levels.

Key management personnel: Experience & Qualifications

NextEra continues to emphasis its experience in operating the SEGS 8-9 facilities. It is feasible that they would be able to draw experience operating staff from the SEGS facility and could use that plant as a training base for the Genesis project. The SEGs facility is approximately a three hour drive from Ford Dry Lake.

Operating Staff: Size, experience & qualifications

A plant staffing level of 47 has been presented. Approximately half are for the power block, 30 percent are for the solar field and the remaining are exempt level management personnel.

2.10 Electrical Transmission Interconnections

Existing and new facilities: NextEra is in the process of constructing a 67 mile 230 kV transmission line from Blythe, CA to the Julian-Hinds substation. This is an 1100 kVA line and is intended to serve at least three plants: The 520 MW Blythe Energy combined cycle plant, 250 MW from the two 125 MW solar units at Ford Dry Lake, and another 250 MW of solar power from the McCoy site. This new line will be complete in approximately August 2010.

A new 230 kV tie-line, approximately 4 – 5 miles long will be needed to tie the Ford Dry Lake solar plant into the Blythe-Julian Hinds line. NextEra anticipates a small substation on the southern side of Interstate 10 for the interconnection.

Network Upgrades

Impacts and costs associated with power leaving the Julian-Hinds substation: USE Consulting has estimated that the project's share of network upgrades could range from $35- $52 Million.

2.11 Environmental Review

Status of Permits-- Required and Available:

NextEra has filed its Plan of Development with the BLM and is in the process of preparing data for the California Energy Commissions' certification. Filing is planned by October 2009. Biological and Class III cultural resource field surveys will begin in March 2009 as part of that preparation.

A Temporary Use Permit has been granted by the BLM for test well drilling and to erect a solar meter on-site.

Water Supply & quality data:

NextEra has based its preliminary assumptions on historical well data and contemporary data from a nearby well used by the State Prison. A temporary use permit has been granted by the BLM to drill test wells at the site. They plan on conducting this work in the 2nd quarter of 2009.

A groundwater study was commissioned in November 2007. Based upon that work by Worley Parsons and other investigations NextEra believes that adequate supplies will be available in fairly shallow aquifers under the site.

In order to be considered suitable for power plant cooling makeup the water quality must be non-potable and generally not suitable for other uses such as agricultural. NextEra believes they can source water for the project that will meet these criteria.

There is concern however, based on PG&E's independent discussions with the California Energy Commission and recent Energy Commission staff assessment[2] that the project will still be pushed toward dry cooling instead of wet, mechanical draft cooling towers. There are cost, performance, and schedule implications to this possibility.

Dry cooling would increase the cost for a plant this size by approximately $20 - $30 million. In addition, because of a loss of steam turbine efficiency the peak day output would drop by 6% - 10%. Some of this decrease could be recovered by increasing the solar field and steam turbine design but at a further increase in capital cost. Without any additional solar field increase to compensate for lost generation the impact will be a decrease in net annual capacity factor from 26.5% to 24%.

NextEra has indicated it intends to vigorously defend water use for wet cooling throughout the permitting process. If this occurs the normal 12 – 15 month approval time from the CEC may be considerably extended, despite a possible outcome allowing wet cooling. NextEra has not offered any alternative schedule to allow for this, nor have they shared any backup plan to switch the project to dry cooling if the permitting process pushes back on the wet cooling plans. They may, however, be able to use the work

[2] Preliminary Staff Assessment, Beacon Solar Energy Project, APRIL 2009 (08-AFC-2), CEC-700-2009-005-PSA

prepared for Beacon Solar Energy and adopt it to the Genesis project with minimal added engineering efforts.

Drainage Plan: NextEra commissioned a conceptual drainage study completed in January 2009. This addressed 100 year storm events and outlined diversion berms to manage water flows.

Visual: No visual studies have been done. They are scheduled for summer 2009.

Other issues:

The project will need to address Desert Tortoise, and Burrowing Owl habitats. Incidental Take Permits are likely to be required by the US Fish & Wildlife Service because the site is within Desert Tortoise habitat.

There is a high level of uncertainty of costs for biological mitigation. NextEra has budgeted $5 million per unit ($10 million total). This could change depending on the ratio of offset lands to disturbed lands ultimately required by BLM. This estimated mitigation cost is included in the $520 Million cost to PG&E. Determination of who takes the risk/benefit of a different mitigation cost is a contract negotiation issue.

Hazardous materials: the main hazardous material used at the site will be the heat transfer fluid. Each 125 MW solar field will have approximately one million gallons of this synthetic oil piped throughout the solar collection field. The fluid is flammable and spillage is treated as an oil spill. On-site bioremediation will be installed to manage small spills. Major spills would require off-site disposal by a licensed contractor.

Project Schedule

3.1 Project Milestones (Financing, Permitting, Engineering, Procurement, Construction Completion, Startup, COD)

NextEra has provided the following major milestones:

Prepare and file the Plan of Development with the BLM to obtain rights of way for the Ford Dry Lake land. *Updated POD for Ford Dry Lake to be submitted March 2009.*

Conduct biological and cultural surveys of the site for BLM and California Energy Commission permits: *Presently planned for spring, 2009.*

Prepare and file Application for Certification (AFC) with California Energy Commission: *Preparation in progress, Target filing date October 2009[3]. Data Adequacy by December 2009.*

[3] Based on January 27, 2009 meeting with NextEra. Earlier schedules had AFC filing in August of 2009.

Receive CEC AFC Certificate to Construct: *2nd Quarter 2011*[4].

Receive BLM Record of Decision (ROD) and Right of Way (ROW) for Ford Dry Lake property: *December 2010 (Final Approval cited as 2nd Quarter 2011).*

Start Construction/pre-Mobilization & Site Prep. *December 2011.*

Commercial Operation: *June 2014*

3.2 Permitting, Engineering, Procurement, Labor Agreements, and Other Major Development Tasks

See above for major permitting milestones

Select EPC contractor: *April 2011*

Secure all Transmission Line easements: *June 2011*

Gas supply contract: *June 2011*

Place Equipment Orders and Major contracts:

- Steam Turbine: *June 2010*
- Mirrors & Heat Collector Elements*: February 2011*
- Solar Collector Assembly contract: *July 2011*

3.3 Construction

- Pre-Mobilization site prep: *December 2011*
- Prime Contractor site mobilization: *February 2012*
- Transmission EPC Site mobilization: *February 2013*
- Back-feed power: *August 2013*
- Steam Turbine generator (critical equipment delivery) on-site: *October 2013.*
- Provisional Acceptance: *February 2014*
- Commercial Operations: *June 2014*

Critical Equipment Delivery time:

Steam turbine: 6/10 – 10/13 is 40 months. Comment: Other projects report steam turbine delivery times of 24 – 29 months. Present NextEra schedule may

[4] NextEra has provided conflicting dates. AFC Certification varies from Oct 2010 to 2nd Quarter 2011.

not represent recent shifts in manufacturing lead times.

Solar Collector Tubes: NextEra does not break this out. Other projects have reported up to 24 months lead time. It is possible that if steam turbine delivery times shorten solar collector tube fabrication and delivery may become the major critical path item.

3.4 Interconnection and CAISO Schedule

Project Cost Estimates, Pro Forma & Financing Viability

4.1 Overview of Project Cost and Financing

NextEra provided Capital cost estimates for both the full 250 MW project and, as of March 3, 2009, provided a 125 MW specific cost to PG&E for a Power Sales Agreement (PSA) for one half of the project. The total, presented with the assumption of "an open book nature of the deal" was $520,000,000. A breakdown follows. Note that approximately 48% of the cost is for the solar field, 33% is for the power block, and 10% is for the development fee.

Owner Equipment Solar Field	**Estimates**	
Mirror	28,928	
Tubes	32,551	
Oil	16,883	
Supports	25,057	
Torque Tubes	31,228	
Site Prep solar	22,928	
EPC solar Contract	90,116	
Solar Field	**247,691**	
Steam Turbine Generator	25,139	
Steam Generator	21,807	
EPC Power Block Contractor	121,181	
Additional EPC Owner Costs	1,500	
Power Plant	**169,628**	
Gas Pipeline & Interconnection:	4,028	
Transmission Interconnection:	3,652	
Common Facilities - Interconnect includes the items Below:		
Transmission system upgrade		
Interconnect, String Busses		
Gas Line		
Interconnect	**7,681**	
Owner Costs	17,298	
Development Cost	8,183	Includes $5MM for mitigation
Project Contingency	-	
Capital Total	**450,480**	
+ Interest During Construction	-	
+ Capitalized Taxes (Sales)	19,200	
+ Capitalized Taxes (Property)	-	
+ NextEra Development Fee	50,000	
Total Sale Price	**519,680**	

Table 4.1: Project Cost to PG&E for one 125 MW Unit

Note that NExtEra has presented the project cost as "Open Book" to PG&E. This means PG&E is at risk for possible cost overruns, changes in scope, and other changes from NextEra's preliminary estimate. Black & Veatch has noted a significant lack of engineering detail, design, equipment specifications or vendor quotes that would otherwise support the total sale price.

4.2 EPC Costs

See table 3.1 above.

As outlined in the solar technology section Black & Veatch has commented that NextEra's assumptions for solar collector assemblies appear low; perhaps by as much as 12% - 13%. Other equipment, including the heat transfer fluid system and the power block has pricing in line with contemporary market benchmarks.

Black & Veatch's also points out that NextEra's treatment of indirect costs, including engineering, construction management and overall contractor contingency, risk and fee charges appear aggressive. No quantification of possible impacts has been made however.

Price & Payment schedule

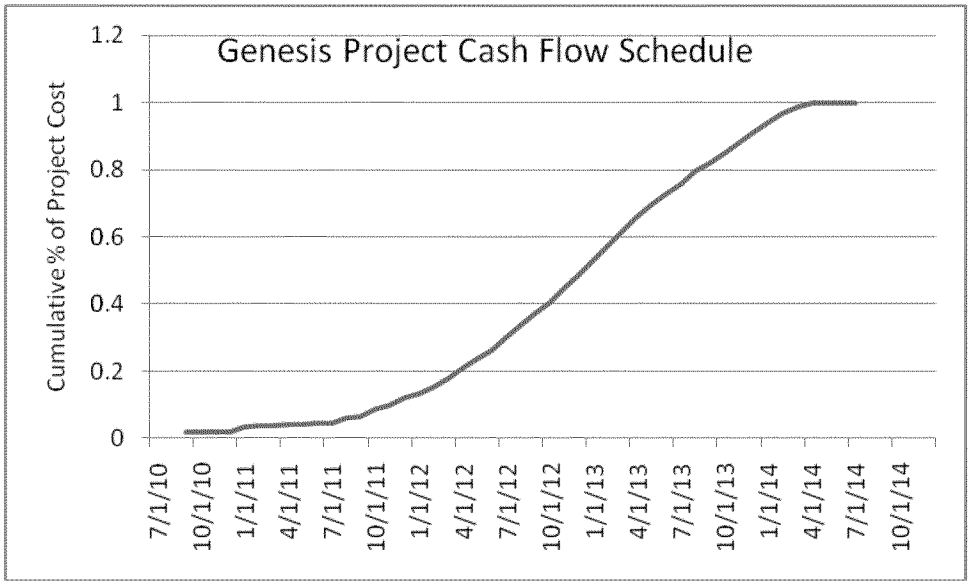


Table 3.2. Payment Schedule

Scope of work

NextEra would be responsible for all work up to commercial operation

Warranties

To be developed between PG&E and NextEra

Completion Requirements

To be developed between PG&E and NextEra

Development Cost Estimates & Assumptions

See EPC details above for breakout. Note $50 Million development fee

Construction Cost Estimates & Assumptions

See EPC cost details above

4.3 Gen-Tie/Transmission Cost Estimates & Assumptions

4.4 O&M Cost Estimates & Assumptions

NextEra has provided the following O&M information. All costs are based on a 30 year average.

		($000)
Production Fixed O&M	$	4,609
Labor & Payroll (staff total = 47)	$	4,950
Variable O&M	$	963
Major Maintenance	$	3,176
Capital Replacement	$	1,049
Total	$	14,747

Availability Factors

NextEra has not provided any assumptions for availability

Net electric Power Output

NextEra has indicated each 125 MW unit will produce 290,000 MWhr/year in net generation. This is the amount delivered to the Blythe transmission line and does not reflect line losses up to Julian Hinds.

Performance Degradation

NextEra has not provided any assumptions for availability

Adequacy of Technical Assumptions

Black & Veatch were not able to make a thorough assessment of the technical level of the Genesis project because NextEra has not yet prepared significant design details. NextEra's work on other solar thermal projects with similar technology and sizes would appear to give them the knowledge and experience necessary to execute this project but no specific details are available to confirm this.

Other Energy and Environmental Policy Considerations

Wet vs. dry cooling remains problematic with the California Energy Commission. A recent Preliminary Staff Assessment (PSA) issued for the Beacon Solar project indicates that there is a strong preference for dry cooling for solar thermal plants but also appears to at least allow consideration of wet cooling if brackish water is used. At best this can be expected to be determined on a case-by-case basis. If the project were required to shift to dry cooling it would increase capital costs by approximately $30 Million and reduce the net annual capacity factor from 27.7% to about 26.3% according to preliminary calculations from B&V.

In the same PSA for the Beacon Solar Project the staff also indicated that evaporation ponds for disposing of cooling tower blowdown were likely to be disapproved. This would then require addition of a zero liquid discharge system which adds significantly to capital and operating costs as well as increasing the overall complexity of the project's operation. Capital cost for such a system is about $20 Million per unit and annual costs would increase by $2 - $3 Million.

Reference Documents

Next Era

A. Project Genesis Plan of Development by Boulevard Associates, LLC with assistance by Tetra Tech, July 2007.

B. Project Genesis – Development Update, September 11, 2008 (Genesis Meeting Shell v10.ppt)

C. Genesis Solar Project – Interconnection, by Bill Narvaez, Transmission Business Manager, January 27, 2009.

D. Groundwater Study for Project Genesis, Chuckwalla Valley Groundwater Basin, Riverside County, California. By Worley Parsons Komex, November 12, 2007.

E. O and M Cost Detail to PGE 2-2009.doc
F. Genesis_Open_Book_summary 2-3-2009.xls.xlsm
G. 2 x 125MW PGE_Genesis_Solar_20080217.xls / Sale – PSA – 3/3/2009