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PACIFIC GAS AND ELECTRIC COMPANY

PHOTOVOLTAIC PROGRAM

PREPARED TESTIMONY



PACIFIC GAS AND ELECTRIC COMPANY
PHOTOVOLTAIC PROGRAM

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PACIFIC GAS AND ELECTRIC COMPANY
CHAPTER 1
POLICY CHAPTER: EXECUTIVE SUMMARY AND OVERVIEW
OF APPLICATION

PACIFIC GAS AND ELECTRIC COMPANY
CHAPTER 1
POLICY CHAPTER: EXECUTIVE SUMMARY AND OVERVIEW OF APPLICATION

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1 **PACIFIC GAS AND ELECTRIC COMPANY**
2 **CHAPTER 1**
3 **POLICY CHAPTER: EXECUTIVE SUMMARY AND OVERVIEW OF**
4 **APPLICATION**

5 **A. Introduction**

6 This chapter provides an overview of Pacific Gas and Electric Company's
7 (PG&E or the Company) Application for approval of an up to 500 megawatt
8 (MW) Photovoltaic Program (PV Program) and discusses the rationale for and
9 the policy objectives advanced by the PV Program.

10 PG&E proposes to initiate by January 2010, a multi-year program to develop
11 up to 500 MW^[1] of dispersed, mid-sized (typically 1 to 20 MW) photovoltaic
12 generation installations in PG&E's service territory in northern and
13 central California. The PV Program will consist of up to 250 MW of
14 Utility-Owned Generation (UOG), with an anticipated capital cost of up to
15 \$1.45 billion, and up to 250 MW of Power Purchase Agreements (PPA) with third
16 party renewable resource developers, with both programs anticipated to be
17 developed over a 5-year period. PG&E will also build an up to 2 MW PV Pilot
18 Project starting in 2009, to speed deployment of the larger PV Program, once it
19 is approved.

20 A unique feature of this PV Program is that the pricing for the PPAs will be
21 derived from the cost-of-service of the UOG projects. Under PG&E's
22 PV Program proposal, the terms and conditions and the pricing of the PPAs will
23 be pre-approved by the California Public Utilities Commission (CPUC or
24 Commission), thus enabling a developer to execute the form contract with
25 streamlined regulatory review, avoid the need for negotiations, and immediately
26 commence development of its project.

[1] Unless otherwise specified, references to capacity targets and overall program design in this filing are presented as alternating current (AC). PV unit cost estimates, on the other hand, are presented in terms of \$/unit of direct current (DC) output as PV panels are usually priced in DC. PG&E relies on a conversion factor of 0.82 to convert from MW (DC) to MW (AC). Based on this conversion factor, PG&E's 250 MW (AC) PV UOG Program equates to the development of up to 305 MW (DC).

1 PG&E selected the PV technology proposed in this Application for a number
2 of reasons: (1) PV is a proven and commercially ready technology; (2) northern
3 and central California contain a number of regions with good insolation suitable
4 for PV deployment; (3) PV is modular and can be rapidly deployed starting in
5 2010, and thereafter, helping to meet the 2010 Renewable Portfolio Standard
6 (RPS) target (under flexible compliance); (4) mid-size PV projects will facilitate
7 an expedited interconnection process; and (5) solar technology addresses
8 PG&E's peak load demands.

9 A key objective of the PV Program is to expedite and simplify the regulatory
10 approval process and to facilitate the systematic development of PV resources.
11 The PV Program will provide a timely economic stimulus to the suddenly
12 struggling PV industry, send strong signals to PV manufacturers to invest in and
13 expand their manufacturing capability, and provide the foundation for driving PV
14 costs down through efficiency gains expected to result from continuous
15 investment and development experience. The PV Program also fits with
16 PG&E's goal to demonstrate environmental leadership.

17 **B. Program Overview**

18 **1. PV UOG Program**

19 As described in Chapter 2, the UOG portion of the PV Program targets
20 development of up to 250 MW of PV generation. Each project will generally
21 be between 1 and 20 MW in size and connected to PG&E's electricity grid.
22 Projects will be primarily ground-mounted, although some projects will
23 potentially be rooftop-mounted. PG&E anticipates developing 25 MW in
24 2010, 50 MW each in 2011, 2012 and 2013, and 75 MW in 2014, although
25 the actual amount of annual development may vary. PG&E may pursue
26 projects below 1 MW where opportunities exist that complement rather than
27 compete with the California Solar Initiative (CSI), and requests explicit
28 authority to develop projects of any size below 20 MW. PG&E does not
29 anticipate that projects below the 1 MW size would constitute a significant
30 portion of the PV UOG Program.

31 All UOG projects will be located within PG&E's service territory. Where
32 feasible, PG&E will work to develop projects on utility-owned land that is at

1 or near its existing substations, in addition to targeting regions of PG&E's
2 service territory that are transmission constrained, where feasible.

3 PG&E will use a competitive procurement process to secure the lowest
4 possible costs for the PV UOG Program. PG&E's solicitation will consider
5 both bundled turnkey (engineering, procurement and construction (EPC))
6 bids and unbundled EPC bids (where PG&E could supply owner-furnished
7 major equipment to a construction/installation contractor). In 2009, PG&E
8 will issue a PV UOG Program competitive solicitation concurrent with
9 regulatory review of the PV Program, providing for expedited program
10 implementation once CPUC review is complete. Acceptance of bids will be
11 contingent on CPUC approval of this Application.

12 As described in Chapter 6, PG&E proposes that the Commission
13 approve annual capacity price targets for the UOG portion of the
14 PV Program. These price targets, plus a contingency, will establish a
15 regulatory benchmark that will be tracked over the life of the Program. At
16 the end of the Program, PG&E will true-up its actual costs to the benchmark.
17 If actual installed capacity costs are at or below the target, no additional
18 reasonableness review would be required. If actual installed capacity costs
19 are in excess of the target, PG&E would retain the opportunity to file an
20 application to recover the excess amounts, subject to a reasonableness
21 review of those excess amounts. If PG&E determines it cannot meet the
22 regulatory benchmark or external economic factors (e.g., the financial
23 market crisis) limit the prudent and economic use of capital, PG&E reserves
24 the right to suspend or scale back the Program.

25 PG&E anticipates securing some land, via deposits, ahead of CPUC
26 approval of the PV Program. This land, supplemented by utility-owned land,
27 will allow PG&E to begin the detailed and site-specific development work to
28 ensure timely online dates for the future PV facilities.

29 **2. PV PPA Program**

30 The PPA portion of the PV Program has been designed to minimize the
31 time for regulatory review and transaction negotiation, and to spur
32 development of PV facilities by third party renewable developers. To be
33 eligible for the PV PPA Program, the project size must be from 1 to 20 MW,
34 and located in PG&E's service territory. As described in Chapter 3, PG&E

1 has requested that the CPUC adopt a standard form of contract, including
2 an up-front, non-negotiable standard price derived from the PV UOG
3 Program cost. The standard contract will be closely modeled after PG&E's
4 standard contract proposal submitted with its 2009 RPS Plan.^[2] Thus, the
5 PV PPA Program proposal, once approved by the CPUC, streamlines the
6 regulatory review of individual transactions because the price and terms will
7 be pre-approved.

8 The anticipated size of the PV PPA Program is up to 250 MW, which is
9 consistent with the size of the PV UOG Program. The PV PPA Program will
10 be implemented over the 5-year life of the Program, although the exact
11 annual allocation will be determined by the strength of the submissions to
12 the annual Requests for Offers (RFO). If the solicitation is undersubscribed,
13 the remaining MWs will roll over to future solicitations. If the PPA RFO is
14 oversubscribed, PG&E will favor PV projects that are highly viable (e.g., site
15 control and online date) and provide the most energy value (e.g., delivery
16 time). PG&E anticipates that it will issue the first PPA RFO in early 2010,
17 shortly after CPUC approval of the PV Program. Based on this RFO, PG&E
18 expects to award approximately 50 MW of contracts in the second or third
19 quarter of 2010. PG&E will hold an annual PPA RFO each year thereafter
20 until the up to 250 MW is filled, although any remaining RFOs for the PV
21 PPA Program will be eliminated if the PV UOG Program is terminated for
22 any reason.

23 The standard contract will require the winning PV projects to be online
24 within 18 months after execution of the PPA. Pricing for the PPAs will be
25 based on PG&E's expected levelized cost of energy for the PV UOG
26 Program, which should equate to \$246/megawatt-hour (MWh), and which
27 will be adjusted by time-of-day (TOD) factors.

28 3. PV Pilot Project

29 As described in Chapter 2, PG&E intends to proceed with the
30 development of an up to 2 MW PV Pilot Project in 2009, prior to regulatory
31 approval of this Application. Cost recovery for the Pilot is requested in this

[2] PG&E 2009 Renewable Energy Procurement Plan (R.08-08-009), filed September 15, 2008; pp. 33-35 and Appendix C.

1 Application, which would provide capacity in addition to the overall up to
 2 250 MW PV UOG Program. The capital cost of the PV Pilot Program is
 3 expected to be \$11.9 million.

4 The up to 2 MW Pilot will likely be located on existing utility-owned land.
 5 The purpose of the Pilot is to expedite the deployment of the PV Program,
 6 demonstrate PG&E's commitment to the PV Program, and to allow PG&E to
 7 develop and refine internal and external processes needed to develop,
 8 permit, construct, and operate a PV facility prior to deployment of the larger
 9 PV Program.

10 C. Rationale for the PV Program

11 1. The PV Program Supports California and Federal Environmental 12 Goals

13 As the CPUC is well aware, the RPS Program requires utilities in
 14 California to attain and maintain a renewable resource portfolio equal to
 15 20 percent of their retail load by 2010, or 2013 with flexible compliance.
 16 In addition, California is actively considering increasing its renewable goals
 17 beyond the current 20 percent renewable energy target.
 18 Governor Schwarzenegger's Executive Order issued in November 2008,
 19 describes a new target for California of 33 percent renewable energy by
 20 2020.^[3] The California Legislature is actively considering legislation
 21 increasing the overall RPS target to 33 percent.^[4] The California Air
 22 Resource Board's (CARB) Scoping plan, adopted in December 2008, also
 23 identifies an increase in the renewables target to 33 percent by 2020, as a
 24 key measure for reducing greenhouse gas emissions and meeting
 25 California's climate change goals.^[5]

[3] Executive Order S-14-08, signed November 17, 2008;
<http://gov.ca.gov/index.php?/press-release/11073/>.

[4] Assembly Bill (AB) 64 and Senate Bill 14 currently consider increases to
 California's renewable portfolio standard to 35 percent and 33 percent,
 respectively:

SB14 http://www.leginfo.ca.gov/pub/09-10/bill/sen/sb_0001-0050/sb_14_bill_20090129_amended_sen_v98.html.

AB64 http://www.leginfo.ca.gov/pub/09-10/bill/asm/ab_0051-0100/ab_64_bill_20081209_introduced.html.

[5] CARB Scoping Plan, pp. ES-3.

1 The PV Program is designed to rapidly increase renewable resource
 2 energy deliveries in order to help meet the 2010 RPS goal under flexible
 3 compliance. The PV UOG Program is anticipated to add up to 0.5 percent
 4 to renewable energy sales by 2013, add up to 0.7 percent by 2014 when the
 5 PV UOG Program is fully deployed, and add up to 1.3 percent when the
 6 entire PV Program, including PPAs, is fully built. California leads the nation
 7 in its targets for renewable energy, but many risks and obstacles remain that
 8 may jeopardize the state's ability to meet this goal. The PV Program
 9 diversifies California's renewable portfolio by adding utility ownership and
 10 emphasizing mid-sized (1 to 20 MW) PV projects for PPAs.

11 The PV Program will also further the goals of California's 2006 Global
 12 Warming Solutions Act (AB 32), which seeks to reduce California's
 13 greenhouse gas emissions through an initial goal of returning economy wide
 14 emissions back to 1990 levels by 2020. Finally, the PV Program will also
 15 support the federal energy and environmental policy objectives outlined in
 16 President Obama's energy plan and detailed in several drafts of federal
 17 House and Senate legislation that call for aggressive action to reduce
 18 greenhouse gas emissions over the next 10 to 40 years.^[6]

19 **2. Utility Ownership of PV, Coupled With a Similar PPA Program, Is** 20 **Appropriate and Beneficial for Customers**

21 Solar PV is, in many respects, at a crossroads. The PV industry has the
 22 potential to continue to grow or to stagnate. PV technology is proven and
 23 efficiency gains are being realized every year.^[7] Until the recent financial
 24 downturn, the industry was increasing production, driving down costs, and
 25 expanding manufacturing. PG&E has signed a number of PPAs for
 26 large-scale PV facilities, as well as some smaller contracts for promising

[6] President Obama's "New Energy for America" plan proposes that 10 percent of our electricity comes from renewable sources by 2012, and 25 percent by 2025; and recommends an economy-wide cap-and-trade program to reduce greenhouse gas (GHG) emissions 80 percent by 2050.
http://www.whitehouse.gov/agenda/energy_and_environment/.

[7] National Renewable Energy Lab's National Center for Photovoltaics publishes a chart that depicts "Best Research – Cell Efficiency" demonstrating a steady improvement across a variety of materials in efficiency of photovoltaics since 1975.
http://www.nrel.gov/pv/thin_film/docs/kaz_best_research_cells.ppt.

1 innovative variations to the technology. As bright as this future seems, the
2 industry is threatened by the financial market crisis, delays associated with
3 obtaining development permits, and completion of transmission upgrades
4 and interconnections needed to interconnect large projects. Independent
5 developers are facing challenges in funding projects due to: (1) a reduced
6 number of large institutions willing to invest tax equity; (2) reduced
7 availability of credit for asset-based project financing; and (3) higher
8 required rates of return for those who can raise the necessary equity and
9 debt capital.**[8]** The PV Program will provide a needed economic stimulus
10 for the PV industry in California.

11 First and foremost, PV is a good technology for California because:
12 California is fortunate to have significant solar resources; there are a
13 number of regions in northern and central California with excellent insolation
14 and many others with good insolation that can support PV; solar technology
15 fits well with PG&E's portfolio; and solar technology produces energy when it
16 is warm and sunny, and matches PG&E's peak-load energy demands.

17 Second, PV can be deployed rapidly starting in 2010, and each year
18 thereafter, to help meet the 2010 RPS goal (under flexible compliance). By
19 targeting medium scale projects specifically designed to avoid the
20 interconnection and transmission barriers confronting other larger projects,
21 the PV Program will facilitate an expedited connection process. The target
22 size of primarily 1 to 20 MW for the proposed projects also complements
23 other programs such as the CSI Program and feed-in tariff that support
24 small projects (less than 1 MW or 1.5 MW, respectively).

25 Third, utility ownership of PV projects bypasses the financial challenges
26 confronting renewable development today. PG&E is highly likely to be
27 capable of financing the UOG portion of the PV Program. PG&E also has a
28 sufficient tax obligation to make full use of the tax incentives now available
29 to utility-owned renewable projects. These tax incentives were extended to

[8] A recent article in the *New York Times*, "Dark Days for Green Energy," reported on the significant impact of financial and economic crises on renewable development; February 4, 2009.
<http://www.nytimes.com/2009/02/04/business/04windsolar.html?partner=permalink&exprod=permalink>.

1 utilities by recent federal legislation and provide the investment tax credit
2 (ITC) to reduce the cost of utility-owned renewable generation.

3 Fourth, for several years, the CPUC has actively encouraged utility
4 ownership of renewable resources. In decisions approving PG&E's 2006,
5 2007 and 2008 RPS Plans, the Commission emphasized the importance of
6 an aggressive renewable strategy, part of which would involve utility
7 ownership of new renewable resources.^[9] More recently, in the
8 2006 Long-Term Procurement Plan (LTPP) proceeding, the Commission
9 authorized utilities to propose ownership of renewable facilities outside of an
10 RFO.^[10]

11 Finally, new utility-owned renewable generation will provide a greater
12 level of transparency for PG&E and the CPUC on the cost of renewable
13 development that cannot be obtained through the RPS contracting process
14 with an independent power producer.

15 Renewable projects developed by independent power producers are a
16 critical part of PG&E's overall effort to meet its RPS goals and will remain
17 so. The current financial market turmoil and economic slowdown, coupled
18 with the tax credits only just now made available for utility renewables
19 investment, warrants PG&E diversifying its portfolio of renewable resources
20 by adding UOG.

21 **D. Testimony Overview**

22 The remaining chapters of this testimony provide additional detail to support
23 the PV Program. The remaining chapters are organized as follows:

- 24 • Chapter 2: Photovoltaic Utility-Owned Generation Program;
- 25 • Chapter 3: Photovoltaic Power Purchase Agreement Program;
- 26 • Chapter 4: Capital Costs;
- 27 • Chapter 5: Operations and Maintenance Costs; and
- 28 • Chapter 6: Revenue Requirement and Ratemaking for PG&E's Photovoltaic
29 Program.

[9] D.06-05-039 at p. 34; D.07-02-011 at p. 24; D.08-02-008 at p. 32.

[10] D.07-12-052 at p. 211; D.08-11-008 at p. 21.

1 **E. Conclusion**

2 PG&E's PV Program proposes up to 500 MW of development of mid-sized
3 (typically 1 to 20 MW) PV projects over five years, split between UOG and
4 standard contract PPAs. The PV Program will also include an up to 2 MW pilot
5 project designed to aid rapid deployment of the PV Program once regulatory
6 review is complete by the end of 2009. PG&E's PV Program supports
7 California's environmental goals, is the appropriate technology, and is beneficial
8 for customers.

PACIFIC GAS AND ELECTRIC COMPANY
CHAPTER 2
PHOTOVOLTAIC UTILITY-OWNED GENERATION PROGRAM

PACIFIC GAS AND ELECTRIC COMPANY
CHAPTER 2
PHOTOVOLTAIC UTILITY-OWNED GENERATION PROGRAM

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1 **PACIFIC GAS AND ELECTRIC COMPANY**
2 **CHAPTER 2**
3 **PHOTOVOLTAIC UTILITY-OWNED GENERATION PROGRAM**

4 **A. Introduction**

5 The purpose of this chapter is to describe the Utility-Owned Generation
6 (UOG) portion of Pacific Gas and Electric Company's (PG&E or the Company)
7 proposed photovoltaic program (PV Program). Specifically, this chapter
8 provides an overall outline for this part of the PV Program, its anticipated timing,
9 its size, the expected deployment locations, types of technology being
10 examined, and the implementation plan. This section covers only the UOG
11 portion of the PV Program, with the Power Purchase Agreement (PPA) portion
12 covered separately in Chapter 3.

13 **B. Outline of Program**

14 The UOG portion of the PV Program targets development of up to
15 250 megawatts (MW) of utility-owned PV-based generation with projects
16 typically ranging in size from 1 to 20 MW.^[1] Projects will be primarily
17 ground-mounted PV installation, though PG&E may deploy some roof-mounted
18 systems. The systems will be connected to PG&E's grid. As described in more
19 detail below, the typical 1 to 20 MW size should allow PG&E to bring these
20 projects online faster and begin delivering renewable solar power to customers
21 sooner than larger-scale PV installations. All UOG projects will be located within
22 PG&E's service territory. Where possible, PG&E will work to develop projects
23 on utility-owned land in order to further lower costs and better control project
24 deployment.

25 PG&E will bring projects online at 50 MW per year on average, with the
26 first projects coming online in 2010. However, project timelines could be
27 affected if regulatory approval is significantly delayed beyond 2009.

[1] Unless otherwise specified, references to capacity targets and overall program design in this filing are presented as alternating current (AC). PV unit cost estimates, on the other hand, are presented in terms of \$/unit of direct current (DC) output as PV panels are usually priced in DC. PG&E relies on a conversion factor of 0.82 to convert from MW DC to MW AC. Based on this conversion factor, PG&E's 250 MW AC PV UOG Program equates to the development of up to 305 MW DC.

1 As described in Chapter 6, PG&E has estimated the total cost of the PV
2 UOG Program to be approximately \$1.45 billion.

3 **C. Size**

4 PG&E plans to develop up to 250 MW of UOG, with an average of 50 MW
5 deployed annually. A total scale of 250 MW represents approximately
6 0.7 percent of PG&E's retail load. PG&E anticipates enough units to be online
7 by 2013 to supply approximately 0.5 percent of load, which will count toward
8 PG&E's 2010 Renewable Portfolio Standard (RPS) target under flexible
9 compliance. At the same time, the 50 MW a year average size provides a
10 manageable scale for annual deployment. This would represent 3 to 50 projects
11 annually (depending on each project's size). PG&E believes this is a
12 manageable project load and that it will be successful in bringing projects online
13 in the timeline contemplated.

14 The PV UOG Program will target projects typically sized from 1 to 20 MW.
15 This size range has been selected for two key reasons. First, projects at this
16 scale are too large to qualify for incentives under the California Solar Initiative
17 (CSI) program. Second, projects at this scale allow for an accelerated time to
18 market. These projects can be constructed in a matter of months, rather than
19 years when compared to larger projects. Furthermore, projects at this scale are
20 not required to participate in the California Independent System Operator's
21 (CAISO) Large Generator Interconnection Procedures (LGIP), which should
22 allow these projects to come online quicker. These factors, combined together,
23 make this size range a logical scale for the PV UOG Program to target. PG&E
24 may also pursue the development of some smaller scale projects under 1 MW
25 where opportunities exist that complement the CSI.

26 **D. Timing**

27 PG&E proposes to roll out the PV UOG Program over five years between
28 2010 and 2014. After anticipated CPUC approval by the end of 2009, PG&E
29 plans to bring approximately 25 MW of new PV capacity online in 2010. For
30 2011 through 2013, PG&E is targeting approximately 50 MW of new PV capacity
31 additions annually, with approximately 75 MW brought online in 2014. PG&E's
32 actual rate of annual deployment may vary from these estimates depending on
33 factors such as financial market conditions, site availability, equipment

1 availability and permitting. PG&E may either accelerate deployment to bring
2 more generating capacity online sooner, or slow or suspend deployment if
3 market conditions make deployment unfeasible. PG&E would not exceed the
4 PV Program total of 250 MW without seeking California Public Utilities
5 Commission (CPUC or Commission) approval to expand the program.

6 PG&E anticipates taking some action ahead of CPUC approval, including
7 developing a PV Pilot Project, securing land, and conducting a competitive
8 process to secure equipment and construction services.

9 PG&E will develop, construct and operate an up to 2 MW PV Pilot Project.
10 Developing this plant ahead of CPUC approval will allow PG&E to establish
11 internal mechanisms to ensure an effective deployment of the PV UOG Program
12 and will provide practical, hands-on experience. The PV Pilot Project will also
13 ensure that once the Program is approved, PG&E is better able to efficiently
14 develop and construct multiple facilities.

15 Similarly, PG&E anticipates securing some land, via deposits, ahead of
16 CPUC approval of the PV Program. This land, supplemented by PG&E
17 utility-owned land, will allow PG&E to begin the detailed and site-specific
18 development work to ensure timely online dates for the future PV facilities.

19 Finally, PG&E will solicit competitive bids in 2009, in order to execute its
20 proposed implementation plan described later in this chapter.

21 **E. Location**

22 The PV UOG Program will be limited to developing facilities within PG&E's
23 service territory. This limitation will ensure that PG&E can provide maintenance
24 and support to these sites economically and assists with keeping the overall
25 project costs down.

26 Most projects will be located near PG&E substations to minimize the cost of
27 interconnecting to PG&E's grid, though roof-mounted projects would have more
28 flexibility. Where feasible, PG&E will develop projects on PG&E utility-owned
29 properties. This option can be more economical than developing projects on
30 third-party sites where the cost of securing land would increase the delivered
31 cost of energy for the project. The location of any specific facility will be
32 determined based on least cost, best fit. This means that PG&E will examine
33 multiple location factors (listed below) and balance them to achieve the greatest
34 value for our customers. For example, PG&E may choose a location with more

1 expensive land because a lower interconnection cost provides a more
2 economical project. The criteria for site selection are listed below:

- 3 • **Insolation:** The quality of the solar resources in a specific site, which
4 partially determines the amount of energy a site can generate annually;
- 5 • **Slope:** Flat, level, or gently sloped locations are less costly to construct on
6 and operate;
- 7 • **Cost of Interconnection:** Sites that provide lower cost interconnections will
8 lower the overall cost of the project.
- 9 • **Capacity Available at the Substation:** Substations that have a greater
10 ability to accept power will allow PG&E to build larger individual plants,
11 which are likely to come at a lower cost per kilowatt (kW);
- 12 • **Availability and Cost of Sites:** Locations with lower cost of land in large
13 areas will lower overall project costs. PV facilities generally require 7 to
14 10 acres per MW of capacity;
- 15 • **Minimal Environmental Impact:** Minimizing environmental impact fits with
16 PG&E's and its customers values. It also minimizes development costs and
17 reduces uncertainty; and
- 18 • **Local Transmission Constraints:** Placing projects in locations with local
19 transmission constraints can create additional value for customers.

20 F. Technology

21 PG&E has not selected a single technology for the PV UOG Program, but
22 instead plans to select the best technology based on the results of its
23 competitive solicitation. The current PV technologies all have various trade-offs,
24 including: panel cost, panel efficiency, peak performance in direct sunlight, best
25 average performance during an entire day, best diffuse light performance
26 (performance on a cloudy day), reliability, and maintenance requirements.
27 PG&E will weigh these different attributes to select the technology that provides
28 the best value for its customers.

29 The two main categories of PV technology in the market today are
30 crystalline silicon solar cells and thin-film solar cells. Crystalline silicon solar
31 cells make up the majority of the market today and have the longest operating
32 history. They come in two forms: monocrystalline and polycrystalline. The

1 crystalline technology has evolved from the semiconductor industry and
2 crystalline cells tend to have higher efficiency than thin-film solar cells, thereby
3 requiring less space to produce the same total output. However, the historic
4 disadvantage of crystalline cells is that they tend to be expensive.

5 An alternative technology is thin-film solar cells. These cells are made by
6 depositing a thin layer of semiconductor material to a substrate (for example,
7 coated glass). The deposited material can be amorphous silicon (still silicon as
8 used in crystalline cells, but in a different form) or a polycrystalline material such
9 as cadmium telluride. Thin-film cells use very thin layers of material, thereby
10 reducing material costs and reducing the overall cost of the cells. However,
11 thin-film cells also tend to be less efficient than traditional crystalline cells,
12 meaning more cells and more space are required to produce the same amount
13 of energy.

14 Beyond the PV panels, a complete system requires inverters, racks, and
15 wiring. The power generated by PV panels, no matter the technology, is DC. In
16 order to be fed into the power grid, this must be converted to AC by the inverter.
17 Similarly, racks are required to hold and position the panels and wiring is
18 required to connect all of the panels together into a complete system.

19 As stated earlier, PG&E does not have a technology preference for its
20 utility-owned projects. PG&E will weigh panel cost, efficiency, cost of
21 construction, maintenance costs, total power output, and other attributes to
22 select the technology that is the best and most economic fit for our customers.

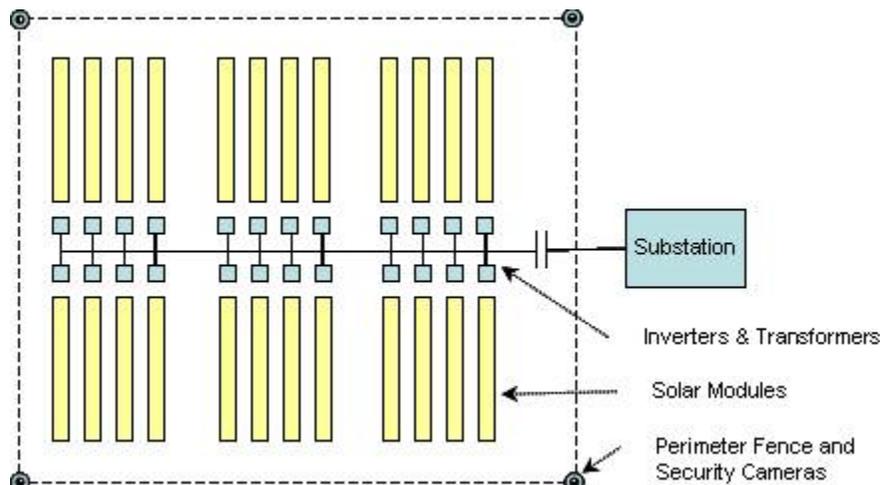
23 **G. Interconnection**

24 PG&E proposes using the Federal Energy Regulatory Commission
25 (FERC)-approved Small Generator Interconnection Procedures (SGIP) to
26 ensure a non-discriminatory interconnection process for PG&E's UOG facilities.
27 While the focus or expectation of these programs is on distribution voltage
28 interconnections (below 50 kilovolt (kV), typically 12 kV and 21 kV), the SGIP
29 does provide for transmission interconnections as well, as long as the capacity is
30 no greater than 20 MW per generation facility. While PG&E anticipates that the
31 majority of facilities will be interconnected at the distribution voltage level, it may
32 be that in some circumstances, a transmission level interconnection is more
33 appropriate. The pre-application process outlined in Section 1.2 of the SGIP
34 provides an opportunity for the Distribution Provider and the Interconnection

1 Customer to gain clarity on whether the Interconnection Request (Application) to
 2 the Distribution Provider should be at the distribution or transmission voltage
 3 level.

4 There are a range of interconnection options that PG&E will use for its
 5 PV UOG Program. The type of facilities required to interconnect PV projects to
 6 substations will vary depending on the interconnection configuration required for
 7 each project. In general, PV modules will be connected to inverters, which will
 8 then be connected to step-up transformers, which will be connected to the power
 9 grid. These general interconnection facilities are depicted graphically below in
 10 Figure 2-1. However, the precise facilities that will be required and the cost of
 11 interconnection will vary significantly depending on the type of configuration
 12 required to connect each facility.

**FIGURE 2-1
 PACIFIC GAS AND ELECTRIC COMPANY
 SAMPLE PV FACILITY LAYOUT**



13 H. Implementation

14 To leverage its resources and obtain cost competitive facilities, PG&E will
 15 use a small construction management team to manage contractors
 16 implementing the engineering, procurement, construction, and commissioning of
 17 the PV facilities. PG&E will structure its solicitation method to maximize
 18 competitive pricing, volume discounts, and price certainty that will provide the
 19 most cost-effective systems. PG&E's solicitation will consider both bundled
 20 turnkey (engineering, procurement and construction (EPC)) bids and unbundled

1 EPC bids (where PG&E could supply owner-furnished major equipment to a
2 construction installation contractor).

3 **I. Conclusion**

4 This section of testimony provides a summary of the UOG portion of the
5 PV Program. The timing, scale, location, implementation, and technology
6 choices described in this section should be combined with the capital cost
7 estimates in Chapter 4 and the Operating and Maintenance (O&M) costs in
8 Chapter 5 to provide a complete understanding of the UOG portion of the
9 PV Program.

PACIFIC GAS AND ELECTRIC COMPANY
CHAPTER 3
PHOTOVOLTAIC POWER PURCHASE AGREEMENT PROGRAM

PACIFIC GAS AND ELECTRIC COMPANY
CHAPTER 3
PHOTOVOLTAIC POWER PURCHASE AGREEMENT PROGRAM

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1 **PACIFIC GAS AND ELECTRIC COMPANY**
2 **CHAPTER 3**
3 **PHOTOVOLTAIC POWER PURCHASE AGREEMENT PROGRAM**

4 **A. Introduction**

5 The purpose of this chapter is to describe the Power Purchase Agreement
6 (PPA) portion of Pacific Gas and Electric Company's (PG&E or the Company)
7 proposed Photovoltaic (PV) Program. Specifically, this chapter will provide an
8 overall outline for this part of the PV Program, its anticipated timing, its size,
9 eligibility requirements, project selection and pricing and key terms.

10 **B. Outline of Program**

11 The PPA portion of the PV Program is designed to target development of up
12 to 250 MW of seller-owned photovoltaic-based generation. Through PG&E's
13 PV PPA Program, independent power producers (IPPs) will be offered an
14 opportunity to provide PG&E with similar generation capacity compared to the
15 PV Utility-Owned Generation (UOG) Program megawatts (MW). PG&E will
16 contract with sellers for up to 250 MW of PV generation over five years at a price
17 comparable to the utility cost-of-service. PG&E will conduct annual Requests for
18 Offers (RFO) for PPAs and select up to 50 MW per year. Winning bidders will
19 sign a standard, 20-year, fixed-price contract that includes appropriate terms
20 and conditions to induce the seller to develop and deliver renewable energy to
21 PG&E by the contractual online date and over the contract term. The PV PPA
22 Program RFO protocol and standard contract will be modeled after the then-
23 current California Public Utilities Commission (CPUC or Commission) approved
24 PG&E Renewable Portfolio Standard (RPS) RFO protocol and standard form
25 contract. In this case the current protocol and standard contract are those filed
26 with PG&E's 2009 RPS Plan.^[1] The first PV PPA Program RFO would be
27 conducted in early 2010, after regulatory approval of the PV Program. The
28 contracts would be targeted for award in the summer of 2010, with project online
29 dates within 18 months of the contracts being effective. PG&E will conduct

[1] PG&E 2009 Renewable Energy Procurement Plan (R.08-08-009) filed September 15, 2008.

1 annual RFOs thereafter, although any remaining RFOs for the PV PPA Program
2 will be eliminated if the PV UOG Program is terminated for any reason.

3 Each project will be between 1 MW and 20 MW in size. As with the
4 PV UOG Program, these mid-sized projects should allow the IPPs to bring these
5 projects online quickly and begin delivering renewable solar power to PG&E's
6 customers expeditiously. All projects must be located within PG&E's service
7 territory.

8 **C. Timing and Timeline**

9 PG&E will hold annual RFOs (up to 50 MW each) from 2010 to 2014. The
10 first PV PPA RFO will be held in early 2010, and will seek projects with online
11 dates by the end of 2011. Each subsequent PV PPA RFO will solicit projects
12 that would be online within 18 months after the contracts become effective, with
13 anticipated project online dates by the end of 2012, 2013, 2014 and 2015. If
14 PG&E does not award a total of 50 MW in a given RFO, the unallocated
15 megawatts will be rolled over into the following year's PV PPA RFO. The
16 schedule below illustrates the timing for the first PV PPA RFO. This schedule
17 could change if the CPUC approval is delayed beyond 2009.

**TABLE 3-1
PACIFIC GAS AND ELECTRIC COMPANY
PV PPA RFO SCHEDULE**

<u>Line No.</u>		
1	End of 2009	CPUC Approval of PV Program.
2	January 2010	PG&E Updates/Finalizes PPA Documents and Solicitation Protocol Consistent with CPUC Decision.
3	February 2010	PG&E Issues PV PPA RFO.
4	March 2010	Bids Due in PV PPA RFO.
5	June 2010	Winning Bidders Selected.
6	July 2010	PPA Contracts Approved by CPUC via Tier 1 Advice Letter.
7	December 2011	Deadline for PV Projects to be Online.

18 **D. Eligibility**

19 In order to participate in the PV PPA RFO, sellers must meet the following
20 eligibility requirements:

1. Technology

To qualify as eligible for the PV PPA RFO, a generation facility must use photovoltaic technology, as defined by the current version of the applicable California Energy Commission (CEC) Guidebooks.^[2] PG&E has not selected a single PV technology for its PV PPA Program, but instead may select multiple technologies based on the results of its RFO. Photovoltaic technology is rapidly evolving. The best cost/performance choice today may not be the best cost/performance choice a couple years from now as the technology continues to evolve and new companies enter the market. This is one of the key reasons for holding annual PV PPA RFOs. There may be cost-effective technologies that can participate in later PV PPA RFOs that do not exist today.

2. Project Size

For the PV PPA RFO, the minimum size for eligible projects to bid into the competitive solicitation is 1 MW, with a maximum size of 20 MW. This size range has been selected for two key reasons. First, the 1 MW minimum provides an opportunity for projects that exceed the 1 MW maximum eligibility for net metering and the California Solar Initiative (CSI) Program incentive. Second, projects at this scale (and under 20 MW) can be constructed relatively quickly. As described in Chapter 2, projects at this scale are not required to participate in the California Independent System Operator's (CAISO) Large Generator Interconnection Procedures (LGIP), allowing projects to come online more quickly. These factors make this size range a logical scale for the PV PPA Program to target.

3. New Projects

In order to ensure that the PV PPA Program increases the total supply of renewable generation, PG&E will consider only new PV generating facilities in the PV PPA RFO. Existing projects have other options to contract with PG&E, depending on their size. Projects greater than 1.5 MW may bid into PG&E's annual RPS solicitation or enter into a bilateral

[2] CEC Renewables Portfolio Standard Eligibility, Third Edition, Adopted December 19, 2007.

1 negotiation with PG&E. Projects less than 1.5 MW may sell all or excess
2 generation to PG&E under a standard contract form.

3 **4. Location of Generating Facility**

4 Consistent with the UOG portion of the PV Program, projects must be
5 located in PG&E's service territory.

6 **E. RFO Selection Process**

7 The PV PPA RFO will be modeled on the successful RPS RFOs that PG&E
8 has conducted since the RPS program began in 2002. As with the RPS RFOs,
9 the PV PPA RFO will be conducted according to a published protocol, under the
10 supervision of an Independent Evaluator. The 2010 PV PPA RFO will be based
11 on the 2009 RPS Plan and Protocol, which includes a standard contract, subject
12 to modifications or changes that may be made by the Commission to the
13 2009 Protocol or standard contract. After the 2009 RPS Plan and Protocol are
14 adopted by the CPUC, PG&E will submit the approved 2009 protocol and
15 standard contract, with any necessary changes for this program, through a
16 compliance filing in this proceeding. PG&E will update its standard contracts for
17 future solicitations as needed to reflect changes in law, CPUC decisions or
18 changed market conditions.

19 PG&E will award up to 50 MW of PV in each annual RFO. The evaluation
20 process used by PG&E will be similar to the process used in the RPS RFO
21 evaluation. The primary difference is that in the PV PPA RFO bidders do not bid
22 a price—the price is set for all bidders before the RFO. Thus, a key distinction
23 between offers will be the viability of the project. PG&E will select those projects
24 that are most likely to be brought online and deliver energy as promised. The
25 following describes the CPUC approved RPS evaluation criteria and how they
26 will be applied to the PV PPA RFO bids.

27 **1. Project Viability**

28 Project viability is a critical factor in the selection process. Project
29 viability addresses the project status, the project site, and the experience
30 and qualification of the project developer. Project status is assessed by the
31 developmental stage and the likelihood of the project's ability to obtain
32 permits. Since projects must be online within 18 months of a contract being
33 effective, those projects in advanced development (e.g., permits received,

1 equipment purchased, sites and easements obtained, transmission studies
2 completed (if necessary) and status of design/construction) will be preferred
3 to those in earlier stages of development. Resource risk will be assessed on
4 whether resource availability and sustainability have been proven in the
5 project location. Bidder experience will be assessed on whether the bidder
6 has experience with the specific technology offered or whether the bidder
7 has experience with other renewable or conventional power generation.
8 Long run viability is also important and takes into account an assessment of
9 the technology as it relates to continued project reliability. PG&E will
10 incorporate other potential changes to viability assessment, including seller
11 concentration once they are adopted by the CPUC for the 2009 RPS Plan.

12 **2. Market Valuation**

13 Although winning bidders will be receiving the same price for their
14 energy, and the deliveries will all be from PV projects, the market value,
15 including local Resource Adequacy value, may differ due to delivery location
16 and generation profile.

17 **3. Credit**

18 Credit is assessed by the bidder's ability to provide collateral to secure
19 its obligations under the PPA. Credit requirements are standard and must
20 be fully met for a project to be eligible.

21 **4. RPS Goals**

22 The PV PPA RFO evaluation will take into account the bidder's status as
23 a Women, Minority and Disabled Veterans Business Enterprise (WMDVBE)
24 and/or the bidder's intent or policy of subcontracting with WMDVBEs.
25 PG&E's evaluation will also take into account whether the bidder has signed
26 Project Labor Agreements and whether the bidder plans to pay prevailing
27 wage.

28 **F. General Contract Terms**

29 All participants will be required to sign a standard, non-modifiable contract.
30 Given the tight timeframes between the PV PPA solicitation, contract execution
31 and commercial operation of the PV projects, there will be no negotiation of
32 contract terms and conditions. The 2010 PV PPA will be based on the standard
33 contract PPA from the 2009 RPS RFO that is adopted by the CPUC, as

1 discussed above. However, the PV PPA will include modifications to the RPS
2 PPA to reflect the unique nature of the PV PPA Program. The changes required
3 are limited in nature and reflect the fact that the PV PPA projects will be limited
4 to PV technology and between 1 and 20 MW. Given the current draft of the
5 2009 RPS PPA, PG&E anticipates the following changes would be required to
6 create a PV-only PPA:

- 7 • **Price and Term:** RPS PPA allows seller to specify price and term. PV PPA
8 would mandate a fixed price and 20-year term.
- 9 • **Interconnection:** RPS PPA assumes seller will interconnect using LGIPs.
10 PV PPA would delete references to LGIP and replace with SGIP.
- 11 • **Contract Delays:** RPS PPA allows for 18-month delay in construction start
12 and online date associated with delays in transmission interconnection and
13 transmission upgrade. Since smaller projects are expected to have shorter
14 interconnection times, PV PPA would reduce allowance for transmission
15 upgrade and interconnection delays from 18 months to 12 months and
16 delete provisions for CAISO Limited Operations Studies, which are
17 associated with LGIP. Consistent with the RPS PPA, the PV PPA would
18 also allow for extension of online dates as a result of permitting delays or
19 force majeure, as long as the cumulative delay associated with
20 transmission, permitting and force majeure does not exceed 12 months.
- 21 • **Conditions Precedent:** RPS PPA is not effective and binding unless CPUC
22 approval is received within 240 days. PV PPA would also be conditioned
23 upon CPUC approval, but approval time would be substantially shorter given
24 the Tier 1 Advice Letter process.

25 Key elements of the form PV PPA are summarized below. PG&E will
26 update its PV PPA for future solicitations as needed to reflect changes in law,
27 CPUC decisions or changed market conditions.

TABLE 3-2
PACIFIC GAS AND ELECTRIC COMPANY
PV PPA SUMMARY OF MAJOR TERMS AND CONDITIONS

<u>Line No.</u>		
1	Delivery Term	20 years.
2	Price	Based on UOG price. Payment is adjusted by Time of Delivery (TOD) factors. See Section G below.
3	Contract Quantity	Seller specifies annual delivery amount, which may decline over time to reflect PV degradation.
4	Online Date	Full capacity must be online within 18 months. It is anticipated that projects will be online by December 31, 2011 (based on the timing of the first RFO).
5	Performance Standards/ Requirements: Minimum production requirement.	In order to ensure that the Seller provides energy over the 20-year contract term, the PPA requires a minimum amount of energy, Guaranteed Energy Production (GEP) each year.
6	Scheduling	PG&E is Scheduling Coordinator (SC) for all projects.
7	Eligible Intermittent Resource Program (EIRP)	Generator is required to qualify and register for the EIRP for solar facilities, once the program is operational.
8	Metering	Required to have CAISO approved meter.
9	Imbalance Energy	For all resource types in the CAISO where PG&E is the SC, PG&E will assume Imbalance Energy risk. However, if Seller does not provide information required by the PPA, Seller bears the imbalance risk outside of a pre-determined tolerance band.
10	Guaranteed Milestones and other Key Limits	Seller specifies Guaranteed Construction Start Date (GCSD) and Guaranteed Commercial Operation Date (GCOD), which may be no longer than 18 months from when the contract becomes effective. Milestones may be extended up to one year due to cumulative delays in permitting, interconnection or force majeure.
11	Non-Performance or Termination Penalties and Default Provisions: Events of Default	Seller is subject to daily delay damages and contract default if project milestones are not met. Daily delay damages are assessed from and capped at project development security. This ensures that Seller has an incentive to bring project online as promised.
12	Credit Terms	The Seller must provide collateral during the project development period and delivery term: <ul style="list-style-type: none"> • Project development security: \$50/kW upon CPUC approval; and • Delivery Term Security: Upon commercial operation, 12 months revenue.

1 **G. Pricing**

2 Consistent with standard renewable PPAs, Sellers will receive a contract
3 price, adjusted by a TOD factor, for each megawatt-hour (MWh) produced. TOD
4 factors will be the annual TOD factors adopted for the annual RPS solicitations.

5 The price for the PPAs to be awarded in the first RFO is set based on the
6 average levelized cost of energy presented in Chapter 6. Chapter 6 shows a
7 levelized annual cost of energy of \$295/MWh. This translates to a pre-TOD
8 contract price of approximately \$246/MWh.^[3]

9 For future PV PPA RFOs, PG&E recognizes the possibility that there could
10 be significant technological improvements or efficiency gains which could result
11 in substantial reductions to PV costs for the UOG projects. PG&E would expect
12 to take advantage of these cost savings for customers for the UOG Program and
13 would also want customers to be able to benefit from lower PPA costs. If PG&E
14 determines that PV Program costs are substantially lower than forecast, based
15 on experience with the PV Program or changed market conditions, PG&E will
16 submit a revised PV PPA price through an advice letter, along with updated PPA
17 forms, for CPUC approval prior to conducting subsequent annual PV PPA
18 RFOs.

19 **H. Regulatory Approval**

20 The PV PPAs will have a pre-approved price and pre-approved terms and
21 conditions. Thus, PG&E will file these agreements using a Tier 1 Advice Letter
22 process. Under the Tier 1 process, approval of the advice letter is complete
23 within 30 days unless the CPUC takes action otherwise. This streamlined
24 approval process will allow developers a better chance to complete their
25 projects, since the lag between contract execution (and commitment to a price
26 and milestones) will be reduced.

27 **I. Conclusion**

28 This section of testimony provides a summary of the PPA portion of the
29 PV program, detailing the timing, eligibility, RFO selection process, general
30 contract terms, pricing and regulatory approval.

^[3] Given the expected generation profile of the PV facilities targeted by the PV Program, and PG&E's current TOD factors, expected revenues/MWh for a PV project would be 1.20 times contract price. Contract price × 1.2 = Levelized cost of energy.

PACIFIC GAS AND ELECTRIC COMPANY

CHAPTER 4

CAPITAL COSTS

PACIFIC GAS AND ELECTRIC COMPANY
CHAPTER 4
CAPITAL COSTS

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1 **PACIFIC GAS AND ELECTRIC COMPANY**
2 **CHAPTER 4**
3 **CAPITAL COSTS**

4 **A. Introduction**

5 The purpose of this chapter is to set forth Pacific Gas and Electric's
6 (PG&E or the Company) estimate of the capital costs necessary to construct
7 250 MW of the Utility-Owned Generation (UOG) portion of its Photovoltaic (PV)
8 Program. PG&E currently intends to begin construction in 2010, assuming
9 regulatory approval in late 2009.

10 **B. Summary**

11 In the summer of 2008, PG&E assembled vendor data and PG&E-supplied
12 balance of plant components to arrive at an estimated total system cost (by year
13 and on a weighted average), as presented in Table 4-1 below. PG&E collected
14 indicative cost estimates from PV manufacturers and system integrators for
15 PV panels, inverters, and complete systems. Discussions were held with a
16 cross-section of established and emerging companies offering a variety of solar
17 technologies, including crystalline silicon and thin-film panels, fixed and tracking
18 mounts, and single-axis and dual-axis concentrating systems.

19 Vendors were asked to provide indicative pricing, technology specifications,
20 and performance data for PV modules or turnkey systems for the following
21 program design:

- 22 • 300 megawatts (MW) total program size, 75 MW per year deployment over
23 four years, 2010-2013;^[1]
- 24 • 2 MW or 5 MW project size;
- 25 • Flat, greenfield sites adjacent to PG&E substations;
- 26 • PG&E to provide sites, permitting, grid interconnection; and
- 27 • Prevailing wage labor.

[1] The program was subsequently changed up to 250 MW, with approximate
deployments of up to 25, 50, 50, 50 and 75 MW per year. PG&E assumed
that these changes would have negligible impact on the solar field cost
per MW.

1 Technical data requested included:

- 2 • Technology descriptions;
- 3 • Physical weight and dimensions;
- 4 • Materials of construction;
- 5 • Performance ratings and curves showing the influence of varying ambient
- 6 and cell temperatures and solar radiation levels;
- 7 • Degradation rates as a function of ambient and cell operating temperatures;
- 8 • Laboratory stress test data used to support lifetime performance claims;
- 9 • Field operating experiences, including deployment schedules by year of
- 10 manufacture and location, associated failure and degradation rates; and
- 11 • Energy production at representative California locations (Bakersfield,
- 12 Fresno, Daggett, Sacramento) using the 30-year average
- 13 National Renewable Energy Laboratory (NREL) “Red Book” insolation and
- 14 weather data set.

15 Commercial data requested included:

- 16 • Manufacturing capacities;
- 17 • Sales volumes;
- 18 • Warranty terms; and
- 19 • Operating and maintenance costs.

TABLE 4-1
CAPITAL COST ESTIMATE
PV UOG PROGRAM
\$2009/KILOWAT (kW) DIRECT CURRENT (DC)(a)

Line No.	Program Cost Element	2010	2011	2012	2013	2014	Weighted Average
1	PV System Contract	3,605	3,334	3,108	2,943	2,884	3,103
2	Land Acquisition, Site Preparation and Permitting	270	268	265	262	259	264
3	Grid Interconnection	238	234	229	224	219	227
4	Security and SCADA	161	158	155	152	149	154
5	PG&E Supervisory Labor and Consulting	174	87	87	87	48	84
6	Subtotal	4,448	4,081	3,843	3,667	3,559	3,831
7	Contingency	499	470	445	427	419	444
8	Total Project Cost	4,947	4,551	4,288	4,094	3,979	4,275

(a) Costs are presented in year 2009 dollars.

1 As described in Chapter 2, PG&E intends to perform a competitive
2 solicitation for the PV UOG Program. The costs presented above are the result
3 of non-binding discussions with vendors.

4 **C. Global Assumptions**

5 In preparing the cost estimate used in this testimony, PG&E used the
6 following global project assumptions:^[2]

- 7 • 250 MW program, consisting of 25 MW deployment in 2010, 50 MW in 2011,
8 2012 and 2013 and 75 MW in 2014;
- 9 • 5 MW average project size per site;
- 10 • Ground mounted systems on flat, already disturbed agricultural land;
- 11 • Seismic Zone 4;
- 12 • Construction to local building regulations, codes and standards;
- 13 • 10 acres of land per MW of solar field;

^[2] As discussed in Chapter 2, actual deployment, project sizes, and locations may vary from the assumptions used to develop the cost estimates.

- 1 • Annual performance degradation of 0.89 percent, which is consistent with a
- 2 typical warranty of 80 percent output at 25 years of operating life;^[3]
- 3 • Inverters replaced after 10 years of operation; and
- 4 • 25-year economic life with zero salvage value/disposal cost.^[4]

5 **D. PV System Contract Cost**

6 The estimated PV System Contract cost, Table 4-1, line 1, is based on
 7 indicative price estimates provided by vendors, as mentioned above. The scope
 8 of the contract is bundled (turnkey), engineering design, equipment
 9 procurement, and construction (EPC). The system equipment includes panels,
 10 mounting racks or trackers, inverters and medium voltage field transformers,
 11 combiner boxes, fuse boxes and fuses, DC string wiring, alternating current (AC)
 12 system wiring to the interconnection switchyard, and a performance monitoring
 13 system. Construction costs are based on prevailing wage costs.

14 PG&E would provide the balance of system components: land and
 15 permitting; grid interconnection; site preparation; site security; and a
 16 System Control and Data Acquisition (SCADA) connection to the PG&E
 17 communication network.

18 **E. Land Acquisition, Site Preparation and Permitting**

19 The estimated land acquisition, permitting, and site preparation costs are
 20 indicated on line 2 of Table 4-1.

21 The estimated land cost is based on recent sales prices for Central Valley
 22 crop land, escalated at 2 percent per year, and with 10 acres required per MW.
 23 Given the need to develop land quickly, PG&E plans to use disturbed farmland,
 24 preferably of marginal agricultural quality. PG&E plans to use land having high
 25 insolation, as long as the price of the land and the grid interconnection costs are
 26 reasonable. PG&E also plans to use its own “buffer” land surrounding existing
 27 substations, to the extent that that land is not needed for future substation
 28 expansion and can be easily permitted. Use of existing land would result in

[3] This assumption and the two below it affect annual energy production and operating costs, not the capital costs presented in Table 5-1.

[4] This is a conservative assumption in that the PV systems are expected to still be producing 80 percent of the original power output at the end of 25 years.

1 PV UOG Program cost savings, to the benefit of customers. As discussed
2 earlier, PG&E may also deploy roof-mounted systems.

3 The land areas required to build solar fields make it important to use sites
4 that require minimal preparation and that are suitable for low-cost foundations.
5 PG&E conducted preliminary geotechnical surveys of 12 potential sites during
6 the fall of 2008. The geotechnical surveys of these sites indicated that there
7 were no major geotechnical or structural obstacles for PV development. Soil on
8 the sites consisted of varying amounts of low-plasticity clay (CL), silty sand (SM)
9 and clay sand (SC). This *mélange* of sand, soil, and silt is often termed “loam.”
10 None of the surveyed sites were in the Federal Energy Management
11 Administration (FEMA) 100-year flood plain. This lack of inundation potential
12 means there should be no *caliche* or significant amounts of cemented soil (which
13 would prevent driving PV panel support columns). The potential for steel and
14 concrete corrosion due to the soil can be mitigated with proper concrete mix
15 designs and steel coatings (e.g., galvanizing). The seismic hazard is generally
16 low with slight increases for sites in the Bakersfield area and for sites closer to
17 Interstate 5.

18 PG&E’s Geosciences department estimated site preparation costs using
19 best-judgment estimates for clearing minor vegetation, scarifying the upper
20 12 inches, and compacting. The estimate assumes that importing/disposing soil
21 or significant grading and drainage would not be required at any of the sites. If
22 additional features at the sites are desired (e.g., base rock, paving), these would
23 need to be added to the total development costs. Large amounts of vegetation
24 removal (e.g., vineyards) would also be extra.

25 **F. Grid Interconnection**

26 PG&E estimated interconnection costs for a variety of possible
27 configurations. Costs can vary significantly depending on the design and
28 capacity of the particular substation and feeder, the amount of MW to be
29 injected, and the location of the interconnection point. The value shown in
30 Table 4-1, line 3, corresponds to a mix of interconnection configurations that
31 PG&E judged most likely to be used in the PV UOG Program.

1 **G. Security and SCADA**

2 Security includes fences and monitoring equipment. Security and plant
3 performance monitoring data are connected to the PG&E SCADA network.
4 The estimated cost, shown in Table 4-1, line 4, was developed by scaling costs
5 for similar, recently completed PG&E projects to the solar field dimensions,
6 expected site locations, and data requirements.

7 **H. PG&E Supervisory Labor, Consulting Support, and Permits**

8 PG&E's cost estimate on line 5 of Table 4-1 is for labor and consulting
9 support to supervise land acquisition and permitting activities, to conduct
10 biological surveys, to conduct environmental site assessments, to locate
11 properties and negotiate land purchases, to prepare site plans and construction
12 bid documents, to prepare solicitation documents and evaluate and award bids,
13 to supervise field construction, to manage the PV UOG Program schedule and
14 budgets, and for fees, permits and implementation of permit terms and
15 conditions.

16 **I. Contingency**

17 PG&E used different contingency factors for the PV UOG Program cost
18 elements depending on the level of variability and uncertainty in the estimates:
19 a 10 percent contingency for the turnkey solar field, 33 percent for land
20 acquisition and permitting, 20 percent for grid interconnection, 15 percent for site
21 preparation, 18 percent for Security/SCADA, and 0 percent for supervisory labor
22 and consulting support. The contingency amount is shown on line 7 of
23 Table 4-1.

24 **J. Pilot Project**

25 PG&E plans to initiate the PV UOG Program by building a PV Pilot Project
26 starting in 2009. The estimated cost of the PV Pilot Project is \$11.9 million. The
27 basis for this cost estimate is the same as for the larger PV UOG Program, as
28 described above. The PV system contract pricing is based on indicative vendor
29 quotations. The land cost was estimated to be zero, assuming PG&E land will
30 be used. The grid interconnection cost is based on a specific site under
31 consideration. Other costs are scaled from the baseline 5 MW project size to
32 the nominal 2 MW pilot size. No contingency costs are included in the

1 PV Pilot Project estimate. If vendor bids are higher than estimated, PG&E will
2 reduce the size of the PV Pilot Project to match the targeted estimated cost.

3 **K. Conclusion**

4 This chapter presents PG&E's estimated capital costs for the PV UOG
5 Program. The capital costs presented in this chapter are reasonable and form
6 the basis of the revenue requirement and ratemaking presented in Chapter 6.

PACIFIC GAS AND ELECTRIC COMPANY
CHAPTER 5
OPERATIONS AND MAINTENANCE COSTS

PACIFIC GAS AND ELECTRIC COMPANY
CHAPTER 5
OPERATIONS AND MAINTENANCE COSTS

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1 **PACIFIC GAS AND ELECTRIC COMPANY**
2 **CHAPTER 5**
3 **OPERATIONS AND MAINTENANCE COSTS**

4 **A. Operations and Maintenance Costs: Photovoltaic Utility-Owned**
5 **Generation Program**

6 **1. Introduction**

7 This chapter describes the operating and design characteristics of the
8 Photovoltaic Utility-Owned Generation Program (PV UOG Program)
9 facilities, which determine the subsequent Operations and Maintenance
10 (O&M) expenditure requirements to support their ongoing safe, compliant,
11 reliable and cost-effective operation.^[1] This chapter presents the O&M
12 expenses for the first five years of commercial operation that are used in the
13 development of the initial revenue requirement presented in Chapter 6.

14 **2. Summary**

15 After the PV facilities achieve commercial operation, O&M expenditures
16 will be required to ensure safe, compliant, reliable and cost-effective
17 operation. Pacific Gas and Electric Company's (PG&E or the Company)
18 estimate of the O&M costs, including contingency, for the first five years of
19 operation is summarized in Table 5-1 below.

[1] In this chapter, all references to the electrical output capability are presented on an alternating current (AC) basis unless denoted otherwise. Costs are represented in year 2009 dollars.

**TABLE 5-1
PACIFIC GAS AND ELECTRIC COMPANY
O&M COSTS INCLUDING CONTINGENCY
(2009 THOUSAND DOLLARS)**

Line No.	Year of Operation	First	Second	Third	Fourth	Fifth
1	PG&E Labor and Preventive Maintenance	619	889	1,159	1,428	1,833
2	Corrective Maintenance	31	94	157	220	315
3	Safety/Security/Compliance	29	87	146	204	291
4	Infrastructure	153	460	767	1,074	1,534
5	Consumables and Materials	6	17	28	39	55
6	Contracts	250	750	1,250	1,750	2,500
7	Contingency	218	459	701	943	1,306
8	Total O&M Including Contingency	1,306	2,756	4,207	5,657	7,833

1 **3. Basis of Design and Cost Assumptions**

2 This section describes the technical aspects of typical solar facilities
3 which were used as the basis for the O&M costs required to operate and
4 support the facilities. The UOG portion of the PV Program will consist of up
5 to 250 megawatts (MW) dispersed over a number of locations determined
6 by solar performance, interconnection cost, and land availability along with
7 other factors. Basic design components for the solar facilities include a
8 standard configuration consisting of “strings” of PV panels with each string
9 connected to a 0.5 MW or 1 MW inverter. Multiple strings and inverters
10 located on a project site determine the size of the installation up to 20 MW.
11 The O&M estimates are based upon the simplifying assumptions that the
12 average site will produce 5 MW and the 250 MW PV UOG Program total will
13 be installed according to the quantities shown in Table 5-2, below, and
14 outlined in Chapter 2.

**TABLE 5-2
PACIFIC GAS AND ELECTRIC COMPANY
PROGRAM INSTALLATION QUANTITIES**

Line No.	Year of Operation	First	Second	Third	Fourth	Fifth
1	MW of installed PV Systems Per Year, AC	25	50	50	50	75
2	Cumulative MW of Installed PV Systems Per Year, AC	25	75	125	175	250

15 The O&M estimates are based upon a fixed-panel design. Movable
16 panels that track the motion of the sun have the potential to provide greater

1 energy production than the fixed panel design, at increased capital and
 2 ongoing maintenance expenditures. Should the Company ultimately choose
 3 to implement a tracking panel design, additional O&M expenditures will be
 4 required.

5 Because the volume of PV facilities installed may vary from year to year,
 6 the annual O&M costs can be expressed on a normalized basis in terms of
 7 dollars per kilowatt-year (\$/kW-yr). Table 5-3, below, presents the O&M
 8 costs in this fashion. As some costs vary directly with the volume of PV
 9 facilities installed, the actual O&M expenditures required for a given year will
 10 vary based upon the actual number of MW installed.

TABLE 5-3
PACIFIC GAS AND ELECTRIC COMPANY
O&M COSTS INCLUDING CONTINGENCY
(\$2009/KW-YR)

Line No.	Year of Operation	First	Second	Third	Fourth	Fifth
1	Annual O&M (\$/kW-yr) AC	52.24	36.75	33.66	32.33	31.33

11 **4. Description of O&M Costs**

12 As the solar facilities are brought online, PG&E will incur ongoing
 13 O&M costs for their operation. O&M consists of labor, materials, and
 14 contracts to support the routine O&M of the facilities.

15 **a. PG&E Labor and Preventive Maintenance**

16 PG&E's staffing plan assumes that the PV facilities will be monitored
 17 remotely from an existing PG&E facility with existing operating
 18 personnel. Existing PG&E personnel will monitor the multiple solar sites
 19 from a high level, with the ability to "drill down" to finer levels of detail for
 20 troubleshooting and failure determination. Operating personnel will
 21 monitor high-level information from each solar facility, including the
 22 following:

- 23 1. PV site power output;
- 24 2. PV site power output relative to expected output, or deviation from
 25 expected output;
- 26 3. PV site voltage output;

- 1 4. Main breaker status; and
- 2 5. High level trouble alarms.

3 PG&E personnel will also monitor PV site security.

4 Additionally, PG&E personnel will perform regular anticipated
5 preventive maintenance tasks, including annual inspections of all solar
6 facility inverters, as well as instrument calibration, to ensure the solar
7 facilities operate in a safe, compliant, and reliable fashion. Other
8 preventive maintenance activities include minor maintenance such as
9 cleaning and replacement of inverter filters, infrared monitoring of key
10 electrical connections, and breaker maintenance.

11 Based on the standard site sizing assumption of 5 MW, at full build
12 out of the PV UOG Program, eight additional personnel will be required
13 to perform the monitoring and preventive maintenance for the PV
14 facilities. One contract manager will oversee the washing,
15 infrastructure, and miscellaneous contracts. One data analyst will
16 monitor system performance, and coordinate corrective and preventive
17 maintenance activities. Five field technicians will perform preventive
18 maintenance activities. One security person will oversee the additional
19 security support for the PV facilities. The contract manager and data
20 analyst will be added in the first year resulting in a higher \$/kW-yr rate
21 for the first two years of operation. Additional personnel will be added
22 as build out takes place in the following years. Labor costs are based
23 on PG&E's fully loaded costs and include benefits, payroll taxes,
24 overtime, and supervision.

25 **b. Safety, Security and Compliance**

26 Safety supplies, equipment, and training are included in the forecast
27 to ensure a safe and compliant workplace. Additionally, PG&E must
28 maintain security systems associated with the PV facilities to assure
29 employee and public safety. Finally, PG&E must ensure it is in
30 compliance with any permit requirements associated with these
31 PV facilities.

32 **c. Infrastructure**

33 The PV facilities require funding for certain infrastructure
34 maintenance activities typical for day-to-day operation of a solar facility.

1 Examples include pest control, weed abatement, dust suppression,
2 perimeter fence and gate maintenance, and communication and data
3 acquisition software and hardware upgrades. These tasks will be
4 performed by contract personnel as necessary. Additionally,
5 miscellaneous equipment rentals and vehicles will be needed to perform
6 infrequent tasks.

7 **d. Consumables and Materials**

8 The PV facilities also require funding for minor consumables and
9 materials that are typical for day-to-day operation of a solar facility and
10 include inverter air filters, connectors, and replacement of non-warranty
11 covered components.

12 **e. Corrective Maintenance**

13 Actual PV facility performance will be compared to expected
14 performance and analyzed over time. PG&E personnel will monitor
15 performance and respond to changes in performance or other alarms as
16 necessary. If output drops below the expected value, and monitoring
17 personnel cannot determine the cause, field personnel will be
18 dispatched to troubleshoot the problem and perform any repairs that are
19 not covered under warranty or a vendor service agreement. Corrective
20 maintenance may include activities such as inverter repair and
21 replacement of broken panels. PG&E expects to secure multi-year
22 manufacturer's warranties for the inverters and panels and other
23 components. Even with these warranties, a certain degree of PG&E
24 support is required to diagnose equipment problems and facilitate repair
25 of warranty covered equipment.

26 **f. Contracts: Panel Washing**

27 At full build out of the PV UOG Program, roughly 2,500 acres of land
28 occupied by solar panels will be monitored for performance and washed
29 as needed. PG&E will establish a panel-washing contract to facilitate
30 this periodic maintenance function. Panel washing will be performed
31 seasonally on a scheduled basis. More frequent washing may be
32 required depending on the benefits of cleaning compared to the cost.
33 PG&E personnel will track performance output and trends to calculate
34 degradation rate and predict when panel washing should be scheduled

1 to restore performance. PG&E personnel will oversee panel-washing
2 activities performed by contract personnel to ensure performance
3 requirements are met. Scheduled washing will be planned for two times
4 per year; more frequent washing may be required depending on the
5 benefits of cleaning compared to the cost.

6 **g. Contracts: Vendor Service Agreement**

7 Vendor service agreements are used in the industry as a way to
8 provide high reliability and efficiency of a solar facility. They provide
9 reliability and efficiency benefits while also providing predictable cost
10 streams. Vendor service agreements may be utilized to perform repair
11 or replacement of equipment that is not covered under warranty.

12 **5. Contingency on O&M Costs**

13 PG&E's estimate of ongoing O&M expenditures is based upon
14 estimates from solar equipment suppliers, consultants, and PG&E's best
15 professional judgment. However, since PG&E does not have any significant
16 ownership experience with solar PV facilities, there is some uncertainty in
17 these estimates. Primary areas of uncertainty are driven by site specifics at
18 each project location. A site prone to panel fouling due to dust may require
19 more frequent cleaning than planned in order to maintain performance.
20 If greater than expected vegetation growth results in panel shading, more
21 aggressive weed abatement will be required. If the program results in many
22 sites separated by large distances, costs may increase due to greater
23 inefficiencies when compared to fewer sites that are located closer to each
24 other. Because the commercial operation date will vary over a period of
25 five years, O&M costs estimated today may be substantially different from
26 the forecast due solely to inflation varying from the assumed rate. Given the
27 uncertainties identified in the ongoing operation of the solar facilities, a
28 20 percent contingency has been applied to the O&M expenditures.

29 **B. PV Pilot Project O&M Costs**

30 In 2009, the Company will implement a PV Pilot Project that will become
31 operable in early 2010. Table 5-4 below, provides the O&M costs associated
32 with the PV Pilot Project based upon the same estimating methodology used for
33 the PV UOG Program.

TABLE 5-4
PACIFIC GAS AND ELECTRIC COMPANY
PV PILOT O&M COSTS INCLUDING CONTINGENCY
(2009 THOUSAND DOLLARS)

Line No.	Year of Operation	First	Second	Third	Fourth	Fifth
1	Total O&M Including Contingency	369	369	369	369	369

1 **C. Conclusion**

2 This chapter provides a reasonable estimate of the costs of operating and
3 maintaining the utility-owned solar facilities to be used in the development of the
4 revenue requirement presented in Chapter 6.

PACIFIC GAS AND ELECTRIC COMPANY
CHAPTER 6
REVENUE REQUIREMENT AND RATEMAKING FOR PG&E'S
PHOTOVOLTAIC PROGRAM

PACIFIC GAS AND ELECTRIC COMPANY
CHAPTER 6
REVENUE REQUIREMENT AND RATEMAKING FOR PG&E'S PHOTOVOLTAIC
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PACIFIC GAS AND ELECTRIC COMPANY
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1 **PACIFIC GAS AND ELECTRIC COMPANY**
2 **CHAPTER 6**
3 **REVENUE REQUIREMENT AND RATEMAKING FOR PG&E'S**
4 **PHOTOVOLTAIC PROGRAM**

5 **A. Introduction**

6 The purpose of this chapter is to present Pacific Gas and Electric
7 Company's (PG&E or the Company) proposal for recovering the cost of PG&E's
8 proposed Photovoltaic Program (PV Program). This chapter addresses PG&E's
9 cost recovery proposal for the elements of the PV Program. Adoption of PG&E's
10 ratemaking proposal for the PV Utility-Owned Generation Program (PV UOG
11 Program) will assure timely recovery of the reasonable cost of completing,
12 owning and operating the facilities as of the date of commercial operation, while
13 providing PG&E a strong incentive to develop and build the facilities at or below
14 the reasonable and prudent cost determined by the California Public Utilities
15 Commission (CPUC or Commission). In addition, this chapter describes the
16 proposed ratemaking recovery for PG&E's PV Pilot Project, land deposits, and
17 PV Power Purchase Agreement Program (PV PPA Program).

18 **B. Ratemaking Proposal for PV Programs**

19 As discussed in Chapter 1, the components of the PV Program include:

- 20 1. PV UOG Program;
21 2. PV Pilot Project;
22 3. Land deposits; and
23 4. PV PPA Program.

24 PG&E requests that the Commission adopt its ratemaking proposal
25 presented in this chapter for each element of the PV Program. The estimated
26 annual revenue requirement associated with the utility-owned components of the
27 PV Program is shown in Table 6-1.

TABLE 6-1
PACIFIC GAS AND ELECTRIC COMPANY
SUMMARY OF UTILITY-OWNED PV PROGRAM REVENUE REQUIREMENTS
(THOUSANDS OF NOMINAL DOLLARS)

Line No.		2010	2011	2012	2013	2014
1	PV UOG Program	13,559	47,744	87,685	123,755	168,629
2	PV Pilot	2,261	1,964	1,862	1,766	1,694
3	Land Deposits	675	573	433	291	110
4	Total Revenue Requirement	16,495	50,280	89,980	125,813	170,432

1 The utility-owned and PPA components of the PV Program are described in
2 more detail below.

3 **1. Ratemaking Proposal for 250 MW PV UOG Program**

4 **a. Recovery of Initial Capital Costs**

5 PG&E estimates the capital cost to complete the PV UOG Program
6 to be \$1.454 billion. This corresponds to the average capital cost target
7 of \$4,275/kilowatt (kW) direct current (DC) for the 5-year,
8 250 megawatts (MW) PV UOG Program described in Chapters 2 and 4.
9 PG&E requests the Commission find that the annual price targets in
10 Table 6-2 are reasonable and prudent cost targets for the PV UOG
11 Program.

TABLE 6-2
PACIFIC GAS AND ELECTRIC COMPANY
\$/kW CAPITAL TARGET BY YEAR
(2009 DOLLARS DC)(a)

Line No.		2010	2011	2012	2013	2014	Average
1	\$/kW \$2009 DC	4,448	4,081	3,843	3,667	3,559	3,831
2	Contingency	499	470	445	427	419	444
3	\$/kW Target \$2009 DC	4,947	4,551	4,288	4,094	3,978	4,275

(a) PG&E will adjust actual program dollars based on Consumer Price Index (CPI) and DC to alternating current (AC) conversion factor of 0.82.

12 PG&E requests that the initial revenue recovery of the PV UOG
13 Program be based on the estimated cost targets submitted by PG&E in
14 this Application. If the actual total capital costs are at or below the

1 average target at the end of the 5-year PV UOG Program period, PG&E
2 will be allowed to recover the actual capital cost of the PV UOG
3 Program without any further reasonableness review. To the extent the
4 total capital costs are less than the average target, customers will be
5 refunded the difference. In the event that the average installed cost of
6 the PV UOG Program exceeds the average target, PG&E would be
7 allowed to recover the actual capital costs up to the average target. In
8 addition, PG&E would be entitled to file an application with the
9 Commission for recovery of amounts in excess of the average target to
10 the extent the amounts in excess are subsequently found to have been
11 reasonably incurred.

12 If circumstances cause the PV UOG Program to be terminated
13 early, the capital target would be the weighted average of the annual
14 targets for the years up to termination.

15 PG&E is requesting the rate of return on rate base equal to the
16 currently authorized rate of return of 8.79 percent adopted in
17 Decision 07-12-049 for 2008, plus 1 percent for renewable assets as
18 allowed by Decision 06-05-039.

19 **b. Initial Revenue Requirement**

20 To allow for recovery of the costs of owning and operating the UOG
21 PV facilities, PG&E requests that the Commission adopt an estimated
22 average revenue requirement per MW of installed capacity for each year
23 of the PV UOG Program, as shown in Table 6-3.

**TABLE 6-3
PACIFIC GAS AND ELECTRIC COMPANY
250 MW PV UOG PROGRAM
AVERAGE \$/MW BY PROGRAM YEAR
(THOUSANDS OF NOMINAL DOLLARS)**

Line No.	Program Year(a)	2010	2011	2012	2013	2014
1	2010 Projects	1,085	923	864	808	764
2	2011 Projects		1,008	857	802	749
3	2012 Projects			975	829	776
4	2013 Projects				953	811
5	2014 Projects					942

(a) For purposes of this table, PG&E assumes the PV UOG Program starts on January 1, 2010. PG&E proposes to start the PV UOG Program on the date the first operational facility comes online, and that the first year will be 12 months from that date. If there is a considerable delay in the start of the PV UOG Program, these numbers may need to be updated for additional escalation.

1 The average annual revenue requirement in Table 6-3 is based on
2 the capital costs and the operation and maintenance (O&M) costs of the
3 PV UOG Program. The development of the average annual revenue
4 requirement is described in more detail in Section C below. PG&E
5 proposes to charge customers only for actual MW of capacity installed.
6 As of the date of each facility, PG&E will begin to accrue revenues equal
7 to the \$/MW shown in Table 6-3 times the MW capacity of the facility.
8 For example, if in July 2010, a 1 MW facility becomes operational,
9 PG&E will begin to accrue revenue requirements of \$90,417/month
10 (\$1,085,000/12 months) in the Utility Generation Balancing Account
11 (UGBA) for the next 12 months. In July 2011, the accrual for that facility
12 will be reduced to \$76,917/month (\$923,000/ 12 months). Recovery of
13 the 2010 revenue requirement will begin on January 1 of the following
14 year. This initial revenue requirement will remain in effect until
15 superseded by the revenues that will be established in a General Rate
16 Case (GRC) following commercial operation of the facility. PG&E
17 anticipates including these costs in the GRC filed subsequent to the
18 2011 GRC (currently expected in 2014).

19 Revenues for all of the components of PG&E's PV Program will be
20 collected in generation rates. New rates to recover the PV UOG

1 Program costs will be designed based upon the then-current adopted
2 methods for setting electric rates for generation revenue requirement
3 changes.

4 **c. Adjustments to Initial Revenue Requirement**

5 Before the end of each year of the PV UOG Program, PG&E will file
6 an advice letter to update the following year's average annual revenue
7 requirement to reflect the then-current cost of capital, franchise and
8 uncollectibles factors, and property tax factors, if there have been
9 changes. At the end of the PV UOG Program, PG&E will file an advice
10 filing to revise the previous years' revenue requirements to reflect the
11 actual capital cost of the program if the average installed cost is below
12 the capital target. As mentioned above, if the actual capital costs
13 exceed the target, PG&E can recover the costs in excess of the target
14 only after the costs are found reasonable in a separate application.

15 PG&E will establish a memorandum account to record the difference
16 between the revenue requirement booked to UGBA and the revenue
17 requirement based on the actual capital cost of the PV UOG Program. If
18 the actual capital costs are lower than the target, the amount in the
19 memorandum account will be returned to customers at the end of the
20 5-year program. If the actual capital costs exceed the target, the
21 amount in the memorandum account will only be collected upon a
22 finding that the costs above the target were reasonably incurred in a
23 separate application.

24 **2. Ratemaking Proposal for PV Pilot Project**

25 To allow for recovery of the costs of owning and operating the PV Pilot
26 Project, PG&E requests that the Commission adopt the estimated 2010
27 revenue requirement on line 2 of Table 6-1. The development of the
28 PV Pilot revenue requirement is described in more detail below in Section C.
29 PG&E proposes that the revenue requirement be recorded in UGBA as of
30 the date of commercial operation of the PV Pilot Project. After commercial
31 operation, PG&E will file an advice letter to update the revenue requirement
32 for the PV Pilot Project to reflect the actual capital costs of the PV Pilot
33 Project. This initial revenue requirement will remain in effect until
34 superseded by the revenues that will be established in a GRC following

1 commercial operation of the facility. PG&E anticipates including these costs
2 in the GRC filed subsequent to the 2011 GRC (currently expected in 2014).

3 PG&E will establish a memorandum account to record the difference
4 between the revenue requirement booked to UGBA for the PV Pilot Project
5 and the revenue requirement based on the actual capital cost of the PV Pilot
6 Project. After commercial operation of the PV Pilot Project, PG&E will file an
7 advice letter to transfer the balance in the memorandum account to UGBA.

8 **3. Ratemaking Proposal for Land Deposits**

9 To allow for recovery of the carrying costs of land deposits prior to
10 operation of the PV facilities, PG&E proposes to include the land deposits in
11 Plant Held for Future Use (PHFU).^[1] As PG&E places the PV facilities in
12 service the deposits will be transferred to plant in service as part of the
13 capital cost of the facility. Line 3 of Table 6-1 shows the revenue
14 requirement associated with the carrying costs of the deposits between the
15 time they are purchased and the time the costs are transferred to plant in
16 service. The development of the land deposits revenue requirement is
17 described in more detail below in Section C. When PG&E pays for the land
18 deposits it will accrue the revenue requirement in UGBA. PG&E will pro-rate
19 the UGBA accrual to reflect only the actual land deposit costs.

20 **4. PV PPA Program Cost Recovery**

21 PG&E proposes to recover the cost of the PV PPAs through its Energy
22 Resource Recovery Account (ERRA). The ERRA was established to record
23 the authorized ERRA revenue requirement and ERRA actual power costs to
24 determine the recovery of PG&E's procurement plan power costs, excluding
25 costs associated with the California Department of Water Resources
26 (CDWR) power contracts. PG&E's power costs include, as defined in
27 Decision 02-10-062 and modified by Decision 02-12-074, utility retained
28 generation (URG) fuels, Qualifying Facility (QF) contracts, inter-utility
29 contracts, California Independent System Operator (CAISO) charges,
30 irrigation district contracts and other PPAs, bilateral contracts, forward

[1] For property acquired in advance for future utility use, the Commission may allow the utility to earn a cash return on the cost of the property, without any depreciation expense, until the time that the property is placed in service. This type of property is referred to as Plant Held for Future Use.

1 hedges, pre-payments and collateral requirements associated with
 2 procurement, and ancillary services, along with other related power
 3 procurement costs. Therefore, ERRA is the appropriate mechanism for
 4 recovery of the costs associated with the PV PPAs.

5. Non-Bypassable Charge

6 Under Commission decisions, PG&E is entitled to recover stranded
 7 costs associated with the PV Program through a non-bypassable charge.
 8 For the PV PPA Program, PG&E is entitled to recover any stranded costs
 9 associated with the PPAs over the entire term of the agreements.^[2] In
 10 addition, stranded costs associated with the PV UOG Program can be
 11 recovered for each facility installed for a 10-year period following commercial
 12 operation of the facility.^[3] PG&E will implement the non-bypassable charge
 13 cost recovery for the PV Program consistent with the Commission's direction
 14 in Decision 08-09-012.

C. Development of PV Program Revenue Requirements

1. 250 MW PV UOG Program Revenue Requirement

15 Table 6-4 shows the average MW installed by Program Year for the PV
 16 UOG Program.

TABLE 6-4
PACIFIC GAS AND ELECTRIC COMPANY
250 MW PV UOG PROGRAM
AVERAGE MW INSTALLED BY PROGRAM YEAR

Line No.	Program Year	2010	2011	2012	2013	2014
1	2010 Projects	12.5	25	25	25	25
2	2011 Projects		25	50	50	50
3	2012 Projects			25	50	50
4	2013 Projects				25	50
5	2014 Projects					37.5

19 The estimated annual revenue requirement for 2010 through 2014 for
 20 each year of the PV UOG Program commercial operation is shown in
 21 Table 6-5.

^[2] D.08-09-012, pp. 55-57.

^[3] D.04-12-048, Conclusion of Law 16; D.08-09-012, pp. 52-55.

TABLE 6-5
PACIFIC GAS AND ELECTRIC COMPANY
250 MW PV UOG PROGRAM
REVENUE REQUIREMENT BY PROGRAM YEAR
(THOUSANDS OF NOMINAL DOLLARS)

Line No.	Year	2010	2011	2012	2013	2014
1	2010 Projects	13,559	23,066	21,600	20,200	19,092
2	2011 Projects	–	25,205	42,830	40,077	37,446
3	2012 Projects	–	–	24,369	41,445	38,800
4	2013 Projects	–	–	–	23,829	40,557
5	2014 Projects	–	–	–	–	35,308
6	Total	13,559	48,270	88,799	125,551	171,202

1 The revenue requirements in Table 6-5 were developed by multiplying
2 the average \$/MW in Table 6-2 by the average MW installed for each
3 PV UOG Program year in Table 6-4.

4 As mentioned above, PG&E requests that the Commission adopt the
5 average revenue requirements/MW in Table 6-2. As PV facilities are
6 installed, PG&E will accrue revenues in UG&A equal to the installed capacity
7 multiplied by the average \$/MW in Table 6-2. This allows for flexible
8 deployment of the PV UOG Program without potential large over- or
9 under-collection of revenues.

10 **2. Development of Average Revenue Requirement per MW**

11 Table 6-6 shows development of the average revenue requirement for
12 2010 to 2014 for the 2010 projects of the PV UOG Program.

**TABLE 6-6
PACIFIC GAS AND ELECTRIC COMPANY
250 MW PV UOG PROGRAM
REVENUE REQUIREMENT FOR 2010 PROJECTS
(THOUSANDS OF NOMINAL DOLLARS)**

Line No.	Description	2010	2011	2012	2013	2014
1	Operating Revenue	27,117	22,645	21,076	19,617	18,458
2	<u>Operating Expenses</u>					
3	Fixed O&M	1,359	982	923	910	903
4	Uncollectibles	70	58	54	51	48
5	Franchise Requirements	205	171	159	148	139
6	Subtotal Expenses	1,634	1,212	1,137	1,108	1,090
7	<u>Taxes</u>					
8	Property	1,862	1,788	1,714	1,640	1,566
9	State Corporation Franchise	1,151	236	243	210	198
10	Federal Income	5,395	3,740	3,701	3,317	3,032
11	Subtotal Taxes	8,408	5,764	5,659	5,168	4,797
12	Depreciation	6,259	6,259	6,259	6,259	6,259
13	Total Operating Expenses	16,301	13,235	13,055	12,535	12,145
14	Net for Return	10,816	9,410	8,021	7,082	6,312
15	Weighted Average Ratebase	110,484	96,115	81,926	72,338	64,475
16	Rate of Return	9.79%	9.79%	9.79%	9.79%	9.79%
17	MW Installed	25	25	25	25	25
18	Average \$/MW	1,085	906	843	785	738

1 The development of the average \$/MW for PV UOG Program years
2 2011 through 2014 are shown in the supporting workpapers to this chapter.

3 **a. Operation and Maintenance**

4 The O&M expense shown on line 3 of Table 6-6 is the estimated
5 cost of operating and maintaining the PV UOG Program. The
6 development of these costs is presented in Table 6-7.

TABLE 6-7
PACIFIC GAS AND ELECTRIC COMPANY
DEVELOPMENT OF PV UOG PROGRAM O&M EXPENSE
2010 PROJECTS
(THOUSANDS OF DOLLARS)

Line No.		2010	2011	2012	2013	2014
1	O&M Expenses – \$2009 AC	1,306	919	841	808	783
2	Escalation	53	63	82	101	119
3	Total O&M Expense	1,359	982	923	910	903

Line 1 of Table 6-7 is the constant dollar O&M expense forecast for the 2010 Projects of the PV UOG Program included in the O&M forecast from Chapter 5. Line 2 is the escalation from constant 2009 dollars to nominal dollars.^[4] Line 3 is the total nominal O&M for the 2010 Projects of the 250 MW PV UOG Program.

b. Uncollectibles and Franchise Expense

Uncollectible accounts expenses and franchise fees are shown on lines 4 and 5, respectively, of Table 6-6. These amounts are a function of revenue requirements and are developed using historical factors. The initial revenue requirement will be adjusted to reflect the then-current franchise and uncollectibles factors by advice letter as discussed above.

c. Property Taxes

Line 8 of Table 6-6 is the estimated property tax for the PV UOG Program. Property taxes are calculated based on the value of plant as of the property tax lien date multiplied by a property tax factor based in the historical relationship of property tax assessments to recorded plant balances. The initial revenue requirement will be adjusted to reflect the then-current property tax factor by advice letter as discussed above.

d. State and Federal Income Tax

Estimated California Corporation Franchise Tax (CCFT) and federal income tax (FIT) are shown on lines 9 and 10, respectively, of Table 6-6.

^[4] The O&M labor costs have been escalated using terms from PG&E's most recent labor contracts. The non-labor O&M costs have been escalated using CPI.

1 CCFT and FIT expenses are estimated based on net operating income
2 before income taxes. Current tax law has been utilized to compute
3 income taxes for the facility.

4 FIT expense, including deferred income tax, is calculated by
5 multiplying the currently effective corporate FIT rate of 35 percent by
6 applicable federal taxable income. Similarly, state income tax expense
7 is calculated by multiplying the statutory rate of 8.84 percent of state
8 taxable income. Following established Commission policy, FITs are
9 computed on a normalized basis. Deferred FITs are calculated as the
10 difference between book depreciation and federal tax depreciation times
11 the federal tax rate. The Accumulated Deferred FIT is included as a
12 credit to rate base. Federal tax depreciation is based on the 5-year
13 Modified Accelerated Cost Recovery System (MACRS) schedule.

14 As a result of the Jobs Act of 2004, PG&E is eligible to receive an
15 additional FIT deduction (as of the date of this filing, California has not
16 conformed to this act). The Jobs Act of 2004 includes a provision that
17 allows a tax deduction for goods manufactured and produced in the
18 United States. The deduction is computed as a percentage of the net
19 taxable income of a taxpayer derived from the manufacture or
20 production of such goods.^[5] The rate is phased in beginning at
21 3 percent for 2005, and increasing to 9 percent beginning in 2010.
22 Production of electricity qualifies for the deduction; the transmission and
23 distribution of electricity does not. The initial revenue requirement
24 calculation reflects the appropriate tax savings associated with the Jobs
25 Act of 2004.

26 State income taxes are calculated on a flow-through basis. State
27 tax depreciation is based on a Double Declining Balance (DDB) method
28 over 20 years.

[5] The Internal Revenue Code (IRC) section uses the term qualified production activities income and defines that as gross receipts, reduced by the sum of: (1) cost of goods sold that are allocable to the receipts; (2) other deductions, expenses, or losses that are directly allocable to such receipts; and (3) a proper share of other deductions, expenses, and losses that are not directly allocable to such receipts or another class of income. Internal Revenue Code §199(c)(1).

1 **e. Depreciation Expense**

2 Depreciation expense (line 12 of Table 6-6) is determined by
3 dividing the plant balance by the 25 year expected life of the facility.
4 This approach assumes zero net salvage for the PV facilities. In the
5 GRC in which the PV Program is included, we will present a detailed
6 depreciation and decommissioning study for the PV facilities.

7 **f. Return on Rate Base**

8 Return on rate base (line 14 of Table 6-6) is calculated by
9 multiplying the estimated rate base by 9.79 percent. This rate of return
10 equals the currently authorized rate of return of 8.79 percent adopted in
11 Decision 07-12 049 for 2008, plus 1 percent for renewable assets as
12 allowed by Decision 06 05 039. The return on rate base will be adjusted
13 to reflect the currently authorized rate of return in effect at the time of
14 the advice filing prior to commercial operation. The initial revenue
15 requirement will be adjusted to reflect the then-current authorized rate of
16 return by advice letter as discussed above.

17 **g. Megawatts Installed**

18 Line 17 of Table 6-6 shows the megawatts expected to be installed
19 in year 1 of the 250 MW PV Program.

20 **h. Average \$/MW**

21 In line 18 of Table 6-6, the average \$/MW, is derived by dividing
22 line 1 by line 13.

23 **i. PV UOG Program Rate Base**

24 Table 6-8 shows estimated weighted average rate base for the PV
25 UOG Program for the first year of commercial operation.

TABLE 6-8
PACIFIC GAS AND ELECTRIC COMPANY
RATEBASE 2010 PROJECTS
(THOUSANDS OF NOMINAL DOLLARS)

Line No.		2010	2011	2012	2013	2014
1	Plant	160,685	160,685	160,685	160,685	160,685
2	<u>Less Adjustments</u>					
3	Deferred Taxes	3,594	13,478	23,183	28,287	31,665
4	Deferred ITC	43,477	41,702	39,928	38,153	36,379
5	Subtotal Adjustments	47,071	55,181	63,111	66,440	68,044
6	Accumulated Depreciation	3,130	9,389	15,648	21,907	28,166
7	Weighted Average Ratebase	110,484	96,115	81,926	72,338	64,475

1 A discussion of the substantive components of rate base shown in
2 Table 6-8 follows:

3 **(1) Plant**

4 Line 1 of Table 6-8 shows the Plant in Service balance for the
5 first year of the PV UOG Program. This is equal to the 2010 total
6 capital expenditures from line 11 of Table 6-9.

7 **(2) Accumulated Deferred Taxes**

8 Accumulated Deferred Federal Taxes are shown as a deduction
9 from rate base in line 3 of Table 6-8. This is calculated according to
10 the income tax normalization provision of the Economic Recovery
11 Tax Act, and is consistent with the calculation of FIT expense
12 described above.

13 **(3) Accumulated Deferred ITC**

14 Accumulated Deferred Investment Tax Credit (ITC) is shown on
15 line 4 of Table 6-8. The ITC for the facilities is handled consistent
16 with the ratemaking treatment of ITC approved by the Commission
17 in Decision 93848, and IRC Sections 50(d)(2) and 46(f)(1).

18 **(4) Accumulated Depreciation**

19 The estimated accumulated depreciation is deducted from rate
20 base as shown on line 6 in Table 6-8.

(5) Capital Expenditures

Chapter 4 presents capital dollars for the PV UOG Program on a \$/kW DC basis in constant 2009 dollars. In order to determine the revenue requirement, it is necessary to convert the \$/kW numbers into total capital expenditures on a nominal AC basis with contingency and overheads. Table 6-9 shows this conversion.

**TABLE 6-9
PACIFIC GAS AND ELECTRIC COMPANY
DEVELOPMENT OF PV PROGRAM CAPITAL EXPENDITURES**

Line No.		2010	2011	2012	2013	2014	
1	\$/kW 2009\$ DC	4,448	4,081	3,843	3,667	3,559	
2	Contingency	499	470	445	427	419	
3	\$/kW Target 2009\$ DC	4,947	4,551	4,288	4,094	3,979	
4	Escalation	77	159	251	333	411	
5	\$/kW Nominal \$	5,025	4,710	4,539	4,426	4,389	
6	DC/AC Conversion	1,103	1,034	996	972	963	
7	\$/kW Nominal \$ AC	6,128	5,744	5,535	5,398	5,353	
8	Overheads	300	270	261	255	249	
9	\$/kW Nominal AC	6,427	6,014	5,796	5,653	5,601	
10	Capacity (in MW)	25	50	50	50	75	
11	Total Capital Expenditures(a)	160,685	300,712	289,824	282,665	420,094	= 1,453,979

(a) In Thousands of Dollars

3. Revenue Requirement for PV Pilot Project

Table 6-10 shows the development of the revenue requirement for the PV Pilot Project. Table 6-11 shows the development of the rate base used in Table 6-10. See Section C2 above for an explanation of the components of Tables 6-10 and 6-11.

TABLE 6-10
PACIFIC GAS AND ELECTRIC COMPANY
PV PILOT PROJECT REVENUE REQUIREMENT
(THOUSANDS OF NOMINAL DOLLARS)

Line No.		2010	2011	2012	2013	2014
1	Operating Revenue	2,261	1,964	1,862	1,766	1,694
2	Fixed O&M	383	396	411	425	440
3	Uncollectibles	6	5	5	5	4
4	Franchise Requirements	17	15	14	13	13
5	Subtotal Expenses	406	416	429	443	457
6	<u>Taxes</u>					
7	Property	137	132	126	121	115
8	State Corporation Franchise	80	10	10	8	7
9	Federal Income	384	261	258	228	207
10	Subtotal Taxes	601	402	394	357	329
11	Depreciation	475	475	475	475	475
12	Total Operating Expenses	1,482	1,293	1,298	1,275	1,261
13	Net for Return	779	671	564	492	433
14	Weighted Average Rate Base	7,957	6,850	5,758	5,023	4,424
15	Rate of Return	9.79%	9.79%	9.79%	9.79%	9.79%

TABLE 6-11
PACIFIC GAS AND ELECTRIC COMPANY
PV PILOT PROJECT RATE BASE
(THOUSANDS OF NOMINAL DOLLARS)

Line No.	Description	2010	2011	2012	2013	2014
1	Plant	11,867	11,867	11,867	11,867	11,867
2	<u>Less Adjustments</u>					
3	Deferred Taxes	280	1,051	1,807	2,205	2,468
4	Deferred ITC	3,392	3,254	3,115	2,977	2,838
5	Subtotal Adjustments	3,672	4,304	4,922	5,182	5,307
6	Accumulated Depreciation	237	712	1,187	1,661	2,136
7	Weighted Average Ratebase	7,957	6,850	5,758	5,023	4,424

4. Revenue Requirement for Land Deposits

Table 6-12 shows the development of the revenue requirement for the land deposit costs. As mentioned above, this revenue requirement is intended to recover the carrying costs associated with the time between payment of the land deposit and their inclusion in the cost of the PV facilities.

TABLE 6-12
PACIFIC GAS AND ELECTRIC COMPANY
LAND DEPOSIT REVENUE REQUIREMENT
(THOUSANDS OF NOMINAL DOLLARS)

Line No.		2010	2011	2012	2013	2014
1	Operating Revenue	675	573	433	291	110
	<u>Operating Expense</u>					
2	Uncollectibles	2	1	1	1	0
3	Franchise Requirements	5	4	3	2	1
4	Subtotal Operating expenses	7	6	4	3	1
	<u>Taxes</u>					
5	Property	53	45	34	23	9
6	State Corporation Franchise	43	36	27	18	7
7	Federal Income	154	131	99	66	25
8	Subtotal Taxes	250	212	160	108	41
9	Net For Return	419	355	269	181	68
10	Weighted Average Rate Base	4,762	4,037	3,055	2,054	774

TABLE 6-13
PACIFIC GAS AND ELECTRIC COMPANY
LAND DEPOSIT RATE BASE
(THOUSANDS OF NOMINAL DOLLARS)

Line No.	Payment	2010	2011	2012	2013	2014
1	Land in PV Facilities	4,208	8,583	8,755	8,930	13,663
2	Deposit Allocation to Projects	5,000	477	972	992	1,548
3	Plant Held for Future Use Balance					
4	Beginning Balance	5,000	4,523	3,551	2,559	1,548
5	Transfer to PV Facilities	(477)	(972)	(992)	(1,012)	(1,548)
6	Ending Balance	4,523	3,551	2,559	1,548	—
7	Average Balance	4,762	4,037	3,055	2,054	774

1 D. Levelized Cost of Energy for PV UOG Program

2 The levelized cost of energy for the PV UOG Program is
 3 \$295/megawatt-hour. The \$295/megawatt-hour is determined by dividing the
 4 net present value (NPV) of the UOG revenue requirement for the life of the
 5 program by the NPV of the expected generation of the PV facilities. See the
 6 equation below for the development of the levelized cost of energy.

LEVELIZED COST OF ENERGY

	<u>(a)</u>	<u>(b)</u>	<u>(c)=(a)*1000/(b)</u>
NPV	1,367,734	4,635,828	295

7 The annual revenue requirement assumptions shown above are the same
 8 as those used in the UOG revenue requirement in Section C, except that
 9 contingency is excluded from the capital expenditures. The generation
 10 estimates assume a 24 percent capacity factor with annual degradation of
 11 0.89 percent.

12 E. Conclusion

13 PG&E requests the Commission to:

- 14 • Adopt the Capital Cost Targets in Table 6-2 as reasonable and prudent
 15 capital costs for the PV UOG Program;
- 16 • Adopt the Average \$/MW Revenue Requirements in Table 6-3 for the
 17 PV UOG Program;
- 18 • Allow PG&E to establish a Memorandum Account to record the difference
 19 between the revenue requirement booked to UGBA and the revenue
 20 requirement based on the actual capital cost of the PV UOG Program;
- 21 • Approve PG&E's proposal to true-up the Revenue Requirement of the PV
 22 UOG Program to reflect the actual capital costs of the program if the actual
 23 costs are below the target;
- 24 • File for recovery of revenue requirement for capital costs above the target
 25 and be allowed to recover those revenue requirements only if the
 26 Commission finds that the costs above the target were reasonably incurred;
- 27 • Adopt PG&E's proposed revenue requirement for the PV Pilot Project;

- 1 • Allow PG&E to establish a memorandum account to record the difference
2 between the revenue requirement booked to UGBA for the PV Pilot Project
3 and the revenue requirement based on the actual capital cost of the PV Pilot
4 Project;
- 5 • Allow PG&E to file an advice letter to transfer the balance in the
6 memorandum account to UGBA after commercial operative of the PV Pilot
7 Project;
- 8 • Adopt PG&E's proposal for PHFU treatment for land deposits;
- 9 • Approve recovery of PV PPA costs through ERRAs;
- 10 • Approve a Non-Bypassable Charge for the PV PPAs for the life of the
11 contracts;
- 12 • Approve a Non-Bypassable Charge for the PV UOG Program facilities for
13 10 years following commercial operation; and
- 14 • Approve a 1 percent increase in the rate of return on rate base for both the
15 PV UOG Program and the PV Pilot Project.

16 The Commission should adopt PG&E's ratemaking proposal for the
17 PV Program, as it is just and reasonable and will assure PG&E of timely cost
18 recovery of the reasonable cost of the PV Program. PG&E's ratemaking
19 proposal also provides PG&E a strong incentive to develop and build the utility-
20 owned PV facilities at or below the prudent and reasonable cost determined by
21 the Commission, and avoids the need for an after-the-fact reasonableness
22 review in the event the project costs are below the target amounts. It will also
23 allow for timely recovery of the costs associated with the PV PPA program.

PACIFIC GAS AND ELECTRIC COMPANY
APPENDIX A
STATEMENTS OF QUALIFICATIONS

1 **PACIFIC GAS AND ELECTRIC COMPANY**
2 **STATEMENT OF QUALIFICATIONS OF DOUG HERMAN**

3 Q 1 Please state your name and business address.

4 A 1 My name is Doug Herman, and my business address is Pacific Gas and
5 Electric Company, 245 Market Street, San Francisco, California.

6 Q 2 Briefly describe your responsibilities at Pacific Gas and Electric Company
7 (PG&E or the Company).

8 A 2 I am a senior project manager in the Renewable Resource Development
9 Department. I am responsible for developing utility owned renewable
10 energy projects.

11 Q 3 Please summarize your educational and professional background.

12 A 3 I received a Bachelor of Science degree in mechanical engineering from the
13 University of Santa Clara and a Master of Science degree in energy and
14 resources from the University of California, Berkeley.

15 I began my current employment with PG&E in 2006 as a senior
16 regulatory specialist in the Energy Proceedings Department. From 2004 to
17 2006, I was a power industry consultant. From 1993 to 2004, I was a
18 program manager at the Electric Power Research Institute (EPRI) where I
19 managed various emerging technology research, development and
20 demonstration projects. From 1982 to 1993, I managed emerging
21 technology demonstration projects at PG&E in the Mechanical and Nuclear
22 Engineering Department.

23 Q 4 What is the purpose of your testimony?

24 A 4 I am sponsoring the following testimony in PG&E's Photovoltaic Program
25 Application:

- 26 • Exhibit (PG&E-1), "Photovoltaic Program Prepared Testimony":
27 – Chapter 4, "Capital Costs."

28 Q 5 Does this conclude your statement of qualifications?

29 A 5 Yes, it does.

1 **PACIFIC GAS AND ELECTRIC COMPANY**
2 **STATEMENT OF QUALIFICATIONS OF GARRETT P. JEUNG**

3 Q 1 Please state your name and business address.

4 A 1 My name is Garrett P. Jeung, and my business address is Pacific Gas and
5 Electric Company, 245 Market Street, San Francisco, California.

6 Q 2 Briefly describe your responsibilities at Pacific Gas and Electric Company
7 (PG&E or the Company).

8 A 2 I am a senior director in the Energy Supply Department of Energy
9 Procurement. My primary responsibility is to negotiate long-term energy
10 contracts.

11 Q 3 Please summarize your educational and professional background.

12 A 3 I received a Bachelor of Science degree in mechanical engineering and a
13 Masters degree in Business Administration from the University of California,
14 Berkeley. Previously, I was employed by PG&E Corporation's Energy
15 Services as director of Electric Operations and as Chief Strategy Officer of
16 E-lec Trade.

17 Q 4 What is the purpose of your testimony?

18 A 4 I am sponsoring the following testimony in PG&E's Photovoltaic (PV)
19 Program Application:

- 20 • Exhibit (PG&E-1), "Photovoltaic Program Prepared Testimony":
21 – Chapter 3, "Photovoltaic Power Purchase Agreement Program."

22 Q 5 Does this conclude your statement of qualifications?

23 A 5 Yes, it does.

1 **PACIFIC GAS AND ELECTRIC COMPANY**
2 **STATEMENT OF QUALIFICATIONS OF MICHAEL L. JONES**

3 Q 1 Please state your name and business address.

4 A 1 My name is Michael L. Jones, and my business address is Pacific Gas and
5 Electric Company, 245 Market Street, San Francisco, California

6 Q 2 Briefly describe your responsibilities at Pacific Gas and Electric Company
7 (PG&E or the Company).

8 A 2 I am the director of Generation Development, responsible for developing
9 new generation project opportunities for Utility-Owned Generation (UOG).

10 Q 3 Please summarize your educational and professional background.

11 A 3 I received a Bachelor of Science degree in Mechanical Engineering from
12 Washington State University in 1983 and a Master of Business
13 Administration degree from John F. Kennedy University in 1993. I am a
14 registered Mechanical Engineer in the State of California.

15 In 1983, I joined PG&E as a power production engineer at one of the
16 Company's fossil power plants. From 1983 to 1995, I progressed in both
17 management and technical areas of fossil power plant management,
18 staffing, engineering, operations, maintenance, design, construction, and
19 project management throughout the company's fossil fleet. I trained and
20 guided plant personnel in technical fields such as instrumentation, controls
21 and tuning, vibration and balancing, efficiency testing and evaluation, boiler
22 and turbine design, troubleshooting, and root cause analysis. I ultimately
23 became the plant engineer for the Pittsburg and Contra Costa Power Plants.

24 From 1995 to 1998 I worked for PG&E Enterprises, PG&E's unregulated
25 affiliate, in a variety of areas including oversight of our unregulated domestic
26 and international generating investments. Additionally, I supported
27 acquisition efforts of electric distribution companies in Australia and
28 South America and power plant acquisition and development efforts in
29 Australia. Work activities included the bid process, due diligence, and
30 development of acquisition transition plans to cover all aspects of the
31 operation of the business including capital investment, operations and
32 maintenance, staffing, industrial relations, and environmental management.

1 From 1998 to 1999, I returned to PG&E as director of Generation Asset
2 Divestiture and was assigned the task to sell Pittsburg, Contra Costa and
3 Potrero Power Plants, and the Geysers geothermal generating facility as
4 part of PG&E's asset divestiture requirements.

5 From 1999 to 2001, I was the director and plant manager of
6 Hunters Point Power Plant, a 423 MW conventional fossil and combustion
7 turbine power plant located in San Francisco, California.

8 As director of Business Projects from 2001 to 2002, I lead a diverse
9 team consisting of operating, inside and outside legal, regulatory,
10 government, corporate, and financial personnel in the Company's
11 bankruptcy Plan of Reorganization transaction effort for the Generation
12 business.

13 From 2002 to 2006, I was the director of Hydro Operations and
14 Maintenance (O&M). My duties were to lead the O&M organization
15 consisting of 330 people focused on day-to-day safe, reliable, excellent
16 operation of nearly 3,900 MW of hydroelectric generating facilities,
17 organized as 110 generators located in 68 powerhouses in central and
18 northern California. In 2006 to 2007, I worked on the Company's Business
19 Transformation efforts. In my current assignment as director of
20 New Generation Projects, my duties are to develop conventional fossil and
21 hydro power project opportunities for utility investment as well as support the
22 company's solar generation efforts. In the past, I have sponsored testimony
23 for operations and maintenance for Gateway Generating Station
24 (Contra Costa Unit 8) and Tesla Generating Station.

25 Q 4 What is the purpose of your testimony?

26 A 4 I am sponsoring the following testimony in PG&E's Photovoltaic (PV)
27 Program Application:

- 28 • Exhibit (PG&E-1), "Photovoltaic Program Prepared Testimony":
29 – Chapter 5, "Operations and Maintenance Costs."

30 Q 5 Does this conclude your statement of qualifications?

31 A 5 Yes, it does.

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PACIFIC GAS AND ELECTRIC COMPANY
STATEMENT OF QUALIFICATIONS OF BRIAN M. McDONALD

Q 1 Please state your name and business address.

A 1 My name is Brian M. McDonald, and my business address is Pacific Gas and Electric Company, 245 Market Street, San Francisco, California.

Q 2 Briefly describe your responsibilities at Pacific Gas and Electric Company (PG&E or the Company).

A 2 I am the director of Renewable Resource Development in the Energy Supply organization.

Q 3 Please summarize your educational and professional background.

A 3 I received a Master of Business Administration degree from St. Mary's College of California, a Bachelor of Science degree in Mechanical Engineering from California State University, Sacramento and an Environmental Management Certification from University of California, Berkeley. I am a registered Professional Engineer in the state of California.

I've been a professional in the power, energy, and chemical sector for over 20 years. My expertise is in project development, including project siting/permitting/licensing, financing, project management, and construction management. Prior to joining PG&E in September 2008, I was Vice President of Development and co-founder of Third Planet Windpower. Prior to that, I held various positions at Calpine Corp., including Director of Project Development, Director of Renewables and New Technologies, and Director of Origination. Prior to that, I worked for Enpower (an Independent Power Producer (IPP) in California) as a Program Manager. Prior to that, I worked for several Fortune 500 multinational engineering, procurement, and production (EPC) companies responsible for strategy and program management execution of both national and international multi-billion dollar infrastructure projects in the power, energy, and chemical sectors. I have been involved with the development of over 15,000 MW of both gas-fired combined cycle and renewable power plants across the United States.

Q 4 What is the purpose of your testimony?

A 4 I am sponsoring the following testimony in PG&E's Photovoltaic (PV) Program Application:

- 1 • Exhibit (PG&E-1), "Photovoltaic Program Prepared Testimony":
- 2 – Chapter 2, "Photovoltaic Utility-Owned Generation Program."
- 3 Q 5 Does this conclude your statement of qualifications?
- 4 A 5 Yes, it does.

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PACIFIC GAS AND ELECTRIC COMPANY

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STATEMENT OF QUALIFICATIONS OF JOSEPH F. O'FLANAGAN

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Q 1 Please state your name and business address.

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A 1 My name is Joseph F. O'Flanagan, and my business address is Pacific Gas and Electric Company, 77 Beale Street, San Francisco, California.

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Q 2 Briefly describe your responsibilities at Pacific Gas and Electric Company (PG&E or the Company).

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A 2 I am a director in the Senior Vice President – Generation organization and am responsible for various regulatory matters.

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Q 3 Please summarize your educational and professional background.

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A 3 I received a Bachelor of Science degree in Marine Engineering from the United States Merchant Marine Academy at Kings Point, New York, in 1975.

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I also attended the Harvard Graduate School of Business Administration, where I was a candidate for a Masters in Business Administration degree.

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Prior to joining PG&E in 1979, I served as an engineering officer on ocean-going merchant vessels. Prior to assuming my present position at

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PG&E, I held the positions of rate economist in the Rates Department,

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senior valuation engineer in the Valuation Department, supervisor in the

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Revenue Requirements Department, manager in the Rates, Market Planning

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and Research, and Revenue Requirements Departments, and director of the

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Budget, Tax, and Capital Accounting Departments.

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Q 4 What is the purpose of your testimony?

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A 4 I am sponsoring the following testimony in PG&E's Photovoltaic (PV)

24

Program Application:

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- Exhibit (PG&E-1), "Photovoltaic Program Prepared Testimony":

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- Chapter 6, "Revenue Requirement and Ratemaking for PG&E's Photovoltaic Program."

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Q 5 Does this conclude your statement of qualifications?

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A 5 Yes, it does.

1 **PACIFIC GAS AND ELECTRIC COMPANY**
2 **STATEMENT OF QUALIFICATIONS OF FONG WAN**

3 Q 1 Please state your name and business address.

4 A 1 My name is Fong Wan, and my business address is Pacific Gas and Electric
5 Company, 245 Market Street, San Francisco, California.

6 Q 2 Briefly describe your responsibilities at Pacific Gas and Electric Company
7 (PG&E or the Company).

8 A 2 I am a Senior Vice President, Energy Procurement. In this position I am
9 responsible for gas and electric supply planning and policies, market
10 assessment and quantitative analysis, supply development, procurement,
11 and settlement.

12 Q 3 Please summarize your educational and professional background.

13 A 3 I graduated from Columbia University in 1984 with a Bachelor of Science
14 degree in Chemical Engineering and from University of Michigan in 1986
15 with a Master of Business Administration degree.

16 From 1986 to 1988, I worked as a business analyst with Exxon U.S.A.
17 I began work with PG&E in 1988 as a financial analyst in the financial
18 planning and analysis area. I was promoted to senior financial analyst in
19 1989 and to manager in 1991. In this area, I worked on recommendations
20 involving capital structure and dividend policies, as well as various capital,
21 acquisition, and divestiture analyses.

22 From 1992-1993, I was on a special assignment working on the
23 decontracting of Canadian gas supply contracts. In this capacity, I oversaw
24 financial and economic analyses and participated in contract negotiations
25 with suppliers.

26 In 1994, I joined the Product and Sales Department in California Gas
27 Transmission. I was promoted to director of the department in 1995, where I
28 was responsible for the sales of interstate and intrastate gas transmission
29 capacity and gas storage-related services. I also participated in the
30 development of Gas Accord.

31 In 1996, I transferred as director to the Power Market Planning
32 Department and the Energy Trading Department. Here, I participated in
33 market structure activities involving the California Independent System

1 Operators (CAISO) and Power Exchange (PX), and oversaw electric supply
2 planning and trading activities.

3 In 1997, I left PG&E and joined PG&E Corporation's Energy Trading
4 subsidiary of the National Energy Group, in Bethesda, Maryland. I was
5 promoted to Vice President of Structured Trading in 1999 and my
6 responsibilities encompassed all complex, structured transactions at
7 Energy Trading.

8 In 1999, I joined AltaGas Inc., in Calgary, Alberta. At AltaGas, I was
9 Senior Vice President and Chief Operating Officer, overseeing all trading,
10 acquisition, strategy and planning, operations, and engineering activities for
11 this midstream gas company.

12 In 2000, I rejoined PG&E Corporation as Vice President of
13 Risk Initiative, in San Francisco. I participated in PG&E's Plan of
14 Reorganization and advised on power procurement issues.

15 In 2004, I rejoined PG&E as Vice President of Power Contracts and
16 Electric Resource Development. I oversaw all existing power contracts,
17 including qualifying facility, renewable generation, and irrigation district
18 contracts. In addition, I was also responsible for acquiring all long-term
19 supply needs via contracts or generation ownership.

20 In 2006, I assumed the position of Vice President of
21 Energy Procurement.

22 In 2008, I assumed my current position as Senior Vice President of
23 Energy Procurement.

24 Q 4 What is the purpose of your testimony?

25 A 4 I am sponsoring the following testimony in PG&E's Photovoltaic (PV)
26 Program Application:

- 27 • Exhibit (PG&E-1), "Photovoltaic Program Prepared Testimony":
 - 28 – Chapter 1, "Policy Chapter: Executive Summary and Overview of
29 Application."

30 Q 5 Does this conclude your statement of qualifications?

31 A 5 Yes, it does.