

Application No.: \_\_\_\_\_

Exhibit No.: SCE-4

Witnesses: S. R. Hemphill

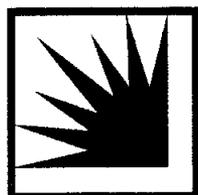
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## ***Cost-Effectiveness Study***

Before the

**Public Utilities Commission of the State of California**

Rosemead, California

February, 2004

**CONFIDENTIAL VERSION**

# STEAM GENERATOR REPLACEMENT: SCE-4

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I.

**SUMMARY OF COST-EFFECTIVENESS STUDY**

**A. The Proposed Project**

Southern California Edison (SCE) analyzed the cost-effectiveness of replacing San Onofre Nuclear Generating Station Unit Nos. 2 & 3 (SONGS 2 & 3) steam generators during the Fuel Cycle 16 Refueling and Maintenance Outage (RFO).<sup>1</sup> This exhibit, SCE-4, describes this cost-effectiveness analysis comparing ratepayers' benefits from the Steam Generators Replacement Project (SGRP) to ratepayers' costs of SGRP. The benefits of SGRP are the costs which ratepayers avoid or defer as a result of SGRP. Specifically, this avoided cost is the difference between what ratepayers would have to pay for electric service assuming SONGS 2 & 3 is shutdown in 2009<sup>2</sup> and what they would have to pay for electricity assuming SONGS 2 & 3 continues to operate (with replacement steam generators) through 2022.

As demonstrated in SCE-2, SONGS 2 & 3 original steam generators are reaching the end of their useful lives, due to steam generator degradation.<sup>3</sup> As demonstrated in SCE-3, steam generator replacement requires engineering, fabrication, delivery, and on-site replacement activity.<sup>4</sup> The fabrication, delivery, and preparation for installation timeline for the Replacement Steam Generators (RSGs) is approximately five years. As demonstrated in SCE-7, to maintain the option to replace steam generators in Fuel Cycle

<sup>1</sup> Based on 100% Production Factor operation, Fuel Cycle 16 RFO for SONGS 2 would occur in Spring 2009 and Fuel Cycle 16 RFO for SONGS 3 would occur in Fall 2009. These represent the earliest likely RFOs and are the planning contingency for beginning of steam generator replacement operations.

<sup>2</sup> For the purposes of cost-effectiveness analysis, 88% Capacity Factor operation was modeled based on a historic 7 year plant operating average (1996-2002). Fuel Cycle 16 RFO for SONGS 2 would occur Fall 2009 and Fuel Cycle 16 RFO for SONGS 3 would occur Spring 2010.

	<b>SONGS 2</b>	<b>SONGS 3</b>
88% Capacity Factor	Fall 2009	Spring 2010
100% Production Factor	Spring 2009	Fall 2009

<sup>3</sup> SCE-2, Chapter 1.

<sup>4</sup> SCE-3, Part 1, Chapter 1.

1 16 RFOs, SCE must make significant financial commitments to SONGS 2 & 3 RSG  
2 fabrication beginning in September 2004.

3 The following equation sets forth the benefit-to-cost ratio for the SGRP:

4 
$$\text{Benefit-to-Cost Ratio} = \frac{\text{PV of Ratepayer Benefits}}{\text{PV of Ratepayer Costs}}$$

5  
6  
7 The 2004 net present value (NPV) of the revenue requirement of SONGS 2 & 3 shutdown  
8 avoided cost ranges from \$1,527 to \$1,807 million based on analysis of several technically  
9 feasible mitigation alternatives. The 2004 NPV cost of the revenue requirement of the  
10 steam generator replacement and disposal is \$707 million. The benefit-to-cost ratio  
11 ranges from 2.16–2.56 to 1 (100% level). SCE found that benefits exceed costs robustly  
12 across a variety of scenarios and sensitivities.

13 **B. “No Action” Alternative**

14 SCE advocates avoiding the “no action” alternative which results in a SONGS 2 & 3  
15 dual unit shutdown **without any system mitigation efforts**. SCE’s analysis of the  
16 Southern California transmission system in SCE-5 indicates that shutdown of SONGS 2 &  
17 3, without significant compensating transmission mitigation, would leave the system  
18 vulnerable to voltage collapse. Voltage collapse is largely driven by an undersupply of  
19 reactive power (MVAR),<sup>5</sup> which SONGS 2 & 3 currently supply. If there is a severe  
20 transmission system voltage instability, there could be blackouts and other service  
21 reductions resulting in customer load being dropped and not served. SCE’s study also  
22 identifies a significant probability of loss of load due to thermal overloading on the  
23 Imperial Valley-Miguel 500 kilowatt (kV) line. If there is thermal overloading, there could

---

<sup>5</sup> MVAR is a mega Volt-Ampere reactive which is the power that magnetic equipment, such as transformers, motors, and relays, need to operate/function. A good way to understand the correlation between MVAR and MW is an air compressor analogy. The pressure in the air compressor tank is the MVAR and the flow out of the tank is the MW. The longer the transmission line, the more MVARs are needed. The more users on a transmission line, the more MWs are needed.

1 be blackouts and other service reductions resulting in customer load being dropped and  
2 not served.

3 SCE's load flow modeling indicates that during conditions of heavy imports on a  
4 summer day to Southern California from the Palo Verde (Arizona) area, major  
5 transmission system components would be overloaded beyond thermal capacity ratings.  
6 This overload would occur under normal, heavy summer import day-to-day conditions, to  
7 the point of potential multiple transmission path failures under contingency conditions.  
8 Industry standards do not allow continuous overloading during system operation.  
9 Consequently, the Southern California area would be required to reduce its imports of  
10 economy energy and replace that supply with more costly, and more polluting, local  
11 generation, which is typically older and less efficient than the new Combined Cycle Gas  
12 Turbines (CCGTs) that provide economy energy over the transmission import system.

13 During actual system operation, transmission components cannot operate above  
14 rated capacity on a continuous basis. So, the available capacity and utilization of critical  
15 import transmission paths to obtain economic replacement power would be reduced to  
16 ensure no violation of thermal capacity ratings. SCE's transmission modeling shows that  
17 a range of impacts, including voltage collapses, thermal overloads, and increased system  
18 costs due to reduced economy imports, are all likely if SONGS 2 & 3 shutdown. These  
19 impacts could lead to blackouts and other service reductions resulting in customer load  
20 being dropped and not served.

21 **C. "No Project" Alternative**

22 SONGS 2 & 3 original steam generators are reaching the end of their useful life.  
23 SCE used its models to develop a "No Project" Alternative. This alternative assumes that  
24 one of three transmission mitigation scenarios and a replacement generation scenario  
25 would be in place in 2009. This assumption is made for analysis purposes, and the actual  
26 combination of SONGS 2 & 3 operation and mitigation may vary if SGRP is not

1 undertaken. California could implement this alternative as a mitigation for a SONGS 2 &  
2 3 shutdown.

3 SCE's model assumes that a renegotiation of the existing Federal lands easement is  
4 possible to accommodate continued use of the 2,300 MW transmission tie between San  
5 Diego Gas & Electric Company (SDG&E) and SCE service areas that are joined via the  
6 SONGS switchyard. If the transmission path must be removed and remediated as terms  
7 of the existing easement conclude, then a much more complex and costly mitigation project  
8 than the ones outlined below will be required.

9 SCE developed three transmission mitigation scenarios that are presented in SCE-  
10 5: one 230 kV and two 500 kV based solutions. SCE based the 230 kV mitigation on  
11 reinforcement of the Barre-Ellis corridor to support SDG&E's transmission system during  
12 an Imperial Valley (IV) – Miguel N-1 outage. This project will also require additional  
13 reactive support across the SCE and SDG&E systems. SCE has also identified two  
14 alternative mitigation 500 kV transmission lines: (1) IV-Ramona, and (2) Valley-Rainbow.  
15 In addition to the transmission line indicated in each project's name, each project includes  
16 reactive support.

17 The assumed removal of SONGS 2 & 3 as a resource in this analysis in 2009 and  
18 2010, respectively, will create a need for new resources that SCE assumed would be in  
19 place in 2009. Thus, SCE also included replacement baseload generation in the form of  
20 CCGTs constructed both in California and Arizona.

21 **1. Mitigation Transmission**

22 Transmission analysis shows that if SONGS 2 & 3 shut down, the California  
23 transmission system would require increased transmission capability. SCE developed  
24 three transmission mitigation scenarios: (1) Barre-Ellis 230 kV transmission line  
25 upgrade, (2) IV-Ramona 500 kV transmission line, and (3) Valley-Rainbow 500 kV  
26 transmission line. In addition to the need for one of these three lines, additional dynamic  
27 and static capacitors will be needed at both SDG&E and SCE substations. SCE-5 reviews

1 the Barre-Ellis, IV-Ramona, and Valley-Rainbow transmission line upgrades as  
2 mitigation alternatives to SONGS 2 & 3 operation. SCE bases its benefit-to-cost ratio on a  
3 range of costs of all three transmission mitigation scenarios. The Valley-Rainbow 500 kV  
4 transmission line may not be feasible, since the Commission has twice denied SDG&E a  
5 Certificate of Public Convenience and Necessity (CPCN) for this transmission line.  
6 However, it has a lower cost than the other 500 kV alternative and is included for  
7 completeness.

8 SCE's transmission analysis assumes that a Devers-Palo Verde No. 2 line  
9 (approximate cost \$500 million) and upgrades to the Southwest power link (approximate  
10 cost \$200 million) are implemented. If they are not built, the SONGS 2 & 3 shutdown  
11 analysis may require them as additional transmission mitigation. This would add an  
12 additional \$700 million transmission mitigation cost in 2009, with a corresponding  
13 increase in the benefit-to-cost ratio of SGRP.

14 a) Reinforced SCE/SDG&E 230 kV Interface

15 SCE estimates the Barre-Ellis 230 kV transmission line upgrade would  
16 cost \$20.4 million. In addition, reactive support devices (series SVC dynamic reactive  
17 devices) would be required to provide 2,520 MVARs to the transmission system at a cost of  
18 \$266.6 million. This yields a total cost for Barre-Ellis of \$287.0 million. These estimated  
19 costs are in 2004 dollars and assume 2009 on-line dates.

20 b) IV-Ramona 500 kV Transmission Line Project

21 SCE estimates the IV-Ramona 500 kV transmission line project would  
22 cost \$513.0 million. Also, an upgrade to the Path 49 upgrade project scope would be  
23 required at a cost of \$14.6 million. In addition, reactive support devices (series SVC  
24 dynamic reactive devices) would be required to provide 1,374 MVARs to the transmission  
25 system at a cost of \$145.4 million. This yields a total cost for IV-Ramona 500 kV of \$673.0  
26 million. These estimated costs are in 2004 dollars and assume 2009 on-line dates.

1                   c)     Valley-Rainbow 500 kV Transmission Line Project

2                   SCE estimates the cost of the Valley-Rainbow 500 kV transmission  
3 line project to be \$378.6 million. An addition to the Valley-Rainbow 500 kV line project  
4 scope of \$14.5 million would be required to mitigate shutdown of SONGS 2 & 3. In  
5 addition, 924 MVARs reactive support devices (series SVC dynamic reactive devices)  
6 would be required at a cost of \$97.9 million. The total cost of the Valley-Rainbow 500 kV  
7 transmission mitigation scheme is estimated to be \$491.0 million. These estimated costs  
8 are in 2004 dollars and assume 2009 on-line dates.

9                   **2.     Replacement Generation**

10                  SCE assumed that 895 MW of replacement Combined Cycle Gas Turbines  
11 (CCGTs) would be sited in California, and the remainder, 1,255 MW, are built in Arizona  
12 in the Palo Verde area for a total replacement of 2,150 MW. The precise mix of local and  
13 import generation cannot be known at this time, and may be subject to many factors,  
14 including market forces and environmental limitations. SCE recognizes that transmission  
15 losses will occur from Palo Verde or other out-of-area generators. SCE has made a  
16 conservative analysis assumption and included the costs of only the 2,150 MW of net  
17 generation in this cost-effectiveness analysis. These CCGTs provide replacement capacity  
18 in a SONGS 2 & 3 shutdown scenario and accompanying baseload energy production. The  
19 estimated cost of these net 2,150 MW of CCGTs is \$1,344 million in 2004 dollars and  
20 assumes 2009 on-line dates.

1 **II.**

2 **METHODOLOGY**

3 SCE's cost-effectiveness evaluation of the SGRP is a life-cycle benefit-to-cost  
4 analysis from a ratepayer perspective. A life-cycle perspective measures total benefits and  
5 costs over the entire period of the project from 2004-2022. Because benefits and costs  
6 occur over many years, SCE used net present value (NPV) analysis to bring all benefits  
7 and costs to the base year of 2004. Measuring benefits and costs from a ratepayer  
8 perspective means that SCE valued all benefits and costs using the revenue requirement  
9 that ratepayers would incur or avoid.<sup>6</sup>

10 **A. Benefit-To-Cost Analysis**

11 NPV is the discounted monetized value of expected net benefits (i.e., benefits minus  
12 costs). NPV assigns monetary values to benefits and costs, discounts future benefits and  
13 costs using an appropriate discount rate, and subtracts the sum total of discounted costs  
14 from the sum total of discounted benefits. Discounting benefits and costs transforms gains  
15 and losses occurring in different time periods to a common unit of measurement. The  
16 ratio of the NPV of benefits to the NPV of costs is the benefit-to-cost ratio. Values above  
17 1.0 indicate projects which benefit ratepayers.

18 In this analysis, the benefits of SGRP are the difference between deferred costs of a  
19 SONGS 2 & 3 shutdown and costs of SONGS 2 & 3 continuing operations. Table II-1  
20 shows these deferred costs including (1) the deferral benefits of replacement capacity, (2)  
21 the deferral benefits of replacement transmission, and (3) the increase in replacement  
22 energy costs.

---

<sup>6</sup> SCE assessed SGRP at the 100% benefits and cost level to determine the cost-effectiveness of the SONGS 2 & 3 SGRP.

1 **B. Revenue Requirement Model**

2 **1. Purpose Of Revenue Requirement Model**

3 To quantify ratepayers' benefits resulting from SGRP, it is necessary to  
4 determine the payments which ratepayers will defer during the period 2004-2022 due to  
5 SONGS 2 & 3 continued operation. To do this, SCE converts the deferred costs resulting  
6 from SGRP into payments ratepayers would have otherwise made to offset these costs.  
7 These payments are the ratepayers' revenue requirement.

8 To quantify ratepayers' SGRP costs, it is necessary to determine the annual  
9 payments equivalent to the one time SGRP costs. Therefore, SCE also converts SONGS 2  
10 & 3 continuing operations costs, assuming steam generator replacement, into a revenue  
11 requirement.

12 Because ratepayers pay revenue requirements over a number of years, to  
13 compare different revenue requirements, it is necessary to put them on a consistent basis  
14 relative to the timing of payments. This conversion to a consistent basis is called Present  
15 Value (PV) analysis. For the SONGS 2 & 3 SGRP benefit-to-cost analysis, SCE converted  
16 each revenue requirement into a single PV that assumes 2004 as the base year.  
17 Therefore, the purpose of the revenue requirement model is two-fold. *First*, the model  
18 converts SCE's costs (either avoided or expected) into a revenue requirement which  
19 ratepayers would expect to pay. *Second*, the model changes these streams of revenue  
20 requirements paid over a number of years into a single PV.

21 Table II-1 lists the PV of ratepayers' net benefit due to the SGRP.

**Table II-1**  
**Ratepayer NPV Benefits (Costs Deferred)**  
**Resulting From SONGS 2 & 3 SGRP**  
**(dollars in millions, 100% level)**

Ratepayer cost for electricity assuming SONGS 2 & 3 shutdown in 2009	\$2,731
SONGS operating costs assuming 2009 shutdown	\$322- \$794
Cost of new transmission needed in 2009	\$1,706
Cost of replacement generation needed in 2009	\$3,517
Cost of replacement CCGT baseload energy	<u>\$8,276 - \$8,748</u>
Total: Cost for electricity assuming SONGS 2 & 3 shutdown in 2009	
Ratepayer cost for electricity assuming SONGS 2 & 3 shutdown in 2022	\$5,892
SONGS operating costs assuming 2022 shutdown	\$129-\$321
Cost of new transmission needed in 2022	\$728
Cost of replacement generation needed in 2022	<u>\$6,749 - \$6,941</u>
Total: Cost for electricity assuming SONGS 2 & 3 shutdown in 2022	<u>\$1,527 - \$1,807</u>
Ratepayer net benefit	

1           The PV of ratepayers' cost for SGRP is \$707 million dollars.

2           **2. Overview Of Revenue Requirement Model**

3           As described above, SCE used the revenue requirement model to: (1) convert  
4 costs incurred by the utility into a revenue requirement paid by ratepayers, and (2)  
5 translate the revenue requirement into a PV for comparison purposes. The testimony  
6 below describes the methodology for each of these tasks.

7           a)    Convert Costs Into A Revenue Requirement

8           A utility's cost of service, or revenue requirement, is all of its operating  
9 expenses plus a return on its investment. Therefore, the revenue requirement equals the  
10 sum of all costs necessary to meet its obligation to serve. The following formula expresses  
11 this revenue requirement:

$$\begin{aligned}
 \text{Revenue requirement} = & \text{Operation and Maintenance (O\&M) expense} + \\
 & \text{Depreciation expense} + \\
 & \text{Tax expense} + \\
 & \text{Return on investment}
 \end{aligned}$$

12           O&M expense is the cost of routine work that SCE performs to supply  
13 electric service during the course of a year. O&M expenses include labor, materials,  
14  
15  
16  
17

1 supplies, fuel, and variable administrative and general (A&G) expenses. Section IV.A.2.a.  
2 of this testimony provides the O&M assumptions used in SCE's analysis.

3 Depreciation expense is the charge against earnings that SCE takes  
4 each year to allow for the recovery of an investment (including removal costs) over its  
5 useful life.

6 Tax expense includes taxes based on income, miscellaneous taxes, and  
7 Ad Valorem (property) taxes on incremental investment. Sections III.D and IV.A.2.a.(7) of  
8 this testimony provide additional detail regarding tax expense.

9 Return is the cost of capital SCE incurs to finance its long-term  
10 investments. SCE multiplies the rate of return by its prudently incurred long-term  
11 investment to calculate its return. For the SONGS 2 & 3 SGRP benefit-to-cost analysis,  
12 SCE used its incremental cost of capital as described by Paul Hunt in Section III.C.5.  
13 SCE's prudently incurred long-term investment is its Rate Base.<sup>7</sup> The following formula  
14 illustrates the calculation of Rate Base:

15 Rate Base = Fixed capital - Reserves

16 Fixed capital is the sum of the plant in service, intangible plant  
17 including capitalized software, and plant held for future use. Reserves include  
18 accumulated depreciation, accumulated amortization, and accumulated deferred taxes.

19 b) Translate The Revenue Requirement Into A NPV

20 As previously discussed, once SCE has calculated the revenue  
21 requirements for each cost component, it is necessary to put them on a consistent basis  
22 relative to the timing of the ratepayers' payment. Appendix A lists the annual revenue  
23 requirements for each of the cost components used in the benefit-to-cost analysis. Section  
24 II.B.2.a above, describes the calculation of these revenue requirements. Table II-2 below  
25 compares the sum of each revenue requirement to the PV of each revenue requirement.

---

<sup>7</sup> Additional detail regarding the development of Rate Base is provided in the workpapers to this chapter.

**Table II-2**  
**Ratepayer Net Benefits (Costs Deferred)**  
**Resulting From SONGS 2 & 3 SGRP**  
**(dollars in millions, 100% level)**

	Sum of Annual Revenue Requirement	Present Value Of Revenue Requirement
Ratepayer cost for electricity assuming SONGS 2 & 3 shutdown in 2009		
SONGS operating costs assuming 2009 shutdown	\$3,506	\$2,731
Cost of new transmission needed in 2009	\$1,522 - \$3,357	\$322 - \$794
Cost of replacement generation needed in 2009	\$7,448	\$1,706
Cost of replacement CCGT baseload energy	\$11,033	<u>\$3,517</u>
Total: Cost for electricity assuming SONGS 2 & 3 shutdown in 2009		\$8,276 - \$8,748
Ratepayer cost for electricity assuming SONGS 2 & 3 shutdown in 2022		
SONGS operating costs assuming 2022 shutdown	\$14,220	\$5,892
Cost of new transmission needed in 2022	\$1,890 - \$4,185	\$129 - \$321
Cost of replacement generation needed in 2022	\$10,618	<u>\$728</u>
Total: Cost for electricity assuming SONGS 2 & 3 shutdown in 2022		\$6,749 - \$6,941
Ratepayer net benefit		<u>\$1,527 - \$1,807</u>
Cost of steam generator replacement	\$1,796	\$707

1                                   The difference between the sum of the annual revenue requirements  
2 and the PV of the revenue requirements is due to the timing of the ratepayers' payments.  
3 The earlier the ratepayer pays the revenue requirement, the higher the PV. The following  
4 formula translates the revenue requirement into the PV:

$$5 \quad PV = \frac{RR_1}{(1+r)} + \frac{RR_2}{(1+r)^2} + \dots + \frac{RR_n}{(1+r)^n} = \sum \frac{RR_i}{(1+r)^i}$$

6  
7                   where:

8                   RR - represents the revenue requirement costs.

9                   i - represents the year in which ratepayers pay the revenue  
10                   requirement.

11                   n - represents the year considered.

1           r - represents the discount rate (the discount rate quantifies the  
2           willingness of ratepayers to exchange present costs and benefit for  
3           future costs and benefits).

4           For this analysis, SCE assumes a 10.5% discount rate.<sup>8</sup>

5   **C.   Henwood Model**

6           The Commission ordered SCE to use Henwood models for resource planning.<sup>9</sup> SCE  
7           elected to continue its use for resource decisions such as SONGS 2 & 3 SGRP. As a result,  
8           SCE used Henwood's MARKETSYM<sup>10</sup> and RISKSYSM<sup>11</sup> models to forecast Market  
9           Clearing Prices (MCPs) and electricity production costs, respectively, for this cost-  
10          effectiveness analysis. MARKETSYM simulates the entire Western Electricity  
11          Coordinating Council (WECC) region for development of MCPs by WECC transmission  
12          area. Figure II-1 shows the transmission areas of the WECC region.

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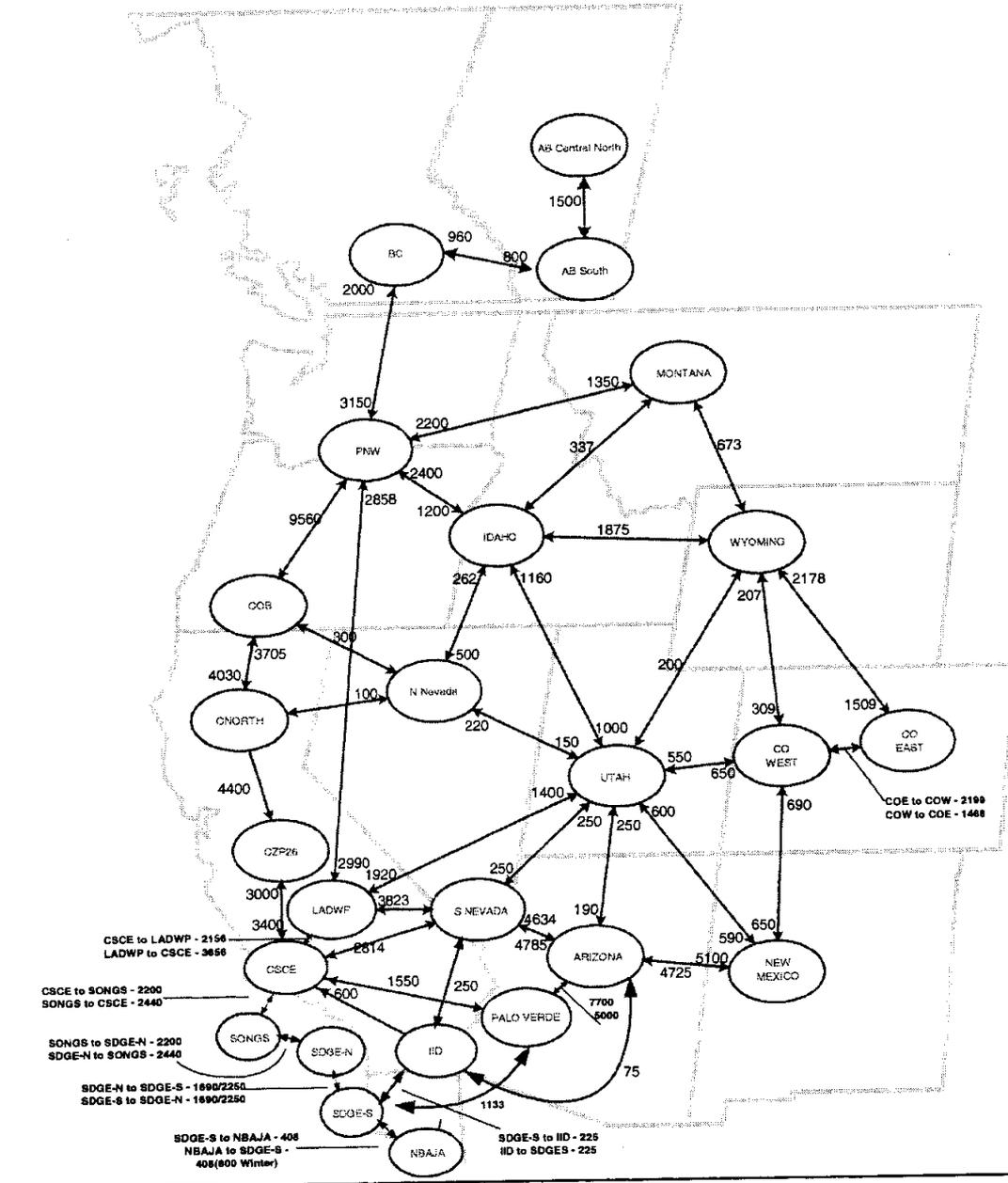
<sup>8</sup> Section III.C.5. provides additional discussion of the discount rate.

<sup>9</sup> Administrative Law Judge's Ruling from February 18, 2003 Prehearing Conference, dated February 21, 2003, in R.01-10-024, p. 3 ("For LT modeling, each utility would use the PROSYM model that has already been used by the Commission in other proceedings."). PROSYM is a Henwood computer model that is part of RISKSYSM utilized in the application.

<sup>10</sup> MARKETSYM is an electricity production cost computer model for the entire Western Electricity Coordinating Council.

<sup>11</sup> RISKSYSM is an electricity production cost computer model for a smaller area, such as an individual utility.

**Figure II-1  
MARKETSYM WECC - TRANSMISSION AREAS**



1 For SCE's long term resource plan, SCE prepared and ran a representation of its  
 2 MARKETSYM model to prepare MCPs for each transmission area. Due to the timing of  
 3 the California long term planning process, Henwood's WECC Fall 2002 dataset was the  
 4 base model. SCE modified the model to include key components of SCE's preferred

1 resource plan, including a representation of Mountainview and a transmission upgrade  
 2 from the Palo Verde region into SCE. Figure II-1 shows the interrelationship between the  
 3 SONGS Trans Area (SONGS) and the SCE (CSCE) and SDG&E (SDGE-N and SDGE-S)  
 4 Trans Areas. Because of this interrelationship, any modeling change to SONGS 2 & 3,  
 5 such as a 2009 shutdown, impacts both SCE and SDG&E MCPs. It is, therefore,  
 6 necessary to include and exclude 100% of SONGS 2 & 3 in order to develop logically  
 7 consistent MCPs. A fractional replacement of SCE's 75.05% share cannot provide useful  
 8 MCPs. This is one reason that SCE evaluated the cost-effectiveness of 100% SGRP.

9         MARKETSYM then produced a series for MCPs for the transmission areas of the  
 10 WECC. SCE then included the MCPs of SDG&E and SCE, which are found at the nodes  
 11 CSCE and SDGE-N on Figure II-1, in RISKSYSM runs. Table II-3 below identifies those  
 12 MCPs.

**Table II-3**  
**MARKETSYM MCPs**  
**(2004 \$ per Megawatt hour)**

Year	SCE	SDG&E
2004	\$ 41.26	\$ 41.23
2005	\$ 36.83	\$ 36.69
2006	\$ 31.81	\$ 31.25
2007	\$ 30.94	\$ 29.96
2008	\$ 30.16	\$ 29.42
2009	\$ 30.18	\$ 29.53
2010	\$ 30.95	\$ 30.35
2011	\$ 33.00	\$ 32.41
2012	\$ 34.03	\$ 33.34
2013	\$ 34.03	\$ 33.34
2014	\$ 34.03	\$ 33.34
2015	\$ 34.03	\$ 33.34
2016	\$ 34.03	\$ 33.34
2017	\$ 34.03	\$ 33.34
2018	\$ 34.03	\$ 33.34
2019	\$ 34.03	\$ 33.34
2020	\$ 34.03	\$ 33.34
2021	\$ 34.03	\$ 33.34
2022	\$ 34.03	\$ 33.34

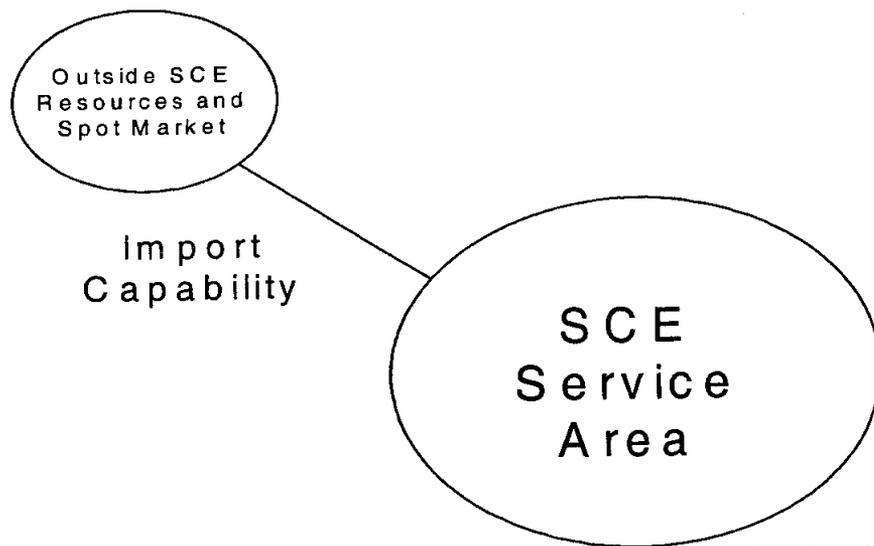
13         SCE and SDG&E MCPs from MARKETSYM are then used as input to RISKSYSM,  
 14 which uses them to simulate the production costs of the SONGS 2 & 3 Continuing

1 Operations and SONGS 2 & 3 Shutdown cases. The output of RISKSYM is real annual  
2 production costs which are converted to nominal dollars using the Global Insight Gross  
3 Domestic Product Chain-Weighted Index.<sup>12</sup>

4 SCE modeled the SCE and SDG&E service areas<sup>13</sup> in RISKSYM. RISKSYM  
5 simulates the impacts of resource additions or removals on smaller areas, such as  
6 individual utilities. For generation asset portfolios, RISKSYM commits and dispatches  
7 resources assuming most economic plants are committed and dispatched first.

8 The RISKSYM model reduces the generalized Henwood MARKETSYM model down  
9 to two areas of interest. As Figure II-2 shows, in SCE's case, RISKSYM models the SCE  
10 system as one area, and all other generators and spot energy as another area.

**Figure II-2**  
**SCE RISKSYM Transmission Areas**



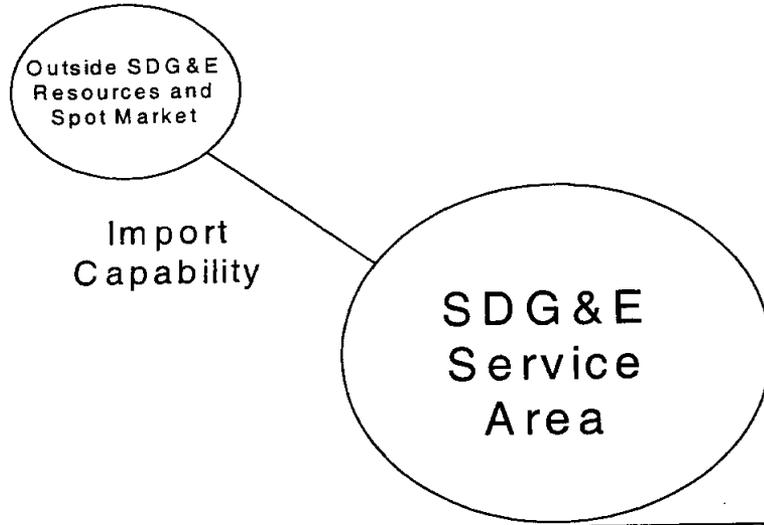
11 As Figure II-3 shows, in SDG&E's case, RISKSYM models the SDG&E system as one area  
12 and all other generators and spot energy as another area.

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<sup>12</sup> SCE-4, III-C.

<sup>13</sup> See Figures II-2 and II-3.

**Figure II-3**  
**SDG&E RISKSYM Transmission Areas**



1 **B. Timeframe**

2 It is possible that SGRP can be completed during 2009-10. Following a successful  
3 SGRP, SCE expects SONGS 2 & 3 will operate until the expiration date of its Nuclear  
4 Regulatory Commission (NRC) operating licenses. The NRC operating license expiration  
5 for SONGS 2 is February 16, 2022, and for SONGS 3 is November 15, 2022. Therefore,  
6 the cost-effectiveness analysis period is 2004 through 2022.<sup>16</sup>

7 **C. Economic Assumptions**

8 This section discusses assumptions for capital escalation, O&M escalation, general  
9 escalation, and discount rate/incremental cost of capital.

10 **1. Global Insight**

11 SCE purchases economic projection data from Global Insight. Global Insight  
12 is one of the largest and most respected economic forecasting services in the world.<sup>17</sup> SCE  
13 subscribes to certain Global Insight products and has used Global Insight projections in  
14 numerous proceedings before the Commission. SCE believes that the Commission staff  
15 also subscribes to Global Insight products. Global Insight projections are the basis for all  
16 of the escalation rates discussed in this section.

17 **2. Capital Escalation**

18 The Global Insight projection of Handy-Whitman Indexes estimates capital  
19 escalation for nuclear production plant construction costs, other power production plant

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<sup>16</sup> This period is consistent with the NRC operating license periods for SONGS 2 & 3. SONGS 2 NRC Docket No. 05000361, Operating License issued – 09/07/1982, expires 02/16/2022. SONGS 3 NRC Docket No. 05000362, Operating License issued – 09/16/1983, expires 11/15/2022. Technical detail of financial analysis goes past 2022 because production cost models simulate the dispatch of generation and demand-side resources to meet loads, and maintain an accounting of the cost-of-service. Production cost models dispatch based on predetermined schedules, unit economics, and plan availability, simulating both scheduled and forced outages. See workpapers.

<sup>17</sup> Before October 2002, Global Insight was known as DRI-WEFA. DRI-WEFA was formed from the merger of Standard & Poor's DRI, known previously as Data Resources Incorporated, and WEFA, also known as Wharton Econometric Forecasting Associates.

1 construction costs, and transmission plant construction costs for the Pacific region.<sup>18</sup> For  
2 this application, SCE used the First Quarter 2003 Global Insight Utility Cost Information  
3 Service (GIUCIS) projection of these indexes.

### 4 **3. O&M Escalation**

5 SCE based estimated escalation rates for labor O&M and nonlabor O&M on  
6 the GIUCIS projection for the first quarter of 2003. This is the same projection used to  
7 support the O&M escalation rates provided in escalation rate update testimony jointly  
8 sponsored by the Commission's Office of Ratepayer Advocates (ORA) and SCE in SCE's  
9 2003 General Rate Case.<sup>19</sup>

#### 10 a) Labor O&M Escalation

11 The labor O&M escalation rate is a weighted average of three GIUCIS  
12 projections of wage increases for (1) electric, gas, and sanitary service workers, (2)  
13 managers and administrators, and (3) professional and technical workers. The GIUCIS  
14 projections are national projections, not specific to California or Southern California.

15 Table III-5 below shows the categories of our workers and the shares of  
16 total wages and salaries that they earn. These are used as the weights to construct the  
17 weighted average of the three GIUCIS projections.

18 For 2004 and 2005, for physical workers, SCE replaced the GIUCIS  
19 projected escalation rate for electric, gas, and sanitary service workers with the actual  
20 wage increases granted to SCE union employees.

---

<sup>18</sup> The Handy-Whitman Indexes are published by Whitman, Requardt & Associates, LLP, of Baltimore, Maryland. The Pacific region comprises California, Oregon, and Washington.

<sup>19</sup> A.02-05-004/I.02-06-002, Exhibit 412.

**Table III-5  
Correspondence Between Employee Categories  
And GIUCIS Variables**

Line No.	Employee Category	Share of Total Wages and Salaries Paid for 1999 and 2000	GIUCIS Labor Escalation Index	GIUCIS Labor Escalation Variable Name
1	Clerical	12.69%	Electric, gas, and sanitary service workers	AHE49NS
2	Physical	33.57%	Electric, gas, and sanitary service workers	AHE49NS; replaced by union wage increase for 2004 and 2005
3	Executive/Manager/Supervisor	20.44%	Managers and administrators	ECIWSPWMGRNS
4	Professional/Technical	33.30%	Professional and technical workers	ECIWSPWP&TNS

b) Nonlabor O&M Escalation

For projected nonlabor O&M escalation, SCE uses various GIUCIS indexes of O&M combined materials and services costs. These indexes are chosen to match the cost categories for which nonlabor O&M escalation rates are required. Unlike the nonlabor O&M escalation indexes used in SCE's 2003 General Rate Case, SCE did not adjust these indexes to account for labor costs that are booked in nonlabor expense by SCE's accounting system. That adjustment is not required here. The result is that the nonlabor O&M escalation rates used in this application are slightly lower than their 2003 GRC counterparts.

4. General Escalation

SCE's analysis requires an estimate of general price escalation to project nominal energy prices and natural gas prices. For an estimate of general price escalation SCE chose the Global Insight projection of the Gross Domestic Product chain-weighted price index. The Gross Domestic Product chain-weighted price index measures price inflation across all sectors of the U.S. economy. Thus, it is a good measure of general price escalation.

1           **5.     Discount Rate/Incremental Cost Of Capital**

2           To calculate PVs, SCE discounts benefits and costs at its estimated  
3 incremental cost of capital. SCE's current incremental cost of capital is 10.5%, constructed  
4 as shown in the following table.

**Table III-6  
Incremental Cost Of Capital**

<b>Component</b>	<b>Percentage of Capital</b>	<b>Cost</b>	<b>Weighted Cost</b>
Long-Term Debt	47.00%	8.15%	3.83%
Preferred Stock	5.00%	7.15%	0.36%
Common Equity	48.00%	13.15%	6.31%
<b>Total</b>	<b>100.00%</b>		<b>10.50%</b>

5           SCE's incremental cost of capital is higher than SCE's CPUC-authorized cost  
6 of capital for 2003. This is not a surprising result, because SCE views its incremental cost  
7 of capital as a forward-looking long-term cost of capital. SCE's authorized costs of long-  
8 term debt and preferred stock reflect the cost of securities that were issued at times when  
9 capital was less costly than it is at present or is likely to be in the future. Similarly, SCE  
10 believes that its future cost of equity will exceed the level authorized by the Commission  
11 for 2003.

12           **D.     State And Federal Tax Treatment**

13           SCE will capitalize the costs of acquiring, transporting, and installing the RSGs for  
14 Federal and State income tax purposes, as the RSGs will be capital assets with useful  
15 lives in excess of one year. Pursuant to regulations and guidance under the Federal  
16 Modified Accelerated Cost Recovery System (MACRS) pursuant to Section 168 of the  
17 Internal Revenue Code (Code), the RSGs that will be installed in SONGS 2 & 3 will be  
18 classified as "electric utility nuclear production plant," class 49.12. As such, SCE will  
19 depreciate them using the 150% declining balance method over a fifteen-year recovery  
20 period. Similarly, under California's Asset Depreciation Range (ADR) system, SCE will  
21 classify the RSGs as "electric utility nuclear production plant," class 49.12, and will

1                   b)     Replacement Generation

2                                 SONGS 2 & 3 shutdown removes 2,150 MW of in-basin baseload  
3 generation which serves the electricity demand of SCE, SDG&E, Anaheim, and the  
4 Riverside electric system customers. The current new baseload generation technology of  
5 choice for California is the CCGT as demonstrated by California Energy Commission  
6 (CEC) licensing and approvals.<sup>23</sup> CCGTs are also most likely to be built based on recent  
7 California and Arizona plant construction history.

8                                 (1)    Type Of Replacement Generation

9   The replacement of SONGS 2 & 3 capacity with gas-fired CCGTs  
10 would reduce California's fuel diversity. According to the CEC's report "Renewable  
11 Resources Development Report,"<sup>24</sup> the most likely non-gas-fired baseload generation  
12 available is geothermal, which the CEC models in 50 Megawatt (MW) units in its report  
13 "The Comparative Cost of California Central Station Generation."<sup>25</sup> Geothermal is three  
14 to four times more expensive to construct than is a CCGT, and per the CEC, it is expected  
15 to have an installed cost of \$1,900 - \$2,150 per kW<sup>26</sup> without allowance for the potentially  
16 long transmission interconnection lines that would add additional costs. Since this would  
17 result in a cost that was very similar to, or greater than, that of a natural gas-fired CCGT,  
18 it would have no effect on the main conclusions of the SONGS 2 & 3 cost-effectiveness  
19 analysis. A SONGS 2 & 3 shutdown would expose California ratepayers to either more

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<sup>23</sup> The CEC's July 15, 2003 website page "PROJECTS GREATER THAN 300 MW Currently On Line," shows that of the 5,546 MW of baseload plants brought on line, 100% are CCGTs. The CEC's July 15, 2003 website page "PROJECTS GREATER THAN 300 MW Currently Under Construction," shows that of the 6,394MW of baseload plants brought under construction, 100% are CCGTs.

<sup>24</sup> "Renewable Resource Development Report" November 2003 from the CEC, available at [http://www.energy.ca.gov/reports/2003-11-24\\_500-03-080F.PDF](http://www.energy.ca.gov/reports/2003-11-24_500-03-080F.PDF).

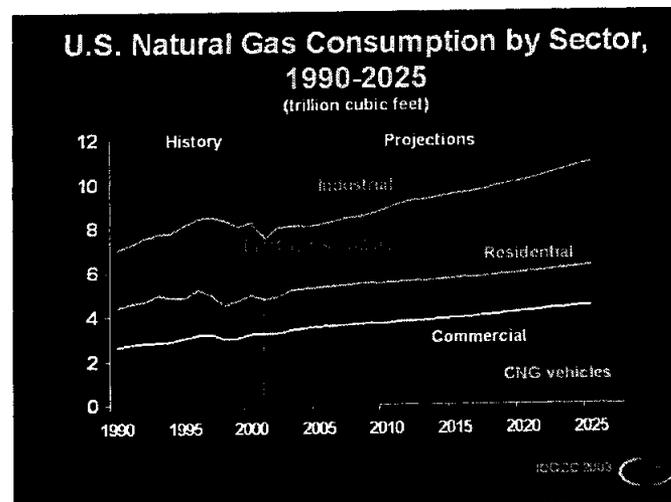
<sup>25</sup> California Energy Commission Final Staff Report, "Comparative Cost of California Central Station Electricity Generation Technologies" (100-03-001F), dated June 5, 2003. Prepared in Support of the Electricity and Natural Gas Report under the Integrated Energy Policy Report Proceeding, Docket 02-IEP-01. Also found at [www.energy.ca.gov/reports/index.html](http://www.energy.ca.gov/reports/index.html).

<sup>26</sup> See p. D-7, "Renewable Resource Development Report."

1 natural-gas price exposure, or very large initial costs for geothermal generation, if  
2 available.

3 United States Energy Information Administration (EIA) forecasts  
4 consistently increasing natural gas use for generation (*i.e.*, CCGTs) in the United States in  
5 their May 19, 2003 report "Outlook for Natural Gas & Petroleum." Figure IV-4 shows EIA  
6 forecasts of Natural Gas Consumption.

**Figure IV-4**  
**EIA Forecast of Natural Gas Consumption**



7 Consistent with the EIA and the CEC, SCE assumes that CCGTs replace SONGS 2 & 3.<sup>27</sup>  
8 SCE developed the cost estimates of the CCGTs considering CEC, Henwood, and SCE  
9 estimates of construction and fixed O&M costs. SCE's analysis assumed utility owned  
10 CCGTs are built and available for operation in 2009.

<sup>27</sup> All recent gas powerplant construction in California has been CCGTs. California Energy Commission Energy Facility Status, updated 11/14/2003, [http://www.energy.ca.gov/sitingcases/all\\_projects.html#online](http://www.energy.ca.gov/sitingcases/all_projects.html#online). All recent gas powerplant construction in Arizona has been CCGTs. Of the 7,465 MW of generation added (or anticipated to be added) in the Arizona/Nevada area from 2000-2003, 100% is natural gas fired CCGTs according to the Fall 2002 Henwood WECC database. SCE included Mountainview in the base case generation.

1 (2) Location Of Replacement Generation

2 SCE assumed 895 MW of the replacement CCGTs are built in  
3 California, and the remainder, 1,255 MW, are built in the Palo Verde, AZ area. SCE  
4 recognizes that there will be transmission losses from Palo Verde or any other out-of-area  
5 generator. SCE used the conservative assumption of no losses, thus underestimating the  
6 deferral benefit of replacement generation for SONGS 2 & 3.<sup>28</sup>

7 (3) Cost Of Replacement Generation

8 SCE estimated CCGT construction cost at \$625/kW in 2004 \$  
9 using (1) market surveys of recently completed plants, (2) CEC's "Comparative Cost Of  
10 California Central Station Electricity Generation Technologies Report," and (3) input from  
11 the Henwood-supplied RISKSYSM database that underlies SCE's Preferred Resource plan.  
12 SCE's estimated cost of construction of \$625/kW is consistent, if not conservatively low,  
13 when weighed against other sources discussed below.

14 In April 2003, Cambridge Energy Research Associates (CERA)  
15 attributed the value of \$670/kW to a new generic CCGT.

16 In testimony sponsored by the California Electricity Oversight  
17 Board (CEOB) and this Commission before the Federal Energy Regulatory Commission  
18 (FERC) in October 2002, Martin Ringo<sup>29</sup> indicated that the "Installed cost per kW" for a  
19 new CCGT in California would be \$761/kW.<sup>30</sup>

20 R. W. Beck, a technical and management consulting firm,  
21 recently estimated the capital cost for a new inland California CCGT to be \$745/kW.

---

<sup>28</sup> The distribution of replacement generation between California and Arizona imports is consistent with SCE-5. SCE conducted a study of the transmission system stability impacts related to SONGS 2 & 3 shutdown scenario. The study results, provided in SCE-5, detail the assumptions used for the analysis.

<sup>29</sup> Martin Ringo is a consulting economist who has worked in the electric utility industry since the advent of deregulation, primarily in the area of independent power. Dr. Ringo holds a Ph.D. from Brown University.

<sup>30</sup> FERC Dockets EL02-60-003 and EL02-62-003.

1 R. W. Beck derived its pricing from reviewing: (1) costs and other information on various  
2 CCGTs in the United States, and (2) present day costs for CCGTs planned to be in service  
3 in the inland Southern California area by 2004.

4 The CEC's "Comparative Cost of California Central Station  
5 Electricity Generation Technologies Report,"<sup>31</sup> in support of the CEC's Integrated Energy  
6 Policy Report Proceeding, estimates costs for several generic electricity generation  
7 technologies, including CCGT generation. The CEC estimate for a new CCGT is \$612/kW  
8 after adjustments for summer vs. winter rating and transmission interconnection costs.

9 Based on "The WECC Regional Outlook" from Henwood, SCE  
10 does not expect the construction costs to vary significantly between Arizona and California  
11 construction.<sup>32</sup> Permitting processes and installation timeframes between jurisdictions  
12 will vary, as will the costs of interconnection for both natural gas supply and electricity.  
13 Because SCE uses these cost estimates for this cost-effectiveness analysis only, and not in  
14 support of construction, SCE has not determined precise construction timing and location.  
15 Table IV-8 below provides SCE's estimated costs and timing of the replacement generation  
16 construction projects.

**Table IV-8**  
**Annual Cash Flow Construction For 2,150 MW**  
**of Replacement Generation**  
**(Nominal \$ in Thousands, 100% Level)**

Generation	2004	2005	2006	2007	2008	2009	Total
	-	-	-	651,057	669,657	172,188	1,492,902

<sup>31</sup> California Energy Commission Final Staff Report, "Comparative Cost of California Central Station Electricity Generation Technologies" (100-03-001F), dated June 5, 2003. Prepared in Support of the Electricity and Natural Gas Report under the Integrated Energy Policy Report Proceeding, Docket 02-IEP-01. Also found at [www.energy.ca.gov/reports/index.html](http://www.energy.ca.gov/reports/index.html).

<sup>32</sup> According to Henwood's "The WECC Regional Outlook, Spring 2003" Report (Propriety and Confidential).

1                   c)     Electricity Production Costs

2                             SONGS 2 & 3 generation output serves the electricity requirements of  
3 SCE, SDG&E, Anaheim, and Riverside customers. SCE modeled electricity production  
4 costs using Henwood's RISKSYSM model. SCE modeled electricity costs for its system in  
5 RISKSYSM using its Preferred Resource Plan and for SDG&E's system using publicly  
6 available information assembled by Henwood.

7                             (1)     SCE's Preferred Resource Plan

8                                     Exhibit 7C in R.01-10-024 described SCE's Preferred Resource  
9 Plan. SCE's Preferred Resource Plan assumed that all regulatory issues which impede  
10 SCE's ability to make long-term resource commitments are appropriately resolved. These  
11 issues include customer load base stability, long-term cost recovery, and demand-side  
12 management planning and implementation. With these issues resolved, SCE can  
13 maximize its ability to procure or invest in resources in an optimal manner.

14                                     The Preferred Plan identifies a need for a significant increased  
15 investment in existing energy efficiency and demand response program above current  
16 levels. These increased investments are expected to reduce the annual peak load by an  
17 additional 235 MW by 2012. New energy efficiency programs are expected to reduce the  
18 annual peak load by an additional 390 MW by 2012. The peak load reduction from  
19 increased investment in demand response and energy efficiency totals about 625 MW by  
20 2012. (This is the total reduction achieved over present programs, with currently  
21 approved levels of funding.) Energy efficiency programs also reduce the amount of energy  
22 necessary to meet customer energy requirements by at least 2,200 GWh per year by the  
23 year 2008.

24                                     With regard to supply side resources, the Preferred Plan  
25 identifies a need for a substantial amount of new long term commitments. SCE chose to  
26 use some long term contracts in the Preferred Plan since these contracts are expected to  
27 have lower capacity payments than shorter term contracts. This expectation assumes that

1 power providers will secure lower cost financing if a longer term contract is secured. The  
2 Preferred Plan identifies a need for about 1,800 MW of long-term contracts in 2006. The  
3 amount of long-term contracts increases to about 4,600 MW by 2012. The reason for the  
4 increase is that various other long term contracts expire by the end of 2011 and SCE could  
5 logically enter into new long-term contracts at that time. The Preferred Plan still contains  
6 a significant number of short-term contracts to maintain an appropriately diverse contract  
7 portfolio.

8 The Preferred Plan, as well as all the other plans and cases,  
9 meets or exceeds the requirements of SB 1078 with respect to renewable energy  
10 purchases. The Preferred Plan includes renewable energy equal to 20% of SCE's expected  
11 retail sales.

12 Also included in the Preferred Plan are the following resource  
13 assumptions:

- 14 • The Palo Verde generating station is operational throughout the  
15 entire plan;
- 16 • The Four Corners coal facility is operational throughout the  
17 entire plan;
- 18 • SCE's current hydroelectric system is available throughout the  
19 plan;
- 20 • The existing QF contracts expire based on existing contract  
21 terms in all the plans. (The amount of QF capacity in 2004 is  
22 expected to be about 2,850 MW, which reduces to about 1,550  
23 MW by 2012);
- 24 • SCE currently has various interutility contracts which expire in  
25 the coming years. These contracts are exactly the same in each  
26 case or plan. The contract capacity reduces from about 2,790  
27 MW in 2004 to about 550 MW by 2012. This contract capacity

1 (3) Treatment Of SDG&E

2 Because SDG&E faces different MCPs, loads and resources, SCE  
3 modeled SDG&E separately using a representation of its service area in RISKSYM. SCE  
4 requested that Henwood Consulting create a RISKSYM base dataset for use in modeling  
5 SDG&E's service territory. Henwood provided SCE with an extract from the Henwood  
6 WECC Spring 2003 base dataset, including the SDG&E system load forecast, transmission  
7 links, and generation units serving SDG&E. Henwood developed the load forecast and  
8 generation unit listing using publicly available information and Henwood expert  
9 judgment. MCPs included in the dataset were for the SDG&E transmission area from  
10 SCE's MARKETSYM run conducted by Henwood in support of the long term resource  
11 plan.

12 (4) Natural Gas Price Forecast

13 SCE contracts with Global Insight to provide long term natural  
14 gas prices forecasts twice each year. The forecasts are based on world energy supply and  
15 demand, United States energy supply and demand, and California and the southwest  
16 infrastructure. The Henwood MARKETSYM and RISKSYM models used the Global  
17 Insight base forecast. Table IV-9 below, presents the base forecast for Fall 2003.

**Table IV-9**  
**Global Insight Gas Price Forecast**  
**Fall 2003**  
**\$/Million British Thermal Units (MMBTU)**

Year	2004 \$ Henry Hub
2004	4.75
2005	4.12
2006	3.58
2007	3.43
2008	3.46
2009	3.46
2010	3.56
2011	3.76
2012	3.83
2013	3.89
2014	3.92
2015	4.00
2016	4.05
2017	4.07
2018	4.10
2019	4.13
2020	4.15
2021	4.17
2022	4.20

(5) MCP Forecast

MCP forecast inputs to both the SCE and SDG&E RISKSYSM models were derived from a common baseline MARKETSYM run, previously described in Section II.C.

(6) Production Costs

Table IV-10 below provides the production costs for the SONGS continued operations. Table IV-10 summarizes the results of the RISKSYSM model runs for the SCE and SDG&E service areas. The Anaheim and Riverside results in Table IV-10 are derived from the SCE model, since they are fully contained with the same control area. The first column represents the electricity production costs from the SONGS continuing operations case, excluding any SONGS 2 & 3 nuclear operating costs. The second column represents the electricity production costs from the SONGS shutdown case and excluding

1 any SONGS 2 & 3 nuclear operating costs.<sup>35</sup> The third column is the difference between  
 2 the Shutdown case values and the continuing operations values, and represents the  
 3 benefit (avoided cost) of SONGS 2 & 3 SGR on system electricity production costs, net of  
 4 nuclear operating costs.

**Table IV-10**  
**Electricity Production Costs Using Henwood Model**  
**(2004 \$ in Billions)**

SCE Production Costs From RiskSym			
	SONGS Continuing Operations	SONGS Shutdown	Net Benefit
2009	\$4.03	\$4.16	\$0.08
2010	\$4.16	\$4.54	\$0.34
2011	\$4.28	\$4.76	\$0.43
2012	\$4.01	\$4.50	\$0.44
2013	\$4.01	\$4.50	\$0.44
2014	\$4.01	\$4.50	\$0.44
2015	\$4.01	\$4.50	\$0.44
2016	\$4.01	\$4.50	\$0.44
2017	\$4.01	\$4.50	\$0.44
2018	\$4.01	\$4.50	\$0.44
2019	\$4.01	\$4.50	\$0.44
2020	\$4.01	\$4.50	\$0.44
2021	\$4.01	\$4.48	\$0.44
2022	\$2.29	\$2.54	\$0.25

<sup>35</sup> Chapter IV.A.2. presents SONGS 2 & 3 nuclear operating costs.

SDGE Production Costs From RiskSym

	SONGS Continuing Operations	SONGS Shutdown	Net Benefit
2009	\$0.77	\$0.85	\$0.07
2010	\$0.79	\$0.90	\$0.10
2011	\$0.80	\$0.92	\$0.10
2012	\$0.70	\$0.83	\$0.11
2013	\$0.70	\$0.83	\$0.11
2014	\$0.70	\$0.83	\$0.11
2015	\$0.70	\$0.83	\$0.11
2016	\$0.70	\$0.83	\$0.11
2017	\$0.70	\$0.83	\$0.11
2018	\$0.70	\$0.83	\$0.11
2019	\$0.70	\$0.83	\$0.11

SDGE Production Costs From RiskSym			
	SONGS Continuing Operations	SONGS Shutdown	Net Benefit
2009	\$0.77	\$0.85	\$0.07
2010	\$0.79	\$0.90	\$0.10
2011	\$0.80	\$0.92	\$0.10
2012	\$0.70	\$0.83	\$0.11
2013	\$0.70	\$0.83	\$0.11
2014	\$0.70	\$0.83	\$0.11
2015	\$0.70	\$0.83	\$0.11
2016	\$0.70	\$0.83	\$0.11
2017	\$0.70	\$0.83	\$0.11
2018	\$0.70	\$0.83	\$0.11
2019	\$0.70	\$0.83	\$0.11
2020	\$0.70	\$0.83	\$0.11
2021	\$0.70	\$0.82	\$0.11
2022	\$0.40	\$0.46	\$0.06

Anaheim and Riverside Production Costs From RiskSym			
	SONGS Continuing Operations	SONGS Shutdown	Net Benefit
2009	\$0.27	\$0.27	\$0.01
2010	\$0.27	\$0.30	\$0.02
2011	\$0.28	\$0.31	\$0.03
2012	\$0.26	\$0.30	\$0.03
2013	\$0.26	\$0.30	\$0.03
2014	\$0.26	\$0.30	\$0.03
2015	\$0.26	\$0.30	\$0.03
2016	\$0.26	\$0.30	\$0.03
2017	\$0.26	\$0.30	\$0.03
2018	\$0.26	\$0.30	\$0.03
2019	\$0.26	\$0.30	\$0.03
2020	\$0.26	\$0.30	\$0.03
2021	\$0.26	\$0.30	\$0.03
2022	\$0.15	\$0.17	\$0.02

Total Production Costs From RiskSym			
	SONGS Continuing Operations	SONGS Shutdown	Net Benefit
2009	\$5.07	\$5.29	\$0.16
2010	\$5.22	\$5.74	\$0.46
2011	\$5.36	\$5.99	\$0.56
2012	\$4.98	\$5.63	\$0.58
2013	\$4.98	\$5.63	\$0.58
2014	\$4.98	\$5.63	\$0.58
2015	\$4.98	\$5.63	\$0.58
2016	\$4.98	\$5.62	\$0.58
2017	\$4.98	\$5.62	\$0.58
2018	\$4.98	\$5.62	\$0.58
2019	\$4.98	\$5.62	\$0.58
2020	\$4.98	\$5.62	\$0.58
2021	\$4.98	\$5.60	\$0.58
2022	\$2.84	\$3.17	\$0.33

1           **2.     Operating Costs**

2           Assuming SONGS 2 & 3 steam generators are replaced, SONGS 2 & 3 would  
3 continue to operate through 2022 (NRC licenses expiration). California would defer  
4 mitigation activities until the 2022 SONGS 2 & 3 shutdown. This section of the testimony  
5 describes the costs associated with SONGS 2 & 3 operation and the deferred transmission  
6 and replacement generation. These are costs of continued SONGS 2 & 3 operation. To  
7 calculate net benefits of SONGS 2 & 3 continued operation, shown in Appendix A, these  
8 costs are subtracted from the total avoided costs in the SONGS 2 & 3 shutdown scenarios  
9 to derive net ratepayer benefits of SONGS 2 & 3 continued operation.

10           a)     Nuclear Operating Costs

11                     (1)   Base Operations & Maintenance Expense

12                             SCE forecasts 2004 SONGS 2 & 3 Base O&M<sup>36</sup> expenses at  
13 \$284.3 million, as shown in Table IV-11. SCE adjusted the SONGS 2 & 3 Base O&M  
14 estimate in the Test Year 2003 (TY 2003) GRC<sup>37</sup> as follows:

- 15                             • Added payroll loads;<sup>38</sup>
- 16                             • Added NRC Fees increase;<sup>39</sup>
- 17                             • Added Design Basis Threat (DBT) O&M expense  
18                                 described in workpapers;
- 19                             • Escalated TY2003 GRC Base O&M forecast (from 2000\$  
20                                 to 2004 \$) utilizing escalation rates provided in SCE-4,  
21                                 Chapter III; and

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<sup>36</sup> SCE considers O&M costs incurred during normal plant operations, including overtime, as “base” O&M costs.

<sup>37</sup> See SCE’s TY2003 GRC, A.02-05-004, Exhibit 8, p. 88.

<sup>38</sup> Payroll loads of 37% are calculated using effective rates for social security, unemployment insurance, pensions, medical insurance, and other employee benefits.

<sup>39</sup> See SCE’s TY2003 GRC, A.02-05-004, Exhibit 411, Volume 1.

1 (2) Allocation of Common Site Support Costs

2 SONGS 2 & 3 Base O&M expense includes an allocation of  
3 SONGS common site support costs. SONGS common site support costs include activities  
4 that provide support to all SONGS work activities.<sup>41</sup> Because these activities support all  
5 SONGS work activities, it would be burdensome and impractical to accurately direct  
6 charge their work hours and expenses to the following cost categories:

- 7 • SONGS 2 & 3 O&M (Base and RFO)
- 8 • SONGS 2 & 3 Capital
- 9 • SONGS 2 & 3 SGRP
- 10 • SONGS 1 Shutdown O&M
- 11 • SONGS 1 Decommissioning

12 SCE allocates common site costs to these cost categories based on each cost categories'  
13 direct labor costs. SCE first identified the annual SCE and Contractor labor dollars for  
14 each of the cost categories, for years 2004 through 2022. The annual breakdown resulted  
15 in a percentage allocation for total SONGS labor by cost category. SCE then estimated  
16 allocation of the annual common site support O&M budget of \$89.1 million (2004 \$, 100%  
17 level) based on these percentages, to provide an estimate for use in the cost-effectiveness  
18 study. As direct labor costs change over time, the allocation of common site support cost  
19 dollars to those cost categories also changes.

20 Examples of drivers that impact the common site support O&M  
21 allocation over the years include: (1) SONGS 1 Shutdown O&M ending in 2004, (2)  
22 SONGS 1 Decommissioning ramp-down starting in 2005 with a significant decrease in  
23 2009, and (3) the SGRP from 2004 through 2012. Each of these changes to individual cost

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<sup>41</sup> Examples of Divisions and groups that charge their labor and expenses to common site support O&M include Payroll, Administration, Business Planning & Financial Services, Communications, Emergency Preparedness, and Regulatory Affairs.

1 categories result in a change to the SONGS 2 & 3 portion of the common site support  
2 O&M allocation.

3 SCE calculated the change to the Base O&M cash flow due to  
4 variations in the common site support cost allocation for the three scenarios: (1) SGRP  
5 during the Fuel Cycle 16 RFO using the base capital case, (2) SGRP during the Fuel Cycle  
6 16 RFO using the increased regulatory/reliability capital case (excluding SGRP costs), and  
7 (3) shutdown of both units if the steam generators are not replaced. Figure IV-6 shows the  
8 changes to the common site support allocation as an addition to, or reduction from, the  
9 value included in the TY2003 GRC. The cost effectiveness analysis used the resulting  
10 values.



**Table IV-13**  
**SONGS 2 & 3 RFO O&M Forecast**  
**2004 \$ in Millions, 100% Level**

Year	Outage Days	Forecast in Millions	
		Replace SG's	Shutdown
2004	90	123	123
2005	8	0	0
2006	86	123	123
2007	62	64	64
2008	45	60	60
2009	110	60	0
2010	120	46	0
2011	45	58	0
2012	45	58	0
2013	45	53	0
2014	45	53	0
2015	45	58	0
2016	45	58	0
2017	90	106	0
2018	0	0	0
2019	90	117	0
2020	45	53	0
2021	45	53	0
2022	0	0	0

1 RFO O&M expenditures can vary for similar reasons to those  
2 identified for the Base O&M: industry events, increased NRC scrutiny, and plant  
3 conditions. Accordingly, SCE also developed a 20% higher RFO O&M cost case, assuming  
4 this higher case will reasonably bound most of the unforeseeable regulatory and  
5 extraordinary operating expenses. SCE developed the higher RFO O&M case by adding  
6 20% to: (1) the total RFO O&M estimate of \$59.7 million (2004 \$, 100% level, including  
7 payroll loads), and (2) the increased steam generator inspection and repair costs  
8 forecasted until steam generator replacement is performed in Fuel Cycle 16 RFO.

9 (4) Capital

10 SCE forecasted its SONGS 2 & 3 ongoing capital expenditures  
11 (provided in nominal dollars, 100% level) for the period 2004 through 2022, to reflect the

1 need to (1) perform routine capital maintenance, (2) provide for base level station tools,  
2 equipment, and facilities, and (3) perform modifications related to safety, NRC licensing  
3 and regulatory requirements, long-term plant reliability, plant betterment, and  
4 obsolescence issues.

5 Ongoing capital expenditures can vary significantly because of  
6 emergent industry events, increased NRC scrutiny, plant conditions, and external events,  
7 such as the September 11, 2001, terrorist attacks. Accordingly, SCE developed a base case  
8 and a higher capital cost case (excluding SGRP costs), assuming that significant  
9 regulatory/reliability issues arise. In SCE's judgment, a case which is approximately 50%  
10 higher will reasonably bound most of the unforeseeable regulatory and extraordinary  
11 capital costs.

12 The base case uses SCE's capital additions forecast from the  
13 TY2003 GRC<sup>46</sup> as the basis for the 19-year forecast. SCE developed the base case forecast  
14 as follows:

- 15 • 2004-2008 – Based on a 5-year forecast (using 2004 and  
16 2005 capital forecasts presented in TY2003 GRC and the  
17 2006-2008 forecast prepared in conjunction with that  
18 filing), plus a 10% scope growth allowance, plus additional  
19 DBT security capital costs of \$63.5 million in 2004 to  
20 comply with NRC orders (see workpapers), plus 37%  
21 payroll loads added to SCE labor;
- 22 • 2009-2017 – Based on average of 2004-2008,<sup>47</sup> plus  
23 escalation;<sup>48</sup> and

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<sup>46</sup> See SCE's TY2003 GRC, A.02-05-004, Exhibit 58, Appendix E, p. E-10.

<sup>47</sup> Average used except for Used Fuel Storage Project for which a detailed projection exists.

<sup>48</sup> See SCE-4, Chapter III.

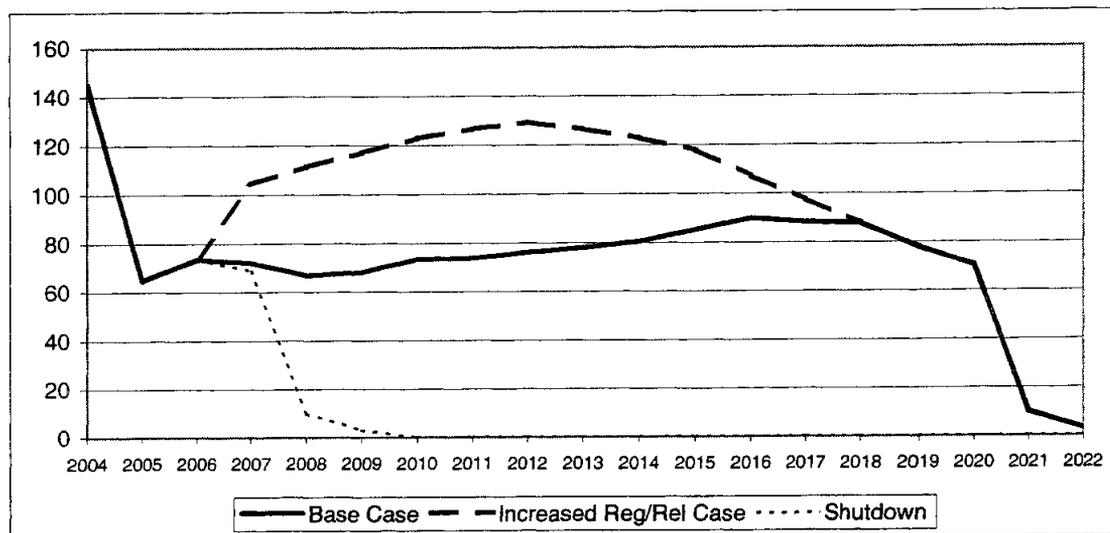
- 2018-2022 – Ramp-down to account for 2022 end of license.

In the base case, SCE forecasted the years beyond the 5-year period provided in the TY2003 GRC by using an averaging methodology. Project-by-project forecasting, as used in the TY2003 GRC, is the appropriate method for near-term analysis; however, a long term forecast, as required by the SGRP cost effectiveness analysis, requires utilization of a different process/method, such as averaging. SCE developed the higher cost regulatory/reliability capital case forecast as follows:

- 2004-2006 – Based on 3-year forecast (using 2004 and 2005 capital forecasts presented in TY2003 GRC and the 2006 forecast prepared in conjunction with that filing), plus 10% scope growth allowance, plus additional DBT security capital costs of \$63.5 million in 2004 to comply with NRC orders (see workpapers), plus 37% payroll adders;
- 2007-2017 – Base case forecast for 2007-2017, plus a 50% allowance for additional expenditures associated with potential emergent NRC and industry events, obsolescence, and mature plant issues; and
- 2018-2022 – Ramp-down to account for 2022 end of license.

SCE's forecast of capital additions for a shutdown in 2009 assumes TY2003 GRC level capital for 2004-2006, including DBT, followed by a ramp-down period during 2007-2009, in anticipation of shutdown at Fuel Cycle 16. Figure IV-7 depicts the three forecasts.

**Figure IV-7**  
**SONGS 2 & 3 Capital Forecast**  
**Nominal \$ in Millions, Without Corporate Overheads,**  
**100% Level**



1                                   (5)    Nuclear Fuel

2                                   SCE forecasts nuclear fuel costs as the sum of the following cost  
3 components:

- 4                                   • Nuclear fuel costs – Purchase costs for nuclear fuel include: (1)
- 5                                    mining, milling and enrichment<sup>49</sup> activities, and (2) design,
- 6                                    fabrication, and transportation costs. SCE amortizes these costs
- 7                                    over the expected electricity production during the life of each
- 8                                    fuel batch,<sup>50</sup> which is typically two fuel cycles. SCE has
- 9                                    contracts with various suppliers for all SONGS 2 & 3 fuel

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<sup>49</sup> The enrichment process is necessary to increase the concentration of the U235 isotope to 3-5%, as required by the fuel design.

<sup>50</sup> A fuel batch is the group of fuel rods that is loaded together into the core and later removed together at the end of their operating life.

1 requirements through the end of 2008. SCE adopted a fuel cost  
2 estimate for 2009 and escalated it for the period 2010 through  
3 2022;

- 4 • In-core carrying costs – interest expense associated with the un-  
5 amortized value of each SONGS 2 & 3 batch of fuel contained in  
6 the reactors; and
- 7 • Department of Energy (DOE) Spent Fuel Disposal Charge –  
8 SCE pays a 1.0 mil/kWh fee to the DOE, as mandated under  
9 SCE's Standard contract with DOE, entered into pursuant to the  
10 Nuclear Waste Policy Act of 1982, for permanent disposal of  
11 spent fuel.

12 Table IV-14 shows SCE's SONGS 2 & 3 nuclear fuel expense for  
13 the period 2004 through 2022.

**Table IV-14**  
**SONGS 2 & 3 Nuclear Fuel Expense**  
**Nominal Annual Mil/kWh<sup>51</sup>**

Year	Fuel Cost
	(mil/kWh)
2004	5.04
2005	5.11
2006	5.24
2007	5.22
2008	5.43
2009	5.40
2010	5.87
2011	5.82
2012	6.23
2013	6.24
2014	6.58
2015	6.59
2016	6.84
2017	6.98
2018	7.15
2019	7.49
2020	7.48
2021	7.91
2022	7.87

(6) Insurance

SCE estimates SONGS 2 & 3 insurance at \$6.038 million (2004 dollars, 100% level), as identified in the TY2003 GRC.<sup>52</sup> SCE maintains property and

<sup>51</sup> Assuming a Capacity Factor of 88%.

<sup>52</sup> The estimate excludes Nuclear Electric Insurance Limited (NEIL) credit because there is no guarantee that SCE will receive these credits over the next 19 years. Nuclear property insurance is purchased from a mutual insurance company owned by a number of nuclear plant owner/operators called the NEIL. The board of directors of NEIL may approve a distribution to the members. Generally, the board of directors meets in December to approve a distribution for the current year. The distribution is then paid in March of the following year. Such distribution would be based on the losses experienced in the year, the estimate of future claims, and the surplus funds and reinsurance available to pay future claims. As a member, SCE receives a distribution from NEIL. (See SCE's TY2003 GRC, A.02-05-004, Exhibit 43, pp. 43-45.)

1 liability insurance as a condition of its NRC operating license. Additionally, SCE  
2 maintains nuclear business interruption insurance to cover replacement power costs  
3 resulting from long-term physical damage occurrences at SONGS 2 & 3.<sup>53</sup> SCE assumes  
4 that SONGS 2 & 3 insurance costs will remain at this level, throughout the operating  
5 period.

6 In the event of SONGS 2 & 3 shutdown scenario at Fuel Cycle  
7 16 RFO, SCE reduced property and liability insurance costs when: (1) the unit is  
8 shutdown for the last time (2009), and (2) the fuel is removed from the reactor (2010).  
9 Table IV-15 shows 2004-2022 anticipated insurance costs assuming a SONGS 2 & 3  
10 shutdown in 2009.

***Table IV-15***  
***SONGS 2 & 3 Shutdown Insurance Expense***  
***2004 \$ in Millions, 100% Level***

Year	Amount
2004	6.0
2005	6.0
2006	6.0
2007	6.0
2008	6.0
2009	6.0
2010	3.3
2011	2.5
2012	2.5
2013	2.5
2014	2.5
2015	2.5
2016	2.5
2017	2.5
2018	2.5
2019	2.5
2020	2.5
2021	2.5
2022	2.0

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<sup>53</sup> Deductible period is 12 weeks.

1 (7) Property Tax Expense On Sunk Investment

2 SCE estimates property taxes using the 2002 Property Tax  
3 Expense as a starting point and adjusting it annually such that it is zero in 2022 (in  
4 relation to the undepreciated rate base).

5 (8) Variable Administrative & General Expense

6 SCE estimates SONGS 2 & 3 Variable Administrative and  
7 General (A&G) expense at \$11.6 million (2004 dollars, 100% level). Variable A&G expense  
8 is comprised of Results Sharing<sup>54</sup> and Worker's Compensation Insurance.<sup>55</sup> SCE used the  
9 most recent, available annual data for each category. SCE estimated Results Sharing  
10 using a 5-year average (1997-2001), and Worker's Compensation using a 4-year average  
11 (1999-2002). SCE assumes that variable A&G expense will remain at its 2004 level  
12 throughout the operating period.

13 (9) Future Generation Output

14 SONGS 2 & 3 are rated at 2,150 MWs (net nameplate) at the  
15 100% level. SCE based its estimate of annual production hours on the following  
16 parameters:

- 17 • 585 Effective Full Power Days (EFPD)<sup>56</sup> between RFOs;
- 18 • 45 days per RFO;<sup>57</sup> and
- 19 • 21 days (approximately) annual off-line allowance,<sup>58</sup> per  
20 unit.

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<sup>54</sup> As defined in SCE's TY2003 GRC, A.02-05.004, Exhibit 53, pp. 55-74.

<sup>55</sup> Other A&G costs are included in Base O&M as corporate nuclear-specific support.

<sup>56</sup> Effective Full Power Days is the number of days the unit would operate if it were to run at 100% output.

<sup>57</sup> Exceptions: (1) U2C14 RFO = 49 days and U2C15 RFO = 62 days (to provide sufficient time prior to replacement to perform anticipated steam generator repairs); and U2C16 RFO and U3C16 RFO = 115 days (to perform steam generator replacement). U3 steam generator repairs do not require extended RFOs prior to replacement.

<sup>58</sup> Off-line allowance accounts for down-powers, unit trips, and unplanned maintenance activities.



**Table IV-16**  
**SONGS 2 & 3 Future Annual Production Forecasts,**  
**100% Level**

Year	Billions of kWh
2004	15.5
2005	17.5
2006	15.6
2007	16.2
2008	16.6
2009	15.0
2010	14.8
2011	16.6
2012	16.6
2013	16.6
2014	16.6
2015	16.6
2016	16.6
2017	15.5
2018	17.7
2019	15.5
2020	16.6
2021	16.6
2022	16.6

b) Deferred Mitigation Transmission And Replacement Generation

Replacement transmission and generation constitute a technically feasible, and realistic alternative to SONGS 2 & 3 SGRP for the purposes of developing cost-effectiveness results only. For example, it is not possible to foresee the condition of the system in 2022 on the NRC operating licenses expiration dates. Therefore, it is impossible to know exactly what mitigation measures will be needed. As a proxy, SCE identified technically feasible and realistic mitigation measures that could be implemented for a 2009 SONGS 2 & 3 shutdown. SCE then valued those 2009 mitigation measures, and used that valuation in its cost-effectiveness analysis for shutdown in 2022. Replacing the SONGS 2 & 3 steam generators in 2009 defers the need to construct mitigation transmission and generation associated with the 2009 shutdown. SCE

1 assumed that it, therefore, defers the 2009 mitigation costs for 13 years from 2009 until  
 2 2022. Table IV-17 provides SCE's estimated costs and timing for replacement  
 3 transmission mitigation projects.

**Table IV-17**  
**SCE's Estimated Costs and Timing**  
**For Replacement Transmission Mitigation Projects<sup>60</sup>**  
**(Nominal \$ in Thousands, 100% Level)**

<b>Reinforced SCE/SDGE</b>						
<b>230kv Interface</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>Total</b>
Transmission Line	-	-	819	10,121	19,004	29,944
Transmission Station	-	-	12,731	157,388	295,523	465,642
Land	-	-	-	-	-	-
<b>Total</b>	<b>-</b>	<b>-</b>	<b>13,550</b>	<b>167,509</b>	<b>314,527</b>	<b>495,586</b>
<b>IV Ramona Alternative</b>						
	<b>2017</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>Total</b>
Transmission Line	7,184	14,787	114,143	352,571	298,436	787,120
Transmission Station	-	-	9,177	110,237	201,033	320,447
Land	-	41,076	-	-	-	41,076
<b>Total</b>	<b>7,184</b>	<b>55,864</b>	<b>123,320</b>	<b>462,808</b>	<b>499,469</b>	<b>1,148,644</b>
<b>Valley Rainbow Alternative</b>						
	<b>2017</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>Total</b>
Transmission Line	5,504	11,329	87,449	270,118	228,644	603,044
Transmission Station	-	-	5,811	69,807	127,302	202,921
Land	-	31,470	-	-	-	31,470
<b>Total</b>	<b>5,504</b>	<b>42,799</b>	<b>93,261</b>	<b>339,925</b>	<b>355,946</b>	<b>837,435</b>

4 Table IV-18 provides SCE's estimated costs and timing for replacement generation  
 5 projects.

**Table IV-18**  
**SCE's Estimated Costs and Timing**  
**for Replacement Generation Projects**  
**(Nominal \$ in Thousands, 100% Level)**

Generation	2018	2019	2020	2021	2022	Total
	-	910,807	932,272	241,114	-	2,089,193

<sup>60</sup> Totals may not add due to rounding.

**B. SONGS 2 & 3 Steam Generator Replacement Cost**

SCE-3, Part 2 provides a comprehensive estimate of the project cost. SCE used its Revenue Requirement model to derive the ratepayers' cost. SCE-3, Part 2, Tables III-1 and III-2, reproduced below as Table IV-19, shows the main components of the costs.

**Table IV-19**  
**SONGS 2 & 3 SGRP Estimate**  
**2004 Dollars in Millions, 100% Level**

SGRP Installation Segment

Category	Amount
Engineering Design & Support	34.2
Fabrication	154.6
Transportation	23.7
Site Preparation	43.5
Installation	179.9
Project Support	41.8
Common Site Support	47.0
A&G (including Payroll Adders)	44.3
Total RSG Installation Estimate	569.0

SGRP Removal and Disposal Segment

Category	Amount
Removal	71.9
Disposal	27.2
Project Support	3.7
Common Site Support	7.3
Payroll Adders	0.9
Total Removal & Disposal Estimate	111.0

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V.

**RESULTS**

**A. Benefit-To-Cost Ratio**

Figure V-9 below shows how SCE calculates the benefit-to-cost ratio for SONGS 2 & 3 SGRP in three representations of the same equation. Each representation of the equation provides more details of the data utilized in the calculation. Equation No. 1, shows at the most summary level the benefit-to-cost ratio, comparing ratepayer benefits to ratepayer costs. Equation No. 2, in Figure V-9, shows how the ratepayer benefits are calculated by subtracting the Present Value Revenue Requirement (PVRR) of SONGS 2 & 3 operating costs from the PVRR of avoided costs of shutdown. The result of that equation is then divided by the PVRR of SGRP costs.

Equation No. 3 in Figure V-9 delves even more deeply into the details of determining the PVRR for avoided costs of shutdown and operating costs. Equation No. 3 shows that the PVRR of avoided costs of shutdown are equivalent to the PVRR of mitigation transmission completed in 2009, plus the PVRR of replacement generation completed in 2009, plus the PVRR of nuclear operating costs in 2004 to 2009, plus the PVRR of electricity production costs from 2009 to 2022 without SONGS 2 & 3 in service. From this PVRR for shutdown costs, SCE subtracts the PVRR of operating costs. The present PVRR of operating costs is the PVRR of deferring construction of mitigation transmission until 2022, plus the PVRR of deferring construction of replacement generation until 2022, plus the PVRR of nuclear operating costs between 2004 and 2022. This PVRR of ratepayer benefits is then divided by the PVRR of SGRP costs.

As described above, there are three classes of costs: (1) transmission related, (2) generation related, and (3) energy production related. The latter two classes of costs are subject to the jurisdiction of the CPUC and the Cities, and SCE fully anticipates those costs to be borne by those entities that benefit directly from the expenditures. Thus,

**Figure V-10**  
**Benefit-To-Cost Calculation, 100% Level**

<b>Shutdown</b>	<b>Reinforced SCE/SDG&amp;E</b>	
	<b>230 kV Interface</b>	<b>IV-Ramona</b>
• Mitigation Transmission	\$ 322	\$ 794
• Replacement Generation	\$ 1,706	\$ 1,706
• Nuclear Operating Costs 2004-09	\$ 2,731	\$ 2,731
• <u>Electricity Production Costs 2009-22</u>	<u>\$ 3,517</u>	<u>\$ 3,517</u>
• Total Avoided Costs	\$ 8,276	\$ 8,748
<b>Continuing Operations Costs</b>	<b>Reinforced SCE/SDG&amp;E</b>	
	<b>230 kV Interface</b>	<b>IV-Ramona</b>
• Nuclear Operating Costs 2004-2022	\$ 5,892	\$ 5,892
• Deferred Transmission	\$ 129	\$ 321
• <u>Deferred Generation</u>	<u>\$ 728</u>	<u>\$ 728</u>
• Total Deferred and Reduced Costs	\$ 6,749	\$ 6,941
• Total Ratepayer Benefit	\$ 1,527	\$ 1,807
• Steam Generator Replacement Cost	\$ 707	\$ 707
• Benefit Cost Ratio	2.16 to 1	2.56 to 1

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**1. SCE's Customers Benefit From SGRP**

The preceding section discussed the cost-effectiveness of SGRP at a 100% project level, that is, the benefits and cost accruing to all co-owners. In order to verify the cost-effectiveness of SGRP from an SCE customer perspective, SCE performed a system separation study<sup>61</sup> to determine how the relative benefits of SGRP were shared between SCE's customers and the customers of the co-owners. For the purposes of the analysis, SCE's service area included Anaheim and Riverside, both of which are located within SCE's control area. The resulting system separation analysis determined that in the absence of SDG&E transmission planning requirements, SCE's system would require 600 MVAR of reactive mitigation support. When both SCE's and SDG&E's requirements are considered, the total reactive mitigation support was found to be 2,520 MVAR. Thus, 600/2,520 or 23.8% of the mitigation transmission scenario is related to mitigation

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<sup>61</sup> SCE-5, Chapter III.

1 required to support SCE, Anaheim and Riverside customers. The remainder, 76.2%, is  
 2 related to support for SDG&E customers.

3 SCE used this relative proportion of cost responsibility for mitigation  
 4 transmission to allocate the costs of the three mitigation transmission scenarios presented  
 5 in Appendix A. Table V-20 below, shows how costs and benefits were allocated in each  
 6 case.<sup>62</sup>

**Table V-20**  
**Allocation of Costs of Benefits From SGRP**

	<b>Allocation Method</b>	<b>SCE Share*</b>	<b>SDG&amp;E Share</b>
<b>SGR Costs</b>	Ownership Share	80%	20%
<b>Deferred Generation Benefits</b>	Ownership Share	80%	20%
<b>Mitigation Transmission Benefits</b>	Cost Responsibility	23.8%	76.2%
<b>Avoided Production Cost Benefits</b>	Ownership Share	80%	20%
*SCE share includes Anaheim and Riverside			

7 This results in a revised computation of SGRP benefit-to-cost ratios reflecting  
 8 the higher benefits received by SDG&E customers from SGRP for each of the three  
 9 mitigation transmission scenarios described in SCE-4, Section V-A. The results are  
 10 presented in Table V-21 below. Detailed analysis results are presented in Appendix A.

<sup>62</sup> The mitigation transmission facilities are part of the CA-ISO Grid and operate at a voltage in excess of 200 kV, so they are considered "High Voltage Facilities" under the CA-ISO Tariff. Under the CA-ISO's currently-effective Transmission Access Charge (TAC), the revenue requirements associated with newly-constructed High Voltage Facilities are allocated among the PTOs on a load ratio share basis. SCE allocated the benefits of mitigation transmission deferral based on cost responsibility due to transmission need.

**Table V-21**  
**Cost-Effectiveness of SGRP by Utility Owner**

	<b>IV-Ramona</b>	<b>Valley-Rainbow</b>	<b>Reinforced SCE/SDG&amp;E 230 kV Interface</b>
<b>SCE Benefit-to-Cost Ratio*</b>	2.08	2.03	1.82
<b>SDG&amp;E Benefit-to-Cost Ratio</b>	4.44	3.75	2.93
*SCE share includes Anaheim and Riverside			

1 As presented in Table V-21, SCE customers' benefit-to-cost ratio for SGRP  
 2 ranges from 1.82-2.08 to 1, while SDG&E customers' benefit-to-cost ratio for SGRP ranges  
 3 from 2.93-4.44 to 1. The project is cost-effective for the customers of all SONGS 2 & 3 co-  
 4 owners' customers.

5 **B. Sensitivity Analyses**

6 SCE tests the robustness of the SONGS 2 & 3 SGRP benefit-to-cost ratios by  
 7 performing a number of sensitivity analyses surrounding key assumptions. Figure V-11  
 8 shows that SGRP is cost-effective across a wide range of sensitivities.

**Figure V-11**  
**SGRP Is Cost-Effective Across A Wide Range Of Sensitivities**  
**Benefit-to-Cost Ratios, 100% Level**

	IV-Ramona	Valley-Rainbow	Reinforced 230 kV Interface
Base Case	2.56	2.38	2.16
High Capital	2.18	2.00	1.78
High O&M	1.98	1.80	1.58
92% Capacity Factor	2.77	2.59	2.37
84% Capacity Factor	2.34	2.16	1.94
-1 Standard Deviation			
Low Cost Gas Case	1.78	1.60	1.38
+1 Standard Deviation			
High Cost Gas Case	3.24	3.06	2.84

1 These sensitivities include: (1) increased SONGS 2 & 3 capital spending, (2)  
2 increased SONGS 2 & 3 O&M spending; (3) 84% capacity factor production from SONGS 2  
3 & 3, (4) 92% capacity factor production from SONGS 2 & 3, and (5) costs of uncertainty  
4 concerning future gas prices captured at plus and minus one standard deviation gas prices  
5 from the Global Insight forecast.

6 **1. Higher Cost SONGS 2 & 3 Capital Spending**

7 Due to the possibility of higher capital expenditures caused by unforeseeable  
8 regulatory and extraordinary operating expenses, SCE forecasted a higher capital<sup>63</sup>  
9 spending sensitivity. Section IV.A.2(a)(4) above describes this forecast. SCE's revenue  
10 requirement for SONGS 2 & 3 continuing operations through 2022 increased by a PV of  
11 \$268 million (2004 \$). This reduces the overall project benefit-to-cost ratio range to 1.78-  
12 2.18 to 1 (100% level).

---

<sup>63</sup> Capital refers to capital expenditures required for ongoing operations of SONGS 2 & 3.

1           **2.     Higher Cost SONGS 2 & 3 O&M Spending**

2           Due to the possibility of higher O&M expenditures caused by a variety of  
3 potential factors, SCE forecasted a higher O&M spending sensitivity. Section IV.A.2(a)(1)  
4 above describes this higher O&M forecast. SCE's net benefit for SONGS 2 & 3 SGRP is  
5 decreased by a PV of \$408 million (2004 \$). This reduces the overall project benefit-to-cost  
6 ratio range to 1.58-1.98 to 1 (100% level).

7           **3.     84% SONGS 2 & 3 Capacity Factor**

8           SCE forecasts SONGS 2 & 3 to operate at the 7-year average capacity factor  
9 of 88%. Capacity factor varies with performance and outage durations, resulting in more  
10 or less energy production. For the decreased capacity factor sensitivity, SCE selected a  
11 low of 84%. This results in lower uranium consumption as well as lower plant output.  
12 SCE's revenue requirement for SONGS 2 & 3 nuclear operating costs under the lower  
13 capacity factor decreased, while the revenue requirement to procure replacement energy  
14 increased. The net of two revenue requirements reduces the benefits portion of the  
15 benefit-to-cost ratios. This sensitivity increased the PV of the revenue requirement by  
16 \$153 million (2004 \$) and reduced the range of benefit-to-cost ratios to 1.94-2.34 to 1  
17 (100% level).

18           **4.     92% SONGS 2 & 3 Capacity Factor**

19           For the increased capacity factor sensitivity, SCE selected a high average of  
20 92%. This results in higher nuclear fuel consumption as well as higher plant output.  
21 SCE's revenue requirement for SONGS 2 & 3 nuclear operating costs under the higher  
22 capacity factor increased, while the revenue requirement to procure replacement energy  
23 decreased. The net of these two revenue requirements increases the benefits portion of  
24 the benefit-to-cost ratio. This sensitivity reduced the PV of the revenue requirement by  
25 \$153 million (2004 \$) and increased the range of benefit-to-cost ratios to 2.37-2.77 to 1  
26 (100% level).

1           **5.     SONGS 2 & 3 SGRP Remains Cost-Effective Under Varying Natural**  
2                           **Gas Price Forecasts**

3           SCE used the stochastic analysis functionality of Henwood's RISKSYSM model  
4 to generate 100 Monte Carlo simulations of production costs for the SONGS 2 & 3  
5 shutdown scenario. Each of the simulations draws natural gas prices, MCPs and system  
6 loads based on the historical volatility of each of these drivers of production costs, and  
7 their correlations to each other. This method provides a more comprehensive analysis of  
8 risk by considering the uncertainties of more production cost drivers, as well as their  
9 interrelationships. A present value of production costs is computed for each of the 100  
10 simulations, as well as, the average price of natural gas over the forecast period.

11           From the 100 simulations SCE chose the plus and minus one standard  
12 deviation gas price cases (68% confidence interval) from Global Insight presented in Table  
13 V-22 below to examine the changes in production costs. In the plus one standard deviation  
14 case (high gas prices with average real 2004 \$ Henry Hub price of \$4.80), the PV of  
15 production costs increased by \$482 million, resulting in a benefit-to-cost ratio range of  
16 2.84-3.24 to 1 (100% level). In the minus one standard deviation case (low gas prices with  
17 real 2004 \$ average real Henry Hub of \$3.00), the PV of production costs decreased by  
18 \$550 million, resulting in a benefit-to-cost ratio range of 1.38-1.78 to 1 (100% level). This  
19 analysis demonstrates that SONGS 2 & 3 SGRP is cost-effective under a wide range of  
20 likely gas prices.

**Table V-22**  
**Global Insight Henry Hub Gas Price Forecast**  
**2004 \$/MMBTU**

Year	-1SD	Base	+1SD
2004	\$ 3.96	\$ 4.75	\$ 5.39
2005	\$ 3.39	\$ 4.12	\$ 4.72
2006	\$ 2.85	\$ 3.58	\$ 4.16
2007	\$ 2.69	\$ 3.43	\$ 4.04
2008	\$ 2.70	\$ 3.46	\$ 4.07
2009	\$ 2.70	\$ 3.46	\$ 4.08
2010	\$ 2.77	\$ 3.56	\$ 4.21
2011	\$ 2.92	\$ 3.76	\$ 4.48
2012	\$ 2.96	\$ 3.83	\$ 4.59
2013	\$ 2.99	\$ 3.89	\$ 4.68
2014	\$ 3.01	\$ 3.92	\$ 4.75
2015	\$ 3.05	\$ 4.00	\$ 4.86
2016	\$ 3.07	\$ 4.05	\$ 4.95
2017	\$ 3.07	\$ 4.07	\$ 4.98
2018	\$ 3.09	\$ 4.10	\$ 5.05
2019	\$ 3.09	\$ 4.13	\$ 5.10
2020	\$ 3.09	\$ 4.15	\$ 5.13
2021	\$ 3.10	\$ 4.17	\$ 5.18
2022	\$ 3.10	\$ 4.20	\$ 5.23
Average*	\$ 3.00	\$ 3.95	\$ 4.80
* - Average of 2009-2022 Analysis Period, Real \$2004			

**C. Non-Quantifiable Benefits**

**1. SONGS 2 & 3 SGRP Reduces Air Emissions**

In section IV.A.1.b.1, SCE posits that replacement generation in the event of SONGS 2 & 3 shutdown will likely come from natural gas fueled CCGT plants. CCGT technology is the most fuel efficient fossil fuel generation source with the least associated air emissions. Even though CCGT plants can operate at relatively low air emission rates that meet all regulatory requirements, they nonetheless do produce unavoidable air emissions. Compared to CCGT plants, SONGS 2 & 3 produces almost no air emissions. To replace SONGS 2 & 3 with CCGT plants will increase regional air basin emission that would otherwise not be produced with SONGS continued operation. This represents an increment of avoided air emissions going into the future for as long as SONGS 2 & 3 operates. Table V-23 below quantifies the relative increased magnitude of emissions to

1 replace SONGS 2 & 3 generation. This estimate is based on replacement with CCGT  
 2 plants using current Best Available Control Technology to limit air emissions. Additional  
 3 detail is provided in Appendix C.

**Table V-23**  
**Estimated Annual Emissions for**  
**SONGS 2 & 3 Replacement Combined Cycle Power Plants<sup>1</sup>**

State/Area	NO <sub>x</sub> (tons/year)	CO (tons/year)	SO <sub>x</sub> (tons/year)	PM <sub>10</sub> (tons/year)	ROG (tons/year)	NH <sub>3</sub> (tons/year)	CO <sub>2</sub> (tons/year)
Arizona	261.9	244.8	58.0	327.7	37.0	202.2	4,605,083
California	186.2	174.3	41.6	235.4	25.8	144.2	3,284,103
<b>Total Replacement Emissions</b>	<b>448.2</b>	<b>419.0</b>	<b>99.6</b>	<b>563.0</b>	<b>64.8</b>	<b>346.3</b>	<b>7,889,186</b>
SONGS 2 & 3 Emissions	32.6	8.4	0.5	0.9	2.4	0.0	2,909 <sup>2</sup>
<b>Total Emissions Increase</b>	<b>415.6</b>	<b>410.6</b>	<b>99.1</b>	<b>562.1</b>	<b>62.4</b>	<b>346.3</b>	<b>7,886,277</b>

1. Assumed 2-on-1 combined cycle plants using "F"-Class turbines, with duct firing for hours with ambient temperature at or above 75°F.
2. SONGS CO<sub>2</sub> estimate based on ratio of CO<sub>2</sub> to NO<sub>x</sub>, AP-42 emission factors, for diesel combustion in internal combustion engines.

## 2. SONGS 2 & 3 SGRP Avoids Statewide Natural Gas Price Increases

4 According to a recent study by Global Insight (GI),<sup>64</sup> the increased natural  
 5 gas demand associated with replacing SONGS 2 & 3 with best available CCGT technology  
 6 would increase natural gas prices statewide. GI estimates the increase statewide in  
 7 natural gas prices would be approximately 15¢ per MMBTU in 2010 and beyond, resulting  
 8 in a nominal increase in the cost of natural gas to all California consumers of over \$350  
 9 million annually. This increase would be spread across all end-uses, including electricity  
 10 generation, space heating, water heating, and industrial gas use. The NPV of this  
 11 increased gas cost in the event of a SONGS 2 & 3 shutdown is \$1.65 billion (NPV 2004).  
 12 This cost increase is over twice the NPV cost of SGRP and represents a significant avoided  
 13 negative externality from maintaining the fuel diversity benefits of SONGS 2 & 3.  
 14

<sup>64</sup> December 2003 The Impact of Replacing California Nuclear Generation with Natural Gas, Prepared for Southern California Edison by Global Insight.

1 SCE did not include this benefit in its calculation of SGRP cost-effectiveness.

2 SCE identified only the increase in gas costs associated with replacement electricity

3 generation for SONGS 2 & 3 as a benefit of SGRP in calculating the benefit-to-cost ratios.

**Appendix A**  
**Net Avoided Cost Spreadsheet**

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Revenue Requirement Summary Table with Valley Rainbow Transmission Project (\$ in 000's)

Year	Ratepayers Benefit (Avoided Costs of Shutdown)					Offsets				Total Benefit	Steam Generator
	Cost of Operation	Costs of Mitigation Transmission 2010	Costs of Replacement Generation 2010	Electricity Production Costs	Total	Cost of Operation	Costs of Mitigation Transmission 2022	Costs of Replacement Generation 2022	Total		
2004	496,771	-	-	-	496,771	496,771	-	-	496,771	-	213
2005	478,411	-	-	-	478,411	444,104	-	-	444,104	34,307	3,787
2006	650,229	266	-	-	650,495	590,462	-	-	590,462	60,033	50,299
2007	637,533	3,705	-	-	641,238	555,131	-	-	555,131	86,107	58,605
2008	664,360	3,705	-	-	668,064	581,286	-	-	581,286	86,778	69,147
2009	578,212	3,705	-	179,706	761,623	579,887	-	-	579,887	181,736	65,919
2010	(0)	139,762	397,609	608,715	1,146,086	608,018	-	-	608,018	538,068	91,028
2011	-	135,687	387,408	732,722	1,255,817	682,112	-	-	682,112	573,705	179,838
2012	-	130,289	373,642	794,623	1,298,554	716,792	-	-	716,792	581,762	161,833
2013	-	125,114	360,561	813,641	1,299,317	738,993	-	-	738,993	560,324	151,398
2014	-	120,145	348,076	833,733	1,301,953	774,236	-	-	774,236	527,717	141,500
2015	-	115,368	336,152	852,311	1,303,831	812,762	-	-	812,762	491,069	132,079
2016	-	110,769	324,785	874,257	1,309,791	851,492	-	-	851,492	458,299	123,090
2017	-	106,334	313,884	895,846	1,316,065	950,868	-	-	950,868	365,196	114,762
2018	-	102,046	303,953	922,973	1,328,972	852,719	369	-	853,088	475,884	106,873
2019	-	97,796	294,107	948,667	1,340,570	1,057,054	5,151	-	1,062,204	278,365	98,948
2020	-	93,563	284,293	976,589	1,354,445	1,008,858	5,151	-	1,014,009	340,436	90,960
2021	-	89,347	274,516	1,007,164	1,371,027	1,054,785	123,551	-	1,178,336	192,690	82,983
2022	-	85,144	264,718	591,744	941,606	863,722	172,439	558,331	1,594,491	(652,885)	72,486
2023	-	80,957	254,984	-	335,941	-	165,516	544,338	709,853	(373,912)	0
2024	-	76,786	245,503	-	322,289	-	158,886	525,417	684,303	(362,014)	0
2025	-	72,628	235,615	-	308,243	-	152,526	507,438	659,964	(351,721)	0
2026	-	68,483	225,762	-	294,245	-	146,420	490,284	636,705	(342,459)	0
2027	-	64,346	215,986	-	280,332	-	140,548	473,947	614,495	(334,163)	0
2028	-	60,212	206,280	-	266,492	-	134,889	458,379	593,267	(326,775)	0
2029	-	56,079	196,641	-	252,719	-	129,419	443,493	572,912	(320,192)	0
2030	-	52,006	183,933	-	235,939	-	123,999	429,837	553,835	(317,896)	0
2031	-	48,745	173,757	-	222,502	-	118,602	416,399	535,001	(312,499)	0
2032	-	46,252	169,409	-	215,662	-	113,226	402,991	516,218	(300,556)	0
2033	-	43,763	165,138	-	208,901	-	107,872	389,637	497,508	(288,608)	0
2034	-	41,277	160,945	-	202,222	-	102,536	376,295	478,831	(276,609)	0
2035	-	38,795	156,835	-	195,630	-	97,219	363,013	460,232	(264,602)	0
2036	-	36,317	152,809	-	189,126	-	91,919	349,993	441,913	(252,786)	0
2037	-	33,844	148,872	-	182,715	-	86,637	336,397	423,034	(240,319)	0
2038	-	31,374	146,877	-	178,252	-	81,365	322,893	404,257	(226,005)	0
2039	-	28,910	145,279	-	174,188	-	76,097	309,483	385,580	(211,391)	0
2040	-	26,455	0	-	26,455	-	70,833	296,172	367,005	(340,551)	0
2041	-	24,071	-	-	24,071	-	65,650	282,962	348,613	(324,542)	0
2042	-	21,754	-	-	21,754	-	61,531	265,471	327,002	(305,248)	0
2043	-	19,443	-	-	19,443	-	58,417	251,533	309,950	(290,508)	0
2044	-	17,137	-	-	17,137	-	55,308	245,762	301,071	(283,934)	0
2045	-	14,836	-	-	14,836	-	52,205	240,110	292,315	(277,479)	0
2046	-	12,542	-	-	12,542	-	49,109	234,580	283,688	(271,146)	0
2047	-	10,254	-	-	10,254	-	46,018	229,177	275,195	(264,941)	0
2048	-	7,973	-	-	7,973	-	42,934	223,906	266,841	(258,868)	0
2049	-	5,757	-	-	5,757	-	39,857	218,773	258,630	(252,872)	0
2050	-	(129)	-	-	(129)	-	36,787	216,372	253,159	(253,288)	0
2051	-	(1,963)	-	-	(1,963)	-	33,730	214,540	248,270	(250,233)	0
2052	-	(3,790)	-	-	(3,790)	-	30,769	(0)	30,769	(34,558)	0
2053	-	(5,608)	-	-	(5,608)	-	27,896	0	27,896	(33,504)	0
2054	-	(7,419)	-	-	(7,419)	-	25,031	-	25,031	(32,449)	0
2055	-	(9,220)	-	-	(9,220)	-	22,174	-	22,174	(31,395)	0
2056	-	(8,174)	-	-	(8,174)	-	19,327	-	19,327	(27,501)	0
2057	-	-	-	-	-	-	16,489	-	16,489	(16,489)	0
2058	-	-	-	-	-	-	13,661	-	13,661	(13,661)	0
2059	-	-	-	-	-	-	10,843	-	10,843	(10,843)	0
2060	-	-	-	-	-	-	8,112	-	8,112	(8,112)	0
2061	-	-	-	-	-	-	770	-	770	(770)	0
2062	-	-	-	-	-	-	(1,477)	-	(1,477)	1,477	0
2063	-	-	-	-	-	-	(3,713)	-	(3,713)	3,713	0
2064	-	-	-	-	-	-	(5,936)	-	(5,936)	5,936	0
2065	-	-	-	-	-	-	(8,146)	-	(8,146)	8,146	0
2066	-	-	-	-	-	-	(10,343)	-	(10,343)	10,343	0
2067	-	-	-	-	-	-	(8,932)	-	(8,932)	8,932	0
Total	3,505,516	2,467,436	7,448,311	11,032,689	24,453,953	14,220,053	3,083,241	10,617,923	27,909,887	(3,455,935)	1,795,767
Present Value	2,731,349	582,791	1,706,068	3,516,781	8,536,988	5,892,590	235,764	727,793	6,856,147	1,680,841	707,341

**Present Value of Revenue Requirement Summary Table - Valley Rainbow Transmission Project (\$ in 000's)**

Year	Ratepayers Benefit (Avoided Costs of Shutdown)				Offsets				Total Benefit	Steam Generator	
	Cost of Operation	Costs of Mitigation Transmission 2010	Costs of Replacement Generation 2010	Electricity Production Costs	Total	Cost of Operation	Costs of Mitigation Transmission 2022	Costs of Replacement Generation 2022			Total
2004	496,771	-	-	-	496,771	496,771	-	-	496,771	-	213
2005	432,951	-	-	-	432,951	401,904	-	-	401,904	31,047	3,427
2006	532,528	218	-	-	532,745	483,579	-	-	483,579	49,166	41,194
2007	472,516	2,746	-	-	475,261	411,442	-	-	411,442	63,819	43,436
2008	445,609	2,485	-	-	448,094	389,889	-	-	389,889	58,205	46,379
2009	350,975	2,249	-	109,082	462,305	351,991	-	-	351,991	110,314	40,013
2010	-	76,774	218,415	334,380	629,569	333,997	-	-	333,997	295,572	50,004
2011	-	67,453	192,590	364,253	624,296	339,094	-	-	339,094	285,202	89,402
2012	-	58,615	168,096	357,489	584,200	322,474	-	-	322,474	261,726	72,806
2013	-	50,939	146,798	331,263	528,999	300,871	-	-	300,871	228,128	61,640
2014	-	44,267	128,248	307,188	479,703	285,266	-	-	285,266	194,437	52,135
2015	-	38,468	112,086	284,193	434,747	271,006	-	-	271,006	163,741	44,040
2016	-	33,425	97,999	263,810	395,234	256,941	-	-	256,941	138,293	37,143
2017	-	29,038	85,716	244,638	359,391	259,663	-	-	259,663	99,728	31,339
2018	-	25,219	75,116	228,096	328,431	210,734	91	-	210,825	117,606	26,412
2019	-	21,872	65,777	212,168	299,816	236,408	1,152	-	237,560	62,256	22,130
2020	-	18,937	57,540	197,658	274,135	204,190	1,042	-	205,232	68,903	18,414
2021	-	16,365	50,282	184,477	251,123	193,199	22,630	-	215,829	35,294	15,199
2022	-	14,113	43,880	98,087	156,080	143,170	28,583	92,549	264,302	(108,222)	12,015
2023	-	12,144	38,250	-	50,394	-	24,829	81,655	106,484	(56,090)	0
2024	-	10,424	33,328	-	43,752	-	21,569	71,328	92,897	(49,145)	0
2025	-	8,923	28,946	-	37,869	-	18,739	62,341	81,080	(43,211)	0
2026	-	7,614	25,100	-	32,714	-	16,279	54,510	70,789	(38,075)	0
2027	-	6,474	21,732	-	28,206	-	14,141	47,687	61,828	(33,622)	0
2028	-	5,483	18,783	-	24,266	-	12,282	41,738	54,020	(29,755)	0
2029	-	4,621	16,204	-	20,825	-	10,664	36,545	47,210	(26,385)	0
2030	-	3,878	13,716	-	17,595	-	9,247	32,054	41,301	(23,706)	0
2031	-	3,290	11,726	-	15,016	-	8,004	28,101	36,105	(21,090)	0
2032	-	2,825	10,346	-	13,171	-	6,915	24,612	31,527	(18,356)	0
2033	-	2,419	9,127	-	11,546	-	5,962	21,535	27,498	(15,952)	0
2034	-	2,065	8,050	-	10,115	-	5,129	18,822	23,950	(13,836)	0
2035	-	1,756	7,099	-	8,855	-	4,401	16,432	20,833	(11,977)	0
2036	-	1,488	6,260	-	7,747	-	3,765	14,337	18,103	(10,355)	0
2037	-	1,255	5,519	-	6,774	-	3,212	12,471	15,683	(8,909)	0
2038	-	1,053	4,928	-	5,980	-	2,730	10,833	13,563	(7,582)	0
2039	-	878	4,411	-	5,289	-	2,310	9,396	11,707	(6,418)	0
2040	-	727	0	-	727	-	1,946	8,138	10,084	(9,357)	0
2041	-	599	-	-	599	-	1,632	7,036	8,668	(8,070)	0
2042	-	490	-	-	490	-	1,385	5,974	7,358	(6,869)	0
2043	-	396	-	-	396	-	1,190	5,122	6,312	(5,916)	0
2044	-	316	-	-	316	-	1,019	4,529	5,549	(5,233)	0
2045	-	247	-	-	247	-	871	4,005	4,875	(4,628)	0
2046	-	189	-	-	189	-	741	3,541	4,282	(4,092)	0
2047	-	140	-	-	140	-	629	3,130	3,759	(3,619)	0
2048	-	99	-	-	99	-	531	2,768	3,298	(3,200)	0
2049	-	64	-	-	64	-	446	2,447	2,893	(2,829)	0
2050	-	(1)	-	-	(1)	-	372	2,190	2,563	(2,564)	0
2051	-	(18)	-	-	(18)	-	309	1,966	2,275	(2,293)	0
2052	-	(31)	-	-	(31)	-	255	(0)	255	(287)	0
2053	-	(42)	-	-	(42)	-	209	0	209	(251)	0
2054	-	(50)	-	-	(50)	-	170	-	170	(220)	0
2055	-	(57)	-	-	(57)	-	136	-	136	(193)	-
2056	-	(45)	-	-	(45)	-	107	-	107	(153)	-
2057	-	-	-	-	-	-	83	-	83	(83)	-
2058	-	-	-	-	-	-	62	-	62	(62)	-
2059	-	-	-	-	-	-	45	-	45	(45)	-
2060	-	-	-	-	-	-	30	-	30	(30)	-
2061	-	-	-	-	-	-	3	-	3	(3)	-
2062	-	-	-	-	-	-	(5)	-	(5)	5	-
2063	-	-	-	-	-	-	(10)	-	(10)	10	-
2064	-	-	-	-	-	-	(15)	-	(15)	15	-
2065	-	-	-	-	-	-	(18)	-	(18)	18	-
2066	-	-	-	-	-	-	(21)	-	(21)	21	-
2067	-	-	-	-	-	-	(17)	-	(17)	17	-
<b>Present Value</b>	<b>2,731,349</b>	<b>582,791</b>	<b>1,706,068</b>	<b>3,516,781</b>	<b>8,536,988</b>	<b>5,892,590</b>	<b>235,764</b>	<b>727,793</b>	<b>6,856,147</b>	<b>1,680,841</b>	<b>707,341</b>

Revenue Requirement Summary Table with IV Ramona Transmission Project (\$ in 000's)

Year	Ratepayers Benefit (Avoided Costs of Shutdown)				Offsets				Total Benefit	Steam Generator	
	Cost of Operation	Costs of Mitigation Transmission 2010	Costs of Replacement Generation 2010	Electricity Production Costs	Total	Cost of Operation	Costs of Mitigation Transmission 2022	Costs of Replacement Generation 2022			Total
2004	496,771	-	-	-	496,771	496,771	-	-	496,771	-	213
2005	478,411	-	-	-	478,411	444,104	-	-	444,104	34,307	3,787
2006	650,229	347	-	-	650,576	590,462	-	-	590,462	60,114	50,299
2007	637,533	4,835	-	-	642,369	555,131	-	-	555,131	87,237	58,605
2008	664,360	4,835	-	-	669,195	581,286	-	-	581,286	87,908	69,147
2009	578,212	4,835	-	179,706	762,754	579,887	-	-	579,887	182,867	65,919
2010	(0)	190,669	397,609	608,715	1,196,993	608,018	-	-	608,018	588,975	91,028
2011	(0)	185,115	387,408	732,722	1,305,245	682,112	-	-	682,112	623,133	179,838
2012	(0)	177,745	373,642	794,623	1,346,010	716,792	-	-	716,792	629,218	161,833
2013	(0)	170,680	360,561	813,641	1,344,883	738,993	-	-	738,993	605,890	151,398
2014	(0)	163,897	348,076	833,733	1,345,705	774,236	-	-	774,236	571,469	141,500
2015	(0)	157,378	336,152	852,311	1,345,841	812,762	-	-	812,762	533,079	132,079
2016	(0)	151,103	324,765	874,257	1,350,125	851,492	-	-	851,492	498,633	123,090
2017	(0)	145,051	313,884	895,846	1,354,781	950,868	-	-	950,868	403,913	114,762
2018	(0)	139,200	303,953	922,973	1,366,126	852,719	482	-	853,201	512,926	106,873
2019	(0)	133,401	294,107	948,667	1,376,174	1,057,054	6,723	-	1,063,776	312,398	98,948
2020	(0)	127,624	284,293	976,589	1,388,506	1,008,858	6,723	-	1,015,581	372,925	90,980
2021	(0)	121,870	274,516	1,007,164	1,403,550	1,054,785	166,489	-	1,221,274	182,276	82,983
2022	(0)	116,134	264,718	591,744	972,596	863,722	235,290	558,331	1,657,343	(684,747)	72,486
2023	(0)	110,419	254,984	-	365,403	-	225,829	544,338	770,167	(404,764)	0
2024	(0)	104,723	245,503	-	350,227	-	216,769	525,417	742,187	(391,960)	0
2025	(0)	99,046	235,615	-	334,661	-	208,080	507,438	715,518	(380,857)	0
2026	(0)	93,386	225,762	-	319,148	-	199,738	490,284	690,022	(370,874)	0
2027	(0)	87,735	215,986	-	303,720	-	191,715	473,947	665,662	(361,941)	0
2028	(0)	82,087	206,280	-	288,367	-	183,984	458,379	642,363	(353,995)	0
2029	(0)	76,440	196,641	-	273,080	-	176,512	443,493	620,005	(346,925)	0
2030	(0)	70,875	183,933	-	254,808	-	169,109	429,837	598,945	(344,137)	0
2031	(0)	66,424	173,757	-	240,181	-	161,736	416,399	578,135	(337,954)	0
2032	(0)	63,025	169,409	-	232,434	-	154,391	402,991	557,383	(324,948)	0
2033	(0)	59,630	165,138	-	224,768	-	147,074	389,637	536,711	(311,944)	0
2034	(0)	56,239	160,945	-	217,184	-	139,782	376,295	516,077	(298,893)	0
2035	-	52,852	156,835	-	209,686	-	132,515	363,013	495,528	(285,841)	0
2036	-	49,469	152,809	-	202,278	-	125,270	349,993	475,264	(272,985)	0
2037	-	46,091	148,872	-	194,963	-	118,048	336,397	454,445	(259,482)	0
2038	-	42,718	146,877	-	189,596	-	110,838	322,893	433,731	(244,135)	0
2039	-	39,350	145,279	-	184,629	-	103,633	309,483	413,116	(228,487)	0
2040	-	35,993	0	-	35,993	-	96,433	296,172	392,605	(356,611)	0
2041	-	32,734	(0)	-	32,734	-	89,342	282,962	372,304	(339,570)	0
2042	-	29,564	(0)	-	29,564	-	83,709	265,471	349,181	(319,617)	0
2043	-	26,400	(0)	-	26,400	-	79,455	251,533	330,988	(304,588)	0
2044	-	23,242	(0)	-	23,242	-	75,207	245,762	320,969	(297,727)	0
2045	-	20,091	(0)	-	20,091	-	70,965	240,110	311,075	(290,985)	0
2046	-	16,945	(0)	-	16,945	-	66,730	234,580	301,310	(284,365)	0
2047	-	13,807	(0)	-	13,807	-	62,502	229,177	291,679	(277,872)	0
2048	-	10,676	(0)	-	10,676	-	58,281	223,906	282,187	(271,511)	0
2049	-	7,645	(0)	-	7,645	-	54,067	218,773	272,839	(265,194)	0
2050	-	(1,185)	(0)	-	(1,185)	-	49,860	216,372	266,232	(267,418)	0
2051	-	(3,621)	(0)	-	(3,621)	-	45,670	214,540	260,210	(263,831)	0
2052	-	(6,049)	(0)	-	(6,049)	-	41,609	(0)	41,609	(47,657)	0
2053	-	(8,468)	(0)	-	(8,468)	-	37,666	0	37,666	(46,134)	0
2054	-	(10,877)	(0)	-	(10,877)	-	33,733	0	33,733	(44,610)	0
2055	-	(13,278)	(0)	-	(13,278)	-	29,808	0	29,808	(43,086)	0
2056	-	(11,963)	-	-	(11,963)	-	25,894	-	25,894	(37,857)	-
2057	-	-	-	-	-	-	21,989	-	21,989	(21,989)	-
2058	-	-	-	-	-	-	18,095	-	18,095	(18,095)	-
2059	-	-	-	-	-	-	14,212	-	14,212	(14,212)	-
2060	-	-	-	-	-	-	10,461	-	10,461	(10,461)	-
2061	-	-	-	-	-	-	(576)	-	(576)	576	-
2062	-	-	-	-	-	-	(3,574)	-	(3,574)	3,574	-
2063	-	-	-	-	-	-	(6,559)	-	(6,559)	6,559	-
2064	-	-	-	-	-	-	(9,530)	-	(9,530)	9,530	-
2065	-	-	-	-	-	-	(12,488)	-	(12,488)	12,488	-
2066	-	-	-	-	-	-	(15,431)	-	(15,431)	15,431	-
2067	-	-	-	-	-	-	(13,670)	-	(13,670)	13,670	-
<b>Total</b>	<b>3,505,516</b>	<b>3,356,885</b>	<b>7,448,311</b>	<b>11,032,689</b>	<b>25,343,401</b>	<b>14,220,053</b>	<b>4,184,591</b>	<b>10,617,923</b>	<b>29,019,636</b>	<b>(3,676,235)</b>	<b>1,795,767</b>
<b>Present Value</b>	<b>2,731,349</b>	<b>794,437</b>	<b>1,706,068</b>	<b>3,516,781</b>	<b>8,748,634</b>	<b>5,892,590</b>	<b>320,975</b>	<b>727,793</b>	<b>6,941,358</b>	<b>1,807,277</b>	<b>707,341</b>

**Present Value of Revenue Requirement Summary Table - IV Ramona Transmission Project (\$ in 000's)**

Year	Ratepayers Benefit (Avoided Costs of Shutdown)					Offsets				Total Benefit	Steam Generator
	Cost of Operation	Costs of	Costs of	Electricity Production Costs	Total	Cost of Operation	Costs of	Costs of	Total		
		Mitigation Transmission 2010	Replacement Generation 2010				Mitigation Transmission 2022	Replacement Generation 2022			
2004	496,771	-	-	-	496,771	496,771	-	-	496,771	-	213
2005	432,951	-	-	-	432,951	401,904	-	-	401,904	31,047	3,427
2006	532,528	284	-	-	532,811	483,579	-	-	483,579	49,232	41,194
2007	472,516	3,584	-	-	476,099	411,442	-	-	411,442	64,657	43,436
2008	445,609	3,243	-	-	448,852	389,889	-	-	389,889	58,963	46,379
2009	350,975	2,935	-	109,082	462,992	351,991	-	-	351,991	111,000	40,013
2010	-	104,739	218,415	334,380	657,533	333,997	-	-	333,997	323,536	50,004
2011	-	92,025	192,590	364,253	648,868	339,094	-	-	339,094	309,774	89,402
2012	-	79,965	168,096	357,489	605,550	322,474	-	-	322,474	283,076	72,806
2013	-	69,490	146,798	331,263	547,550	300,871	-	-	300,871	246,680	61,640
2014	-	60,388	128,248	307,188	495,824	285,266	-	-	285,266	210,557	52,135
2015	-	52,476	112,086	284,193	448,754	271,006	-	-	271,006	177,749	44,040
2016	-	45,596	97,999	263,810	407,405	256,941	-	-	256,941	150,464	37,143
2017	-	39,611	85,716	244,638	369,964	259,663	-	-	259,663	110,301	31,339
2018	-	34,401	75,116	228,096	337,613	210,734	119	-	210,853	126,760	26,412
2019	-	29,835	65,777	212,168	307,779	236,408	1,504	-	237,912	69,867	22,130
2020	-	25,831	57,540	197,658	281,029	204,190	1,361	-	205,550	75,479	18,414
2021	-	22,322	50,282	184,477	257,081	193,199	30,495	-	223,694	33,386	15,199
2022	-	19,250	43,880	98,087	161,217	143,170	39,002	92,549	274,721	(113,503)	12,015
2023	-	16,564	38,250	-	54,814	-	33,876	81,655	115,532	(60,718)	0
2024	-	14,217	33,328	-	47,545	-	29,427	71,328	100,755	(53,210)	0
2025	-	12,168	28,946	-	41,115	-	25,564	62,341	87,905	(46,790)	0
2026	-	10,383	25,100	-	35,483	-	22,207	54,510	76,717	(41,234)	0
2027	-	8,828	21,732	-	30,559	-	19,290	47,687	66,976	(36,417)	0
2028	-	7,474	18,783	-	26,257	-	16,753	41,738	58,491	(32,233)	0
2029	-	6,299	16,204	-	22,503	-	14,545	36,545	51,090	(28,588)	0
2030	-	5,285	13,716	-	19,002	-	12,611	32,054	44,665	(25,663)	0
2031	-	4,483	11,726	-	16,209	-	10,915	28,101	39,016	(22,807)	0
2032	-	3,849	10,346	-	14,196	-	9,429	24,612	34,042	(19,846)	0
2033	-	3,296	9,127	-	12,423	-	8,129	21,535	29,664	(17,241)	0
2034	-	2,813	8,050	-	10,863	-	6,992	18,822	25,813	(14,950)	0
2035	-	2,392	7,099	-	9,492	-	5,998	16,432	22,430	(12,939)	0
2036	-	2,026	6,260	-	8,286	-	5,132	14,337	19,469	(11,183)	0
2037	-	1,709	5,519	-	7,228	-	4,376	12,471	16,847	(9,619)	0
2038	-	1,433	4,928	-	6,361	-	3,719	10,833	14,551	(8,191)	0
2039	-	1,195	4,411	-	5,606	-	3,146	9,396	12,543	(6,937)	0
2040	-	989	0	-	989	-	2,650	8,138	10,787	(9,798)	0
2041	-	814	-	-	814	-	2,222	7,036	9,257	(8,444)	0
2042	-	665	-	-	665	-	1,884	5,974	7,857	(7,192)	0
2043	-	538	-	-	538	-	1,618	5,122	6,740	(6,203)	0
2044	-	428	-	-	428	-	1,386	4,529	5,915	(5,487)	0
2045	-	335	-	-	335	-	1,184	4,005	5,188	(4,853)	0
2046	-	256	-	-	256	-	1,007	3,541	4,548	(4,292)	0
2047	-	189	-	-	189	-	854	3,130	3,984	(3,795)	0
2048	-	132	-	-	132	-	720	2,768	3,488	(3,356)	0
2049	-	86	-	-	86	-	605	2,447	3,052	(2,967)	0
2050	-	(12)	-	-	(12)	-	505	2,190	2,695	(2,707)	0
2051	-	(33)	-	-	(33)	-	418	1,966	2,384	(2,417)	0
2052	-	(50)	-	-	(50)	-	345	(0)	345	(395)	0
2053	-	(64)	-	-	(64)	-	283	0	283	(346)	0
2054	-	(74)	-	-	(74)	-	229	-	229	(303)	0
2055	-	(82)	-	-	(82)	-	183	-	183	(265)	-
2056	-	(67)	-	-	(67)	-	144	-	144	(211)	-
2057	-	-	-	-	-	-	111	-	111	(111)	-
2058	-	-	-	-	-	-	82	-	82	(82)	-
2059	-	-	-	-	-	-	59	-	59	(59)	-
2060	-	-	-	-	-	-	39	-	39	(39)	-
2061	-	-	-	-	-	-	(2)	-	(2)	2	-
2062	-	-	-	-	-	-	(11)	-	(11)	11	-
2063	-	-	-	-	-	-	(18)	-	(18)	18	-
2064	-	-	-	-	-	-	(24)	-	(24)	24	-
2065	-	-	-	-	-	-	(28)	-	(28)	28	-
2066	-	-	-	-	-	-	(32)	-	(32)	32	-
2067	-	-	-	-	-	-	(25)	-	(25)	25	-
<b>Present Value</b>	<b>2,731,349</b>	<b>794,437</b>	<b>1,706,068</b>	<b>3,516,781</b>	<b>8,748,634</b>	<b>5,892,590</b>	<b>320,975</b>	<b>727,793</b>	<b>6,941,358</b>	<b>1,807,277</b>	<b>707,341</b>

Revenue Requirement Summary Table with Reinforced SCE/SDG&E 230kv Interface (\$ in 000's)

Year	Ratepayers Benefit (Avoided Costs of Shutdown)					Offsets				Total Benefit	Steam Generator
	Cost of Operation	Costs of Mitigation	Costs of Replacement	Electricity Production	Total	Cost of Operation	Costs of Mitigation	Costs of Replacement	Total		
		Transmission 2010	Generation 2010	Costs			Transmission 2022	Generation 2022			
2004	496,771	-	-	-	496,771	496,771	-	-	496,771	-	213
2005	478,411	-	-	-	478,411	444,104	-	-	444,104	34,307	3,787
2006	650,229	-	-	-	650,229	590,462	-	-	590,462	59,767	50,299
2007	637,533	-	-	-	637,533	555,131	-	-	555,131	82,402	58,605
2008	664,360	-	-	-	664,360	581,286	-	-	581,286	83,073	69,147
2009	578,212	-	-	179,706	757,919	579,887	-	-	579,887	178,032	65,919
2010	(0)	76,222	397,609	608,715	1,082,545	608,018	-	-	608,018	474,528	91,028
2011	(0)	74,181	387,408	732,722	1,194,311	682,112	-	-	682,112	512,199	179,838
2012	(0)	71,351	373,642	794,623	1,239,617	716,792	-	-	716,792	522,824	161,833
2013	(0)	68,655	360,561	813,641	1,242,857	738,993	-	-	738,993	503,865	151,398
2014	(0)	66,080	348,076	833,733	1,247,888	774,236	-	-	774,236	473,652	141,500
2015	(0)	63,621	338,152	852,311	1,252,084	812,762	-	-	812,762	439,322	132,079
2016	(0)	61,268	324,765	874,257	1,260,290	851,492	-	-	851,492	408,797	123,090
2017	(0)	59,012	313,884	895,846	1,268,742	950,868	-	-	950,868	317,874	114,762
2018	(0)	56,844	303,953	922,973	1,283,770	852,719	-	-	852,719	431,052	106,873
2019	(0)	54,699	294,107	948,667	1,297,473	1,057,054	-	-	1,057,054	240,419	98,948
2020	(0)	52,564	284,293	976,589	1,313,446	1,008,858	-	-	1,008,858	304,587	90,980
2021	(0)	50,439	274,516	1,007,164	1,332,119	1,054,785	50,320	-	1,105,105	227,014	82,983
2022	(0)	48,322	264,718	591,744	904,784	863,722	95,456	558,331	1,517,509	(612,725)	72,486
2023	(0)	46,215	254,984	-	301,199	-	91,762	544,338	636,100	(334,901)	0
2024	(0)	44,116	245,503	-	289,619	-	88,245	525,417	613,662	(324,043)	0
2025	(0)	42,026	235,615	-	277,641	-	84,890	507,438	592,328	(314,687)	0
2026	(0)	39,944	225,762	-	265,706	-	81,689	490,284	571,973	(306,267)	0
2027	(0)	37,866	215,986	-	253,852	-	78,628	473,947	552,575	(298,723)	0
2028	(0)	35,790	206,280	-	242,070	-	75,695	458,379	534,074	(292,004)	0
2029	(0)	33,714	196,641	-	230,355	-	72,877	443,493	516,370	(286,015)	0
2030	(0)	31,675	183,933	-	215,608	-	70,089	429,837	499,925	(284,317)	0
2031	(0)	30,120	173,757	-	203,877	-	67,315	416,399	483,714	(279,837)	0
2032	(0)	29,024	169,409	-	198,433	-	64,553	402,991	467,545	(269,112)	0
2033	(0)	27,929	165,138	-	193,067	-	61,805	389,637	451,441	(258,375)	0
2034	(0)	26,837	160,945	-	187,782	-	59,067	376,295	435,362	(247,581)	0
2035	-	25,747	156,835	-	182,581	-	56,341	363,013	419,354	(236,773)	0
2036	-	24,659	152,809	-	177,468	-	53,626	349,993	403,619	(226,151)	0
2037	-	23,574	148,872	-	172,446	-	50,921	336,397	387,318	(214,872)	0
2038	-	22,492	146,877	-	169,369	-	48,222	322,893	371,114	(201,745)	0
2039	-	21,412	145,279	-	166,691	-	45,525	309,483	355,008	(188,317)	0
2040	-	20,338	0	-	20,338	-	42,832	296,172	339,003	(318,665)	0
2041	-	19,307	(0)	-	19,307	-	40,186	282,962	323,149	(303,841)	0
2042	-	18,316	(0)	-	18,316	-	38,182	265,471	303,654	(285,338)	0
2043	-	17,328	(0)	-	17,328	-	36,784	251,533	288,317	(270,990)	0
2044	-	16,343	(0)	-	16,343	-	35,390	245,762	281,152	(264,809)	0
2045	-	15,362	(0)	-	15,362	-	33,999	240,110	274,108	(258,748)	0
2046	-	14,384	(0)	-	14,384	-	32,611	234,580	267,191	(252,807)	0
2047	-	13,411	(0)	-	13,411	-	31,228	229,177	260,405	(246,994)	0
2048	-	12,441	(0)	-	12,441	-	29,848	223,906	253,754	(241,313)	0
2049	-	11,610	(0)	-	11,610	-	28,472	218,773	247,245	(235,635)	0
2050	-	2,357	(0)	-	2,357	-	27,101	216,372	243,473	(241,116)	0
2051	-	2,376	(0)	-	2,376	-	25,738	214,540	240,278	(237,902)	0
2052	-	2,399	(0)	-	2,399	-	24,432	(0)	24,432	(22,033)	0
2053	-	2,428	(0)	-	2,428	-	23,180	0	23,180	(20,752)	0
2054	-	2,461	(0)	-	2,461	-	21,932	0	21,932	(19,471)	0
2055	-	2,500	(0)	-	2,500	-	20,690	0	20,690	(18,190)	-
2056	-	2,690	-	-	2,690	-	19,453	-	19,453	(16,763)	-
2057	-	-	-	-	-	-	18,222	-	18,222	(18,222)	-
2058	-	-	-	-	-	-	16,997	-	16,997	(16,997)	-
2059	-	-	-	-	-	-	15,778	-	15,778	(15,778)	-
2060	-	-	-	-	-	-	14,741	-	14,741	(14,741)	-
2061	-	-	-	-	-	-	1,656	-	1,656	(1,656)	-
2062	-	-	-	-	-	-	1,832	-	1,832	(1,832)	-
2063	-	-	-	-	-	-	2,015	-	2,015	(2,015)	-
2064	-	-	-	-	-	-	2,206	-	2,206	(2,206)	-
2065	-	-	-	-	-	-	2,405	-	2,405	(2,405)	-
2066	-	-	-	-	-	-	2,611	-	2,611	(2,611)	-
2067	-	-	-	-	-	-	3,016	-	3,016	(3,016)	-
Total	3,505,516	1,522,447	7,448,311	11,032,689	23,508,964	14,220,053	1,890,563	10,617,923	26,647,058	(3,138,095)	1,795,767
Present Value	2,731,349	322,187	1,706,068	3,516,781	8,276,385	5,892,590	129,031	727,793	6,749,413	1,526,971	707,341

Present Value of Revenue Requirement Summary Table - Reinforced SCE/SDG&E 230kv Interface (\$ in 000's)

Year	Ratepayers Benefit (Avoided Costs of Shutdown)					Offsets				Total Benefit	Steam Generator
	Cost of Operation	Costs of Mitigation Transmission 2010	Costs of Replacement Generation 2010	Electricity Production Costs	Total	Cost of Operation	Costs of Mitigation Transmission 2022	Costs of Replacement Generation 2022	Total		
2004	496,771	-	-	-	496,771	496,771	-	-	496,771	-	213
2005	432,951	-	-	-	432,951	401,904	-	-	401,904	31,047	3,427
2006	532,528	-	-	-	532,528	483,579	-	-	483,579	48,948	41,194
2007	472,516	-	-	-	472,516	411,442	-	-	411,442	61,073	43,436
2008	445,609	-	-	-	445,609	389,889	-	-	389,889	55,720	46,379
2009	350,975	-	-	109,082	460,057	351,991	-	-	351,991	108,065	40,013
2010	-	41,870	218,415	334,380	594,665	333,997	-	-	333,997	260,668	50,004
2011	-	36,877	192,590	364,253	593,720	339,094	-	-	339,094	254,626	89,402
2012	-	32,100	168,096	357,489	557,685	322,474	-	-	322,474	235,211	72,806
2013	-	27,952	146,798	331,263	506,012	300,871	-	-	300,871	205,141	61,640
2014	-	24,347	128,248	307,188	459,783	285,266	-	-	285,266	174,517	52,135
2015	-	21,214	112,086	284,193	417,492	271,006	-	-	271,006	146,487	44,040
2016	-	18,488	97,999	263,810	380,297	256,941	-	-	256,941	123,356	37,143
2017	-	16,115	85,716	244,638	346,469	259,663	-	-	259,663	86,805	31,339
2018	-	14,048	75,116	228,096	317,260	210,734	-	-	210,734	106,526	26,412
2019	-	12,233	65,777	212,168	290,178	236,408	-	-	236,408	53,769	22,130
2020	-	10,639	57,540	197,658	265,837	204,190	-	-	204,190	61,648	18,414
2021	-	9,239	50,282	184,477	243,997	193,199	9,217	-	202,416	41,581	15,199
2022	-	8,010	43,880	98,087	149,977	143,170	15,823	92,549	251,542	(101,565)	12,015
2023	-	6,933	38,250	-	45,182	-	13,765	81,655	95,421	(50,238)	0
2024	-	5,989	33,328	-	39,317	-	11,980	71,328	83,307	(43,990)	0
2025	-	5,163	28,946	-	34,110	-	10,429	62,341	72,770	(38,661)	0
2026	-	4,441	25,100	-	29,541	-	9,082	54,510	63,592	(34,051)	0
2027	-	3,810	21,732	-	25,542	-	7,911	47,687	55,598	(30,056)	0
2028	-	3,259	18,783	-	22,042	-	6,892	41,738	48,630	(26,588)	0
2029	-	2,778	16,204	-	18,982	-	6,005	36,545	42,550	(23,569)	0
2030	-	2,362	13,716	-	16,079	-	5,227	32,054	37,281	(21,202)	0
2031	-	2,033	11,726	-	13,759	-	4,543	28,101	32,644	(18,885)	0
2032	-	1,773	10,346	-	12,119	-	3,943	24,612	28,555	(16,436)	0
2033	-	1,544	9,127	-	10,671	-	3,416	21,535	24,951	(14,281)	0
2034	-	1,342	8,050	-	9,393	-	2,954	18,822	21,776	(12,384)	0
2035	-	1,165	7,099	-	8,264	-	2,550	16,432	18,982	(10,718)	0
2036	-	1,010	6,260	-	7,270	-	2,197	14,337	16,534	(9,264)	0
2037	-	874	5,519	-	6,393	-	1,888	12,471	14,359	(7,966)	0
2038	-	755	4,928	-	5,682	-	1,618	10,833	12,451	(6,768)	0
2039	-	650	4,411	-	5,061	-	1,382	9,396	10,779	(5,718)	0
2040	-	559	0	-	559	-	1,177	8,138	9,315	(8,756)	0
2041	-	480	-	-	480	-	999	7,036	8,035	(7,555)	0
2042	-	412	-	-	412	-	859	5,974	6,833	(6,421)	0
2043	-	353	-	-	353	-	749	5,122	5,871	(5,519)	0
2044	-	301	-	-	301	-	652	4,529	5,181	(4,880)	0
2045	-	256	-	-	256	-	567	4,005	4,572	(4,315)	0
2046	-	217	-	-	217	-	492	3,541	4,033	(3,816)	0
2047	-	183	-	-	183	-	427	3,130	3,557	(3,374)	0
2048	-	154	-	-	154	-	369	2,768	3,137	(2,983)	0
2049	-	130	-	-	130	-	319	2,447	2,766	(2,636)	0
2050	-	24	-	-	24	-	274	2,190	2,465	(2,441)	0
2051	-	22	-	-	22	-	236	1,966	2,201	(2,180)	0
2052	-	20	-	-	20	-	203	(0)	203	(183)	0
2053	-	18	-	-	18	-	174	0	174	(156)	0
2054	-	17	-	-	17	-	149	-	149	(132)	0
2055	-	15	-	-	15	-	127	-	127	(112)	-
2056	-	15	-	-	15	-	108	-	108	(93)	-
2057	-	-	-	-	-	-	92	-	92	(92)	-
2058	-	-	-	-	-	-	77	-	77	(77)	-
2059	-	-	-	-	-	-	65	-	65	(65)	-
2060	-	-	-	-	-	-	55	-	55	(55)	-
2061	-	-	-	-	-	-	6	-	6	(6)	-
2062	-	-	-	-	-	-	6	-	6	(6)	-
2063	-	-	-	-	-	-	6	-	6	(6)	-
2064	-	-	-	-	-	-	6	-	6	(6)	-
2065	-	-	-	-	-	-	5	-	5	(5)	-
2066	-	-	-	-	-	-	5	-	5	(5)	-
2067	-	-	-	-	-	-	6	-	6	(6)	-
Present Value	2,731,349	322,187	1,706,068	3,516,781	8,276,385	5,892,590	129,031	727,793	6,749,413	1,526,971	707,341

Revenue Requirement Summary Table with Valley Rainbow Transmission Project (SCE Share)

Year	Ratepayers Benefit (Avoided Costs)				Total	Offsets				Total Benefit	Steam Generator
	SONGS Operating Costs	Costs of Replacement Transmission 2010	Costs of Replacement Generation 2010	Electricity Production Costs		SONGS Operating Costs	Costs of Replacement Transmission 2022	Costs of Replacement Generation 2022	Total		
2004	397,417	-	-	-	397,417	397,417	-	-	397,417	-	170
2005	382,729	-	-	-	382,729	355,283	-	-	355,283	27,445	3,030
2006	520,184	63	-	-	520,247	472,370	-	-	472,370	47,877	40,239
2007	510,027	882	-	-	510,908	444,105	-	-	444,105	66,803	46,884
2008	531,488	882	-	-	532,369	465,029	-	-	465,029	67,340	55,318
2009	462,570	882	-	143,765	607,217	463,910	-	-	463,910	143,307	52,735
2010	(0)	33,263	318,087	486,972	838,322	486,414	-	-	486,414	351,908	72,823
2011	-	32,293	309,927	586,177	928,398	545,690	-	-	545,690	382,708	143,871
2012	-	31,009	298,914	635,698	965,621	573,434	-	-	573,434	392,187	129,466
2013	-	29,777	288,449	650,913	969,139	591,194	-	-	591,194	377,945	121,119
2014	-	28,594	278,460	666,986	974,041	619,389	-	-	619,389	354,652	113,200
2015	-	27,458	268,922	681,849	978,228	650,210	-	-	650,210	328,018	105,663
2016	-	26,363	259,812	699,406	985,581	681,194	-	-	681,194	304,387	98,472
2017	-	25,308	251,108	716,677	993,092	760,695	-	-	760,695	232,397	91,810
2018	-	24,287	243,163	738,379	1,005,828	682,175	88	-	682,263	323,565	85,498
2019	-	23,275	235,286	758,933	1,017,495	845,643	1,226	-	846,869	170,626	79,158
2020	-	22,268	227,434	781,271	1,030,973	807,087	1,226	-	808,313	222,661	72,784
2021	-	21,264	219,613	805,731	1,046,609	843,828	29,405	-	873,233	173,375	66,386
2022	-	20,264	211,775	473,395	705,434	690,977	41,040	446,665	1,178,682	(473,249)	57,989
2023	-	19,268	203,987	-	223,255	-	39,393	435,470	474,863	(251,608)	0
2024	-	18,275	196,403	-	214,678	-	37,815	420,334	458,149	(243,471)	0
2025	-	17,285	188,492	-	205,777	-	36,301	405,950	442,252	(236,474)	0
2026	-	16,299	180,610	-	196,909	-	34,848	392,227	427,075	(230,167)	0
2027	-	15,314	172,789	-	188,103	-	33,450	379,158	412,608	(224,505)	0
2028	-	14,330	165,024	-	179,355	-	32,104	366,703	398,806	(219,452)	0
2029	-	13,347	157,312	-	170,659	-	30,802	354,794	385,596	(214,937)	0
2030	-	12,377	147,147	-	159,524	-	29,512	343,869	373,381	(213,857)	0
2031	-	11,601	139,005	-	150,607	-	28,227	333,119	361,347	(210,740)	0
2032	-	11,008	135,527	-	146,535	-	26,948	322,393	349,341	(202,805)	0
2033	-	10,416	132,110	-	142,526	-	25,673	311,709	337,383	(194,857)	0
2034	-	9,824	128,756	-	138,580	-	24,404	301,036	325,440	(186,859)	0
2035	-	9,233	125,468	-	134,701	-	23,138	290,410	313,549	(178,848)	0
2036	-	8,643	122,247	-	130,891	-	21,877	279,995	301,871	(170,981)	0
2037	-	8,055	119,097	-	127,152	-	20,620	269,118	289,737	(162,585)	0
2038	-	7,467	117,502	-	124,969	-	19,365	258,314	277,679	(152,710)	0
2039	-	6,881	116,223	-	123,104	-	18,111	247,586	265,697	(142,594)	0
2040	-	6,296	0	-	6,296	-	16,858	236,937	253,796	(247,499)	0
2041	-	5,729	-	-	5,729	-	15,625	226,370	241,995	(236,266)	0
2042	-	5,177	-	-	5,177	-	14,644	212,377	227,021	(221,844)	0
2043	-	4,627	-	-	4,627	-	13,903	201,226	215,130	(210,502)	0
2044	-	4,078	-	-	4,078	-	13,163	196,610	209,773	(205,695)	0
2045	-	3,531	-	-	3,531	-	12,425	192,088	204,513	(200,982)	0
2046	-	2,985	-	-	2,985	-	11,688	187,664	199,352	(196,367)	0
2047	-	2,441	-	-	2,441	-	10,952	183,342	194,294	(191,853)	0
2048	-	1,898	-	-	1,898	-	10,218	179,125	189,343	(187,446)	0
2049	-	1,370	-	-	1,370	-	9,486	175,018	184,504	(183,134)	0
2050	-	(31)	-	-	(31)	-	8,755	173,098	181,853	(181,884)	0
2051	-	(467)	-	-	(467)	-	8,028	171,632	179,660	(180,127)	0
2052	-	(902)	-	-	(902)	-	7,323	(0)	7,323	(8,225)	0
2053	-	(1,335)	-	-	(1,335)	-	6,639	0	6,639	(7,974)	0
2054	-	(1,766)	-	-	(1,766)	-	5,957	-	5,957	(7,723)	0
2055	-	(2,194)	-	-	(2,194)	-	5,278	-	5,278	(7,472)	0
2056	-	(1,945)	-	-	(1,945)	-	4,600	-	4,600	(6,545)	-
2057	-	-	-	-	-	-	3,924	-	3,924	(3,924)	-
2058	-	-	-	-	-	-	3,251	-	3,251	(3,251)	-
2059	-	-	-	-	-	-	2,581	-	2,581	(2,581)	-
2060	-	-	-	-	-	-	1,931	-	1,931	(1,931)	-
2061	-	-	-	-	-	-	183	-	183	(183)	-
2062	-	-	-	-	-	-	(352)	-	(352)	352	-
2063	-	-	-	-	-	-	(884)	-	(884)	884	-
2064	-	-	-	-	-	-	(1,413)	-	(1,413)	1,413	-
2065	-	-	-	-	-	-	(1,939)	-	(1,939)	1,939	-
2066	-	-	-	-	-	-	(2,462)	-	(2,462)	2,462	-
2067	-	-	-	-	-	-	(2,126)	-	(2,126)	2,126	-
<b>Total</b>	<b>2,804,413</b>	<b>587,250</b>	<b>5,958,649</b>	<b>8,826,151</b>	<b>18,176,463</b>	<b>11,376,042</b>	<b>733,811</b>	<b>8,494,338</b>	<b>20,601,495</b>	<b>(2,425,032)</b>	<b>1,436,614</b>
<b>Present Value</b>	<b>2,185,079</b>	<b>138,704</b>	<b>1,364,854</b>	<b>2,813,425</b>	<b>6,502,062</b>	<b>4,714,072</b>	<b>56,112</b>	<b>582,234</b>	<b>5,352,418</b>	<b>1,149,644</b>	<b>565,873</b>

Revenue Requirement Summary Table with Valley Rainbow Transmission Project (SDGE Share)

Year	Ratepayers Benefit (Avoided Costs)					Offsets				Total Benefit	Steam Generator
	SONGS Operating Costs	Costs of Replacement Transmission 2010	Costs of Replacement Generation 2010	Electricity Production Costs	Total	SONGS Operating Costs	Costs of Replacement Transmission 2022	Costs of Replacement Generation 2022	Total		
2004	99,354	-	-	-	99,354	99,354	-	-	99,354	-	43
2005	95,682	-	-	-	95,682	88,821	-	-	88,821	6,861	757
2006	130,046	202	-	-	130,248	118,092	-	-	118,092	12,156	10,060
2007	127,507	2,823	-	-	130,330	111,026	-	-	111,026	19,303	11,721
2008	132,872	2,823	-	-	135,695	116,257	-	-	116,257	19,437	13,829
2009	115,642	2,823	-	35,941	154,407	115,977	-	-	115,977	38,429	13,184
2010	(0)	106,499	79,522	121,743	307,763	121,604	-	-	121,604	186,160	18,206
2011	-	103,393	77,482	146,544	327,419	136,422	-	-	136,422	190,997	35,968
2012	-	99,280	74,728	158,925	332,933	143,358	-	-	143,358	189,575	32,367
2013	-	95,337	72,112	162,728	330,178	147,799	-	-	147,799	182,379	30,280
2014	-	91,550	69,615	166,747	327,912	154,847	-	-	154,847	173,065	28,300
2015	-	87,911	67,230	170,462	325,603	162,552	-	-	162,552	163,051	26,416
2016	-	84,406	64,953	174,851	324,211	170,298	-	-	170,298	153,912	24,618
2017	-	81,027	62,777	179,169	322,973	190,174	-	-	190,174	132,799	22,952
2018	-	77,759	60,791	184,595	323,144	170,544	281	-	170,825	152,319	21,375
2019	-	74,520	58,821	189,733	323,075	211,411	3,925	-	215,336	107,740	19,790
2020	-	71,295	56,859	195,318	323,471	201,772	3,925	-	205,696	117,775	18,196
2021	-	68,082	54,903	201,433	324,418	210,957	94,146	-	305,103	19,315	16,597
2022	-	64,880	52,944	118,349	236,172	172,744	131,398	111,666	415,809	(179,636)	14,497
2023	-	61,689	50,997	-	112,686	-	126,123	108,868	234,991	(122,304)	0
2024	-	58,511	49,101	-	107,611	-	121,071	105,083	226,154	(118,543)	0
2025	-	55,343	47,123	-	102,465	-	116,225	101,488	217,713	(115,247)	0
2026	-	52,184	45,152	-	97,337	-	111,572	98,057	209,629	(112,293)	0
2027	-	49,032	43,197	-	92,229	-	107,098	94,789	201,887	(109,658)	0
2028	-	45,882	41,256	-	87,138	-	102,785	91,676	194,461	(107,323)	0
2029	-	42,732	39,328	-	82,060	-	98,617	88,699	187,316	(105,255)	0
2030	-	39,629	36,787	-	76,415	-	94,487	85,967	180,454	(104,039)	0
2031	-	37,144	34,751	-	71,895	-	90,374	83,280	173,654	(101,759)	0
2032	-	35,244	33,882	-	69,126	-	86,279	80,598	166,877	(97,751)	0
2033	-	33,347	33,028	-	66,375	-	82,198	77,927	160,126	(93,751)	0
2034	-	31,453	32,189	-	63,642	-	78,132	75,259	153,391	(89,749)	0
2035	-	29,562	31,367	-	60,929	-	74,081	72,603	146,683	(85,755)	0
2036	-	27,674	30,562	-	58,236	-	70,043	69,999	140,041	(81,806)	0
2037	-	25,789	29,774	-	55,563	-	66,017	67,279	133,297	(77,734)	0
2038	-	23,907	29,375	-	53,283	-	62,000	64,579	126,578	(73,296)	0
2039	-	22,029	29,056	-	51,085	-	57,986	61,897	119,882	(68,797)	0
2040	-	20,158	0	-	20,158	-	53,975	59,234	113,209	(93,051)	0
2041	-	18,342	-	-	18,342	-	50,026	56,592	106,618	(88,276)	0
2042	-	16,577	-	-	16,577	-	46,887	53,094	99,981	(83,404)	0
2043	-	14,815	-	-	14,815	-	44,514	50,307	94,820	(80,005)	0
2044	-	13,058	-	-	13,058	-	42,145	49,152	91,297	(78,239)	0
2045	-	11,305	-	-	11,305	-	39,781	48,022	87,803	(76,497)	0
2046	-	9,557	-	-	9,557	-	37,421	46,916	84,337	(74,780)	0
2047	-	7,814	-	-	7,814	-	35,066	45,835	80,901	(73,087)	0
2048	-	6,075	-	-	6,075	-	32,716	44,781	77,497	(71,422)	0
2049	-	4,387	-	-	4,387	-	30,371	43,755	74,126	(69,738)	0
2050	-	(98)	-	-	(98)	-	28,032	43,274	71,306	(71,404)	0
2051	-	(1,496)	-	-	(1,496)	-	25,703	42,908	68,610	(70,106)	0
2052	-	(2,888)	-	-	(2,888)	-	23,446	(0)	23,446	(26,333)	0
2053	-	(4,274)	-	-	(4,274)	-	21,256	0	21,256	(25,530)	0
2054	-	(5,653)	-	-	(5,653)	-	19,073	-	19,073	(24,726)	0
2055	-	(7,026)	-	-	(7,026)	-	16,897	-	16,897	(23,923)	0
2056	-	(6,229)	-	-	(6,229)	-	14,727	-	14,727	(20,956)	0
2057	-	-	-	-	-	-	12,565	-	12,565	(12,565)	0
2058	-	-	-	-	-	-	10,410	-	10,410	(10,410)	0
2059	-	-	-	-	-	-	8,262	-	8,262	(8,262)	0
2060	-	-	-	-	-	-	6,181	-	6,181	(6,181)	0
2061	-	-	-	-	-	-	587	-	587	(587)	0
2062	-	-	-	-	-	-	(1,126)	-	(1,126)	1,126	0
2063	-	-	-	-	-	-	(2,829)	-	(2,829)	2,829	0
2064	-	-	-	-	-	-	(4,523)	-	(4,523)	4,523	0
2065	-	-	-	-	-	-	(6,207)	-	(6,207)	6,207	0
2066	-	-	-	-	-	-	(7,881)	-	(7,881)	7,881	0
2067	-	-	-	-	-	-	(6,806)	-	(6,806)	6,806	0
<b>Total</b>	<b>701,103</b>	<b>1,880,186</b>	<b>1,489,662</b>	<b>2,206,538</b>	<b>6,277,490</b>	<b>2,844,011</b>	<b>2,349,429</b>	<b>2,123,585</b>	<b>7,308,392</b>	<b>(1,030,902)</b>	<b>359,153</b>
<b>Present Value</b>	<b>546,270</b>	<b>444,087</b>	<b>341,214</b>	<b>703,356</b>	<b>2,034,926</b>	<b>1,178,518</b>	<b>179,652</b>	<b>145,559</b>	<b>1,503,729</b>	<b>531,197</b>	<b>141,468</b>

Revenue Requirement Summary Table with IV Ramona Transmission Project (SDGE Share)

Year	Ratepayers Benefit (Avoided Costs)				Total	Offsets				Total Benefit	Steam Generator
	SONGS Operating Costs	Costs of Replacement Transmission 2010	Costs of Replacement Generation 2010	Electricity Production Costs		SONGS Operating Costs	Costs of Replacement Transmission 2022	Costs of Replacement Generation 2022	Total		
2004	99,354	-	-	-	99,354	99,354	-	-	99,354	-	43
2005	95,682	-	-	-	95,682	88,821	-	-	88,821	6,861	757
2006	130,046	264	-	-	130,310	118,092	-	-	118,092	12,218	10,060
2007	127,507	3,684	-	-	131,191	111,026	-	-	111,026	20,165	11,721
2008	132,872	3,684	-	-	136,556	116,257	-	-	116,257	20,299	13,829
2009	115,642	3,684	-	35,941	155,268	115,977	-	-	115,977	39,291	13,184
2010	(0)	145,290	79,522	121,743	346,555	121,604	-	-	121,604	224,951	18,206
2011	-	141,057	77,482	146,544	365,083	136,422	-	-	136,422	228,661	35,968
2012	-	135,442	74,728	158,925	369,095	143,358	-	-	143,358	225,736	32,367
2013	-	130,058	72,112	162,728	364,899	147,799	-	-	147,799	217,100	30,280
2014	-	124,890	69,615	166,747	361,251	154,847	-	-	154,847	206,404	28,300
2015	-	119,922	67,230	170,462	357,615	162,552	-	-	162,552	195,062	26,416
2016	-	115,140	64,953	174,851	354,945	170,298	-	-	170,298	184,646	24,618
2017	-	110,529	62,777	179,169	352,475	190,174	-	-	190,174	162,301	22,952
2018	-	106,070	60,791	184,595	351,456	170,544	367	-	170,911	180,545	21,375
2019	-	101,651	58,821	189,733	350,206	211,411	5,123	-	216,534	133,672	19,790
2020	-	97,250	56,859	195,318	349,426	201,772	5,123	-	206,895	142,532	18,196
2021	-	92,865	54,903	201,433	349,201	210,957	126,864	-	337,821	11,379	16,597
2022	-	88,494	52,944	118,349	259,787	172,744	179,291	111,666	463,702	(203,915)	14,497
2023	-	84,139	50,997	-	135,136	-	172,082	108,868	280,949	(145,814)	0
2024	-	79,799	49,101	-	128,900	-	165,178	105,083	270,262	(141,362)	0
2025	-	75,473	47,123	-	122,596	-	158,557	101,488	260,044	(137,448)	0
2026	-	71,160	45,152	-	116,312	-	152,200	98,057	250,257	(133,945)	0
2027	-	66,854	43,197	-	110,051	-	146,087	94,789	240,876	(130,825)	0
2028	-	62,550	41,256	-	103,806	-	140,196	91,676	231,872	(128,065)	0
2029	-	58,247	39,328	-	97,575	-	134,502	88,699	223,201	(125,626)	0
2030	-	54,007	36,787	-	90,794	-	128,861	85,967	214,828	(124,034)	0
2031	-	50,615	34,751	-	85,367	-	123,243	83,280	206,522	(121,156)	0
2032	-	48,025	33,882	-	81,907	-	117,646	80,598	198,245	(116,338)	0
2033	-	45,438	33,028	-	78,465	-	112,071	77,927	189,998	(111,533)	0
2034	-	42,854	32,189	-	75,043	-	106,514	75,259	181,773	(106,730)	0
2035	-	40,273	31,367	-	71,640	-	100,976	72,603	173,579	(101,939)	0
2036	-	37,696	30,562	-	68,257	-	95,456	69,999	165,455	(97,197)	0
2037	-	35,122	29,774	-	64,896	-	89,953	67,279	157,232	(92,336)	0
2038	-	32,551	29,375	-	61,927	-	84,459	64,579	149,037	(87,110)	0
2039	-	29,985	29,056	-	59,040	-	78,968	61,897	140,865	(81,824)	0
2040	-	27,427	0	-	27,427	-	73,482	59,234	132,716	(105,289)	0
2041	-	24,943	-	-	24,943	-	68,078	56,592	124,671	(99,728)	0
2042	-	22,528	-	-	22,528	-	63,786	53,094	116,881	(94,353)	0
2043	-	20,117	-	-	20,117	-	60,545	50,307	110,851	(90,735)	0
2044	-	17,711	-	-	17,711	-	57,308	49,152	106,460	(88,750)	0
2045	-	15,309	-	-	15,309	-	54,076	48,022	102,098	(86,789)	0
2046	-	12,912	-	-	12,912	-	50,848	46,916	97,764	(84,852)	0
2047	-	10,521	-	-	10,521	-	47,626	45,835	93,462	(82,941)	0
2048	-	8,135	-	-	8,135	-	44,410	44,781	89,191	(81,056)	0
2049	-	5,826	-	-	5,826	-	41,199	43,755	84,953	(79,128)	0
2050	-	(903)	-	-	(903)	-	37,994	43,274	81,268	(82,171)	0
2051	-	(2,759)	-	-	(2,759)	-	34,801	42,908	77,709	(80,468)	0
2052	-	(4,609)	-	-	(4,609)	-	31,706	(0)	31,706	(36,315)	0
2053	-	(6,452)	-	-	(6,452)	-	28,702	0	28,702	(35,154)	0
2054	-	(8,289)	-	-	(8,289)	-	25,704	-	25,704	(33,993)	0
2055	-	(10,118)	-	-	(10,118)	-	22,714	-	22,714	(32,832)	-
2056	-	(9,116)	-	-	(9,116)	-	19,731	-	19,731	(28,847)	-
2057	-	-	-	-	-	-	16,756	-	16,756	(16,756)	-
2058	-	-	-	-	-	-	13,789	-	13,789	(13,789)	-
2059	-	-	-	-	-	-	10,830	-	10,830	(10,830)	-
2060	-	-	-	-	-	-	7,972	-	7,972	(7,972)	-
2061	-	-	-	-	-	-	(439)	-	(439)	439	-
2062	-	-	-	-	-	-	(2,723)	-	(2,723)	2,723	-
2063	-	-	-	-	-	-	(4,998)	-	(4,998)	4,998	-
2064	-	-	-	-	-	-	(7,262)	-	(7,262)	7,262	-
2065	-	-	-	-	-	-	(9,516)	-	(9,516)	9,516	-
2066	-	-	-	-	-	-	(11,759)	-	(11,759)	11,759	-
2067	-	-	-	-	-	-	(10,416)	-	(10,416)	10,416	-
<b>Total</b>	<b>701,103</b>	<b>2,557,946</b>	<b>1,489,662</b>	<b>2,206,538</b>	<b>6,955,250</b>	<b>2,844,011</b>	<b>3,188,659</b>	<b>2,123,585</b>	<b>8,154,021</b>	<b>(1,198,771)</b>	<b>359,153</b>
<b>Present Value</b>	<b>546,270</b>	<b>605,361</b>	<b>341,214</b>	<b>703,356</b>	<b>2,196,200</b>	<b>1,178,518</b>	<b>244,583</b>	<b>145,559</b>	<b>1,568,659</b>	<b>627,541</b>	<b>141,468</b>

Revenue Requirement Summary Table with Reinforced SCE/SDG&E 230kv Interface (SCE Share)

Year	Ratepayers Benefit (Avoided Costs)					Offsets				Total Benefit	Steam Generator
	SONGS Operating Costs	Costs of Replacement Transmission 2010	Costs of Replacement Generation 2010	Electricity Production Costs	Total	SONGS Operating Costs	Costs of Replacement Transmission 2022	Costs of Replacement Generation 2022	Total		
2004	397,417	-	-	-	397,417	397,417	-	-	397,417	-	-
2005	382,729	-	-	-	382,729	355,283	-	-	355,283	27,445	-
2006	520,184	-	-	-	520,184	472,370	-	-	472,370	47,814	-
2007	510,027	-	-	-	510,027	444,105	-	-	444,105	65,922	-
2008	531,488	-	-	-	531,488	465,029	-	-	465,029	66,458	-
2009	462,570	-	-	143,765	606,335	463,910	-	-	463,910	142,425	-
2010	(0)	18,141	318,087	486,972	823,200	486,414	-	-	486,414	336,785	-
2011	-	17,655	309,927	586,177	913,759	545,690	-	-	545,690	368,070	209,058
2012	-	16,982	298,914	635,698	951,594	573,434	-	-	573,434	378,160	206,428
2013	-	16,340	288,449	650,913	955,702	591,194	-	-	591,194	364,508	194,132
2014	-	15,727	278,460	666,986	961,174	619,389	-	-	619,389	341,785	182,162
2015	-	15,142	268,922	681,849	965,912	650,210	-	-	650,210	315,702	170,662
2016	-	14,582	259,812	699,406	973,799	681,194	-	-	681,194	292,605	159,587
2017	-	14,045	251,108	716,677	981,829	760,695	-	-	760,695	221,135	149,172
2018	-	13,529	243,163	738,379	995,070	682,175	-	-	682,175	312,895	139,196
2019	-	13,018	235,286	758,933	1,007,237	845,643	-	-	845,643	161,595	129,186
2020	-	12,510	227,434	781,271	1,021,216	807,087	-	-	807,087	214,129	119,133
2021	-	12,004	219,613	805,731	1,037,349	843,828	11,976	-	855,804	181,544	109,053
2022	-	11,501	211,775	473,395	696,670	690,977	22,719	446,665	1,160,361	(463,691)	97,266
2023	-	10,999	203,987	-	214,986	-	21,839	435,470	457,310	(242,323)	-
2024	-	10,500	196,403	-	206,902	-	21,002	420,334	441,336	(234,434)	-
2025	-	10,002	188,492	-	198,494	-	20,204	405,950	426,154	(227,660)	-
2026	-	9,507	180,610	-	190,116	-	19,442	392,227	411,669	(221,553)	-
2027	-	9,012	172,789	-	181,801	-	18,713	379,158	397,871	(216,070)	-
2028	-	8,518	165,024	-	173,542	-	18,015	366,703	384,718	(211,176)	-
2029	-	8,024	157,312	-	165,336	-	17,345	354,794	372,139	(206,803)	-
2030	-	7,539	147,147	-	154,685	-	16,681	343,869	360,550	(205,865)	-
2031	-	7,169	139,005	-	146,174	-	16,021	333,119	349,140	(202,966)	-
2032	-	6,908	135,527	-	142,435	-	15,364	322,393	337,757	(195,322)	-
2033	-	6,647	132,110	-	138,757	-	14,710	311,709	326,419	(187,662)	-
2034	-	6,387	128,756	-	135,143	-	14,058	301,036	315,094	(179,951)	-
2035	-	6,128	125,468	-	131,595	-	13,409	290,410	303,820	(172,224)	-
2036	-	5,869	122,247	-	128,116	-	12,763	279,995	292,758	(164,641)	-
2037	-	5,611	119,097	-	124,708	-	12,119	269,118	281,237	(156,529)	-
2038	-	5,353	117,502	-	122,855	-	11,477	258,314	269,791	(146,936)	-
2039	-	5,096	116,223	-	121,319	-	10,835	247,586	258,421	(137,102)	-
2040	-	4,841	0	-	4,841	-	10,194	236,937	247,131	(242,291)	-
2041	-	4,595	-	-	4,595	-	9,564	226,370	235,934	(231,339)	-
2042	-	4,359	-	-	4,359	-	9,087	212,377	221,464	(217,105)	-
2043	-	4,124	-	-	4,124	-	8,755	201,226	209,981	(205,857)	-
2044	-	3,890	-	-	3,890	-	8,423	196,610	205,033	(201,143)	-
2045	-	3,656	-	-	3,656	-	8,092	192,088	200,179	(196,523)	-
2046	-	3,423	-	-	3,423	-	7,761	187,664	195,425	(192,002)	-
2047	-	3,192	-	-	3,192	-	7,432	183,342	190,774	(187,582)	-
2048	-	2,961	-	-	2,961	-	7,104	179,125	186,229	(183,268)	-
2049	-	2,763	-	-	2,763	-	6,776	175,018	181,794	(179,031)	-
2050	-	561	-	-	561	-	6,450	173,098	179,548	(178,987)	-
2051	-	565	-	-	565	-	6,126	171,632	177,757	(177,192)	-
2052	-	571	-	-	571	-	5,815	(0)	5,815	(5,244)	-
2053	-	578	-	-	578	-	5,517	0	5,517	(4,939)	-
2054	-	586	-	-	586	-	5,220	-	5,220	(4,634)	-
2055	-	595	-	-	595	-	4,924	-	4,924	(4,329)	-
2056	-	640	-	-	640	-	4,630	-	4,630	(3,990)	-
2057	-	-	-	-	-	-	4,337	-	4,337	(4,337)	-
2058	-	-	-	-	-	-	4,045	-	4,045	(4,045)	-
2059	-	-	-	-	-	-	3,755	-	3,755	(3,755)	-
2060	-	-	-	-	-	-	3,508	-	3,508	(3,508)	-
2061	-	-	-	-	-	-	394	-	394	(394)	-
2062	-	-	-	-	-	-	436	-	436	(436)	-
2063	-	-	-	-	-	-	480	-	480	(480)	-
2064	-	-	-	-	-	-	525	-	525	(525)	-
2065	-	-	-	-	-	-	572	-	572	(572)	-
2066	-	-	-	-	-	-	621	-	621	(621)	-
2067	-	-	-	-	-	-	718	-	718	(718)	-
<b>Total</b>	<b>2,804,413</b>	<b>362,342</b>	<b>5,958,649</b>	<b>8,826,151</b>	<b>17,951,556</b>	<b>11,376,042</b>	<b>449,954</b>	<b>8,494,338</b>	<b>20,300,942</b>	<b>(2,349,386)</b>	<b>1,865,036</b>
<b>Present Value</b>	<b>2,185,079</b>	<b>76,681</b>	<b>1,364,854</b>	<b>2,813,425</b>	<b>6,440,038</b>	<b>4,714,072</b>	<b>30,709</b>	<b>582,234</b>	<b>5,327,015</b>	<b>1,113,023</b>	<b>612,251</b>

Revenue Requirement Summary Table with Reinforced SCE/SDG&E 230kv Interface (SDGE Share)

Year	Ratepayers Benefit (Avoided Costs)				Total	Offsets				Total Benefit	Steam Generator
	SONGS Operating Costs	Costs of Replacement Transmission 2010	Costs of Replacement Generation 2010	Electricity Production Costs		SONGS Operating Costs	Costs of Replacement Transmission 2022	Costs of Replacement Generation 2022	Total		
2004	99,354	-	-	-	99,354	99,354	-	-	99,354	-	43
2005	95,682	-	-	-	95,682	88,821	-	-	88,821	6,861	757
2006	130,046	-	-	-	130,046	118,092	-	-	118,092	11,953	10,060
2007	127,507	-	-	-	127,507	111,026	-	-	111,026	16,480	11,721
2008	132,872	-	-	-	132,872	116,257	-	-	116,257	16,615	13,829
2009	115,642	-	-	35,941	151,584	115,977	-	-	115,977	35,606	13,184
2010	(0)	58,081	79,522	121,743	259,346	121,604	-	-	121,604	137,742	18,206
2011	-	56,526	77,482	146,544	280,552	136,422	-	-	136,422	144,130	35,968
2012	-	54,370	74,728	158,925	288,023	143,358	-	-	143,358	144,664	32,367
2013	-	52,315	72,112	162,728	287,155	147,799	-	-	147,799	139,357	30,280
2014	-	50,353	69,615	166,747	286,715	154,847	-	-	154,847	131,868	28,300
2015	-	48,479	67,230	170,462	286,172	162,552	-	-	162,552	123,619	26,416
2016	-	46,686	64,953	174,851	286,490	170,298	-	-	170,298	116,192	24,618
2017	-	44,967	62,777	179,169	286,913	190,174	-	-	190,174	98,740	22,952
2018	-	43,315	60,791	184,595	288,700	170,544	-	-	170,544	118,157	21,375
2019	-	41,681	58,821	189,733	290,235	211,411	-	-	211,411	78,825	19,790
2020	-	40,054	56,859	195,318	292,230	201,772	-	-	201,772	90,458	18,196
2021	-	38,435	54,903	201,433	294,771	210,957	38,344	-	249,301	45,470	16,597
2022	-	36,822	52,944	118,349	208,114	172,744	72,738	111,666	357,148	(149,034)	14,497
2023	-	35,216	50,997	-	86,212	-	69,923	108,868	178,790	(92,578)	0
2024	-	33,617	49,101	-	82,717	-	67,242	105,083	172,326	(89,609)	0
2025	-	32,024	47,123	-	79,147	-	64,686	101,488	166,174	(87,027)	0
2026	-	30,437	45,152	-	75,589	-	62,247	98,057	160,304	(84,714)	0
2027	-	28,854	43,197	-	72,051	-	59,914	94,789	154,704	(82,653)	0
2028	-	27,272	41,256	-	68,528	-	57,680	91,676	149,356	(80,828)	0
2029	-	25,690	39,328	-	65,018	-	55,532	88,699	144,231	(79,212)	0
2030	-	24,136	36,787	-	60,923	-	53,408	85,967	139,375	(78,452)	0
2031	-	22,952	34,751	-	57,703	-	51,294	83,280	134,574	(76,871)	0
2032	-	22,116	33,882	-	55,998	-	49,190	80,598	129,788	(73,790)	0
2033	-	21,282	33,028	-	54,309	-	47,095	77,927	125,023	(70,713)	0
2034	-	20,449	32,189	-	52,639	-	45,009	75,259	120,268	(67,630)	0
2035	-	19,619	31,367	-	50,986	-	42,932	72,603	115,535	(64,549)	0
2036	-	18,790	30,562	-	49,352	-	40,863	69,999	110,862	(61,510)	0
2037	-	17,963	29,774	-	47,738	-	38,802	67,279	106,081	(58,343)	0
2038	-	17,139	29,375	-	46,514	-	36,745	64,579	101,323	(54,809)	0
2039	-	16,316	29,056	-	45,372	-	34,690	61,897	96,587	(51,215)	0
2040	-	15,498	0	-	15,498	-	32,638	59,234	91,872	(76,374)	0
2041	-	14,712	-	-	14,712	-	30,622	56,592	87,214	(72,502)	0
2042	-	13,957	-	-	13,957	-	29,095	53,094	82,189	(68,233)	0
2043	-	13,204	-	-	13,204	-	28,030	50,307	78,336	(65,133)	0
2044	-	12,453	-	-	12,453	-	26,967	49,152	76,119	(63,666)	0
2045	-	11,706	-	-	11,706	-	25,907	48,022	73,929	(62,223)	0
2046	-	10,961	-	-	10,961	-	24,850	46,916	71,766	(60,805)	0
2047	-	10,219	-	-	10,219	-	23,795	45,835	69,631	(59,412)	0
2048	-	9,480	-	-	9,480	-	22,744	44,781	67,525	(58,045)	0
2049	-	8,847	-	-	8,847	-	21,696	43,755	65,450	(56,603)	0
2050	-	1,796	-	-	1,796	-	20,651	43,274	63,925	(62,130)	0
2051	-	1,810	-	-	1,810	-	19,612	42,908	62,520	(60,710)	0
2052	-	1,828	-	-	1,828	-	18,617	(0)	18,617	(16,789)	0
2053	-	1,850	-	-	1,850	-	17,663	0	17,663	(15,813)	0
2054	-	1,875	-	-	1,875	-	16,712	-	16,712	(14,837)	0
2055	-	1,905	-	-	1,905	-	15,766	-	15,766	(13,861)	-
2056	-	2,050	-	-	2,050	-	14,823	-	14,823	(12,773)	-
2057	-	-	-	-	-	-	13,885	-	13,885	(13,885)	0
2058	-	-	-	-	-	-	12,952	-	12,952	(12,952)	0
2059	-	-	-	-	-	-	12,023	-	12,023	(12,023)	0
2060	-	-	-	-	-	-	11,232	-	11,232	(11,232)	0
2061	-	-	-	-	-	-	1,262	-	1,262	(1,262)	0
2062	-	-	-	-	-	-	1,396	-	1,396	(1,396)	0
2063	-	-	-	-	-	-	1,536	-	1,536	(1,536)	0
2064	-	-	-	-	-	-	1,681	-	1,681	(1,681)	0
2065	-	-	-	-	-	-	1,832	-	1,832	(1,832)	0
2066	-	-	-	-	-	-	1,990	-	1,990	(1,990)	0
2067	-	-	-	-	-	-	2,299	-	2,299	(2,299)	0
Total	701,103	1,160,105	1,489,662	2,206,538	5,557,408	2,844,011	1,440,609	2,123,585	6,346,116	(788,708)	359,153
Present Value	546,270	245,507	341,214	703,356	1,836,346	1,178,518	98,321	145,559	1,422,398	413,948	141,468

**Appendix B**  
**SONGS SGRP Capital Streams**

This Appendix B summarizes the various forms of the SONGS Steam Generator capital streams. The first column provides the estimate of direct steam generator capital expenses in thousands of constant 2004 dollars. The second column adds the costs related to CFC to direct costs. The third column escalates the first column by nuclear escalation rates. The fourth column escalates the second column by nuclear escalation rates. The fifth column provides the revenue requirement associated with the capital shown in the first four columns. The last column converts the fifth column into the present value.

APPENDIX B						
Steam Generator Replacement Project Cost Table						
	1	2	3	4	5	6
Year	Steam Generator Capital (2004\$)	Steam Generator Capital with CFC (2004\$)	Steam Generator Capital (Nominal\$)	Steam Generator Capital with CFC (Nominal\$)	Nominal Revenue Requirement	Present Value Revenue Requirement
2004	18,000	18,000	18,000	18,000	213	213
2005	65,000	66,870	66,716	68,635	3,787	3,427
2006	64,000	72,619	67,523	76,615	50,299	41,194
2007	73,000	88,285	79,190	95,771	58,605	43,436
2008	63,000	85,917	70,276	95,839	69,147	46,379
2009	205,000	234,558	235,125	269,027	65,919	40,013
2010	159,000	206,733	193,990	250,244	91,028	50,004
2011	32,000	32,000	49,936	49,936	179,838	89,402
2012	1,000	1,000	1,695	1,695	161,833	72,806
2013	-	-	-	-	151,398	61,640
2014	-	-	-	-	141,500	52,135
2015	-	-	-	-	132,079	44,040
2016	-	-	-	-	123,090	37,143
2017	-	-	-	-	114,762	31,339
2018	-	-	-	-	106,873	26,412
2019	-	-	-	-	98,948	22,130
2020	-	-	-	-	90,980	18,414
2021	-	-	-	-	82,983	15,199
2022	-	-	-	-	72,486	12,015
Total	680,000	805,982	782,450	925,762	1,795,767	707,341

**Appendix C**  
**Air Emissions Analysis**

resulting from retirement of SONGS 2 & 3 would be generated by plants of this basic design, but with the addition of duct firing.

The power generation requirements cited above for each State do not conform to even multiples of 500 MW; therefore, the approach used here has been to calculate emission factors (tons/MWh) for each regulated emission typical of the combined cycles plants in 2-on-1 "F" Class turbine configuration, and apply these factors to the assumed MWh generation requirements in the individual States. Because of the high fuel efficiency of this plant type, the emission estimates developed for all new plants based on this assumption are expected to be lower than those that would result from many other configurations that could be postulated.

Regulatory emissions limitations for similar equipment in Arizona and southern California are currently somewhat different, with those in California being the more stringent. Recent Best Available Control Technology (BACT) determinations for actual combined cycle "F" class turbine projects in both States were examined to provide a first approximation of the emission levels that will be allowed for future plants. BACT requirements change over time and the emission rates that will be in effect in 2010 cannot be precisely foreseen. However, the low emission levels that have been achieved by advances in gas turbine emission control technologies over the last 10-15 years and the trend toward near-exclusive use of natural gas fuel for power generation suggest that the requirements governing emissions for the SONGS 2 & 3 replacement generation units may not be significantly more stringent than current BACT levels. To the extent that lower emissions can be achieved over the next several years, then actual emissions for the replacement plants will be lower than the estimates presented in this section.

Table 5.3-5 shows the BACT emission levels assumed in this analysis for all replacement plants. For conservatism, it was assumed that by 2010 the new facilities in both Arizona and southern California would likely be required to meet at least the most stringent emissions control requirements for NO<sub>x</sub>, CO, VOC, and ammonia currently in effect in these

areas. For these regulated emissions, the SCAQMD's current BACT requirements for CCGT plants were used. Emission control for these substances does not rely heavily on site-specific factors, and is determined primarily by the type of control equipment selected.

**Table 5.3-5  
Assumed Best Available Control  
Technology Requirements for  
SONGS 2 & 3 Replacement Combined Cycle Power Plants**

State	NO <sub>x</sub> (ppmvd @ 15% O <sub>2</sub> )	CO (ppmvd @ 15% O <sub>2</sub> )	SO <sub>x</sub> (lb/MMBtu)	PM <sub>10</sub> (lb/MMBtu)	VOC (ppmvd @ 15% O <sub>2</sub> )	NH <sub>3</sub> (ppmvd @ 15% O <sub>2</sub> )
Arizona	2.0	3.0	0.0021	0.014	2.0	5.0
California	2.0	3.0	0.0007	0.006	2.0	5.0

The BACT limits used for the presumed southern California replacement plant(s) were based on current requirements for CCGT plants in the SCAQMD. The requirements for NO<sub>x</sub> and CO, shown in Table 5.3-5, were taken from a SCAQMD memorandum published in January 2003, which states their intention to impose the limits. Although these levels have not yet been formally adopted by SCAQMD as BACT, it is reasonable to expect that the requirements in effect at the time new SONGS 2 & 3 replacement plants would be permitted would be at least this stringent. The projected BACT levels for VOC, SO<sub>x</sub>, and particulate matter (PM<sub>10</sub>) reflect the limitations placed on the most recent combined cycle power projects in the SCAQMD. For instance, when a range of values has been specified by SCAQMD for a given substance depending on project-specific circumstances, the most stringent requirement has been assumed for this analysis.

Recent power plant projects in Arizona have been permitted with higher SO<sub>2</sub> and PM<sub>10</sub> emission limits than those allowed for plants in Southern California. Because these limits may reflect a difference in the sulfur contents of natural gas fuels available within the two States and because SO<sub>2</sub> and particulate emissions are generally minor air quality issues for plants fired by natural gas, it was considered prudent to assume higher SO<sub>2</sub> and PM<sub>10</sub> emission rates for the Arizona plants. Specifically, the emission factors presented in the air

quality permit documents for the Gila Bend Power Generation Project served as the basis for estimating these regulated emissions. The Gila Bend project is a CCGT plant with three “F” Class turbines and three HRSGs. The air permit for this facility was issued by the Maricopa County Environmental Services Department on April 30, 2002, and contains detailed information on the emission limits for each turbine-HRSG train with and without duct firing.

Ammonia emissions are included in this analysis, because this chemical is usually used in conjunction with the selective catalytic reduction (SCR) technology that is widely used to meet the stringent modern NOx emission limits. A small fraction of the ammonia injected into the exhaust of each turbine-HRSG train escapes unreacted to the atmosphere (ammonia slip). For this reason, BACT requirements for ammonia are now specified in permits involving CCGT plants equipped with SCR, and the limit most recently specified for new units in the SCAQMD (5 ppm by volume dry basis at 15% O2) was assumed for all plants in this analysis.

The replacement power plants in both Arizona and California were assumed to be equipped with duct firing to provide supplemental capacity during hot weather, when the capacity of the gas turbine generators are negatively affected by high ambient temperatures. Based on information provided by SCE engineers, the required makeup generation by duct firing to maintain operations at a plant’s rated capacity would vary, depending on ambient temperature, from approximately zero to eight percent. Inlet evaporative cooling is provided in virtually all new plants in the Southwest, and was assumed to limit duct firing requirements at the replacement plants to hours of the year when ambient temperatures are 75°F or higher. Examination of available annual meteorological data sets for Gila Bend, Arizona, and Riverside, California, (which are near the areas assumed to be most likely for site future new plants) showed that the number of hours with temperatures of 75°F or above amount to approximately 3,800 hours and 2,200 hours, respectively. Accordingly, duct firing was assumed to generate an average of 4 percent of the replacement plant MWh for the corresponding number of hours in each location. The MWh generated by combined cycle

operation without duct firing were estimated as the total required generation minus the MWh calculated for duct firing. The results are described in Table 5.3-6.

**Table 5.3-6**  
**MWh Generated by**  
**Combined Cycle With and Without Duct Firing**

<b>Duct Firing</b>	Arizona	169,813 MWh
	California	69,498 MWh
<b>No Duct Firing</b>	Arizona	9,504,731 MWh
	California	6,829,878 MWh

Using the assumed BACT requirements described above and the mass emission rates corresponding to these levels for “F” Class turbines, emission factors for each regulated emission (tons of emission per MWh) for both turbines and duct firing were calculated. These factors were then multiplied by the projected annual replacement MWh requirements for the two states to obtain estimated annual emissions. The annual estimates were based on an assumed capacity factor of 88%, which would correspond to the same total MWh that would be lost by a shutdown of SONGS 2 & 3. The results are presented in Table 5.3-7, including emissions from the replacement plants and the net increase above the current SONGS 2 & 3 emissions.

The total emissions shown in Table 5.3-7 correspond to plants using conventional wet cooling systems. Regulatory agencies are increasingly requiring careful consideration of dry and wet-dry cooling during the licensing process for plants in the desert southwest where water resources are limited. It is thus quite possible that dry cooling would be required for some, if not all, new plants by 2010, and plants using such systems would suffer an annual energy penalty of about 3 percent. Additional fuel would need to be expended to replace this loss, which would also result in additional emissions. The adjusted total emissions assuming dry cooling for all replacement plants are shown in the last line of Table 5.3-7.

**Table 5.3-7**  
**Estimated Annual Emissions for**  
**SONGS 2 & 3 Replacement Combined Cycle Power Plants<sup>1</sup>**

State/Area	NO <sub>x</sub> (tons/year)	CO (tons/year)	SO <sub>x</sub> (tons/year)	PM <sub>10</sub> (tons/year)	ROG (tons/year)	NH <sub>3</sub> (tons/year)
Arizona	261.9	244.8	58.0	327.7	37.0	202.2
California	186.2	174.3	41.6	235.4	25.8	144.2
<b>Total Replacement Emissions</b>	<b>448.2</b>	<b>419.0</b>	<b>99.6</b>	<b>563.0</b>	<b>64.8</b>	<b>346.3</b>
SONGS 2 & 3 Emissions	32.6	8.4	0.5	0.9	2.4	0.0
<b>Total Emissions Increase</b>	<b>415.6</b>	<b>410.6</b>	<b>99.1</b>	<b>562.1</b>	<b>62.4</b>	<b>346.3</b>
<b>Total Emissions Increase (assuming all dry cooling)</b>	<b>429.0</b>	<b>423.2</b>	<b>102.1</b>	<b>579.0</b>	<b>64.3</b>	<b>356.7</b>

1. Assumed 2-on-1 combined cycle plants using “F”-Class turbines, with duct firing for hours with ambient temperature at or above 75°F.

Use of fossil-fuel power generation in lieu of SONGS 2 & 3 would also produce additional emissions of carbon dioxide (CO<sub>2</sub>), an unregulated greenhouse gas emission implicated in global climate change. Using the emission factor of 0.476 tons (0.432 metric tons) of CO<sub>2</sub> per MWh of generation for CCGT power plants (American Petroleum Institute Compendium of Greenhouse Gas Emissions Estimation Methodologies for the Oil and Gas Industry), the emissions of this compound that would result by replacing 16.6 million MWh with gas-fired units would amount to approximately eight million tons per year, versus the comparatively negligible quantity produced by the SONGS 2 & 3 equipment. Natural gas combustion also produces emissions of organic compounds, principally benzene, formaldehyde and acetaldehyde, which like ammonia, are included on federal and California lists of hazardous air pollutants.

Additionally, the incremental costs for obtaining air quality permits and, in many cases, emissions offsets for such facilities can add substantially to the capital equipment expenditures and operating costs that would be incurred to replace SONGS 2 & 3 generation. Offsetting of new plant emissions, most likely those of NO<sub>x</sub>, VOC and PM, will be required for

the new plants in California to ensure that the regional air quality impacts of the replacement plants are below a level of significance. Licensing by the California Energy Commission (CEC) will be required for individual replacement plants of 50 MW or greater. The policy of CEC in its role of CEQA lead agency for such projects is to require emissions offsets for any increase in the emissions of a regulated nonattainment substance or precursors, even those for which offsets are not required by the regulation of the local air district. Offsets may or may not be required for the new plants in Arizona, depending on how the required capacity would be distributed among multiple sites and the attainment status of the selected site areas at the time of licensing. Thus, replacement generation associated with the No-Project Alternative is expected to result in significant, but mitigable, air quality impacts.

**Appendix D**  
**Witness Qualifications**

1                                   **SOUTHERN CALIFORNIA EDISON COMPANY**  
2                                   **QUALIFICATIONS AND PREPARED TESTIMONY**  
3                                   **OF STUART R. HEMPHILL**

4    Q.    Please state your name and business address for the record.

5    A.    My name is Stuart R. Hemphill, and my business address is 2244 Walnut  
6            Grove Avenue, Rosemead, California 91770.

7    Q.    Briefly describe your present responsibilities at the Southern California  
8            Edison Company.

9    A.    I am the Director of Resource Planning and Strategy for Southern California  
10           Edison.

11   Q.    Briefly describe your educational and professional background.

12   A.    I received a Bachelor of Science in Electrical Engineering from California  
13           State University, Fullerton, in 1988 and a Master's degree in Business  
14           Administration from Cal Poly, Pomona in 1995.

15                I began working at Southern California Edison Company in 1986 in  
16           the Transmission Planning section of Electric System Planning. I was  
17           responsible for studying Edison's transmission system and making  
18           recommendations on possible system improvements. I also prepared  
19           interconnection studies for Qualifying Facilities (Methods of Service).

20                In 1988, I began working in the Supply Planning section of System  
21           Planning. I was responsible for production cost modeling and project analysis  
22           for Edison's long-term resource plans. I prepared economic and operational  
23           analyses on Edison projects such as the Devers-Palo Verde Transmission  
24           Line No. 2 project and Balsam Meadow Pumped Storage. I performed  
25           modeling support and implemented the Iterative Cost-Effectiveness  
26           Methodology (ICEM) for the Biennial Resource Plan Update. I represented

1 Edison in the ICEM workshops and worked with the CEC staff performing  
2 ICEM analysis for the final recommendations in the 1990 Electricity Report.

3 From 1990 to 1994, I worked in the Resource Strategies section of  
4 System Planning. I performed studies in integrated planning, integrated  
5 bidding, and addressed other resource planning issues. Specifically, I was  
6 responsible for examining and evaluating supply- and demand-side resource  
7 alternatives and the economic and environmental consequences of alternative  
8 choices. I also performed economic and operational studies and helped  
9 develop Edison's long-term resource plan.

10 From 1994-1996, I worked in the Corporate Development department  
11 of SCEcorp. I developed business plans for new businesses and evaluated  
12 large technology investments.

13 From 1996 through September 2000, I worked in Edison  
14 International's Strategic Planning and New Business Development group,  
15 where I helped evaluate business initiatives for Edison International's  
16 companies. These initiatives included new business startups, acquisitions,  
17 performance improvement programs, and alternative operating strategies.

18 From September 2000 through October 2002, I served as Director of  
19 Business Development of SCE, where I evaluated a variety of opportunities  
20 for the company.

21 In November 2002, I became Director of Resource Planning and  
22 Strategy. In this position, I direct the development of long-term resource  
23 plans for Edison. The Resource Planning group evaluates the economics of  
24 resource options and works with Edison's business units to balance trade-offs  
25 between supply- and demand-side resources.

26 Q. What is the purpose of your testimony in this proceeding?

1 A. The purpose of my testimony in this proceeding is to sponsor the portions of  
2 Exhibit SCE-4, entitled *Cost-Effectiveness Study*, as identified in the Table of  
3 Contents thereto.

4 Q. Was this material prepared by you or under your supervision?

5 A. Yes, it was.

6 Q. Insofar as this material is factual in nature, do you believe it to be correct?

7 A. Yes, I do.

8 Q. Insofar as this material is in the nature of opinion or judgment, does it  
9 represent your best judgment?

10 A. Yes, it does.

11 Q. Does this conclude your qualifications and prepared testimony?

12 A. Yes, it does.

1 | Q. Insofar as this material is in the nature of opinion or judgment, does it  
2 | represent your best judgment?

3 | A. Yes, it does.

4 | Q. Does this conclude your qualifications and prepared testimony?

5 | A. Yes, it does.

1                                   **SOUTHERN CALIFORNIA EDISON COMPANY**  
2                                   **QUALIFICATIONS AND PREPARED TESTIMONY**  
3                                   **OF MARK E. NELSON**

4    Q.    Please state your name and business address for the record.

5    A.    My name is Mark E. Nelson, and my business address is 2244 Walnut Grove  
6           Avenue, Rosemead, California 91770.

7    Q.    Briefly describe your present responsibilities at the Southern California  
8           Edison Company.

9    A.    I am the Integrated Resource Planning Manager of the Resource Planning  
10           and Strategy Department. My present responsibility is to apply business,  
11           economic, financial, technical and statistical analysis to long term planning  
12           issues and large projects.

13   Q.    Briefly describe your educational and professional background.

14   A.    I earned a Bachelor of Science degree in Economics from Iowa State  
15           University with emphasis work in Chemical Engineering and Systems. I  
16           earned a Master of Science degree in Econometrics from Iowa State  
17           University with thesis work in electricity demand analysis. I first joined the  
18           Southern California Edison Company as a Planning Engineer in 1991 and  
19           held various management positions through 1996, including Manager of Real  
20           Time Pricing and Customer Software Systems. In 1996, I joined Edison  
21           Source and held a number of management positions including Director of  
22           Retail Energy Operations until my departure in 1999 following the cessation  
23           of energy marketing activities. From 1999-2003, I served as Managing  
24           Consultant of Commerce Venture Group LLC, with primary responsibility for  
25           energy sector consulting and analysis. I rejoined Southern California Edison  
26           in 2003 in my current position.

1 Prior to joining Southern California Edison, I served as a Consultant  
2 for Midwest Solar, Inc., a leading national supplier of large scale solar  
3 thermal systems, with responsibility for economic and engineering analysis  
4 from 1980-83. From 1983-88, I held management and analysis positions with  
5 subsidiaries of MidAmerican Energy, with responsibility for generation and  
6 transmission projects, economic analysis, regulatory affairs and customer  
7 services. From 1988-91, I served as Vice President of Analysis for  
8 DATASSIST, where I was responsible for economic and statistical analysis of  
9 electric and gas utility projects.

10 I am the author of a number of energy and business books and articles,  
11 including: An Econometric Study of Residential Electricity Demand (ISBN 1-  
12 56471-005-X), Fundamentals of Business Process Analysis (1-56471-009-2),  
13 and "Understanding Natural Gas Demand for Electric Utilities."

14 Q. What is the purpose of your testimony in this proceeding?

15 A. The purpose of my testimony is to sponsor the portions of Exhibit SCE-4,  
16 entitled *Cost-Effectiveness Study*, as identified in the Table of Contents  
17 thereto.

18 Q. Was this material prepared by you or under your supervision?

19 A. Yes, it was.

20 Q. Insofar as this material is factual in nature, do you believe it to be correct?

21 A. Yes, I do.

22 Q. Insofar as this material is in the nature of opinion or judgment, does it  
23 represent your best judgment?

24 A. Yes, it does.

25 Q. Does this conclude your qualifications and prepared testimony?

1 | A. Yes, it does.



1            *Controls*, and Exhibit SCE-4, entitled *Cost-Effectiveness Study*, as identified  
2            in the Tables of Contents thereto.

3            Q.    Was this material prepared by you or under your supervision?

4            A.    Yes, it was.

5            Q.    Insofar as this material is factual in nature, do you believe it to be correct?

6            A.    Yes, I do.

7            Q.    Insofar as this material is in the nature of opinion or judgment, does it  
8            represent your best judgment?

9            A.    Yes, it does.

10          Q.    Does this conclude your qualifications and prepared testimony?

11          A.    Yes, it does.

1                                   **SOUTHERN CALIFORNIA EDISON COMPANY**  
2                                   **QUALIFICATIONS AND PREPARED TESTIMONY**  
3                                   **OF WILLIAM M. PETMECKY**

4   Q.   Please state your name and business address for the record.

5   A.   My name is William M. Petmecky, and my business address is 2244 Walnut  
6        Grove Avenue, Rosemead, California 91770.

7   Q.   Briefly describe your past and present responsibilities at the Southern  
8        California Edison Company.

9   A.   I am currently a manager in the Treasurer's Department. Prior to this  
10       assignment, I was a project manager in the Regulatory Policy and Affairs  
11       Department. I was previously a Financial Analyst in the Accounting Systems  
12       group in the Controller's Department and had the responsibility for the  
13       development and administration of the appropriate assignment of Edison's  
14       operations and maintenance expenses to Edison's functional areas of  
15       responsibility.

16   Q.   Briefly describe your educational and professional background.

17   A.   I graduated from Southern Methodist University with Bachelor degrees in  
18       Physics and Economics. I have been employed by Southern California Edison  
19       since 1994. Prior to joining Edison, I was employed by Price Waterhouse in  
20       the Public Utilities Industries Services Group. My responsibilities at Price  
21       Waterhouse included: evaluating utility mergers, acquisitions and  
22       restructurings; developing revenue requirements, cost of service programs,  
23       allocation factors and electric rates; and supporting testimony presented  
24       before the Federal Energy Regulatory Commission (FERC) and various State  
25       commissions.

- 1 Q. What is the purpose of your testimony in this proceeding?
- 2 A. The purpose of my testimony is to sponsor portions Exhibit SCE-4, entitled
- 3 *Cost-Effectiveness Study*, as identified in the Table of Contents thereto.
- 4 Q. Was this material prepared by you or under your supervision?
- 5 A. Yes, it was.
- 6 Q. Insofar as this material is factual in nature, do you believe it to be correct?
- 7 A. Yes, I do.
- 8 Q. Insofar as this material is in the nature of opinion or judgment, does it
- 9 represent your best judgment?
- 10 A. Yes, it does.
- 11 Q. Does this conclude your qualifications and prepared testimony?
- 12 A. Yes, it does.