BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA

Order Instituting Rulemaking to Continue Implementation and Administration of California Renewables Portfolio Standard Program.	)	Rulemaking 11-05-005 (Filed May 5, 2011)

DRAFT TRANSMISSION RANKING COST REPORT OF SAN DIEGO GAS & ELECTRIC COMPANY (U 902 E)

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June 27, 2012

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DRAFT TRANSMISSION RANKING COST REPORT OF SAN DIEGO GAS & ELECTRIC COMPANY (U 902 E)

In accordance with the *Assigned Commissioner's Ruling Identifying Issues and Schedule of Review for 2012 Renewables Portfolio Standard Procurement Plans Pursuant to Public Utilities Code Sections 3.11 et seq. and Requesting Comments on New Proposals*, issued April 5, 2012 in the above-captioned docket, San Diego Gas & Electric Company ("SDG&E") hereby submits its draft 2012 Transmission Ranking Cost Report, attached hereto as Attachment A.

Respectfully submitted this 27th day of June, 2012.

/s/ *Aimee M. Smith*

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ATTACHMENT A

Draft 2012 Transmission Ranking Cost Report

San Diego Gas & Electric Company

2012 Renewables Transmission Ranking Cost Report

DRAFT

June 25, 2012

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1. Executive Summary

In accordance with the *Assigned Commissioner's Ruling Identifying Issues and Schedule of Review for 2012 Renewables Portfolio Standard Procurement Plans Pursuant to Public Utilities Code Sections 3.11 et seq. and Requesting Comments on New Proposals* (the ACR), issued in R.11-05-005 on April 5, 2012, San Diego Gas & Electric Company (SDG&E) provides this draft version of its Transmission Ranking Cost Report (TRCR). (*See*, ACR, Section 6.8). The TRCR is intended to provide estimated cost information regarding transmission upgrades needed for RPS solicitations, based on conceptual studies of proposed renewable additions modeled according to the CPUC methodology. The methodology for identifying and estimating these conceptual transmission costs is established in D.04-06-013 and D.05-07-040.

In April 2012, SDG&E issued a solicitation for information ("Solicitation") requesting that potential developers of renewable energy projects provide information regarding the projects that they would like SDG&E to consider for delivery into and out of the SDG&E service territory. The rankings included herein relate to those projects that were submitted in response to the Solicitation and met pre-defined criteria including (i) the project intends to bid into the 2012 Renewable Portfolio Standard (RPS) procurement solicitation; and (ii) the project will be interconnected within the next 5 years.

In response to the Solicitation, respondents submitted 31 projects for consideration. All renewable energy projects that met pre-defined parameters were included in SDG&E's analysis. Gas-fired plants were not included in this analysis. (Note: excluding respondents from this study does not prevent them from participating in the RPS process or seeking interconnection to the California Independent System Operator [CAISO] grid). The 31 projects were organized into four geographic clusters, as summarized in Figure 1.

The interconnection point for each cluster is designated according to the individual respondent information and the CPUC study methodology. External resources are modeled as interconnected and delivered to the first point of SDG&E's service territory based on geographical location within the CAISO controlled grid. Internal resources are modeled at the first Point of Interconnection to the CAISO controlled grid within the SDG&E transmission system. The study assumed that energy from the renewable resource locations identified by each cluster would be delivered at, but not necessarily connected to, the following:

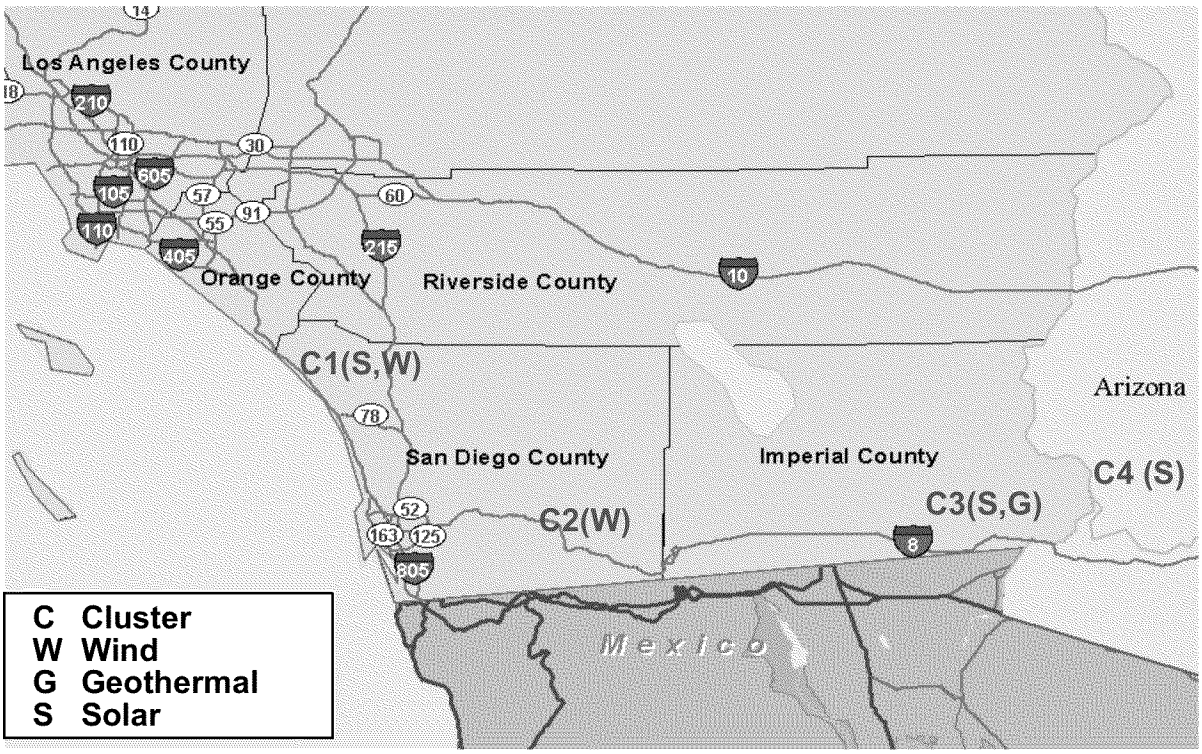
- **Cluster 1 (External)**: North of San Onofre Nuclear Generating Area
  - San Onofre Nuclear Generating Station (SONGS) Substation 230kV bus for generation located north of SONGS
- **Cluster 2 (Internal)**: East County (ECO) Area
- **Cluster 3**: Imperial Valley Area
  - **(Internal)**: Imperial Valley Substation 230kV bus
  - **(External)**:
    - Imperial Irrigation District (IID), and
    - Mexicali
- **Cluster 4 (Internal)**: North Gila Area
  - Hoodoo Wash 500kV, and
  - New Switchyard between Hassyampa and Hoodoo Wash 500kV

The map below illustrates the approximate location of the renewable resources. The cluster points (**C**) indicate the approximate points of delivery.

Table 1 - Transmission Cost Ranking Summary

Cluster	Internal/External	Interconnection Point	Total MW
C1	External	SONGS 230kV	1143 MW
C2	Internal	ECO 230kV	1120 MW
C3	Internal	IV 230kV	886 MW
	External		827 MW
C4	Internal	Hoodoo Wash 500kV	290 MW
		New HAA-HDWSH Switchyard 500kV	700 MW
Total			**4966 MW**

Figure 1 - Overview of Potential Renewable Projects



Screening level studies were performed to determine the need for transmission system improvements (within the SDG&E system) to facilitate the interconnection and dispatch of the prospective projects. This screening level evaluation would not cover the developer owned and operated transmission facilities necessary to connect any single generator to the first Point of Interconnection with the SDG&E-owned, CAISO-controlled grid (*e.g.* generation tie lines and associated equipment owned by the project developer). Furthermore, information developed from such an evaluation will be based on off-the shelf data and generic information.

Moreover, this general conceptual assessment is made without the benefit of: (a) knowing the outcome of the renewable procurement process, (b) generation project-specific data, (c) performing investigations of detailed power flow, stability, and short circuit studies or any of the other detailed analyses typical of formal interconnection studies, and (d) environmental studies or detailed engineering evaluation and design that would produce more detailed construction cost estimates. SDG&E's screening evaluation, therefore, will identify a possible transmission concept, but the evaluation results are subject to change following the more detailed technical studies that typically are performed as part of the CAISO generation interconnection study process with detailed knowledge of the characteristics, location, and timing of proposed generation facilities. The studies do not evaluate specific routes for new transmission lines, locations of new substations, or the environmental impacts of these projects.

These studies are conceptual. Identifying a more realistic list of required upgrades and cost estimates for integration of such a large amount of renewable generation would require very detailed studies with operational considerations taken into account.

The transmission upgrades and their associated cost estimates are based on a 2017 power flow analysis for this study. The base case used includes SDG&E's CAISO approved expansion projects including the Sunrise Powerlink. Also included are the proposed East County (ECO) 500/230/138kV Substation between Imperial Valley and Miguel substations, and looping the existing 500kV Southwest Power Link (SWPL) into ECO. With the Sunrise Powerlink in-service, the IV SPS with its current modules/logic is no longer needed until more generation connects to the IV and ECO Substations. If the need is identified, a new SPS will be implemented to trip generation at Imperial Valley and ECO when necessary.[1]

All planned generation in SDG&E's territory that have power purchase agreements on or before May 2012 were modeled with their associated upgrades, but not necessarily dispatched in the cases. These generation projects, totaling 1,182.4 MW, include the following:

- 764 MW at Imperial Valley 230kV
- 150 MW at ECO 230kV
- 1.5 MW at Carlton Hills 138kV
- 12.2 MW at Capistrano 138kV
- 4.5 MW at Chicarita 138kV
- 0.3 MW at Shadowridge 138kV
- 45 MW at Boulevard 138kV
- 10.9 MW at Otay 69kV
- 1.5 MW at Lilac 69kV
- 1.5 MW at Descanso 69kV
- 50 MW at Kumeyaay 69kV
- 1.5 MW at Ash 69kV
- 105 MW at Boulevard 69kV
- 2 MW at Rancho Santa Fe 69kV
- 1.5 MW at San Marcos 69kV
- 31 MW at Borrego 69kV

[1] All new SPSs and modifications to existing SPSs are subject to review by Affected System Operators, members of the Imperial Valley RAS Technical Committee, and review and approval by WECC RASRS.

This screening level study identifies upgrades for overloads during normal operation, and following outages of any single element (an "N-1 contingency"). This study does not evaluate transmission system improvements required to deliver the output (of the renewable resources) to the SDG&E system from the areas external to SDG&E service territory. There is no accounting of impacts on transmission systems other than SDG&E's.

The results of the transmission cost ranking study are summarized in Table 2. The conceptual costs are in millions of dollars, and estimates reflect the estimated capital investment needed to upgrade the transmission system to accommodate delivery of the output from the proposed renewable resources.

Table 2 also contains an estimate of carrying costs reflecting the CAISO transmission customer's Levelized Annual Capital Cost (LACC). The LACC is a uniform nominal-dollar cost stream whose present value is equal to that of the annual revenue requirements associated with the asset or assets. The LACC includes Book Depreciation, Return on Capital, Income Taxes, Property Taxes, and Salvage Effects associated with FERC-jurisdiction transmission accounts.

The levels within each cluster in the table are defined later in this report (Study Assumptions Case Parameters) and are consistent with the renewable applicants' responses.

This report does not attempt to quantify power plant production costs, impacts on economics, or congestion management costs. The cost estimates in Table 2 are only to evaluate and compare the RPS bids against each other and do not reflect the actual interconnection cost of connecting a renewable resource to the grid.

Integration of renewable resource issues including known problems such as voltage control, instability, operating intermittency, and spinning reserve requirements must be considered when the interconnection studies are performed.

Table 2 - Transmission Cost Ranking Summary[2]

Cluster	Level		MW	Network Upgrades	Cost[3] (Millions)	Carrying Charge[4] (Millions)
C1 SONGS Area	1		0-1143	No Upgrades	0.0	0.0
C2 ECO Area	0[5]	A	PTO IF	(Internal generation only) ECO 230kV Bay position for 1st gen-tie	2.726	3.089
		B		(Internal generation only) ECO 230kV Bay position for 2nd gen-tie	2.726	3.089
		C		(Internal generation only) ECO 230kV Bay position for 3rd gen-tie	2.726	3.089
	1		0-760	No Upgrades	0.0	0.0
	2		760-1000	2nd 500/230kV Transformer at ECO Substation	61.345	69.51
	3		>1000	Upgrade is not feasible	*Note 6*	*Note 6*
C3 Imperial Valley Area	0[5]	A	PTO IF	(Internal generation only) Imperial Valley 230kV Bay position for 1st gen-tie	11.070	12.543
		B		(Internal generation only) Imperial Valley 230kV Bay position for 2nd gen-tie	5.438	6.162
		C		(Internal generation only) Imperial Valley 230kV Bay position for 3rd gen-tie	5.438	6.162
		D		(Internal generation only) Imperial Valley 230kV Bay position for 4th gen-tie	2.726	3.089
		E		(Internal generation only) Imperial Valley 230kV Bay position for 5th gen-tie	2.726	3.089
		F		(Internal generation only) Imperial Valley 230kV Bay position for 6th gen-tie	*Note 7*	*Note 7*
		G		(Internal generation only) Imperial Valley 230kV Bay position for 7th gen-tie	*Note 7*	*Note 7*
	1		0-900	No Upgrades	0.0	0.0
	2		900-1200	New Sycamore – Pomerado 69kV Line	10.285	11.654
	3		1200-1300	New Sycamore – Miramar 69kV Line	27.706	31.393
	4		>1300	Upgrade is not feasible	*Note 6*	*Note 6*
C4	0[5]	A	PTO IF	(Internal generation only) Hoodoo Wash 500kV Bay position for 1st gen-tie	5.209	5.902

[2] With the Sunrise Powerlink in-service, the IV SPS with its current modules/logic is no longer needed until more generation connects to the IV and ECO Substations. If the need is identified, a new SPS will be implemented to trip generation at Imperial Valley and ECO when necessary.
[3] All costs are based on conceptual estimates in year-of-expenditure dollars without Allowance for Funds Used During Construction (AFUDC). Costs for taxes, landscaping, walls, gates, driveways, and CAISO metering are not included. Also excludes costs for land, licensing, environmental mitigation, environmental monitoring, or habitat management.
[4] Carrying Charge assumed 13.31% estimated LACC.
[5] PTO's Interconnection Facilities are necessary for each developer requesting to connect directly to an SDG&E facility and the costs for each subsequent position are indicated in Level 0 for each cluster.
[6] Beyond this generation injection level, the next transmission upgrade is not feasible.
[7] Based on the TRCR study assumptions, only five bay positions are available at the existing Imperial Valley 230kV bus.

North Gila Area		B		(Internal generation only) New 500kV Switchyard between Hassyampa - Hoodoowash	101.411	114.909
	1		0-990	No Upgrades	0.0	0.0

The results of the transmission cost ranking study are summarized in Table 2. The conceptual costs are in millions of dollars, and estimates reflect the estimated capital investment needed to upgrade the transmission system to accommodate full dispatch of the output from the proposed renewable resources. With the Sunrise Powerlink in-service, the IV SPS with its current modules/logic is no longer needed until more generation connects to the IV and ECO Substations. If the need is identified, a new SPS will be implemented to trip generation at Imperial Valley and ECO when necessary.[8]

The study is performed by dispatching generation in the vicinity of the cluster under study. Clusters show stand-alone costs based on studies with the proposed generation within its respective cluster. Clusters 2 and 3 directly impact one another because the point of injection to the grid is electrically close to one another. This is discussed in further detail in each cluster description below. Depending on the sequencing of generator additions at Clusters 2 and 3, the upgrade will be attributed to generators at one cluster or the other, but not at both.

The cost estimates in this report are conceptual and do not establish the ultimate cost of connecting a renewable resource to the grid. As previously stated, the reported cost estimates will be used solely for comparison (to evaluate bids against each other) and are not representative of actual transmission upgrade costs. The estimates in this report were not calculated for any purpose than comparison. Additionally, the implied in-service dates for the transmission upgrades may not be achievable. Completion of identified transmission upgrades is dependent on many factors including permitting requirements and realistic construction schedules. However, potential RPS bidders should use the information regarding transmission upgrades in developing bid responses to SDG&E's RPS procurement solicitations.

Renewable projects desiring more detailed transmission upgrades and associated cost information may participate in the CAISO interconnection process which will result in performing the appropriate detailed interconnection studies.

[8] All new SPSs and modifications to existing SPSs are subject to review by Affected System Operators, members of the Imperial Valley RAS Technical Committee, and review and approval by WECC RASRS.

2. Introduction

This screening level study examines the impacts on the SDG&E transmission network from integration of the potential renewable generation identified through SDG&E's April, 2012 Solicitation. These studies are cursory in nature and are intended only to identify the coarse effects of adding new renewable generation. The RPS program considers indirect costs associated with needed transmission investments and will rank, order, and select the least-cost and best-fit renewable resources.

Set forth below is an analysis of RPS-eligible renewable generation resources. SDG&E continues to use the Methodology for Development and Consideration of Transmission Costs in Initial Renewable Portfolio Standard Procurement (Interim Methodology) adopted in D.04-06-013. (*See*, D.04-06-013, *mimeo*, Attachment A). SDG&E's TRCR reflects data regarding potential renewable energy provided by the bidders in response to SDG&E's Solicitation.

Study Objective:

The objectives of this study are to:

(1) Investigate the impacts of injecting energy from renewable resources into the SDG&E system at various locations per the Solicitation responses.

(2) Identify potential transmission upgrades/expansion necessary to integrate the resources into the SDG&E system.

(3) Provide conceptual cost estimates associated with the transmission upgrades/expansion.

(4) Address and discuss other issues associated with the construction of new facilities that may ultimately impact the transmission plan of service and cost.

The study focuses on identifying the magnitude of potential transmission upgrades and costs as appropriate, and identifying critical issues that might affect the development of those facilities. The scope and cost estimates of potential new transmission facilities or upgrades can only be as detailed as the resource development information that has been collected in the timeframe allowed, and will be further dependent upon the order and timing of actual interconnections sought by developers of renewable energy projects.

The study delineates a set of system upgrades and limits related to renewable resource development with various in-service dates, based on the geographic location and magnitude of the resource provided by renewable developers through SDG&E's Solicitation.

2.1. Applicability of Study:

These screening level evaluations do not constitute Interconnection Studies under the CAISO Tariff[9] on file with the Federal Energy Regulatory Commission (FERC), as modified or superseded from time to time. Any developer seeking interconnection to the CAISO controlled grid will have to submit an Interconnection Request to the CAISO. This requirement includes any developer whose RPS bid is accepted, based on the transmission cost estimates developed through this process that later seeks interconnection, or seeks to increase its generating capacity to make its RPS deliveries. Interconnection Studies required by the CAISO Tariff must be conducted based on the then-existing CAISO Controlled Grid Generation interconnection process. The final interconnection facilities, costs, and construction schedule for any developer resulting from an Interconnection Request to the CAISO may differ significantly from the transmission facilities, cost estimates, and implied construction schedule developed through the Solicitation. Therefore, the conceptual cost estimates developed in this TRCR should not be relied upon to establish the actual cost of interconnection to the grid.

[9] For historical information regarding the GIP tariff, please refer to the following: http://sdge.com/customer-choice/electricity/generation-interconnection-tariff-history, On January 31, 2012, as requested by the CAISO, the Commission approved GIP-2 tariff amendment to the revised GIP procedures. The Generation Interconnection & Deliverability Allocation Procedures (GIDAP) which will cover GIP delivery upgrade costs for projects aligned with TPP resource portfolios, was filed by the CAISO at FERC on May 25, 2012, and the initial ruling is expected by July 25, 2012.

3. Study Assumptions

3.1. Case Parameters:

This study assumes that each renewable resource connected in response to SDG&E's renewable solicitation would operate in accordance with existing and anticipated Western Electricity Coordinating Council/ North American Electric Reliability Council (WECC/NERC) path ratings, internal system operating limitations, and existing and anticipated SDG&E import capabilities and operating procedures.

The assessment covers transmission Network Upgrades designed to deliver energy from the first Point of Interconnection of the renewable resources to the SDG&E transmission system. Interconnection Facilities[10] or gen-ties are not included, but where deemed necessary, facility costs are estimated to integrate the renewable project(s) with the presumed Point of Interconnection. Transmission cost estimates are based on proxy facilities that could mitigate the identified potential overloads due to the addition of renewable resources, for normal operation and single contingency conditions. The studies do not include the impact on voltage profiles or any cost associated with voltage control and reactive power planning. The power flow analysis utilized the then-current WECC approved GE PSLF load-flow program, Version 18.

A PSLF power flow case was used to study the proposed generation projects. This case modeled a heavy summer load, high imports, and all planned generation with power purchase agreements to create a stressed scenario for generation interconnected at or near the tie lines between SDG&E and neighboring utilities at the SONGS (Cluster 1), ECO (Cluster 2), Imperial Valley (Cluster 3), North Gila (Cluster 4). The case is described in more detail below:

[10] For Interconnection Facilities and Network Upgrades definitions and categorization refer to the CAISO Generation Interconnection Procedures.

- Cluster 1 (SONGS), Cluster 2 (ECO), and Cluster 3 (Imperial Valley), and Cluster 4 (North Gila)
    - A 2017 heavy summer grid planning power flow case from the 2012 Grid Assessment and Expansion Study was used. A one-in-ten year load forecast was used for SDG&E's service territory. The SDG&E import level is approximately 4,000 MW in the 2017 heavy summer cases.
        - The base case used includes SDG&E's CAISO approved expansion projects and also the approved ECO 500/230/138kV Substation between Imperial Valley and Miguel substations, and looping the existing 500kV SWPL into ECO.
        - All SDG&E transmission projects and generation approved in the CAISO 2011 Grid Assessment study for SDG&E were modeled, but not necessarily dispatched in the cases.
        - All planned generation in SDG&E's territory (and their associated transmission upgrades) that have power purchase agreements were modeled, but not necessarily dispatched in the cases. These projects, totaling 1182.4 MW, include the following:
            - 764 MW at Imperial Valley 230kV
            - 150 MW at ECO 230kV
            - 1.5 MW at Carlton Hills 138kV
            - 12.2 MW at Capistrano 138kV
            - 4.5 MW at Chicarita 138kV
            - 0.3 MW at Shadowridge 138kV
            - 45 MW at Boulevard 138kV
            - 10.9 MW at Otay 69kV
            - 1.5 MW at Lilac 69kV
            - 1.5 MW at Descanso 69kV
            - 50 MW at Kumeyaay 69kV
            - 1.5 MW at Ash 69kV
            - 105 MW at Boulevard 69kV
            - 2 MW at Rancho Santa Fe 69kV
            - 1.5 MW at San Marcos 69kV
            - 31 MW at Borrego 69kV

3.2. Planning Horizon

Responses to SDG&E's Solicitation varied in type of resource capacity, type of renewable resources, and location. All generation projects had an in-service date at or prior to 2017 and no major transmission projects are planned beyond 2017, so this base case was used to represent the system for the study.

4. Cluster Development

In response to the Solicitation, respondents submitted 31 projects for consideration. All renewable energy projects that met pre-defined parameters were included in SDG&E's analysis. Gas-fired plants were not included in this analysis. (Note: excluding respondents from this study does not prevent them from participating in the RPS process or seeking interconnection to the CAISO grid).

SDG&E's TRCR includes conceptual transmission cost estimates for the following types of potential renewable energy bidders, which are assumed to be dispatched as if delivered into the SDG&E service territory. This approach allows for the determination of SDG&E system upgrades and is not intended to determine or constrict the business plan of various respondents.

- **SDG&E Internal** Renewable energy resources for which the first Point of Interconnection with the transmission grid is, or will be, at a facility inside SDG&E service area and whose output is expected to be sold to SDG&E.
- **SDG&E Export** Renewable energy resources for which the first Point of Interconnection with the transmission grid is, or will be, at a facility owned by SDG&E and whose output is expected to be sold to a different entity.
- **SDG&E External** Renewable energy resources located outside of the SDG&E service area, for which the project developer has indicated that it anticipates submitting an RPS bid to SDG&E.

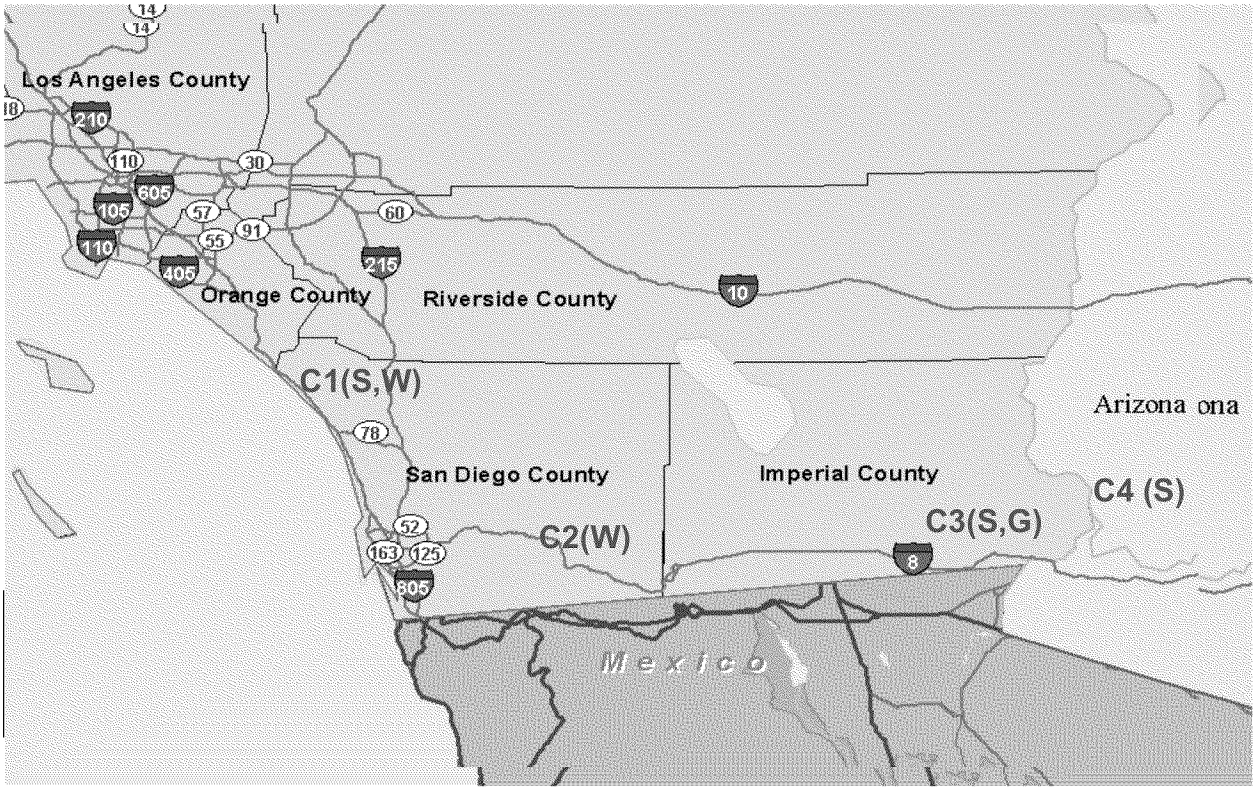
All respondents in this 2012 study are in SDG&E's Internal or External categories. No respondents are in the SDG&E Export category.

SDG&E divided 31 renewable energy bidders into four cluster categories based on locations both geographically as shown in Figure 2 and electrically as summarized in Table 3, to which the identified renewable resources would most likely interconnect. If the renewable resource's first Point of Interconnection is at a substation or bus not owned by SDG&E, that renewable resource will be treated as part or all of a cluster, injecting energy at the first point where such added generation would reach SDG&E's transmission system. Table 3 shows the details of the clusters and Figure 2 illustrates the approximate location of the renewable resources.

Table 3 - Renewable Energy Cluster Details

Cluster	Internal/External	Interconnection Point	Total MW
C1	External	SONGS 230kV	1143 MW
C2	Internal	ECO 230kV	1120 MW
C3	Internal	IV 230kV	886 MW
	External		827 MW
C4	Internal	Hoodoo Wash 500kV	290 MW
		New HAA-HDWSH Switchyard 500kV	700 MW
Total			**4966 MW**

Figure 2 – Geographic Overview of Potential Renewable Projects



Three types of renewable energy generation responded to the Solicitation:

- Geothermal
- Solar
- Wind

Table 4 summarizes the capacity and type of renewable energy proposals considered in the Transmission Ranking Cost Report.

Table 4 - SDG&E Renewable Energy Capacity (MW)
Considered in the TRCR

Renewable Resource	Total MW
Geothermal	812
Solar	2983
Wind	1171
TOTAL	**4966**

Note that the CAISO-queued generation is not included in the renewable resources considered in the TRCR unless the planned generation has a power purchase agreement with SDG&E and an in-service date on or before 2017 as described in the Study Assumptions Section.

The transmission upgrade capacities and estimated transmission costs were divided into the following levels:

- **Level 0** – The PTO's interconnection facilities required for generators to interconnect to SDGE's transmission network. These do not include developer owned and operated facilities such as the gen-tie and associated equipment.
- **Level 1** – The available transmission capacity, taking into account all upgrades planned for generation projects in the CAISO interconnection queue with completed System Impact Studies and Facility Studies, which were included in the base case in the utility's conceptual transmission studies. The upgrades included a third 500/230kV transformer bank at Imperial Valley, and the proposed East County 500/230/138kV Substation between Imperial Valley and Miguel substations. If the generation projects are not developed, the associated upgrades will not materialize.
- **Levels 2-4** – The transmission capacity available with the lowest cost (or most cost-effective) network upgrades, in addition to upgrades included in Level 1. An additional level will be created for the next-most cost-effective network upgrade.

5. Results

5.1. Summary of Results:

SDG&E conducted thermal steady state power flow studies limited to single contingency analysis to address each cluster, as described above, to determine transmission upgrades required for each level of capacity listed in Table 5.

This screening level study identifies upgrades for overloads during normal system operation and following the outage of any single element. This study does not evaluate transmission system improvements needed to deliver the output (of the renewable resources) to the SDG&E system from the areas external to the SDG&E service territory. There is no accounting of impacts on transmission systems other than SDG&E's.

The results of the transmission cost ranking study are summarized in Table 5. Interconnection Facilities costs are not included in the cost estimates in this study. The study assumes that these costs are to be paid by the generation developer. The conceptual costs are in millions of dollars, and are estimated to reflect the capital investment needed for upgrading the transmission system to accommodate integration of the proposed renewable resources. Costs in Table 5 do not include projects from the higher queued generation modeled in the case as described in the Study Assumptions Section. The cost estimates in Table 5 are to evaluate RPS bids against each other and do not reflect the actual interconnection cost of connecting a renewable resource to the grid.

Finally, Table 5 also contains an estimate of carrying costs reflecting the CAISO transmission customer's LACC. The LACC is a uniform nominal-dollar cost stream whose present value is equal to that of the annual revenue requirements associated with the asset or assets. The LACC includes Book Depreciation, Return on Capital, Income Taxes, Property Taxes, and Salvage Effects associated with FERC-jurisdiction transmission accounts. The levels within each cluster in the table are defined in the preceding sections of this report (Study Assumptions Case Parameters) and are consistent with the renewable applicants' responses.

Table 5 - Transmission Cost Ranking Summary[11]

Cluster	Level		MW	Network Upgrades	Cost[12] (Millions)	Carrying Charge[13] (Millions)
C1 SONGS Area	1		0-1143	No Upgrades	0.0	0.0
C2 ECO Area	0[14]	A	PTO IF	(Internal generation only) ECO 230kV Bay position for 1st gen-tie	2.726	3.089
		B		(Internal generation only) ECO 230kV Bay position for 2nd gen-tie	2.726	3.089
		C		(Internal generation only) ECO 230kV Bay position for 3rd gen-tie	2.726	3.089
	1		0-760	No Upgrades	0.0	0.0
	2		760-1000	2nd 500/230kV Transformer at ECO Substation	61.345	69.51
	3		>1000	Upgrade is not feasible	*Note 19*	*Note 19*
C3 Imperial Valley Area	0[5]	A	PTO IF	(Internal generation only) Imperial Valley 230kV Bay position for 1st gen-tie	11.070	12.543
		B		(Internal generation only) Imperial Valley 230kV Bay position for 2nd gen-tie	5.438	6.162
		C		(Internal generation only) Imperial Valley 230kV Bay position for 3rd gen-tie	5.438	6.162
		D		(Internal generation only) Imperial Valley 230kV Bay position for 4th gen-tie	2.726	3.089
		E		(Internal generation only) Imperial Valley 230kV Bay position for 5th gen-tie	2.726	3.089
		F		(Internal generation only) Imperial Valley 230kV Bay position for 6th gen-tie	*Note 20*	*Note 20*
		G		(Internal generation only) Imperial Valley 230kV Bay position for 7th gen-tie	*Note 20*	*Note 20*
	1		0-900	No Upgrades	0.0	0.0
	2		900-1200	New Sycamore – Pomerado 69kV Line	10.285	11.654
	3		1200-1300	New Sycamore – Miramar 69kV Line	27.706	31.393
	4		>1300	Upgrade is not feasible	*Note 19*	*Note 19*
C4	0[5]	A	PTO IF	(Internal generation only) Hoodoo Wash 500kV Bay position for 1st gen-tie	5.209	5.902

[11] With the Sunrise Powerlink in-service, the IV SPS with its current modules/logic is no longer needed until more generation connects to the IV and ECO Substations. If the need is identified, a new SPS will be implemented to trip generation at Imperial Valley and ECO when necessary.
[12] All costs are based on conceptual estimates in year-of-expenditure dollars without Allowance for Funds Used During Construction (AFUDC). Costs for taxes, landscaping, walls, gates, driveways, and CAISO metering are not included. Also excludes costs for land, licensing, environmental mitigation, environmental monitoring, or habitat management.
[13] Carrying Charge assumed 13.31% estimated LACC.
[14] PTO's Interconnection Facilities are necessary for each developer requesting to connect directly to an SDG&E facility and the costs for each subsequent position are indicated in Level 0 for each cluster.
[15] Beyond this generation injection level, the next transmission upgrade is not feasible.
[16] Based on the TRCR study assumptions, only five bay positions are available at the existing Imperial Valley 230kV bus.

North Gila Area		B		(Internal generation only) New 500kV Switchyard between Hassyampa - Hoodoowash	101.411	114.909
	1		0-990	No Upgrades	0.0	0.0

The results of the transmission cost ranking study are summarized in Table 5. The conceptual costs are in millions of dollars, and estimates reflect the estimated capital investment needed to upgrade the transmission system to accommodate delivery of the output from the proposed renewable resources. With the Sunrise Powerlink in-service, the IV SPS with its current modules/logic is no longer needed until more generation connects to the IV and ECO Substations. If the need is identified, a new SPS will be implemented to trip generation at Imperial Valley and ECO when necessary.[17]

Clusters show stand-alone costs based on studies with proposed generation within its respective cluster. Clusters 2 and 3 have two common upgrades. Depending on the sequencing of generator additions at Clusters 2 and 3, these upgrades will be attributed to generators at one cluster or the other, or a combination of both.

Combing Cluster 2 (ECO Area) and Cluster 3 (Imperial Valley Area) simultaneously have similar impacts to the transmission system, but vary slightly based on electrical distance to system stress points. Generation at ECO will stress the Sycamore - Pomerado transmission before generation at Imperial Valley. On the other hand, Generation at Imperial Valley will trigger upgrades in the Sycamore region before generation at ECO.

The cost estimates in this report are conceptual and do not establish the ultimate cost of connecting a renewable resource to the grid. The reported cost estimates will be used solely to evaluate bids against each other and may not be representative of actual transmission upgrade costs. The estimates in this report were not calculated for any purpose other than comparison of bids. Additionally, the implied in-service dates for the transmission upgrades may not be achievable. Completion of identified transmission upgrades is dependent on many factors, including permitting requirements and realistic construction schedules. Potential RPS bidders should use the information regarding transmission upgrades in developing bid responses to SDG&E's RPS procurement solicitations.

Renewable projects desiring more detailed transmission upgrade and associated cost information may participate in the CAISO generation interconnection process which will result in appropriate interconnection studies being performed.

[17] All new SPSs and modifications to existing SPSs are subject to review by Affected System Operators, members of the Imperial Valley RAS Technical Committee, and review and approval by WECC RASRS.

5.2 Cluster 1 - North of San Onofre Nuclear Generating Area

Total Cluster Size: 1143MW

Cluster 1 represents 7 projects in the North of SONGS Area including six solar (1092 MW) and one wind (51 MW) generation projects totaling 1143 MW. All seven projects are external to SDG&E. Six Cluster 1 projects are proposed to be in service by 2015 and one project by 2016.

Plan of Interconnection

Cluster 1 generation was modeled as external generation interconnected at the San Onofre 230kV Substation, jointly owned by SDG&E and Southern California Edison Company (SCE). This substation is the first point of interconnection to SDG&E's transmission system. It was assumed that this generation would not displace existing generation within SDG&E's transmission system and SDG&E's import level would not be changed. However, import flows would shift with higher import coming from SCE and PG&E and less import from the east flowing to SDG&E.

Table 6 - Generation by Location for Cluster 1

Location	Internal/ External	Modeled Point of Interconnection	MW	Breaker Bay Position for Gen-Tie
SCE	External	SONGS 230kV bus	300	To be provided by SCE
SCE	External	SONGS 230kV bus	300	To be provided by SCE
SCE	External	SONGS 230kV bus	92	To be provided by SCE
SCE	External	SONGS 230kV bus	125	To be provided by SCE
SCE	External	SONGS 230kV bus	75	To be provided by SCE
SCE	External	SONGS 230kV bus	200	To be provided by SCE
PG&E	External	SONGS 230kV bus	51	To be provided by PG&E

Power Flow Results

Generation from Cluster 1 flows both north to SCE and south to SDG&E. Based on the responses from the TRCR inquiries, no upgrades were required for the full dispatch of generation in this cluster.

Table 7 - Transmission Cost Ranking Summary for Cluster 1

Cluster	Level	MW	Network Upgrades	Cost[18] (Millions)	Carrying Charge[19] (Millions)

[18] All costs are based on conceptual estimates in year-of-expenditure dollars without Allowance for Funds Used During Construction (AFUDC). Costs for taxes, landscaping, walls, gates, driveways, and CAISO metering are not included. Also excludes costs for land, licensing, environmental mitigation, environmental monitoring, or habitat management.

[19] Carrying Charge assumed 13.31% estimated LACC.

C1 SONGS Area	1	0-1143	No Upgrades	0.0	0.0

The results of the transmission cost ranking study are summarized in Table 7. The conceptual costs are in millions of dollars, and estimates reflect the estimated capital investment needed to upgrade the transmission system to accommodate delivery of the output from the proposed renewable resources.

Limitations

No limitations exist for the level of generation dispatched in this cluster.

5.3 Cluster 2 – ECO Area

Total Cluster Size: 1120MW

Cluster 2 represents 3 projects in the ECO Area including three wind generation projects totaling 1120 MW. The three wind projects are internal to SDG&E. All projects are proposed to be in service by 2015.

Plan of Interconnection

Each of the projects interconnecting at the ECO 230kV bus require a bay position to accommodate the project's gen-tie. Table 9, Level 0, shows the costs of these upgrades.

It was assumed that the Cluster 2 generation would not displace existing generation within SDG&E's transmission system and SDG&E's import level would not be changed. However import flows would shift with less import south from SCE and higher import from the east to SDG&E.

Table 8 - Generation by Location for Cluster 2

Location	Internal/ External	Modeled Point of Interconnection	MW	Breaker Bay Position for Gen-Tie
SDG&E	Internal	ECO 230kV	400	To be provided by SDG&E
SDG&E	Internal	ECO 230kV	300	To be provided by SDG&E
SDG&E	Internal	ECO 230kV	420	To be provided by SDG&E

Power Flow Results

The addition of 760 MW at the ECO 230kV caused no reliability violations for the single contingency analysis and required no upgrades beyond the new ECO 230kV bus. Level Two generation output between 760 - 1000 MW caused one facility overload requiring an upgrade.

At Level Three, generation output is limited due to the infeasibility of building out the Miguel - Bay Boulevard 230kV transmission line beyond its proposed plan of service. This is dependent on the ultimate design and scope of the Bay Boulevard project and the final rating is dependent on the final approved construction design.

Table 9 - Transmission Cost Ranking Summary for Cluster 2

Cluster	Level		MW	Network Upgrades	Cost[20] (Millions)	Carrying Charge[21] (Millions)
C2 ECO Area	0[22]	A	PTO IF	(Internal generation only) ECO 230kV Bay position for 1st gen-tie	2.726	3.089
		B		(Internal generation only) ECO 230kV Bay position for 2nd gen-tie	2.726	3.089
		C		(Internal generation only) ECO 230kV Bay position for 3rd gen-tie	2.726	3.089
	1		0-760	No Upgrades	0.0	0.0
	2		760-1000	2nd 500/230kV Transformer at ECO Substation	61.345	69.51
	3		>1000	Upgrade is not feasible	*Note 27*	*Note 27*

The results of the transmission cost ranking study are summarized in Table 9. The conceptual costs are in millions of dollars, and estimates reflect the estimated capital investment needed to upgrade the transmission system to accommodate delivery of the output from the proposed renewable resources. With the Sunrise Powerlink in-service, the IV SPS with its current modules/logic is no longer needed until more generation connects to the IV and ECO Substations. If the need is identified, a new SPS will be implemented to trip generation at Imperial Valley and ECO when necessary.[24]

Limitations

The ECO Area cluster increases reactive losses and degrades voltages in the SDG&E area. Transferring large amounts of generation across a long transmission line, from Imperial Valley 500kV to Miguel 500kV, causes the voltage at Miguel to drop. Detailed power flow and stability studies in the CAISO process may show the need for additional reactive support for any amount of new generation connected to the Imperial Valley area. Detailed transient and post transient studies may indicate potential voltage violations which would also limit Cluster 3 generation.

Combining Cluster 2 (ECO Area) and Cluster 3 (Imperial Valley Area) simultaneously have similar impacts to the transmission system, but vary slightly based on electrical distance to system stress points. Generation at ECO will stress the Sycamore - Pomerado transmission before generation at Imperial Valley. On the other hand, Generation at Imperial Valley will trigger upgrades in the Sycamore region before generation at ECO.

[20] All costs are based on conceptual estimates in year-of-expenditure dollars without Allowance for Funds Used During Construction (AFUDC). Costs for taxes, landscaping, walls, gates, driveways, and CAISO metering are not included. Also excludes costs for land, licensing, environmental mitigation, environmental monitoring or habitat management.
[21] Carrying Charge assumed 13.31% estimated LACC.
[22] PTO's Interconnection Facilities are necessary for each developer requesting to connect directly to an SDG&E facility and the costs for each subsequent position are indicated in Level 0 for each cluster.
[23] Beyond this generation injection level, the next transmission upgrade is not feasible.
[24] All new SPSs and modifications to existing SPSs are subject to review by Affected System Operators, members of the Imperial Valley RAS Technical Committee, and review and approval by WECC RASRS.

5.4 Cluster 3 – Imperial Valley Area

Total Cluster Size: 1713 MW

Cluster 3 represents 19 projects in the Imperial Valley Area including seven solar (901 MW) and twelve geothermal (812 MW) generation projects totaling 1713 MW. The twelve geothermal projects are external to SDG&E and the sevens solar projects are internal to SDG&E. Fourteen Cluster 3 projects are proposed to be in service by 2015, two projects by 2016, and three projects by 2017.

Plan of Interconnection

Cluster 3 includes 886 MW of internal generation modeled at the Imperial Valley 230kV Substation bus. Each of the internal projects interconnecting at the Imperial Valley 230kV bus require a bay position to accommodate the project's gen-tie. Table 11, Level 0, shows the costs of these upgrades.

Cluster 3 also includes 827 MW of external generation modeled at the Imperial Valley 230kV Substation bus. Interconnection points for the projects in IID are located outside of SDG&E service territory and therefore are not included in this study.

It was assumed that the Cluster 3 generation would not displace existing generation within SDG&E's transmission system, and SDG&E's import level would not be changed. However import flows would shift with less import south from SCE and higher import from the east to SDG&E.

Table 10 - Generation by Location for Cluster 3

Location	Internal/ External	Modeled Point of Interconnection	MW	Breaker Bay Position for Gen-Tie
SDG&E	Internal	Imperial Valley 230kV	200	To be provided by SDG&E
SDG&E	Internal	Imperial Valley 230kV	100	To be provided by SDG&E
SDG&E	Internal	Imperial Valley 230kV	300	To be provided by SDG&E
SDG&E	Internal	Imperial Valley 230kV	200	To be provided by SDG&E
SDG&E	Internal	Imperial Valley 230kV	150	To be provided by SDG&E
SDG&E	Internal	Imperial Valley 230kV	75	To be provided by SDG&E
SDG&E	Internal	Imperial Valley 230kV	15	To be provided by SDG&E
IID	External	Imperial Valley 230kV	38	To be provided by IID
IID	External	Imperial Valley 230kV	10	To be provided by IID
IID	External	Imperial Valley 230kV	42	To be provided by IID
IID	External	Imperial Valley 230kV	42	To be provided by IID
IID	External	Imperial Valley 230kV	50	To be provided by IID
IID	External	Imperial Valley 230kV	42	To be provided by IID
IID	External	Imperial Valley 230kV	20	To be provided by IID
IID	External	Imperial Valley 230kV	46	To be provided by IID
IID	External	Imperial Valley 230kV	42	To be provided by IID
IID	External	Imperial Valley 230kV	10	To be provided by IID
IID	External	Imperial Valley 230kV	235	To be provided by IID
IID	External	Imperial Valley 230kV	235	To be provided by IID

Power Flow Results

The addition of 900 MW at the Imperial Valley 230kV caused no reliability violations for the single contingency analysis and required no upgrades beyond the new Imperial Valley 230kV bus. Level Two generation output starting at 900 MW caused one facility overload requiring an upgrade. Level Three generation output starting at 1200 MW caused another facility overload requiring an upgrade. Level Five generation output starting at 1200 MW caused another facility overload requiring an upgrade as shown in the Table 11.

At Level Four, generation output is limited due to the infeasibility of building out the Miguel - Bay Boulevard 230kV transmission line beyond its proposed plan of service. This is dependent on the ultimate design and scope of the Bay Boulevard project and the final rating is dependent on the final approved construction design.

Table 11 - Transmission Cost Ranking Summary for Cluster 3

Cluster	Level		MW	Network Upgrades	Cost[25] (Millions)	Carrying Charge[26] (Millions)
C3 Imperial Valley Area	0[5]	A	PTO IF	(Internal generation only) Imperial Valley 230kV Bay position for 1st gen-tie	11.070	12.543
		B		(Internal generation only) Imperial Valley 230kV Bay position for 2nd gen-tie	5.438	6.162
		C		(Internal generation only) Imperial Valley 230kV Bay position for 3rd gen-tie	5.438	6.162
		D		(Internal generation only) Imperial Valley 230kV Bay position for 4th gen-tie	2.726	3.089
		E		(Internal generation only) Imperial Valley 230kV Bay position for 5th gen-tie	2.726	3.089
		F		(Internal generation only) Imperial Valley 230kV Bay position for 6th gen-tie	*Note 31*	*Note 31*
		G		(Internal generation only) Imperial Valley 230kV Bay position for 7th gen-tie	*Note 31*	*Note 31*
	1		0-900	No Upgrades	0.0	0.0
	2		900-1200	New Sycamore – Pomerado 69kV Line	10.285	11.654
	3		1200-1300	New Sycamore – Miramar 69kV Line	27.706	31.393
	4		>1300	Upgrade is not feasible	*Note 32*	*Note 32*

[25] All costs are based on conceptual estimates in year-of-expenditure dollars without Allowance for Funds Used During Construction (AFUDC). Costs for taxes, landscaping, walls, gates, driveways, and CAISO metering are not included. Also excludes costs for land, licensing, environmental mitigation, environmental monitoring, or habitat management.
[26] Carrying Charge assumed 13.31% estimated LACC.
[27] Based on the TRCR study assumptions, only five bay positions are available at the existing Imperial Valley 230kV bus.
[28] Beyond this generation injection level, the next transmission upgrade is not feasible.

The results of the transmission cost ranking study are summarized in Table 11. The conceptual costs are in millions of dollars, and estimates reflect the estimated capital investment needed to upgrade the transmission system to accommodate delivery of the output from the proposed renewable resources. With the Sunrise Powerlink in-service, the IV SPS with its current modules/logic is no longer needed until more generation connects to the IV and ECO Substation. Generation at Imperial Valley and ECO will be included in this new SPS when enough generation develops if the need is identified at a minimal cost.[29]

Limitations

The Imperial Valley area cluster increases reactive losses and degrades voltages in the SDG&E area. Transferring large amounts of generation across a long transmission line, from Imperial Valley 500kV to Miguel 500kV, causes the voltage at Miguel to drop. Detailed power flow and stability studies in the CAISO process may show the need for additional reactive support for any amount of new generation connected to the Imperial Valley area. Detailed transient and post transient studies may indicate potential voltage violations which would also limit Cluster 2 generation.

Combining Cluster 2 (ECO Area) and Cluster 3 (Imperial Valley Area) simultaneously have similar impacts to the transmission system, but vary slightly based on electrical distance to system stress points. Generation at ECO will stress the Sycamore - Pomerado transmission before generation at Imperial Valley. On the other hand, Generation at Imperial Valley will trigger upgrades in the Sycamore region before generation at ECO.

[29] All new SPSs and modifications to existing SPSs are subject to review by Affected System Operators, members of the Imperial Valley RAS Technical Committee, and review and approval by WECC RASRS.

5.5 Cluster 4 – North Gila Area

Total Cluster Size: 990 MW

Cluster 4 represents two projects in the North Gila Area including two solar generation projects totaling 990 MW. Both projects are internal to SDG&E. Both projects are proposed to be in service by 2015.

Plan of Interconnection

Cluster 4 includes 290 MW of internal generation modeled at the Hoodoo Wash 500kV Substation bus which requires a bay position to accommodate the project's gen-tie. The project interconnecting at the New 500kV Switchyard between Hassyampa and Hoodoo Wash 500kV bus requires a cost for a new switchyard to accommodate the project's gen-tie. Table 13, Level 0, shows the costs of these upgrades.

Table 12 – Generation by Location for Cluster 4

Location	Internal/ External	Modeled Point of Interconnection	MW	Breaker Bay Position for Gen-Tie
SDG&E	External	Hoodoo Wash 500kV bus	290	To be provided by SDG&E
SDG&E	External	New 500kV Switchyard between Hassyampa – Hoodoo Wash	700	To be provided by SDG&E

Power Flow Results

Based on the responses from the TRCR inquiries, no upgrades were required for the full dispatch of generation in this Cluster.

Table 13 - Transmission Cost Ranking Summary for Cluster 4

Cluster	Level		MW	Network Upgrades	Cost[30] (Millions)	Carrying Charge[31] (Millions)
C4 North Gila Area	0[32]	A	PTO IF	(Internal generation only) Hoodoo Wash 500kV Bay position for 1st gen-tie	5.209	5.902
		B		(Internal generation only) New 500kV Switchyard between Hassyampa - Hoodoowash	101.411	114.909
	1		0-990	No Upgrades	0.0	0.0

The results of the transmission cost ranking study are summarized in Table 13. The conceptual costs are in millions of dollars, and estimates reflect the estimated capital

[30] All costs are based on conceptual estimates in year-of-expenditure dollars without Allowance for Funds Used During Construction (AFUDC). Costs for taxes, landscaping, walls, gates, driveways, and CAISO metering are not included. Also excludes costs for land, licensing, environmental mitigation, environmental monitoring, or habitat management.
[31] Carrying Charge assumed 13.31% estimated LACC.
[32] PTO's Interconnection Facilities are necessary for each developer requesting to connect directly to an SDG&E facility and the costs for each subsequent position are indicated in Level 0 for each cluster.

investment needed to upgrade the transmission system to accommodate delivery of the output from the proposed renewable resources.

Limitations

No limitations exist for the level of generation dispatched in this cluster.

AFFIDAVIT

I am an employee of the respondent corporation herein, and am authorized to make this verification on its behalf. The matters stated in the foregoing **DRAFT TRANSMISSION RANKING COST REPORT OF SAN DIEGO GAS & ELECTRIC COMPANY PURSUANT TO THE ASSIGNED COMMISSIONER'S RULING FOR 2012 RENEWABLES PORTFOLIO STANDARD PROCUREMENT PLANS** are true of my own knowledge, except as to matters which are therein stated on information and belief, and as to those matters I believe them to be true.

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct to the best of my knowledge.

Executed this 27st day of June, 2012, at San Diego, California

/s/ Mariam Mirzadeh
Mariam Mirzadeh
Transmission Planning Manager
Transmission Planning Department