APPENDIX D

APPLICANT'S PREPARED DIRECT TESTIMONY

FOR

TALEGA-ESCONDIDO/VALLEY-SERRANO 500 KV INTERCONNECT PROJECT

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APPENDIX D – Section 1

Prepared Direct Testimony of

Peter Lewandowski

on behalf of the

The Nevada Hydro Company

TE/VS Interconnect

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

A. My Name is Peter Lewandowski and my business address is 2416 Cades Way, Vista California 92081.

Q. By who are you employed?

A. I am the President of The Hydro Company, Inc., which is doing business in California as The Nevada Hydro Company, Inc. ("TNHC").

Q. Briefly describe your present responsibilities at TNHC.

A. As President of TNHC, I have overall responsibility for the advancement of the company's electrical generation and transmission projects, including the responsibility for the preparation and processing of the Proponent's Environmental Assessment ("PEA"), such other environmental documentation as may required under the provisions of the California Environmental Quality Act ("CEQA"). I also am responsible for the preparation, processing, and receipt of those discretionary permits as may be required from federal, State, and local resource agencies for the projects' construction and operation.

Q. Briefly describe your educational and professional background.

A. I have over 25 years of experience in the environmental field, preparing literally hundreds of CEQA and NEPA documents for both energy-related and non-energy projects. I was responsible for the preparation and acceptance by the Federal Energy Regulatory Commission ("FERC") of Exhibit E (Environmental Report), comprising a major part of the federal hydropower license application for the Lake Elsinore Advanced Pumped Storage Project ("LEAPS"), including the management of all technical consultants participating in that work product. For the LEAPS and Talega-Escondido/Valley-Serrano 500-kV Interconnect Project ("TE/VS Interconnect"), I am response for the preparation and processing of environmental permits and associated entitlements from a wide array of state and federal agencies, including the State Water Resources Control Board and the United States Army Corps of Engineers. I formerly served as Director of Planning and Environmental Services for Ultrasystems Engineers & Constructors, Inc., a Hadson Company, a Fortune 500 energy company, subsequently acquired by LG&E Energy and operated as LG&E Power Systems. In 1998, I established a separate consulting firm, Environmental Impact Sciences, specializing in the provision of planning and environmental permitting services to both the public and private sectors, including individual development projects ranging in size up to 10,000 dwelling units. I have an undergraduate degree in Social Ecology from the University of California at Irvine and a Master's Degree in Urban Planning and have post-graduate work in Architecture at California State University at Pomona. In addition, I have completed the certificate program in Construction Management at the University of California at Irvine. Among other awards, based on my professional work, I have received a United States Congressional Recognition for Environmental Excellence.

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

A. I am sponsoring the PEA. I had the principal responsibility for the preparation and technical review of the PEA. The document draws upon and presents, in a cohesive fashion, a wide array of technical studies, including the “Final Environmental Impact Statement for the Lake Elsinore Advanced Pumped Storage Project, FERC Project No. 11858” (“FEIS”) issued in our pending hydropower license proceeding before FERC.

Q. Does this conclude your prepared testimony?

A. Yes it does.

APPENDIX D - SECTION 2

Prepared Direct Testimony of

Rexford Wait

on behalf of the

The Nevada Hydro Company

TE/VS Interconnect

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

A. My Name is Rexford Wait and my business address is 2416 Cades Way, Vista California 92081.

Q. By who are you employed?

A. I am employed by The Nevada Hydro Company ("TNHC").

Q. Briefly describe your present responsibilities at TNHC.

A. I am Vice President of the Company with overall responsibility for the development of the TE/VS Interconnect project, particularly focusing on the engineering and cost aspects of the project.

Q. Briefly describe your educational and professional background.

A. I have been in the business of developing and constructing energy facilities my entire career. I have an undergraduate degree in electrical and process engineering, and have developed and constructed energy facilities in a variety of countries around the world.

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

A. I am sponsoring the engineering cost elements of the project.

Q. Please elaborate on the cost of the project.

A. In the final Environmental Impact Statement ("FEIS") prepared by the Federal Energy Regulatory Commission ("FERC"), the FERC prepared an estimate of the cost for the project. This estimate appears in the following table, extracted in total from the FEIS:

Table 53. Summary of construction costs and characteristics for the co-applicants' proposed and staff alternative transmission alignments. (Source: Staff)

Alignment	Overall Length (miles)	Buried Length (miles)	Helicopter Installed Length (miles)[a]	Conventional Transmission Line (miles)	Access Road Length (miles)[b]	Total Construction Cost ($2005)[c]
Revised co-applicants' proposed transmission alignment	32.1	3.2	24.9	4.0	10.8	$393,316,800
Staff alternative transmission alignment	31.7	2.1	25.5	4.1	9.3	$381,082,875

[a] This length results in additional cost for construction of transmission lines by helicopter in areas where slopes are greater the 15 percent.

[b] We assume that access road lengths are equal to 1.5 times the transmission line length and are required in areas with slopes less than or equal to 15 percent.

[c] Total construction costs include the applicants estimated transmission lines costs and contingency, additional staff contingency and other major construction items such as additional access roads, buried lines or helicopter aided construction. Certain environmental measures associated with erosion control, easements, and terrestrial lands mitigation, etc. are not included in this cost.

[d] We assume the co-applicants may have accounted for up to 50 percent of the helicopter aided construction costs in their cost estimate and have added an additional $1,984,100 for possibly unaccounted helicopter installation costs. We assume a transmission line tower every 1000 feet and that incremental helicopter costs would amount to one-half of $30,761 per tower.

[e] We assume that shorter line lengths in the area where slopes are greater than 15 percent result in saving of $30,761 per tower eliminated or in this case 3 towers or $92,300. We also account for longer access roads at $125,000 per mile or in this case $337,500. Because the overall transmission line is 1.2 miles longer, we also estimate an additional construction cost of $2,496,000.

[f] An additional 2-mile segment connects the main transmission line to the Santa Rosa powerhouse.

[g] The number of towers per mile were determine by GIS analysis for each alignment.

As FERC has selected the "staff alternative" alignment, FERC has concluded that the project will cost roughly $381 million. We are currently working to refine this estimate, but until this revised estimate is completed, we are comfortable relying on FERC's estimated cost for purposes of this filing.

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

A. While the FERC material was not, I am prepared to sponsor it before the Commission.

Q. Insofar as the material is factual in nature, do you believe it to be correct?
A. Yes I do.
Q. Insofar as the material is in the nature of opinion or judgment, does it represent your best judgment?
A. Yes it does.
Q. Does this conclude your qualifications and prepared testimony?
A. Yes it does.

APPENDIX D - Section 3

Prepared Direct Testimony of

Mingxia Zhang, Ph.D.

on behalf of the

The Nevada Hydro Company

TE/VS Interconnect

1.0

1.0 INTRODUCTION AND TESTIMONY OVERVIEW

Q: Please state your name, title, and business address.

A: My name is Mingxia Zhang. I am a consultant with Z Global, Inc., Engineering and Energy Solutions. My business address is Suite 120, 193 Blue Ravine Road, Folsom, CA 95630.

Q: Please describe your employment and other relevant experience prior to becoming a consultant for Z Global.

A: Prior to joining Z Global, I had more than five years experience working at the California Independent System Operator ("CAISO"). While at the CAISO, my responsibilities included: Project Lead for Market Redesign and Technology Upgrade ("MRTU") Competitive Path Assessment; Lead Market Monitoring Specialist for Congestion Management Market, FTR Market, Ancillary Services Market, and Real-Time Market; and Principal Economist for developing the CAISO's Transmission Evaluation Assessment Methodology ("TEAM"). I also testified before the California Public Utilities Commission ("CPUC") on TEAM Methodology and the Palo Verde – Devers #2 Line Study ("PVD2"). In addition, I had over ten years of research and teaching experience at the University of California - Davis prior to joining the CAISO. I have published more than ten peer-reviewed journal articles in nationally and internationally leading economics and power system journals. I have provided my qualifications as an attachment to this testimony.

Q: On whose behalf are you submitting this testimony?

A: I am submitting this testimony on behalf of The Nevada Hydro Company (TNHC).

Q: What is the purpose of your testimony?

A: The purpose of my testimony is to support TNHC's filing at the Commission. In doing so, I have used the PLEXOS for Power System, a production cost and market simulation tool, to create and run a base case model of the CAISO transmission system and markets, and a model consisting of the base case plus the proposed LEAPS and TE/VS facilities. The purpose of these simulations is to quantify the energy and ancillary services benefit to CAISO ratepayers of the TE/VS Interconnect project, and the TE/VS Interconnect project when linked to the LEAPS pumped storage facility as proposed by TNHC in this proceeding.

Q: How is your base model for the CAISO transmission system and markets the same or different from the base case model that the CAISO uses for evaluating its transmission system and markets?

A: Is the essentially the same, as further described below.

Q: How is your testimony organized?

A: My testimony is presented in three parts. First, I will explain the features of the PLEXOS modeling program. Second, I will explain the base case model that I created using PLEXOS, including the sources of inputs, assumptions used and types of outputs. Finally, I will describe the results of adding both the LEAPS and the TE/VS projects to the PLEXOS base case model.

Q: Are the results of your PLEXOS modeling of the LEAPS and TE/VS projects utilized by any other witness to this proceeding?

A: Yes. The results of my analysis of the LEAPS and TE/VS projects using PLEXOS will be used by Mr. Philippe Auclair in performing a cost-benefit analysis of the combined projects. Mr. Auclair's testimony is being submitted contemporaneously with this testimony.

2.0 DESCRIPTION OF PLEXOS MODELING

Q: Please briefly describe the PLEXOS modeling system that you relied on for your analysis in this case.

A: PLEXOS for Power System was developed by Energy Exemplar. It is a proven, Windows-based, market simulation tool. PLEXOS integrates generation dispatch, transmission power flow, and pricing simulation with hydro electric generation (including pumped storage) and ancillary services dispatch. The CAISO, for example, used PLEXOS in implementing TEAM to analyze the benefits and costs of new transmission projects. PLEXOS satisfies the five key principles of TEAM's economic approach because PLEXOS: (i) quantifies benefits to market participants and sets up appropriate economic criterion for cost/benefit analysis; (ii) provides full network modeling; (iii) models market prices (including market power); (iv) models risk and uncertainty; and (v) considers transmission and resource (demand/generation) substitution.

Accordingly, PLEXOS has been used in a number of the CAISO's economic transmission evaluation studies. For example, the CAISO used PLEXOS modeling for its TEAM/Path 26 Study and the PDV2 Study. In addition, PLEXOS modeling is currently used by the CAISO to conduct the MRTU Competitive Path Assessment, as well as in its locational marginal pricing ("LMP") studies.

Q: Why did you choose to use PLEXOS for the modeling you performed in this case?

A: PLEXOS for Power System, unlike other similar tools, has the capability to co-optimize ancillary services ("AS") and energy production and is better capable than other simulation software of modeling hydro electric resources, particularly pumped storage. . The TE/VS project will provide much needed transmission congestion relief in the Southern California area such that there is both an energy benefit and an AS optimization benefit that results from more efficient use of generation resources to meet grid energy and AS requirements with or without LEAPS. This is additionally relevant in the TEVS with LEAPS case because the LEAPS project will enhance CAISO's AS capability As a result; the capability of PLEXOS to optimize both AS and pumped storage in its modeling produces more reliable and accurate results for evaluating the TEVS and TE/VS with LEAPS cases.

3.0 THE PLEXOS BASE CASE MODEL

Q: Please explain how you developed your base case using PLEXOS, including the inputs for the modeling and the source of those inputs.

A: I began with the base case utilized by, and obtained from, the CAISO in its analysis for the pending licensing proceeding for San Diego Gas & Electric Company's ("SDG&E's") proposed Sunrise Powerlink project before the California Public Utilities Commission ("CPUC") in Application No. 06-08-010. Consistent with the CAISO's approach, I set up my base case in PLEXOS using the Western Electricity Coordinating Council's ("WECC") most current production cost simulation database for 2015. The

WECC database included a full WECC system model for the year 2015 (Generation plus Transmission plus Load assumptions) and was converted into PLEXOS format for me by PLEXOS Solutions. I then updated many input assumptions in the WECC 2015 production cost simulation database to make it more consistent with the CAISO's base case used in SDG&E's Sunrise proceeding. In addition, I added some necessary information for ancillary services modeling and pumped storage modeling into this database.

Q: Please describe the assumptions you used in developing the PLEXOS base case model and the outputs of the modeling.

A: The PLEXOS model consists of three major components: Generation, Load, and Transmission Network. Therefore, I will provide additional detail on the development of the base case model and the assumptions for each of these components.

3.1 Generation

For the generation heat rate component of the PLEXOS base case model, I used heat rate data from the WECC database for thermal generation modeling. This heat rate data reflected typical fuel type, size of generation, vintage, and technology of plants as provided by WECC. I also relied on fuel (gas, coal, and others) prices in the WECC database for the thermal generation modeling.

In addition, the generation component of the PLEXOS simulation model produces LMPs for all buses in the network under two alternative assumptions: generators bid in their marginal costs, or generators bid in prices that reflect their strategic positions in the market. I assumed that generators bid in their marginal cost in establishing this component. By doing so, I recognize that the benefit estimated under this assumption is conservative, and that the TE/VS and LEAPS projects will provide higher benefits. (This is because, as a general economic premise, producers either earn more over time than variable operating cost or they become money losing operations and go out of business. If they go out of business then supply goes down and prices tend to rise.)

Next, I assumed the presence of 600 MW of new renewable resources located in the Salton Sea and Imperial Valley areas in the base case and the base case plus TE/VS case and the base case plus TE/VS plus LEAPS case. This is consistent with the CAISO's position in the Sunrise proceeding. Also, I assumed certain generation retirements. For example, I assumed that the South Bay power plant and Mohave power plant will be off-line in year 2015, just as the CAISO assumed in the Sunrise proceeding. See "Initial Testimony of the California Independent System Operator Corporation Part 1," A. 06-08-010, at 21 (January 26, 2007).

Furthermore, I included in the generator component of the PLEXOS base case model all the generators, specified by their capacity, costs, and availability, that are listed in the WECC 2015 database. Generators are identified as dispatchable, such as most thermal units, or as non-dispatchable, such as most hydro, wind, and solar units. I modeled the generation for these non-dispatchable units as hourly curves.

In my study, pumped storage units (such as the existing Helms and Hyatt facilities, as well as LEAPS) are internally optimized using PLEXOS' potential energy modeling approach to optimize the value of water to achieve daily, weekly, or monthly energy targets. More specifically, a pumped storage unit is modeled as if the storage naturally cycles between its upper and lower reservoir a number of times inside its daily or weekly or monthly simulation horizon, and the water value is optimized and equal to the opportunity cost of thermal resources displaced by the pumped storage generation in future periods. In other words, PLEXOS automatically determines the optimal generation and pump pattern for a pumped storage unit to maximize the water value. This functionality of PLEXOS is essential for modeling pumped storage units and calculating the benefit of LEAPS Project.

I included 2500 MW new wind resources in the Tehachapi area. I relied on the hourly dispatch shapes/curves included in WECC database for renewable resources dispatch. These hourly dispatch shapes/curves are developed by WECC based on historical data. Wind resources are assumed to have zero variable cost.

In addition, I input the CAISO utility-retained generation ("URG") ownership in the database. By so doing, the PLEXOS model was able to directly calculate the CAISO URG margin based on dispatch results.

Finally, I included non-QF, participating generation units in the CAISO Control Area as an approximate of generation units that are capable of providing ancillary services in the PLEXOS database. The non-QF, participating generation 1 2 3 4 units are based on the most recent Master CAISO Control Area Generating Capability List[1] since the CAISO certified AS unit list is not publicly available. I assume each non-QF, participating generation unit can provide up to 25% of its maximum capacity as ancillary services.

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[1]/ See Master CAISO Control Area Generating Capability List, publicly available at http://www.caiso.com/14d4/14d4c6c961cc0.xls.

3.2 Load

The load component of the PLEXOS base case model included load distribution by WECC region, which incorporated annual energy, annual peak demand, and base year hourly demand profiles. In setting up this component in the PLEXOS base case model, I used the same assumptions about system loading conditions in 2015 as the CAISO South Regional Transmission Plan ("CSRTP") report.[2] When I was unable to assemble the load forecasts directly from the CSRTP report, I relied on CAISO's TEAM Report[3] to forecast 2015 demand for some of the WECC sub-regions. The following table represents the demand assumptions used in my PLEXOS model, both in the base case and sensitivity cases.

Region Name	Z Global Peak Demand Forecast for 2015 (MW)	Z Global Energy Forecast for 2015 (GWh)	Z Global Data Source
ALBERTA	9,540	65,697	CAISO CSRTP-2006 Study 2015 forecast
AQUILA	976	6,588	CAISO CSRTP-2006 Study 2015 forecast
ARIZONA	22,626	104,761	CAISO CSRTP-2006 Study 2015 forecast
B.C.HYDRO	10,588	63,034	CAISO CSRTP-2006 Study 2015 forecast
IDAHO	3,694	18,621	CAISO CSRTP-2006 Study 2015 forecast
IID	1,644	6,215	CAISO CSRTP-2006 Study 2015 forecast
LADWP	6,597	29,956	CAISO Testimony, CPUC Dkt. A.06-08-010, January, 2007
MEXICO-CFE	3,209	15,278	CAISO CSRTP-2006 Study 2015 forecast
MONTANA	1,698	10,807	CAISO CSRTP-2006 Study 2015 forecast
NEVADA	7,276	29,345	CAISO CSRTP-2006 Study 2015 forecast
NEW MEXICO	4,730	27,246	CAISO CSRTP-2006 Study 2015 forecast
NORTHWEST	30,268	181,939	CAISO CSRTP-2006 Study 2015 forecast
PACE	8,444	48,801	CAISO TEAM Report 2013 forecast*
PG AND E	27,848	139,488	CAISO Testimony, CPUC Dkt. A.06-08-010, January, 2007
PSCOLORADO	8,199	38,983	CAISO TEAM Report 2013 forecast*
SANDIEGO	5,289	24,998	CAISO Testimony, CPUC Dkt. A.06-08-010, January, 2007
SIERRA	1,995	11,728	CAISO CSRTP-2006 Study 2015 forecast
SOCALIF	27,173	121,275	CAISO Testimony, CPUC Dkt. A.06-08-010, January, 2007
WAPA L.C.	252	1,591	CAISO CSRTP-2006 Study 2015 forecast
WAPA R.M.	5,388	27,100	CAISO TEAM Report 2013 forecast*
WAPA U.M.	271	1,545	CAISO TEAM Report 2013 forecast*
TOTAL		974,996	

[2]/ See "CAISO South Regional Transmission Plan for 2006," (July 28, 2006), publicly available at http://www.caiso.com/1841/1841b1925a320.pdf.

[3]/ See CAISO's TEAM Report, publicly available at http://www.caiso.com/docs/2004/06/03/2004060313241622985.pdf.

* Assumed annual growth rate of 2 percent for peak demand and 1.5 percent for energy from TEAM's 2013 forecast. .In addition, I used the WECC database's hourly load profiles for 2008 as my base profiles and used the 2015 load forecast from the above table to grow the 2008 hourly profiles to 2015. I assumed normal conditions for future supply/demand in 2015 for the base case and the base case plus the LEAPS and TE/VS projects.

3.3 Transmission

The base case transmission network used in the PLEXOS model production cost simulation study was developed based on a full-loop WECC 2015 Heavy Summer ("HS") power flow base case. I also included in the PLEXOS base case model certain assumptions about new transmission and transmission upgrades. For example, I assumed Path 42 being upgraded to 1,500 MW transfer capability prior to year 2015, as the CAISO assumed in the CPUC's Sunrise proceeding. See "Initial Testimony of the California Independent System Operator Corporation Part 1," A. 06-08-010, at 27 (January 26, 2007).

Furthermore, the PLEXOS base case model included transmission constraints, including interfaces, transmission lines or group of lines, nomograms, and limitations associated with transmission outages (also modeled as nomograms). While calculating the power flow for each hour of the year, PLEXOS enforced all constraints to ensure that the line flow, interface value, or nomograms flow did not exceed the specified rating by re-dispatching the system generation to satisfy the constraints.

Q: Please briefly describe the co-optimization of energy and ancillary services in PLEXOS modeling.

A: PLEXOS is capable of co-optimizing energy and ancillary services. When co-optimizing energy and ancillary services, the objective function in PLEXOS is minimizing total generation production cost and total ancillary service procurement cost. A generation unit, depending on its capability, can bid to provide energy or ancillary services to the market, or both. AS awards and AS market prices are determined by solving an integrated mathematical problem which considers physical operating limits of the generation units and transmission network, as well as the reserve requirement constraints.

PLEXOS can model several classes of ancillary services, including regulation, spinning reserve, and non-spinning reserve. Due to time constraint, for the evaluation of LEAPS, I chose to focus on regulation up and operating reserve.

To set up the PLEXOS AS model, I first need to define AS regions.[4]. I defined two AS regions for this study: CAISO system AS region, and SP 26 AS region. Next I need to define the reserve requirements in each AS region. For the CAISO system AS region, I assume the operating reserve requirement is 5% of the CAISO internal load and regulation up requirement is 600 MW. For the SP 26 region, I assume the operating reserve requirement is 40% of the CAISO system operating reserve requirement.

Note that due to time constraint I did not model regulation down. Therefore the AS benefit of TEVS and TEVS w/LEAPS reported in this filing is a conservative estimate. I expect that the AS benefit of TEVS and TEVS w/LEAPS will be higher if all ancillary services and all AS regions are modeled.

Q: Please briefly describe the outputs from the PLEXOS base case model.

A: The outputs from the PLEXOS base case model include LMPs, Ancillary Service Market Prices (ASMPs), flows on transmission lines, dispatch levels, AS awards, and economic measurements (such as Cost-to-Load, Production Cost, Producer Revenue, Transmission Congestion Revenue, URG profit, etc.). Having economic measurements calculated

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[4]/ In the future MRTU market, 10 ore more AS regions will be modeled in day ahead and real time market, including CAISO system AS region, expanded system AS region, SP 26 As region, expanded SP 26 AS region, etc.

directly and internally within the simulation tool and reported directly avoids potential errors that may occur during a spreadsheet-type of benefit calculation model.

4.0 PLEXOS MODELING RESULTS OF THE LEAPS AND TE/VS PROJECTS

Q: Can you explain the modeling you performed using the PLEXOS TE/VS case and TV/VS plus LEAPS case and the results of that modeling?

A: Yes. I ran a production cost simulation for the TE/VS case and the TE/VS plus LEAPS case, using PLEXOS. In so doing, I kept all assumptions of the base case model constant and included the generation and transmission facilities that are proposed for the TE/VS and LEAPS projects, as provided to me by TNHC. Table 1 represents the estimation of the total energy/ancillary service cost and benefit of the TE/VS and TE/VS plus LEAPS projects based on the comparison of the base case results (the No TEVS or LEAPS case) with the results of the base case plus TE/VS and the base case with TE/VS and LEAPS. The net results of the model runs of the three cases is that there is a total energy/ancillary service benefit from the LEAPS and TE/VS projects is $151 Million (nominal) in year 2015. The results of the three model runs are summarized in the table below.

Table 1
Estimated energy benefits of the LEAPS and TE/VS projects using PLEXOS modeling (in $millions)

	Cost			Benefit		
	Base Case	**TE/VS**	**LEAPS +TE/VS**	**TE/VS**	**LEAPS**	**LEAPS + TV/ES**
Customer Energy Payments from PLEXOS (M$)	15,546	15,507	15,487	39	20	59
Customer AS Payment from PLEXOS (M$)	189	188	160	1	28	29
less CAISO PTO Transmission Rent (M$)	364	350	347	(15)	(2)	(17)
less CAISO URG Margin (M$)	3,238	3,239	2,232	1	(7)	(6)
less IOU excess loss payments	1,017	1,013	1,008	(4)	(5)	(9)
LEAPS Energy Storage Value (M$)	-	-	66	-	66	66
LEAPS AS Margin to Consumers (M$)	-	-	29	-	29	29
Total Energy/AS Cost and Benefit (M$)	11,116	11,093	10,965	23	128	151

I would note that the energy/ancillary service benefits of the LEAPS and TE/VS projects represented in Table 1 is not an estimate of the total benefits that the LEAPS and TE/VS projects may bring to the CAISO ratepayers. My analysis does not project other benefits of the combined projects, including reliability benefits, renewable portfolio standards ("RPS") compliance benefits, and reliability must run ("RMR") capacity benefits, all of which Mr. Auclair discusses in his testimony. Also note that the AS benefit is a conservative estimate due to not including Regulation Down in the modeling. Furthermore, the energy benefit is also a conservative estimate by assuming generators bid competitively in the market.

Q: What assumptions have you made in term of new Transmission Lines?

A. The base case analysis contains PVD2 and GPN in service and no Sunrise. The sensitivity cases are: Sensitivity Case 1: PVD2, GPN, and TE/VS, but no Sunrise. Sensitivity Case 2: PVD2, GPN, TE/VS plus LEAPS pump storage, but no Sunrise.

Q: What is the amount of renewable capacity in Imperial and Tehachapi modeled in the base case, the TE/VS case, and the TE/VS + LEAPS case?

A: Same input assumptions are used in all three cases in terms of Imperial and Tehachapi renewable resources. I included 900 MW renewable resources in Imperial region, including the 600 MW new geothermal resources in the Salton Sea/IID area. For the Tehachapi area, I included 2500 MW new wind resources in Kern County.

Q. Was Otay Mesa plant available to be dispatch in your cases?

A. Yes.

Q. Was South Bay plant unavailable to be dispatch in all your cases?

A. Yes.

Q. What was the import limits into SDGE in your cases?

A: The import capability into SDG&E is modeled at 2500 MW in the base case and 3500 MW in both the TE/VS case and the TE/VS plus LEAPS case.

Q. What was the limit of the TE/VS line?

A. The limit on the 500kV portion of the TE/VS project (i.e., from Lee Lake to Camp Pendleton) is set to 2598 MW both directions.

Q. What is the total available generation in the San Diego area?

A. Around 3900 MW.

A: Does this conclude your testimony?

A. Yes it does.

APPENDIX D - Section 4

Prepared Direct Testimony of

Philippe Auclair

on behalf of the

The Nevada Hydro Company

TE/VS Interconnect

1.0 INTRODUCTION AND TESTIMONY OVERVIEW

Q. Please state your name, title and qualifications.

A. My name is Philippe Auclair. I am principal in the firm of Auclair Consulting. My resume is attached as Exhibit A to this testimony.

Q. On whose behalf are you submitting this testimony?

A. I am submitting this testimony on behalf of The Nevada Hydro Company (TNHC).

Q. What is the purpose of your testimony?

A. TNHC has asked me to do an economic evaluation, or cost-benefit analysis, of the proposed Talega-Escondido/Valley-Serrano 500 kV Interconnect ("TE/VS") project and the associated Lake Elsinore Advanced Pumped Storage ("LEAPS") project near Lake Elsinore, California. The TE/VS line would interconnect and create a new 500 kV link between the Southern California Edison (SCE) and San Diego Gas & Electric Company (SDG&E) electric systems and would connect LEAPS with California's high voltage transmission grid.

Q. How is your testimony organized?

- First, it summarizes the approach I use to evaluate the economic benefits of the TE/VS transmission line and the combined TE/VS+LEAPS projects.

- Second, it discusses the benefits of TE/VS and the combined TE/VS+LEAPS projects and;
- Third, it provides a net benefit calculation for the TE/VS and the combined TE/VS+LEAPS projects.

Q. Please describe your conclusions.

A. I conclude that the TE/VS transmission line will have a positive net economic benefit, and that the TE/VS transmission line and LEAPS pumped storage project together (TE/VS+LEAPS) will have a positive net economic benefit. Estimates of the value of the principal elements of the benefits of TE/VS and the combined TE/VS+LEAPS projects are summarized in Table 1 below. I will explain the nature of each type of benefit and how the estimates for each were derived later in my testimony.

Table 1
Estimated Net Benefit of the TE/VS and TE/VS+LEAPS Combined Projects
($M 2015 Nominal)

	BENEFIT		
	TE/VS	**LEAPS**	**TE/VS + LEAPS**
Energy Benefit	$22*	$71*	$93*
Ancillary Services Benefit	1*	$57*	$58*
Wind Integration and Over-Gen Mitigation Benefit		$33	$33
Local Reliability Compliance Benefit	$126	-	$126
Resource Adequacy Compliance Benefit	-	$14	$14
Total Benefit	$149	$174	$324
Total Levelized Annual Cost	$51	$94	$145
NET ANNUAL BENEFIT	$98	$81	$179

* These numbers are approximate because the model used does not apportion deductions for PTO Transmission Rent, URG Margin, and IOU Excess Loss Payments between the Energy Benefit and the Ancillary Services Benefit. This issue does not affect the total Energy and Ancillary Service Benefit figures (*see* table 2, *infra*). The impact on the Energy Benefit and Ancillary Services Benefit numbers in Table 1 would be relatively minimal.

2.0 ECONOMIC EVALUATION METHODOLOGY

Q. What methodology do you rely on to evaluate the economic net benefit of the TE/VS and TE/VS+LEAPS projects?

A. I rely on the California Independent System Operator Corporation's (CAISO's) Transmission Economic Assessment Methodology (TEAM),[1] as supplemented by the CAISO South Regional Transmission Plan for 2006 (CSRTP)[2] and by the CAISO's written testimony in the California Public Utilities Commission's (CPUC's) pending proceeding regarding SDG&E's application for a certificate of public convenience and necessity for its proposed Sunrise Powerlink transmission project (Sunrise Proceeding).[3]

Q. What is TEAM?

A. TEAM is a constrained optimization problem in which the economic modeler (resource planner)[4] picks the least-cost[5] transmission and generation resource capacity plan (and energy delivery plan) that satisfies three sets of constraints.[6] The three sets of constraints are:

- A model of the existing and projected infrastructure and network topology;

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[1]/ Transmission Economic Assessment Methodology, July 2004, CAISO, Folsom, CA.

[2]/ CAISO South Regional Transmission Plan for 2006 (CSRTP): Findings and Recommendation on the Sun Path Project, July 28, 2006, California ISO, Folsom, CA.

[3]/ Initial Testimony of the California Independent System Operator Corporation – Part I, San Diego Gas & Elect. Co., Application 06-08-010, January 26, 2007.

[4]/ The term 'resource planner' is not used here to imply that the CAISO is the state's resource planner. Instead, the term is used to illustrate that the TEAM exercise is an integrated resource planning exercise. As such, one who engages in this modeling exercise is a resource planner within the context of the exercise.

[5]/ This study's working assumption is that the price elasticity of demand for electricity is inelastic.

[6]/ Compliance with the State of California's loading order is assumed throughout this discussion. It is assumed that energy efficiency and demand response programs are either resources or means to reduce load forecasts.

- Economic and financial input assumptions (e.g., projected demand based on an adopted load forecast); and
- Policy and regulatory standards.

Another way of explaining the TEAM approach is that the objective of the TEAM modeler (resource planner) is to find the resource plan (generation and transmission capacity) that minimizes total expected consumer expenditures on generation and transmission, while satisfying forecasted energy demand and all network, financial and regulatory constraints.

Q. What do you mean by least-cost resource plan?

A. The least-cost resource plan is the plan that has the lowest total cost. The total cost of generation is equal to the total variable cost plus the total fixed cost of generation infrastructure that consumers must pay. The total cost of transmission is equal to the total variable cost plus the total fixed cost of transmission infrastructure that consumers must pay. The resource planner focuses on avoidable costs, not sunk costs, in choosing the least-cost plan.

Q. How does the TEAM modeler (resource planner) account for and value the expected stream of future costs (expenditures) associated with a resource plan?

A. The resource planner calculates the present value of the stream of expected expenditures across the entire planning horizon. As an alternative, the resource planner may calculate and use the annual levelized equivalent. Lastly, the resource planner may also rely on a snapshot in time, such as 2015 or 2020, or both.

Q. How should the resource planner satisfy, or obey, the existing and projected network topology and regulatory requirements?

A. The TEAM modeler (resource planner) should obey the projected network topology and regulatory requirements by imposing reliability and regulatory constraints (standards) on the transmission and generation infrastructure capacity plan, and by solving a constrained least cost dispatch problem for the present and future financial delivery of energy.

Lastly, the TEAM modeler (resource planner) should obey the State of California's imposed energy procurement constraint - the Renewable Portfolio Standard (RPS), as well as the State's loading order, which includes Demand Response (DR) and Energy Efficiency (EE) programs.

Q. Has the CAISO modified the original TEAM approach to evaluating transmission and generation projects?

A. Yes. The 2006 CAISO CSRTP for the Sun Path Project[7] added a CAISO and WECC reliability constraint to the TEAM approach. In addition, CAISO's written testimony in the Sunrise Proceeding also includes a system RA constraint to comply with the Commission's resource adequacy policy. The reliability and RA constraints now include:

1. CPUC system Resource Adequacy Requirement.
2. CPUC/CAISO Local Capacity Resource Adequacy (LCRA) requirements.
3. CAISO RMR requirements, until the CPUC LCRA is fully implemented.

Q. What is a feasible resource plan?

A. When the TEAM modeler (resource planner) imposes present and projected future network constraints on transmission and generation infrastructure capacity plans, he obtains a feasible resource plan.

Q. What is a feasible dispatch?

A. When the TEAM modeler (resource planner) imposes present and projected future network constraints on present and projected energy delivery, he obtains a set of feasible dispatches across time. (i.e., a feasible set of energy injections and withdrawals from the present to 2015 or 2020.)

Q. What is the objective of the resource planner after he obeys all the network and regulatory constraints?

A. The objective of the TEAM modeler is to find the least-cost resource plan among the set of feasible resource plans. At the same time, the TEAM modeler must also ensure that each feasible resource plan solves the constrained least cost dispatch problem. Solving the constrained least cost dispatch problem yields Locational Marginal Cost Prices (LMP).

Q. What approach does the TEAM modeler use to find the least-cost resource plan?

A. The TEAM modeler first defines a feasible "base-case" resource plan and calculates the total cost of that plan. The base-case resource plan serves as a benchmark or reference against which the modeler compares all other alternative resource plans. The base-case resource plan defines and includes certain financial and electricity infrastructure assumptions (referred to as "input data assumptions") that generally remain constant during the evaluation of the feasible alternative resource plans. These input data assumptions include variables such as load forecasts, forecasted price of natural gas,

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[7]/ CAISO South Regional Transmission Plan for 2006 (CSRTP): Findings and Recommendation on the Sun Path Project, July 28, 2006, California ISO, Folsom, CA.

projected generation infrastructure by location, vintage, and technology (operational profile, such as heat-rates), and projected transmission infrastructure.

The TEAM modeler then specifies alternative feasible resource plans. Each alternative resource plan differs from the base-case resource plan by substituting one or more generation projects and/or one or more transmission projects. In some cases, each alternative resource plan may include input data assumptions that differ from those used in the base-case. The TEAM modeler must be very careful not to allow the changes in input assumptions to bias the results of her study. The TEAM modeler then compares the total costs (total expenditures) of each alternative feasible resource plan to the total cost (total expenditures) of the base-case resource plan.

Q. How is the benefit of an alternative resource plan calculated?

A. The benefit of the alternative resource plan is equal to the total expenditure on the alternative resource plan minus the total expenditures on the base-case resource plan.

Q. How is the net benefit of a proposed alternative resource plan or project calculated?

A. The net benefit of a proposed alternative resource plan or project is obtained by subtracting its total cost from its total benefit. The least-cost (lowest expenditure) resource plan has the highest net benefit.

3.0 APPLICATION OF ECONOMIC EVALUATION METHODOLOGY TO TE/VS AND TEV+LEAPS

Q. How do you apply the TEAM-based approach you describe above to evaluate the cost effectiveness of TE/VS line and TE/VS+LEAPS?

A. I use the three resource plans developed in the testimony of Dr. Mingxia Zhang submitted contemporaneously with mine. The first plan is the base case plan. The second is the TE/VS resource plan, and the third is the combined TE/VS+LEAPS resource plan. Each plan includes one study year, 2015, in which the benefits and costs are expressed in nominal dollars.

I calculate the benefit of the TE/VS line as the difference between the consumer expenditures necessary for the base case resource plan and consumer expenditures necessary for the plan with the TE/VS line in service.

I also calculate the benefit of the combined TE/VS+LEAPS resource as the difference between the consumer expenditures necessary with the combined TE/VS+LEAPS projects in service and the consumer expenditure necessary for the base case plan.

Q. Please describe the types of benefits you considered in evaluating the TE/VS line and the combined TE/VS+LEAPS project relative to the base case plan.

A. I considered and summed the following benefits expressed as the respective differences in expenditures between the project plans and the base case plan:

1. The <u>Energy Benefit</u> of the project is the difference in the load-weighted locational marginal prices ("LMP") in the applicable study area between the project case and the base case, net of:

    - The difference in Utility Retained Generation (URG) margins between the project plan and the base case plan;
    - The difference in congestion rent between the project plan and the base case plan;[8]

[8]/ Adding a well-planned transmission line or a resource may reduce congestion rents. However, this reduction in congestion rents is not included as a benefit because congestion rents are rebated to the CAISO area consumers who already pay the CAISO's Transmission Access Charge (TAC). Congestion rent and congestion cost are two distinct concepts. Congestion cost is the aggregate re-dispatch cost + the consumer deadweight loss due to binding transmission constraints. Congestion rent is an assignable financial property right, and as such, is a transfer payment; congestion cost is a loss to society as a whole

- The difference in the CAISO refund for line loss over-collection (excess loss payments to CAISO utilities) between the project plan and the base case plan; and
- (For the TE/VS+LEAPS case only), the difference in the energy storage value between the combined TE/VS+LEAPS resource plan and the base case plan.

2. The Ancillary Services (AS) Benefit of the project is the difference in the cost of AS in the applicable study area between the project case and the base case.

3. The Local Reliability Compliance Benefit of the project is the difference in the cost of complying with applicable reliability criteria in the relevant study area between the project case and the base case. In addition, I provide estimates of the Wind Integration and Over-

Generation Benefits and Resource Adequacy Capacity Benefits of the TE/VS and TE/VS+LEAPS combined projects. I also discuss California's Renewable Portfolio Standard (RPS) and Green House Gas Policy as they relate to the projects.

Lastly, I determine the net economic benefit of the TE/VS and the combined LEAPS+TE/VS projects by subtracting each project's annual levelized cost from its total benefits (energy benefit + AS benefits + reliability compliance benefit).

4.0 NET BENEFITS OF TE/VS AND TE/VS+LEAPS PROJECTS

Q. Please describe the benefits of the TE/VS transmission line relative to the base case plan.

A. It is my understanding from TNHC that the TE/VS 500 kV transmission line provides 1000 MW of additional transmission import capacity to the SDG&E system. This increase in import capacity provides SDG&E access to a larger pool of lower cost generation for SDG&E customers. As such, it provides an energy price benefit by reducing the energy market clearing prices (i.e., location marginal prices, or LMPs) to CAISO consumers.

The TE/VS line also provides SDG&E with access to renewable energy resources, and may increase the depth of the pool of renewable suppliers to SDG&E. For example, the TE/VS line facilitates access for SDG&E consumers to renewable resources located north of San Diego, including Tehachapi wind resources, as well as Pacific Northwest, other western U.S., and Canadian renewable resources. In addition, should the Los Angeles Department of Water and Power decide to construct its proposed Green Path North transmission project from the Imperial Valley/Salton Sea area to the Los Angeles basin, the TE/VS line could also provide SDG&E customers with access to renewable energy resources to the east of San Diego. As such, the TE/VS line is well-positioned to assist SDG&E in meeting its RPS compliance objectives.

In addition, by increasing the transmission import capacity to the San Diego Local Capacity Requirement (LCR) area by 1000 MW, the TE/VS transmission line will reduce SDG&E's local reliability compliance costs relative to the base case. Finally, by interconnecting LEAPS to the CAISO high voltage transmission system, TE/VS will permit CAISO customers to realize the economic benefits provided by the LEAPS project.

Q. Please describe the benefits of the LEAPS project that would be made possible by the addition of TE/VS.

A. LEAPS will provide the following benefits: Ancillary Services (AS); energy and energy storage; resource adequacy capacity; integration of intermittent resource including wind; and the capability of mitigating over-generation situations.

It is my understanding that the LEAPS resource provides the following Ancillary Services (AS):

- Black Start (15 seconds)
- Regulation up and down (up to 500 MW per minute)
- Spinning Reserve (up to 500 MW per minute)
- Non-spinning reserve (up to 500 MW per minute)

A reasonable benefit evaluation methodology should account for the very rapid response time of the LEAPS resource to dispatch instructions – 15 seconds – and should value it accordingly. The methodology should also account for the fact that LEAPS can provide up to 500 MW to the grid in 15 seconds. These capabilities make LEAPS an extremely valuable asset in assisting the grid operator to maintain system balance and stability. Other than perhaps some conventional hydro,[9] I am unaware of any other grid facility that can match LEAPS' ability to provide 500 MW to the grid within 15 seconds in response to a CAISO dispatch notice. These operational characteristics should make LEAPS one of the best sources of regulation and spinning reserve capacity for the grid operator. In addition, LEAPS' rapid dispatch response and ramping capability should enable it also to efficiently provide load-following service, should the CAISO decide to adopt a load following product as an Ancillary Service. The emergency value of LEAPS

[9]/ It is my understanding that no new, sizeable conventional hydro has been added to the California grid in over 15 years.

should not be overlooked. The ability to provide 500 MW in one minute will be a very valuable service in times of system emergency.

To put LEAPS' response capabilities in perspective, it is my understanding that combustion turbines (CTs) require anywhere from 10 to 60 minutes to respond to a dispatch signal and do not provide regulation or spinning reserve capability. Combined cycle CTs take anywhere from one to four hours to respond to a dispatch signal, have no black start capability, and, compared with a plant like LEAPS, have a much more limited capability to provide regulation and spinning reserve services. It is also my understanding that combined cycle units may take hours to ramp up to full capability, e.g., to provide 500 MW to the grid in one minute may require 10 to 12 combined cycle units, each of 500 MW generating capacity. Accordingly, LEAPS represents an efficient, cost-effective source of regulation, spinning reserve and load-following services.

Another important benefit of LEAPS is that it can effectively function as a large energy storage battery. For example, wind and other generation with low marginal operating costs may be used to power LEAPS' pumps at night to fill the project's upper reservoir. The water stored there thus represents low-cost, stored energy. In a well-designed, competitive spot energy market, this storage value should equal the difference between the on-peak energy price and the off-peak energy price. During conditions of high demand, the value of storage and associated increase in grid efficiency can be quite significant.

Q. Why would the energy storage capability of LEAPS be important in such an evaluation?

A. California is implementing aggressive RPS goals. Achievement of these goals will mean relying on a significant amount of wind generation resources. Wind energy is intermittent and unpredictable. LEAPS' storage capability provides a mechanism to consume and store wind energy (e.g., Tehachapi wind) when it is available, but not needed, during off-peak periods, and to release the stored energy during peak demand periods. Because LEAPS can respond to a CAISO dispatch signal in 15 seconds and also can provide up to 500 MW in one minute, it would be an efficient and valuable complement to wind energy, whose capacity factors typically range from 25 to 35 percent. In this role, LEAPS is said to "firm up" wind energy.

In addition, adding significant quantities of wind capacity to the grid will create integration challenges for the CAISO that, if not properly planned for, may lead to unnecessarily high integration costs. For example, the unpredictable and intermittent nature of wind will increasingly place CAISO operators in the position of having to adjust either up or down the output of slow-responding, fossil fuel thermal generation. This may lead, in turn, to greater reliance on spinning reserve and regulation services. This reliance likely will become increasingly inefficient and costly to CAISO ratepayers.[10] California load is growing by nearly two percent per year. However, it is my understanding that the supply of regulation units (e.g., conventional hydro) in California has not changed appreciably in more than 15 years, and is not expected to change in the foreseeable future. As a percentage of the growing load, the fleet of existing, conventional generation is becoming less and less flexible with respect to the CAISO's operational needs, even as such flexibility is becoming an increasingly valuable and necessary commodity.

10/ This greater reliance on fossil fuel thermal generation for purposes of integrating wind resources would be contrary to California's Greenhouse Gas Policy and RPS objectives.

Q. Please explain your assessment of the Energy and AS Benefits of the TE/VS and TE/VS+LEAPS projects.

A. I use the TE/VS and LEAPS energy benefit results from TNHC's witness Dr. Mingxia Zhang, reproduced and adapted from her testimony in Table 2 below.

Table 2
Estimated Energy & AS Benefits of the LEAPS and TE/VS Projects using PLEXOS Modeling ($M 2015 Nominal)

	Cost			**Benefit† (project case vs. base case)**		
	Base Case	**TE/VS**	**LEAPS + TE/VS**	**TE/VS**	**LEAPS**	**LEAPS + TE/VS**
Customer Energy Payments from PLEXOS (M$)	$15,546	$15,507	$15,487	$39	$20	$59
Customer AS Payment from PLEXOS (M$)	$189	$188	$160	$1	$28	$29
less CAISO PTO Transmission Rent (M$)	$364	$350	$347	$(15)*	$(2)	$(17)
less CAISO URG Margin (M$)	$3,238	$3,239	$3,232	$1	$(7)	($6)
less IOU Excess Loss Payments(M$)	$1,017	$1,013	$1,008	$(4)	$(5)	$(9)
LEAPS Energy Storage Value (M$)	-	-	($66)	-	$66	$66
LEAPS AS Margin to Consumers	-	-	($29)	-	$29	$29
Total Energy & AS Cost and Benefit (M$)	**$11,116**	**11,093**	**10,965**	$23*	$128*	$151

***** These total figures are not the exact sum of their inputs due to rounding.

† The Benefit calculation represents the difference between the total cost of the Base Case and the TE/VS and LEAPS projects.

The TE/VS transmission line alone provides an energy and AS benefit of $23 million. For the combined TE/VS + LEAPS projects, Dr. Zhang's PLEXOS market simulation yields a total energy and AS benefit, relative to the base case outcome, of $151 million (nominal) for the year 2015.

The TE/VS line reduces net LMP energy and AS payments by $23 million annually by providing an additional 1000 MW of import capacity to the San Diego LCR area, thus permitting access for the area to lower cost generation. In addition, the introduction of LEAPS further depresses net LMP energy and AS expenditures in the relevant region by an additional $33 million/year.

The combined TE/VS + LEAPS energy and AS benefit of $151 million a year is explained to a significant degree by the energy storage value of LEAPS of $66 million/year.

Using the CAISO's cost-levelizing methodology[11] for the TE/VS and LEAPS projects, I obtain an annual, levelized cost of $145 million/year for the combined project (i.e., $51.33 million/year for the TE/VS transmission line and $94 million/year for the LEAPS project.)[12]

Thus, the 2015 energy and AS benefits quantified in Table 2 more than offset the combined, levelized annual cost of LEAPS + TE/VS. This result is obtained <u>before</u> accounting for the reliability benefits of TE/VS and the resource adequacy and other benefits of LEAPS, which are not reflected in Table 2. I will discuss these other benefits later in my testimony.

Examination of the LEAPS facility confirms that the $66 million/year storage value is a reasonable estimate. The LEAPS pumped storage facility will consume electricity during off peak (low price) periods in order to generate electricity during peak (high price) periods. It is this capability to consume electricity during off-peak and over-generation periods when LMPs are very low and provide electricity during on-peak periods, when LMPs are high, that allows LEAPS to obtain an energy margin of $66

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[11]/ Second Errata to Initial Testimony, Part II, A.06-08-010, April 20, 2007 (CAISO).

[12]/ The capital cost for TE/VS is $350 million and $650 million the LEAPS project.

million/year on a continuous basis, unconstrained by the unpredictable, year-to-year patterns of precipitation that dictate operation of conventional hydro resources.

A simple example can illustrate that the $66 million/year figure is a reasonable number. LEAPS can generate 500 MWh each hour for 12 hours, 365 days per year. The technology does not face the "water for electricity" constraint faced by conventional hydropower. An assumed average daytime LMP of $52.40/MWh[13] would yield a yearly revenue stream of $114.7 million.

On the other hand, LEAPS consumes power during the 12-hour period when LMPs are expected to be significantly lower. Since the expected energy storage value of LEAPS is the difference between the expected LMPs during the 12 hour peak period and the expected LMPs during the 12 hour off-peak period, it is reasonable to assume that the estimated storage value could be significant.

Q: Your expected storage benefit of LEAPS is based on expected on-peak/off-peak LMP differentials during the life of the asset. Is it reasonable to expect that such differentials between on-peak and off-peak energy prices will continue for the foreseeable future?

A. California continues to refine its wholesale market and retail-side designs. Neither I nor any other observer can be certain of the impacts on future wholesale prices of new, real-time retail pricing programs and possible retail direct access design elements. For example, it is possible that, should all the market design elements now under consideration be put in place, including forward contracting, spot market scarcity pricing could become a reality. Nevertheless, I do not know of any spot commodity market

[13]/ Initial Testimony of the California Independent System Operator – Part I, A.06-08-010, January 26, 2007, page 50. The CAISO testimony calculates an average LMP of $52.40/MWh over the entire period of the transmission study plan, including off-peak periods. Therefore, an assumption of $52.40/MWh for the on-peak period is very conservative.

where, when short-term demand goes up, prices don't go up as well. I do not expect peak and off-peak differences in demand for electricity to change significantly in the foreseeable future.

Q. Please explain your assessment of the **AS benefits** of the LEAPS facility.

A. As mentioned earlier in my testimony, the AS value of LEAPS lies in its ability to provide to the CAISO 500 MW in one minute, and to commence generating within 15 seconds after receiving a CAISO dispatch signal. These capabilities enable LEAPS to provide regulation service and both spinning and non-spinning reserve capacity to the CAISO.

Dr. Zhang's PLEXOS market simulation co-optimized the use of the LEAPS facility for sales of energy vs. ancillary services. Her analysis indicates that LEAPS' AS benefits would be approximately $57 million in 2015 (nominal 2015$). This LEAPS AS benefit comprises two elements. First, LEAPS reduces AS expenditures by $28 million a year. Second, the PLEXOS simulation also yields a LEAPS AS margin of $29 million a year which TNHC proposes be credited back to consumers.

I note the CAISO's own preliminary estimates of the AS benefits of LEAPS in a 2006 presentation on the economic benefits of the LEAPS project.[14] The following table provides the estimates from the CAISO presentation.

Table 3
CAISO Ancillary Service Benefits Preliminary Results
($M 2005 Nominal)

AS Services	Benefit
Regulation Up	14.90
Regulation Down	7.93

[14]/ CAISO Presentation: Economic Benefits Assessment of the LEAPS Project, Regional Transmission South, September 19, 2006, at 20. (Copy attached as Exhibit TNHC-20.).

Spin	11.56
Non-Spin	1.67
Total	36.05

For the sake of consistency, I will utilize Dr. Zhang's estimated AS benefits in my evaluation. In addition, the CAISO also evaluated the wind integration benefits of LEAPS. Its 2006 presentation states:

> LEAPS can provide additional regulation service to help with increased regulation and load following needs due to (the) large volume of wind generation. LEAPS can also reduce the magnitude of wind generation curtailment. [15]

The CAISO estimated the wind integration benefit of LEAPS to be $10.02 million (2006$) in 2015.

In addition, it is important to note that LEAPS will also provide a benefit during low load periods by consuming the output of must-take plants during over-generation conditions – conditions in which certain generation must be curtailed to allow the continued operation of the must-take generation. Over-generation conditions take place during the spring season. In its 2006 presentation on the economic benefits of the LEAPS project, the CAISO stated:

- Adding LEAPS will reduce/eliminate the over-generation condition that take[s] place during the spring season.
- The impact of over-generation on [the] market is that regulation down prices spike.

[15]/ Id. at 31.

- In addition, over-generation [has] caused major operation difficulties, resulting in reliability criteria violations.[16]

LEAPS would therefore mitigate spikes in regulation down prices during over-generation periods. The CAISO, which characterizes this service as an Ancillary Service, estimates the over-generation benefit of LEAPS to be $17.46 million (2006$) in the year 2015.[17]

Therefore, for the year 2015, the total benefit derived from energy sales, ancillary and related services for the TE/VS and LEAPS projects approximates $184.07 million in 2015. (Please see Table 4). This amount exceeds the combined levelized annual cost of the projects by about $39 million.

Table 4
Energy, Ancillary Service & Related Benefits of LEAPS & TE/VS
($Million 2015 Nominal)[18]

Energy Benefits	$93
Ancillary Services Benefits Over-Generation Wind Integration	$58 $20.86 $12.21
Total Energy, AS & Related Benefits	$184.07

Q. Please explain your assessment of the **Local Reliability Benefit** of TE/VS.

A. The TE/VS line provides reliability benefits to the San Diego Local Capacity Requirement area by providing an additional 1000 MW of transmission import capability. This additional capacity will reduce CAISO Reliability Must Run (RMR) contracts and

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16/ Id. at 17.

17/ 17 Id. at 32.

18/ I converted the 2006 CAISO values to 2015 nominal dollars, assuming a two percent annual rate of inflation.

reduce the obligation of SDG&E to procure capacity to comply with the CPUC's Local Capacity Requirement (LCR).[19]

To obtain the LCR compliance benefits for the TE/VS transmission line in 2015, I rely on the local reliability benefit evaluation methodology the CAISO used in its April 20, 2007 testimony in the CPUC's Sunrise Powerlink proceeding.[20][21] However, I change the increase in transmission import capacity attributable to the TE/VS line from the CAISO's assumed 500 MW to 1000 MW to reflect TNHC's estimate of the import capacity of the line. Based on my observation that the LCR benefit of the CAISO's bundled Green Path+LEAPS+TE/VS alternative is associated entirely with the TE/VS transmission line, and since this 1000 MW incremental import capacity is twice that assumed by the CAISO testimony, I have assumed the LCR benefit of TE/VS is twice the benefit of $63 million/year that the CAISO calculated for its bundled LEAPS-TE/VS-Green Path North project.

Accordingly, the LCR benefit of the TE/VS line in 2015 is an annualized $126 million/year. This is a conservative estimate because the Sunrise line would provide the same additional import capacity to the San Diego region as the TE/VS line. Since the CAISO estimates the 2015 reliability benefits of Sunrise to be $138 million/year in 2015,

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[19]/ CAISO RMR contracts comply with the CPUC's LCR. The CAISO intends to phase out the CAISO RMR contract and rely instead on the CPUC LCR contract.

[20]/ Initial Testimony of the California Independent System Operator Corporation – Part I, Application 06-08010, January 26, 2007; Second Errata to Initial Testimony, Part II, CAISO, Application 06-08-010, April 20, 2007.

[21]/ In response to a CPUC Energy Division staff request, the CAISO subsequently revised its local reliability benefit evaluation methodology to include the impact of its alternative resource plans on the LA LCR area, in addition to the San Diego LCR area. However, the structure of the new CAISO testimony "Two-LCR" (LA & SD) benefit evaluation methodology is not fully developed, is not sufficiently explained and is, in fact, internally inconsistent. As such, I have chosen to use the structure of the CAISO's "One-LCR" local reliability benefit evaluation methodology in its April 20, 2007 testimony. My decision to do so is supported by the CAISO reliance on a "One-LCR" reliability benefit evaluation methodology in both its CSRTP and 2008 LCR

one should arguably conclude that the reliability benefits of TE/VS would also be $138 million/year in 2015.

Q. What is the total annualized benefit of the TE/VS and TE/VS+LEAPS projects for the year 2015 at this point of the analysis?

A: The total annualized benefit of the TE/VS transmission project for the year 2015 equals the energy and AS benefits of $23 million + the reliability compliance benefit of $126 million, or $149 million. Since the annualized cost of TE/VS is $51.33 million, the annualized net benefit of TE/VS for the year 2015 is $97.67 million ($149 million - $51.33 million). This net benefit amount is sufficient to recover the cost of TE/VS in under five years.

The total annualized benefit of the combined TE/VS+LEAPS project equals the energy benefit of $93 million + the AS and related services benefits of $91.07 million + the reliability compliance benefit of $126 million, or total benefits of $310.07 million. Against these benefits, one must net the annualized cost of the TE/VS and LEAPS projects of $51.33 million/year and $94 million/year, respectively. Accordingly, the net benefit of the TE/VS+LEAPS projects at this stage of the analysis is an annualized $164.74 million/year. That is, the energy benefits, reliability benefits and AS benefits alone are expected to reduce CAISO consumer expenditures by $164.74 million per year in 2015.

Q. Please explain your assessment of the Resource Adequacy Capacity Benefit of the LEAPS facility.

Study processes. I must note I am not questioning the validity of a two or more LCR benefit evaluation methodological framework, but rather how the CAISO testimony has structured it.

A. The CPUC's resource adequacy policy requires its jurisdictional load-serving entities (LSEs) to procure the bulk of their wholesale electric needs through forward procurement mechanisms. Moreover, the Commission has established a capacity-based, as opposed to an energy-based, resource adequacy (RA) obligation. LEAPS would qualify as RA capacity, thereby providing an RA capacity compliance benefit. Although I do not adopt a value for this RA capacity compliance benefit, the CAISO has agreed in the Sunrise proceeding with and adopted a value of $27/kW-year (in 2006 dollars),[22] or $27,000/MWyear, as a floor for RA payments. For LEAPS, this would amount to $13.5 million/year (500MW x $27,000/MW-year = $13.5 million). Including this benefit brings the total quantified net benefits of TE/VS+LEAPS to CAISO ratepayers to $178.24 million annually.

Q. Please explain your assessment of the **RPS Benefits** of the TE/VS and TE/VS +LEAPS facilities.

A. I have not quantified an RPS compliance benefit for TE/VS and TE/VS+LEAPS. Nevertheless, the TE/VS line will directly assist the state's LSEs in meeting their RPS compliance requirements. As mentioned above, TE/VS will provide 1000 MW of additional import capacity to permit SDG&E to access a varied portfolio of renewable energy resources throughout California, the Pacific Northwest, and other parts of the western United States, as well as western Canada. Since SDG&E will have a wider array of renewable suppliers to choose from, one would reasonably expect its customers to benefit from lower RPS procurement costs than they otherwise would incur.

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[22]/ Rebuttal Testimony of the California Independent System Operator Corporation, A.06-08-010, June 15, 2007, p.35.

Although LEAPS does not qualify as an RPS resource under California law, it nonetheless will be a crucial component of the grid for the purpose of integrating intermittent wind energy resources. As such, LEAPS would greatly facilitate implementation of the state's RPS policy. In addition, LEAPS will facilitate compliance by one or more LSEs with California's Greenhouse Gas policy and associated carbon emissions standard. In this respect, LEAPS will be a critical tool to help the State of California realize its environmental policy objectives, while at the same time providing much needed electricity to serve its growing economy.

Q. What is the total net benefit of the TE/VS and TE/VS+LEAPS projects?

A. The total annualized benefit of the TE/VS and TE/VS+LEAPS projects equals the energy benefit of $93 million + the AS benefits of $58 million + the wind integration and over-generation benefits of $33 million + the reliability compliance benefit of $126 million + $13.5 million of RA benefits. This equals $323.5 million dollars/year. Since the annualized cost of TE/VS and the LEAPS projects are $51.33 million/year and $94 million/year, respectively, the net benefit of the combined TE/VS and LEAPS projects is an annualized $323.5 million - $145.33 million, or $178.17 million/year.

The total benefit of the TE/VS project alone is the energy benefit of $22 million/year + the AS benefit of $ 1 million/year + the reliability benefit of $126 million/year, or $149 million/year. With an annualized cost of $51.33 million/year, the net benefit of the TE/VS transmission project alone is more than $97.67 million/year. Although I do not quantify the RPS compliance benefit for the proposed projects, it is clear from my testimony above that TE/VS and LEAPS will provide significant RPS benefits in addition to the calculated benefits I have provided in this testimony.

Q. Does this conclude your testimony?

A. Yes.