UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
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	)	
STP NUCLEAR OPERATING COMPANY	)	Docket Nos. 52-012 & 52-013
	)	
	)	
(South Texas Project, Units 3 & 4)	)	

REVISED

Direct Testimony of

Philip H. Mosenthal

On Behalf of

Sustainable Energy and Economic Development (SEED) Coalition, Public Citizen, and South Texas Association for Responsible Energy (Intervenors)

August 11, 2011

(I.) Identification and Qualifications

Q. Please state your name and business address.

A. Philip H. Mosenthal, Optimal Energy, Inc., 14 School Street, Bristol, VT 05443.

Q. On whose behalf are you testifying?

A. I am testifying on behalf of the Sustainable Energy and Economic Development (SEED) Coalition, Public Citizen, and South Texas Association for Responsible Energy (Intervenors).

Q. By whom are you employed and in what capacity?

A. I am the founding partner in Optimal Energy, Inc., a consultancy specializing in energy efficiency and utility planning. Optimal Energy advises numerous parties including utilities, non-utility program administrators, government and environmental groups.

Q. Please provide a summary of your qualifications and experience.

A. I have 27 years of experience in all aspects of energy efficiency, including facility energy management, policy development and research, integrated resource planning, cost-benefit analysis, and efficiency and renewable program design, implementation and evaluation. I have developed numerous utility efficiency plans, and designed and evaluated utility and non-utility residential, commercial and industrial energy efficiency programs throughout North America, Europe and China.

I have also completed or directed numerous studies of efficiency potential and economics in many locations, including China, Colorado, Kansas, Maine, Massachusetts, Michigan, New England, New Jersey, New York, Quebec, Texas, and Vermont. These studies ranged from high level assessments to extremely detailed, bottom-up assessments evaluating thousands of measures among numerous market segments. Recent examples of the latter are analyses of electric and natural gas efficiency and renewable potential along with development of suggested programs for New York State, on behalf of the New York State Energy Research and Development Authority (NYSERDA).

I am currently a lead advisor for business energy services in Rhode Island and Massachusetts on behalf of the Energy Efficiency Resource Management Council and the Energy efficiency Advisory Council, respectively, overseeing and advising on utility program administrator's plans, program designs, implementation and performance.

I was the lead author of a study for Texas that identified electric efficiency and policy opportunities that could be used to reduce the total cost for Texans of electric energy services in 2007.[1] I also worked closely with ACEEE on the analysis of efficiency potential in Texas, which included ACEEE's analysis of the savings from building codes. I have also testified before the Texas House Committee on Regulated Industries on HB269 in 2007.

Prior to co-founding Optimal Energy in 1996, I was the Chief Consultant for the Mid-Atlantic Region for XENERGY, INC. (now KEMA). I have a *B.A.* in Architecture and an *M.S.* in Energy Management and Policy, both from the University of Pennsylvania. My resume is attached as Exhibit INT00002.

Q. Have you previously testified before the Nuclear Regulatory Commission ("the Commission" or "NRC")?

A. No.

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[1] Optimal Energy, Natural Resources Defense Council, CERES, *Power to Save: An Alternative Path to Meet Electric Needs in Texas,* January 2007.

(II.) Introduction and Summary of Testimony

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

A. My testimony focuses on the adequacy of the Draft and Final Environmental Impact Statements (DEIS and FEIS) for South Texas Project 3 & 4 (STP) establishing the need for power that units 3 & 4 will address.[2] Specifically, I address the lack of adequately adjusting the ERCOT forecast for additional un-projected electric savings from building codes and standards that would reduce the need for power in the ERCOT region.

Q. Please summarize your testimony.

A. Below I summarize my main points:

1. STP claims a need for baseload power by 2015, the likely earliest date for STP to begin producing power. However, the analysis of the need for power is flawed because it fails to take into account the significant savings likely to accrue to Texans from adoption of building codes addressing residential and commercial building efficiency over the planning period. My testimony presents an updated analysis, building off a 2007 analysis that the American Council for an Energy Efficient Economy (ACEEE) performed for Texas,[3] and shows that building codes in Texas

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[2] Note that the original contentions related to the Draft Environmental Impact Statement, however, since then a Final EIS has been issued. My comments apply to both of them, however, tables below rely on the FEIS.

[3] ACEEE, *Potential for Energy Efficiency, Demand Response, and Onsite Renewable Energy to Meet Texas's Growing Electricity Needs*, Mar 2007.

will provide roughly 2,419 MW of the need claimed by STP by 2025.[4] (Exhibit INT00004).

[redacted]

(III.) Building Code Impacts in Texas

Q. Please explain the building code savings issue?

A. In 2007 ACEEE analyzed the potential electricity savings in Texas from adopting building code efficiency standards. ACEEE estimated that by 2023 cumulative peak demand

[4] This is based on an analysis of the 2010 ERCOT forecast used in the FEIS. Exhibit INT0003 also shows the corresponding analysis working off of the 2009 ERCOT forecast used in the FEIS. Under that scenario, savings by 2025 would be 2,805 MW.

[5] FEIS Table 8-5 (p 8-28).

reductions would be 2,362 MW from adoption of new statewide codes. Since this time, Texas has adopted both new residential and commercial building codes. For residential, Texas has adopted the 2009 International Residential Code (IRC2009), which will require all single family new construction to meet this standard by January 1, 2012. All other residential, commercial, and industrial buildings in Texas must comply with the 2009 International Energy Conservation Code (IECC 2009) by April 1, 2011. These new codes establish much more aggressive standards for new building construction in Texas than has ever existed before. While the ACEEE analysis did not reflect the exact situation Texas finds itself in, I have made appropriate adjustments to the analysis to show that likely impact of the new building code framework in Texas will result in approximately 622 MW of savings by 2015, 1,736 MW in 2020, and 2,805 MW by 2025, compared with the ERCOT 2009 forecast. Working with the latest ERCOT 2010 forecast, these numbers drop to 494 MW in 2015, 1,404 in 2020 and 2,419 in 2025. Annual figures and supporting analysis are shown based on 2009 and 2010 forecasts in Exhibits INT00003 and INT00004, respectively.

Q. Explain the adjustments made to the ACEEE analysis?

A. The ACEEE analysis was fairly simple, and assumed a 15% improvement in all residential and commercial new construction electrical efficiency, starting in 2009 and continuing until 2019, at which point it assumed a 30% improvement for the following 4 years, resulting in a total peak load reduction of 2,362 MW in 2023. There were a few problems with the analysis that have now been modified:

1. The starting point for savings was January 1, 2009. Because the new codes are only now going into effect, the new starting point is 2011 (2012 for residential), and this results in a delay of capturing savings and lower ultimate savings, all else equal.

2. The 15% and 30% improvements were reasonable rough targets of what could be obtained with new codes, as compared to the existing standard practice in Texas which was consistent with 2000 IECC including the 2001 supplement.[6] Now that specific codes have been established, as well as an on-going procedure for regular code updates, these factors were adjusted by year to reflect the current code improvements and expected increases over time. Based on a Pacific Northwest National Laboratory (PNNL) study I assume an initial decrease in electric usage for 2009 IECC compared to the 2001 IECC of 11.4% for the non-residential sector.[7] Savings for the residential sector is assumed to be 20%, based on an analysis done by Energy Systems Laboratory (ESL) at Texas A&M University.[8] Exhibits INT00003 and INT00004 show these factors.

3. The starting point for ACEEE's analysis was the most recent ERCOT forecast at the time. I have now modified the analysis based on both the 2009 ERCOT forecast, which STP relies on in the DEIS, as well as the most recent ERCOT forecast released in June 2010, and reflected in the FEIS.[9] Because the 2010 forecast is lower, building code savings are also lower under the 2010 scenario. However, the resulting ERCOT peak demand after netting out building code savings is still lower under the 2010 scenario.

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[6] Note that a few municipalities have had somewhat stricter codes in place in recent years, however, we assume 2000 IECC with 2001 supplement represents a reasonable baseline practice prior to 2011 in Texas overall consistent with the ERCOT econometric forecast.

[7] PNNL, *Impacts of Standards 90.1-2007 for Commercial Bldgts at State Level,* Sept. 2009, http://www.energycodes.gov/publications/techassist/90-1-2007_Commercial_Nationwide_Analysis.pdf. Note that ASHRAE Standard 90.1-2007 is typically referenced by states as an alternative compliance path to IECC 2009.

[8] TAMU ESL, *Estimates of Energy Cost Savings Achieved From 2009 IECC Code-Compliant, Single-Family Residences in Texas*, Jan 2011, http://www-esl.tamu.edu/docs/terp/2011/ESL-TR-11-01-01.pdf.

[9] ERCOT, *2009 ERCOT Planning, Long-Term Hourly Peak Demand and Energy Forecast*, May 2009; and ERCOT, *2010 ERCOT Planning, Long-Term Hourly Peak Demand and Energy Forecast*, Jun 2010.

Exhibits INT00003 and INT00004 show these estimates for 2009 and 2010 forecasts, by year, respectively.

4. Finally, in my opinion the ACEEE analysis was overly optimistic in that it assumed 100% compliance with building codes. In fact, there is evidence that even once a code is adopted, compliance levels fall short of 100%. Arguably this was true before — meaning actual standard practice prior to the new code was likely less than 2000 IECC including the 2001 supplement — implying that the percentage improvements ACEEE assumed with 100% compliance may still hold. However, I have conservatively assumed initial compliance in 2011 would be 80% for commercial buildings, and 60% for single family residential buildings beginning in 2012. These are based on a review of the limited compliance studies that have been conducted nationally.[10] Further, I assume these compliance levels will ramp up to meet the current federal requirements that all states reach 90% compliance by 2017, and then maintain at the 90% rate thereafter.[11] This adjustment significantly reduces the total impact, all else equal.

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[10] See for example, Building Codes Assistance Project, *Residential Energy Code Evaluations, Review and Future Directions,* June 2005, and Zing Communications, *2007 Commercial Energy Code Compliance Study,* Jan. 2007. Also, note that many compliance studies estimate the percentage of buildings that *fully* meet code. As a result, some very low estimates may reflect that a large majority of buildings had one or a few things that didn't quite comply with code. In this case, the vast majority of the energy savings associated with the code are likely still achieved, since codes address hundreds of pieces of equipment, systems and building components. Therefore, I believe these are reasonable but conservative estimates of the ultimate compliance *on a savings weighted basis.*

[11] The ARRA section of the State Energy Program (SEP) funding included a statutory provision (Section 410) linking SEP funding to building energy code adoption and enforcement. As a condition of accepting ARRA funding, the state provided assurances they would develop and implement a plan, including active training and enforcement provisions, to achieve 90% compliance with the target codes by 2017. See for example, National Association of State Energy Officials (NASEO), *State Compliance Requirements and Resources for ARRA Building Energy Code Provisions,* January 2011, http://naseo.org/codes/documents/NASEO-ARRA_Codes_Compliance_Handout.pdf

Q. Explain your assumptions regarding future building code updates in Texas?

A. Current practice in Texas is to consider updates to statewide codes after each new standard is published, and to adopt the enhanced standards conditional on a recommendation from the Energy Systems Laboratory (ESL) at Texas A&M University. Since model codes are developed by numerous stakeholders on a consensus basis and generally focus on pulling up the lease efficient new buildings rather than pushing the envelope of potentially cost-effective measures, I assume that these model codes will be adopted in Texas. The cycle for model code upgrades is triennially. I therefore assume code updates occur every three years.

To model the increased savings from future codes I estimated future percentage improvements from code updates based on an analysis by ESL for residential code savings as well as a DOE estimate of the improvement of the latest IECC 2012.[12] This resulted in the first updates achieving 39% and 22% better than IECC 2001 for residential and non-residential, respectively. For future years I assume lower increases of 10% for residential and between 4-5% for non-residential for each update.

Q. How do the building code savings affect the claimed need for STP Units 3 & 4?

A. Relying on the 2009 ERCOT forecast, building codes will provide 622 MW by 2015 (likely the earliest STP could be available to produce power), and 2,805 MW by 2025. Adjusting

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[12] TAMU ESL, *Estimates of Energy Cost Savings Achieved From 2009 IECC Code-Compliant, Single-Family Residences in Texas*, Jan 2011, http://www-esl.tamu.edu/docs/terp/2011/ESL-TR-11-01-01.pdf, and U.S. DOE: http://www.energycodes.gov/status/2012_Final.stm.

for ERCOT's latest 2010 forecast the corresponding figures would be 494 MW and 2,419 MW, respectively.

Table 1 below shows the ERCOT projected need based on Table 8-5 of the FEIS both with and without retirements, the building code impacts, and the net actual projected need once these building codes are taken into account. Based on ERCOT's estimate and assumed generating assets, there is no need until after 2015 even when comparing to total peak demand, not just the baseload fraction of load. Specifically, in 2015 there would be excess generating capacity of 1,229 MW. By 2020 there would be a need of 1,828 MW. Interpolating, this would imply the need would not start until sometime around 2017 or 2018.[13] Assuming full retirements per the FEIS there would still be a need as early as 2015, with a shortfall of 4,894 MW of peak demand. Actual baseload need would likely be less.

Table 1: Net Need Adjusting for Building Codes

	Calculation	2015	2020	2025
Firm Load, Less Additional Efficiency (MW)[1]	A	68,141	72,807	76,494
Required Reserve Margin (13.75%) (MW)[2]	B = A x 13.75%	9,369	10,011	10,518
Total Firm Load + Reserve Margin (MW)	C = A + B	77,510	82,818	87,012
Resources, no retirements (MW)[1]	D	78,245	79,586	78,586
Net Need, no retirements (MW)	E = C - D	-735	3,232	8,426
Building Energy Codes Savings (MW)	F	494	1,404	2,419
Net Need After Building Energy Codes (MW)	G = E - F	-1,229	1,828	6,007
Resources, with retirements (MW)[1]	K	72,122	67,149	59,201
Net Need, with retirements (MW)	L = C - K	5,388	15,669	27,811
Building Energy Codes Savings (MW)	M = F	494	1,404	2,419
Net Need After Building Energy Codes (MW)	N = L - M	4,894	14,265	25,392

References:
1) Environmental Impact Statement for Combined Licenses (COLs) for South Texas Project Electric Generating Station Units 3 and 4, U.S. Nuclear Regulatory Commision, February 2011. Table 8-5.
2) Ibid, p.8-15

[13] Note that annual savings grow over time because of the larger load and past buildings built under the code continue to provide savings.

Q. The Table above only addresses the total peak load on the ERCOT system. However, STP would provide baseload power. Therefore, isn't it true that these are not comparable numbers?

A. Not exactly. Baseload is typically provided by plants that enjoy relatively low variable fuel and O&M costs, and are reliably available most of the time. Typically, these are coal, nuclear and hydro plants, which while their capital costs can be very large, are generally the cheapest per kWh to run once they are built. Alternatively, other resources are often used more sporadically because they can be ramped up or down quickly, have relatively lower capital costs but higher variable costs (e.g., combustion turbines), or because they cannot be counted on to be available all the time (e.g., wind and solar). However, currently ERCOT (as is true of all ISOs) meets the full load on the system at any given time, using the most economical dispatch of available resources. So, any reduction in the total loads can translate directly to reductions in the need for baseload capacity, since the "peaker" units that supplement baseload would still exist and can still capture the same differential between the baseload generation and the actual peak.

In addition, because building codes generally address improved efficiency within buildings, like all efficiency resources they have the advantage of generally following loads well. For example, the greatest savings from codes should come at those times that buildings are using the most — for example on a hot summer day with heavy air conditioning load. Therefore, building codes have a tendency to somewhat flatten the load curves on the system, thereby possibly providing even greater benefits related to baseload plants by freeing up more peaking generating capacity for supplemental power.

[redacted]

[redacted]

[redacted]

Table 2: Net Need Adjusting for Building Codes & Federal Standards

	Calculation	2015	2020	2025
Firm Load, Less Additional Efficiency (MW)[1]	A	68,141	72,807	76,494
Required Reserve Margin (13.75%) (MW)[2]	B = A x 13.75%	9,369	10,011	10,518
Total Firm Load + Reserve Margin (MW)	C = A + B	77,510	82,818	87,012
Resources, no retirements (MW)[1]	D	78,245	79,586	78,586
Net Need, no retirements (MW)	E = C - D	-735	3,232	8,426
Building Energy Codes Savings (MW)	F	494	1,404	2,419
Net Need After Building Energy Codes (MW)	G = E - F	-1,229	1,828	6,007
Federal Equipment and Appliance Standards Savings (MW)	H	1,208	1,598	1,989
Net Need After Federal Equipment and Appliance Standards (MW)	J = G - H	-2,437	230	4,018
Resources, with retirements (MW)[1]	K	72,122	67,149	59,201
Net Need, with retirements (MW)	L = C - K	5,388	15,669	27,811
Building Energy Codes Savings (MW)	M = F	494	1,404	2,419
Net Need After Building Energy Codes (MW)	N = L - M	4,894	14,265	25,392
Federal Equipment and Appliance Standards Savings (MW)	P = H	1,208	1,598	1,989
Net Need After Federal Equipment and Appliance Standards (MW)	Q = N - P	3,686	12,667	23,403

References:
1) Environmental Impact Statement for Combined Licenses (COLs) for South Texas Project Electric Generating Station Units 3 and 4, U.S. Nuclear Regulatory Commision, February 2011. Table 8-5.
2) Ibid, p.8-15

Q. How did you estimate the savings from Federal standards?

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

14 ACEEE, *Appliance Efficiency Standards in the 2007 Energy Bill: Key Facts,* Dec 2007, http://www.aceee.org/files/pdf/fact-sheet/EnergyBillSavings12-14.pdf. National figures were scaled to the State of Texas, and then adjusted downward by 15% to reflect ERCOT estimated at 85% of the Texas electric load (FEIS p. 8-2).

[redacted]

[redacted]

[redacted]

[redacted]

(VI.) Conclusions

Q. Please summarize your overall conclusions from your analysis?

A. My analysis shows that the FEIS has failed to adequately show a need for the STP by 2015-2020 (the likely range of dates where STP could begin power production) because:

1. The FEIS failed to adjust the ERCOT forecast for reductions in load resulting from building codes; and

[redacted]

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[15] FEIS pp.8-30, 8-31.

Overall, the need for STP Units 3 and 4 is not proven, given ERCOTs estimates of forecasted load, the energy reductions that will come from building codes and standards, and ERCOT's projections of generating capacity. Rather, ERCOT should enjoy an excess reserve margin as late as 2020 (without retirements) after taking these issues into account, resulting in no need for [redacted]

Q. Does this conclude your testimony?

A. Yes.

Affidavit of Philip H. Mosenthal

I, Philip H. Mosenthal, affirm that the attached Direct Testimony of Philip H. Mosenthal, dated May 9, 2011, on behalf of Intervenors submitted to the United States Nuclear Regulatory Commission before the Atomic Safety and Licensing Board re: In the Matter of STP Nuclear Operating Company (South Texas Project, Units 3 & 4), in Docket Nos. 52-012 & 52-013, is true and correct to the best of my knowledge. The subject testimony and supporting analyses were developed by me or under my direction.

[signature] 5/9/2011

Philip H. Mosenthal — Date

Notarized by:

[signature] 5/9/2011 2/10/15

April Clodgo — Date — Notary Expires:

APRIL CLODGO
NOTARY PUBLIC
ADDISON COUNTY, V.T.