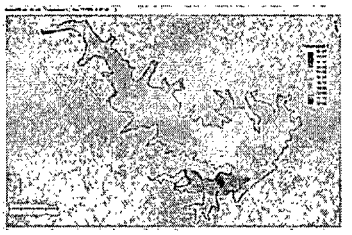
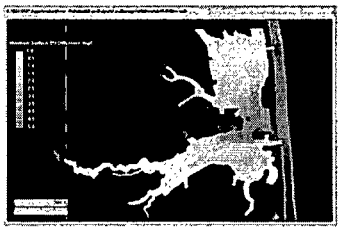
Intake Water Temperature Reduction Alternatives

TXU, Comanche Peak SES, Glen Rose, Texas





Situation

The purpose of this study was to present a performance and economic evaluation of several supplemental cooling options to decrease the cooling water intake temperature for Comanche Peak Steam Electric Station (CPSES). CPSES uses Squaw Creek Reservoir (SCR) to transfer waste heat to the atmosphere. The cooling water intake structure located near the western shore withdraws 2.2 million gpm of water at its peak capacity. This heated water is routed back in to the reservoir through a discharge pipe located at the southern end of the peninsula allowing it to cool naturally. Due condenser pressure limitations at high intake temperatures and inadequate natural cooling, a supplemental cooling options to reduce intake temperatures below 95 F were evaluated. In addition, cost benefit analyses of the options were performed.

Approach

A three dimensional hydrothermal model, GEMSS® (Generalized Environmental Modeling System for Surfacewaters) was used to model the SCR's response to the reduced waste heat loads. The modeling effort consisted of calibrating, then verifying computed temperatures against field data. The calibrated model was then used to predict the SCR response to full capacity operations. For the simulation year chosed, intake temperatures exceeded 95 F more than 80 days. Plant production decreases once the intake temperature goes above 95 F and ultimately needs to be shut down at 101 F when the condenser pressure reaches 5.0 in. HgA.

The supplemental cooling options that were analyzed for the study were: Oriented Spray Cooling Systems (OSCS), Mechanical Draft Cooling Towers (MDCT), and Water Garden Steps (WGS). The option of increasing the SCR surface area by 5% to enhance the surface heat exchange was also considered. These supplemental cooling systems were designed to cool 25% of the intake water. To increase the overall effectiveness of these systems, a dike enclosing the intake was designed to restrict the mixing of the cooled water and the hot reservoir water.

Results

The SCR's response to the designed supplemental cooling system was found to be favorable. On the other hand, the increased surface area did not contribute much to decrease the intake temperature. The supplemental cooling systems lowered the intake temperatures by up to 5F making the occurrence of the "greater than 95 F" event almost non-existent. While effective, these supplemental cooling systems increased the house load by a considerable amount. This increased house load alone rendered the MDCT and WGS systems ineffective in terms of capital and operational costs to benefit ratio. OSCS resulted in an increased power generation but was associated with high capital cost. A minimal return on investment of 2% was not justifiable economically and thus became the basis for subsequent rejection of the OSCS system.

Comments Regarding Draft Environmental Impact Statement for Combined Licenses (COLs) for Comanche Peak Nuclear Power Plant Units 3 and 4

By David Power
Public Citizen's Texas Office

I have reviewed the Nuclear Regulatory Commission's Draft Environmental Impact Statement for Combined Licenses for Comanche Peak Nuclear Power Plant, Units 3 and 4, and I offer the following comments regarding the revision based on my best professional judgment.

Summary

After reviewing the draft, it is my professional judgment that the NRC Staff has committed numerous errors in the calculation of the need for power.

The DEIS failed in the need for power discussion to adequately consider reductions in demand for power and additional capacity from renewables, additional capacity already planned for the ERCOT market and the ability to cost effectively provide significant quantities of additional power through simple modifications to the existing natural gas generation. Additionally, the market conditions make it unlikely that proposed Comanche Peak Units 3 and 4 would be able to operate competitively in the ERCOT market. [1]

The DEIS has also failed to calculate the significance of climate change on the environment, the methods of calculating the global climate change emissions from the proposed nuclear generating facility, the significance of the emissions from this plant compared to alternatives and the impact of climate change on the operations of this plant.

These issues are discussed below.

The NRC Staff's DEIS is flawed because it failed to do a thorough analysis of the need for power[2].

NRC Staff failed to adequately consider:

Net Revenue Analysis The Ercot 2009 State of the Market Report by POTOMAC ECONOMICS, LTD (ERCOT market monitor) performs an analysis of the ERCOT market: Net revenue is defined as the total revenue that can be earned by a new generating unit less its variable production costs. It represents the revenue that is available to recover a unit's fixed and capital costs. Hence, this metric shows the economic

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1 2009_ERCOT_SOM_REPORT_Final.pdf, Page XX.

2 Standards for critiquing the need for power section are from Draft NUREG-1937 D-54 March 2010:
Affected states or regions may prepare a need for power evaluation and assessment of the regional power system for planning or regulatory purposes. A need for power analysis may also be prepared by a regulated utility and submitted to a regulatory authority, such as a state public utility commission. However, the data may be supplemented by information from other sources. The determination for the need for power is not under NRC's regulatory purview. When another agency has the regulatory authority over an issue, NRC defers to that agency's decision. The NRC staff will review the need for power and determine if it is (1) systematic, (2) comprehensive, (3) subject to confirmation, and (4) responsive to forecasting uncertainty. If the need for power evaluation is found to be acceptable, no additional independent review by the NRC is needed. The information provided in this comment will be considered to determine whether it significantly affects the forecast on which the applicant relied for its need for power analysis.

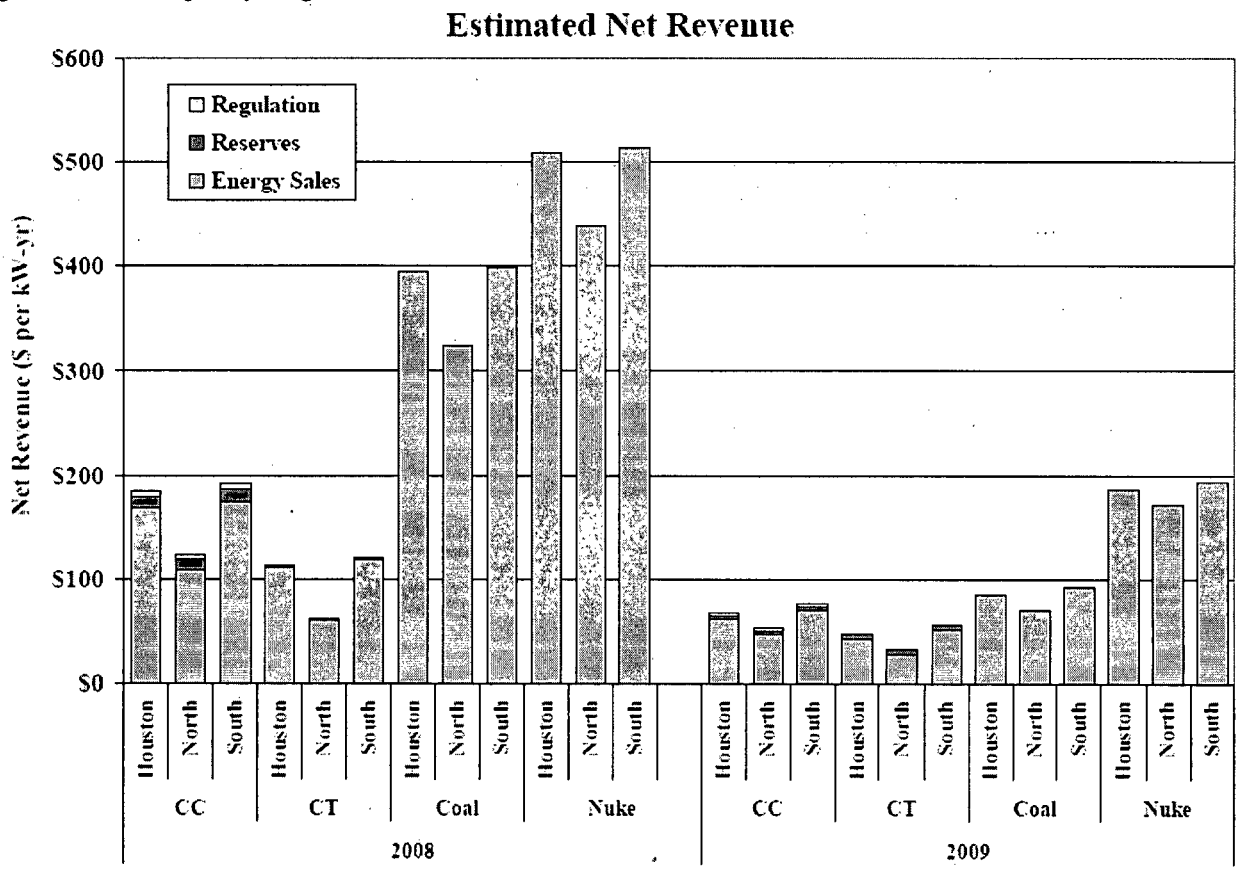
signals provided by the market for investors to build new generation or for existing owners to retire generation. In long-run equilibrium, the markets should provide sufficient net revenue to allow an investor to break-even on an investment in a new generating unit, including a return of and on the investment. In the short-run, if the net revenues produced by the market are not sufficient to justify entry, then one of three conditions likely exists:

(i) New capacity is not currently needed because there is sufficient generation already available;

(ii) Load levels, and thus energy prices, are temporarily low due to mild weather or economic conditions; or

(iii) Market rules are causing revenues to be reduced inefficiently.

1) Likewise, the opposite would be true if the markets provide excessive net revenue in the short-run. Excessive net revenue that persists for an extended period in the presence of a capacity surplus is an indication of competitive issues or market design flaws. The report estimates the net revenue that would have been received in 2008 and 2009 for four types of units: a natural gas combined-cycle generator, a simple-cycle gas turbine, a coal unit, and a nuclear unit.



The figure above shows that the net revenue decreased substantially in 2009 compared to each zone compared in 2008. Based on our estimates of investment costs for new units, the net revenue required to satisfy the annual fixed costs (including capital carrying costs) of a new gas turbine unit ranges from $70 to $95 per kW-year. The estimated net revenue in 2009 for a new gas turbine was approximately $55, $47 and $32 per kW-year in the South, Houston and North Zones, respectively. For a new combined cycle unit, the estimated net revenue requirement is approximately $105 to $135 per kW-year. The estimated net revenue in 2009 for a new combined cycle unit was approximately $76, $67 and $52 per kW-year in the South, Houston and North Zones, respectively.

These values indicate that the estimated net revenue in 2009 was well below the levels required to support new entry for a new gas turbine or a combined cycle unit in the ERCOT region. Prior to 2005, net revenues were well below the levels necessary to justify new investment in coal and nuclear generation. However, high natural gas prices through 2008 allowed energy prices to remain at levels high enough to support new entry for these technologies. The production costs of coal and nuclear units did not change significantly over this period, leading to a dramatic rise in net revenues. With the significant decline in natural gas and energy prices in 2009, these results changed dramatically from recent years. For a new coal unit, the estimated net revenue requirement is approximately $190 to $245 per kW-year. The estimated net revenue in 2009 for a new coal unit was approximately $93, $84 and $70 per kW-year in the South, Houston and North Zones, respectively. For a new nuclear unit, the estimated net revenue requirement is approximately $280 to $390 per kW-year. The estimated net revenue in 2009 for a new nuclear unit was approximately $194, $187 and $172 per kW-year in the South, Houston and North Zones, respectively. These values indicate that the estimated net revenue for a new coal and nuclear unit in the South, Houston and North Zones was well below the levels required to support new entry in 2009. " This calls into question the validity of the NRC staff's determination on 8-1 line 43 that market conditions justify Luminant's proposal.

2) Peaking energy rather than base load is required: On page 43 of the Potomac report the conclusions state that peaking energy rather than base load (as stated by Lumiant) is on the increase and that while average loads increased from 2006 to 2008 and decreased in 2009 it was the top 5% of high demand hours that increased significantly, more than double than 2008.[3] This trend is predicted to continue and significant additional capacity is expected to be needed that will operate less than 5% of the hours in a year or less.[4] In addition, the implementation of PRR 776 allowed quick start turbines, which had been participating in the non-spinning reserve market to offer their capacity into the balancing energy market increasing their ROI and providing additional balancing energy.

3) Underestimating the continued growth of the wind generation market in Texas: at page 9-21, lines 3 thru 8, Luminant concluded that it would take more than 10,000 MW of wind to replace the base load capacity provided by the proposed CPNPP units 3 and 4. Texas has now "officially" exceeded the 10,000 MW of installed wind capacity threshold (with 10,030 MW) based on information on ERCOT's Renewable Energy Credit (REC) Program website[5]. Texas has already exceeded the goals set for its renewables program for the year 2025.

Technology Type	REC Gen Accts	Offset Gen Accts	New MW Capacity	Offset MW Capacity	Total Current MW Capacity
Biomass	6	0	40.3	0.0	40.3
Hydro	3	2	33.1	178.5	211.6
Landfill Gas	14	1	80.3	3.3	83.6
Solar	3	0	1.2	0.0	1.2
Wind	77	3	9914.6	115.8	10030.4
Total (rounded)	103	6	10,069.5	297.6	10,367.1

Based on this information there is currently enough wind power alone to provide the necessary

3 2009_ERCOT_SOM_REPORT_Final.pdf page 43
4 2009_ERCOT_SOM_REPORT_Final.pdf page 45
5 ERCOT'S 2009 ANNUAL REPORT ON THE TEXAS RENEWABLE ENERGY CREDIT TRADING PROGRAM

capacity according to Luminant's calculations.

4) The DEIS analysis does not account for increases in wind carrying capacity: ERCOT has also increased their estimate of wind carrying capacity reported in their March 2010 report from 708 MW to 793 MW in May or a 12% increase in just 2 months and an additional increase of 115 MW6 by 2015[6]. This does not take into account any increases in effective load carrying capacity (ELCC) factor that coastal or off shore wind developments might add or the addition of large scale storage in the market to time shift the energy provided by wind or solar generation assets.
5) More efficient deployment and dispatch: With the nodal deployment in December of 2010 there should be significant reductions in congestion based dispatch of generation resources. The West Energy Zone in ERCOT transitioned from a net importer in 2006 to a net exporter in 2008 and 2009. This reflects the significant increases in the installed capacity of wind resources in the West Zone that occurred over this time period. The bifurcated process of resolving zonal and local congestion can at times lead to reliability conflicts that are difficult to resolve within the relatively inflexible framework of the zonal market design.
   The nodal market will provide many improvements, including unit-specific offers and shift factors, simultaneous resolution of all transmission congestion, actual output instead of schedule-based dispatch, and 5-minute instead of 15-minute dispatch, among others. These changes should help to increase the economic and reliable utilization of scarce transmission resources well beyond that experienced in the zonal market, and in so doing, also dispatch the most efficient resources available to reliably serve demand.
6) The increase of responsive reserves: Ercot currently acquires 1,150 MW of load acting as a responsive reserve (LaaRs) but as of December 2009, over 2,200 MW of capability were qualified as LaaRs[7].
7) The ability of natural gas generation units to inexpensively increase capacity: ERCOT currently calculates EFDH (equivalent forced de-rated hours) of its natural gas turbine fleet due to the decrease in energy output based on weather conditions (increase in inlet air temperature decreases the output of the turbine).

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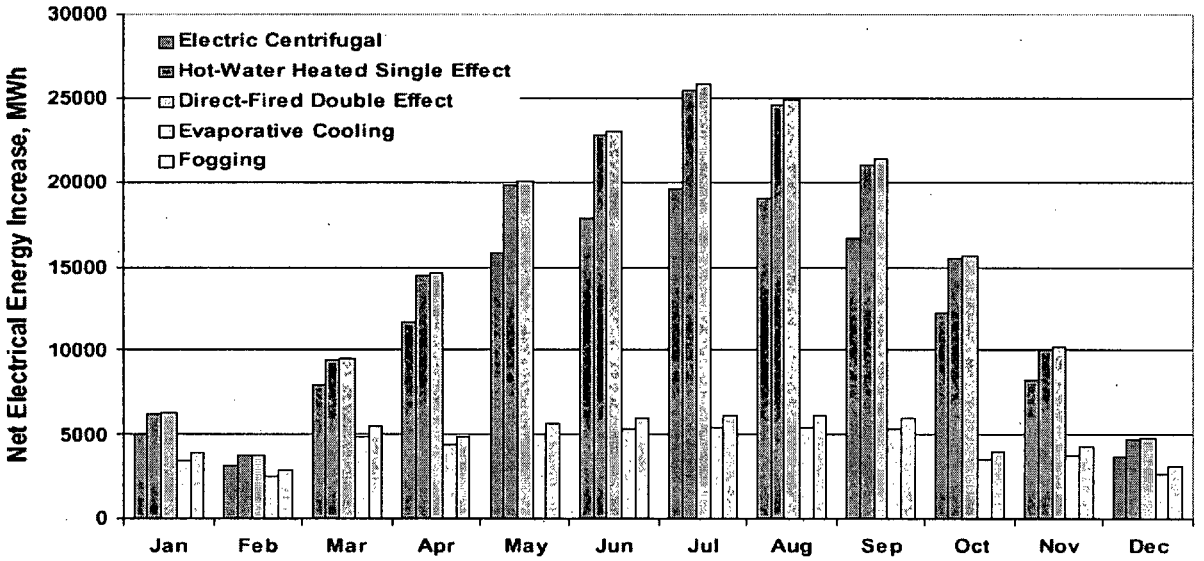
6 This is ERCOT's effective load carrying capacity (ELCC) of additional wind generation expected to be available from planed units installed by 2015. The ERCOT Effective Load Carrying Capacity is an estimate calculation by ECROT on the availability of wind recourse to carry firm load for an extended period of time. In effect it takes the most conservative approach to de-rate the amount of energy that wind provides to the market. It does not take into account the availability of wind generation to provide energy to the market but is a obsolete worst case calculation that is used to perform generation planning. On 3/25/2010 ERCOT reported on a new study to revise these calculations as the old capacity factor has become dated with the installation of thousands of MW new wind generation all across the ERCOT market that have substantially different generation profiles than originally calculated. In addition the original calculation did not take into account all hours of the year but used a statistical sampling, a low number of iterations were used to simplify the calculation and only randomized days were modeled for each month. The new calculation should provide a higher ELLC that more accurately characterizes the generation capability provided by the wind generation recourses. However it will not take into consideration the deployment of energy storage and other technologies being deployed to optimize delivery of the energy generated. From the ERCOT report dated 3/25/2010 they will be addressing these shortcomings for the 2012 projections and realize that this adjustment will have to be updated to account for additional generation as it is deployed.

7 2009_ERCOT_SOM_REPORT_Final.pdf



An example of monthly incremental electrical energy provided by various TIC options for a 316-MW Cogeneration system in Pasadena, TX (Punwani 2001)8

Adding Turbine inlet cooling (TIC) can provide significant increase in energy during the peak load months when it's needed while reducing emissions for a low cost. A national study showed that the reduction in capacity exceeded 29,000 MW in the summer months[9], on average, that could be restored by proper application of this technology. The hot southern states have a greater impact in reduction due to climate conditions of this sort.

8) The much lower cost of energy efficiency: As an example, recent reports by Nexant[10] in a study of the San Antonio demand side management program show that their energy efficiency program has significant energy savings at very low cost. They stated in their report to San Antonio, "As programs expand, CPS Energy should continue planning for the resources necessary to support large-scale deployment of DSM program portfolio and to achieve both short-term and long-term goals." The overall cost of the program as defined for the energy efficiency programs only is: "Cost of Saved Energy = $0.032/kWh." This does not take into account the additional reduction in peak costs that their load management programs achieved. The combined programs were determined to have achieved a reduction of 44.7 MW of peak energy with an expected energy savings of 86,712,978 kwh. The Texas Public Utility Commission has issued a modification of the state's energy efficiency incentive program and has released a rule that will change the goal of the program. The proposed rule will increase the annual reduction from the current standard of 20% of new growth in demand to 25% and then to 30% of new growth in demand. Using the published ERCOT consumption data[11] this would reduce energy consumption in the regulated areas of the state starting in 2012 and increasing every year annually would reduce the need for the projected additional generation. ERCOT does not currently use energy efficiency other than those based on Texas HB3693 in its projections and is currently shown to be calculated at only 242 MW annually this savings will increase to approximately 300 MW annually and will total an additional 580MW saved that are

8 "TICA WhitePaper_2009Nov24.pdf," 12.

9 "TICA WhitePaper_2009Nov24.pdf,"

10 Jim Herndon, Senior Project Manager Energy and Carbon Management CPS Nexant Measurement and Verification of CPS Energy's 2009 DSM Program Offerings 4/26/2010

11 Ercot May 2010 load forecast and reserve margin update.

not shown in the DEIS table 8-1. In Addition ERCOT's current long term demand forecasting does not include future increases in savings from improved building codes, the many large municipalities that are introducing programs that go above the current required code (Dallas, Austin etc). It does not include weatherization or energy efficiency programs implemented by municipally owned utilities, Austin and San Antonio have set aggressive goals in this regard. New appliance standards, solar and other distributed generation and DSM programs (Austin Energy s current program controls between(100-160 MW) of load at peak) will all have an effect of reducing the need for new generation.

9) Texas Non-wind RPS: The PUC is considering adding an additional renewable energy mandate to the state's existing Renewable Portfolio Standard. This has been assigned a project #35792 and a straw-man has been issued.[12] This would provide an additional 500 MW of generating capacity in the ERCOT market.

10) New Building codes: The State Energy Conservation Office (SECO) has announced that the state will be adopting the IECC 2009 building code. The International Energy Conservation Code (IECC) is a national, consensus-based, model code. The 2009 IECC is expected to result in significant energy savings and related emissions reductions estimated at 12 to 15% annual improvement for average homes. In a report examining the potential for energy efficiency in Texas, the American Council for an Energy Efficient Economy estimates that with this new code Texas could save 10,533 kilowatt hours of electricity annually and 2,362 megawatts annually of peak summer demand by 2023.[13][14] These new standards have significant increases in the requirements for energy savings that are required for all new construction.[15] According to the Building Code's Assistance Project (BCAP)[16] when Texas begins implementing the 2009 IECC and Standard 90.1-2007 statewide in 2011, businesses and homeowners would save an estimated $785 million annually by 2020 and $1.605 billion annually by 2030 in energy costs (assuming 2006 prices). Additionally, implementing the latest model codes would help avoid

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12 The hearing on this rule was held 4/30/2010, final comments were filed 5/11/2010, rule would apply starting in 2011 at 100MW and ramp to 500 MW by 2015

13 House Energy Resources Subcommittee for Energy Efficiency and Renewables April 2, 2009, Written Testimony of Kate Robertson, Energy Efficiency Specialist Environmental Defense Fund

14 ACEEE, *Potential for Energy Efficiency, Demand Response, and Onsite Renewable Energy to Meet Texas's Growing Electricity Needs* (Report Number E073), March 2007.

15 SUBCHAPTER E. TEXAS BUILDING ENERGY PERFORMANCE STANDARDS 34 TAC §19.53
"The Comptroller of Public Accounts proposes new §19.53, concerning building energy efficiency performance standards. The new section is created in compliance with Health and Safety Code, §388.003(b-1), which authorizes the State Energy Conservation Office (SECO) to adopt equivalent or more stringent energy codes than those adopted in Health and Safety Code, §388.003(a) and (b).
New §19.53(a) adopts the energy efficiency provisions of the International Residential Code as they existed on May 1, 2009, as the energy code for single family residential dwellings, as that term is defined in Health and Safety Code, §388.002(12). New §19.53(b) adopts the International Energy Conservation Code as it existed on May 1, 2009, for all other residential, commercial, and industrial construction in this state.
§19.53.Building Energy Efficiency Performance Standards.
(a) Single-family residential construction. Effective January 1, 2012, the energy efficiency provisions of the International Residential Code as they existed on May 1, 2009, are adopted as the energy code in this state for single-family residential construction as it is defined in Health and Safety Code, §388.002(12).
(b) All other residential, commercial, and industrial construction. Effective January 1, 2011, the International Energy Conservation Code as it existed on May 1, 2009, is adopted as the energy code for use in this state for all residential, commercial, and industrial construction that is not single-family residential construction under subsection (a) of this section.
This agency hereby certifies that the proposal has been reviewed by legal counsel and found to be within the agency's legal authority to adopt.
Filed with the Office of the Secretary of State on March 11, 2010."

16 http://bcap-energy.org/

about 213.9 trillion Btu of primary annual energy use by 2030 and annual emissions of more than 15.6 million metric tons of CO2 by 2030.[17]

11) The new study on Energy Efficiency in the South found that fewer new power plants would be needed with a commitment to energy efficiency.[18] The analysis of nine illustrative policies shows the ability to retire almost 25 GW of older power plants – approximately 10 GW more than in the reference case. The nine policies would also avoid over the next twenty years the need to construct 49 GW of new plants to meet a growing electricity demand from the RCI sectors.[19] Further, the industrial sector offers the greatest energy efficiency potential in Texas. In 2020, savings from all three sectors is about 10% (1,180 TBtu) of the total energy consumed by the State in 2007. Electricity savings constitute 668 TBtu of this amount. With these policies, the generation of electricity from the equivalent of 17 power plants of 500-MW each could be avoided in the year 2020.[20]
12) Additional Federal Incentives: In addition to the $218 million in funding from the American Recovery and Reinvestment Act, additional federal incentives for energy efficiency programs recently passed in the House of Representatives in HB5019 and would provide over $6 billion in energy efficiency retrofit incentives further reducing the need for new generation.
13) Compressed Air Energy Storage: Significant advances in energy storage technologies are being made and several examples were listed in the report. The DEIS omitted the well publicized project that Luminant has announced. "Shell WindEnergy Inc. and Luminant, a subsidiary of TXU Corp., announced today a joint development agreement for a 3,000-megawatt wind project in the Texas Panhandle and to work together on other renewable energy developments in Texas. Shell and Luminant will also explore the use of compressed air storage, in which excess power could be used to pump air underground for later use in generating electricity. This technology will further improve reliability and grid usage and becomes more economical with large-scale projects, such as proposed for Briscoe County.Recent testimony by Shell before the Public Utility Commission of Texas demonstrated the Briscoe County project could deliver the lowest-cost wind energy for consumers. This low cost is driven by excellent wind resources and the comparatively lower cost to bring that energy to market from the Texas Panhandle region."Shell is constantly looking for solutions to deal with climate change and increasing our energy diversity. Wind is part of the answer. Our approach is a cost-effective solution for consumers," said John Hofmeister, president of Shell Oil Company."Luminant is committed to providing Texans with clean sources of energy, and this agreement with Shell is a real next step in delivering on that commitment" said Mike Childers, CEO of Luminant Development."Luminant is already the state leader in wind-energy purchases, and co-developing this project would take us a long way toward our goal of doubling our portfolio." "Shell and Luminant will also explore the use of compressed air storage, in which excess power could be used to pump air underground for later use in generating electricity. This technology will further improve reliability and grid usage and becomes more economical with large-scale projects, such as proposed for Briscoe County." should not be overlooked.[21]
14) As discussed in the "Comments Regarding Luminant's Revision to the Comanche Peak Nuclear Power Plant" by Raymond H. Dean, Ph.D, there has been considerable additional information on the conclusions of combining new generation power sources with storage that would also apply in this instance. Natural gas, wind, solar; and energy storage either individually or in

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[17] http://bcap-ocean.org/state-country/texas

18 April 13, 2010 Georgia Institute of Technology and Duke University STATE PROFILES OF ENERGY EFFICIENCY OPPORTUNITIES IN THE SOUTH: TEXAS

19 Id

20 Id

[21] "Luminant - News Release," http://www.luminant.com/news/newsrel/detail.aspx?prid=1087.

combination, are viable alternatives that could both produce base-load power and be environmentally preferable to nuclear generation.

Conclusion

When considering all reductions in demand, due to efficiencies, distributed generation and DSM programs that are implemented by municipally owned utilities, the forecast reflects a likely decrease in the total need for energy by 2020. This reduction in demand, combined with the anticipated additional non-nuclear generation, including increased capacity for wind, solar, geothermal and other renewables, makes the addition of Comanche Peak Units 3&4 unnecessary to meet base-load needs. Then, if the industrial customers follow the recommended guidelines[22], an additional 8,500 MW of reduction could be achieved. Any need for additional generation to serve the market at this time would have to be in doubt.

22 Industrials do not currently participate in the State energy efficiency programs

Report of Tom "Smitty" Smith

Data shows that Proposed Plants Plant Operation Could Be Curtailed or Shut Down Due to High Cooling Water Temperatures

There is a great likelihood that climate change will warm the temperatures of the water supplying Comanche Peak. Water temperatures currently hover close to the unsafe range and only an increase of a few degrees may mean the plant will have to be shut down and significant replacement power costs will be incurred. In the summer months of July and August Lake Granbury water temperatures exceed 95 degrees, which is the temperature that leads to a reduction in generation at the plant. If the temperature exceeds 101 degrees, then the plant ultimately needs to be shut down.
http://www.erm-smg.com/TXU%20Comanche%20Peak.pdf

Likely increase of ambient air temperatures

Using the analysis from The Nature Conservancy based on the IPCC's Fourth Assessment Report at http://www.ClimateWizard.org, we find that likely temperature changes within the expected operating life of the plant to be in excess of 6 degrees (f). Add that to the average current high temperatures on Lake Granbury and the plant will likely have to curtail generation and may not be able to operate without constraint several months each summer.

	Average of all Models (regression)	Emissions Scenarios		
		High	Medium	Low
Mid-century (2050s)	**6 °F**	6-6.3 °F	3-5 °F	3-5 °F
Late century (2080s)	**4 °F**	8 -9 °F	6-7 °F	4-6 °F

Here is the raw data based on the specific longitude and latitude of the Comanche Peak region from the various climate models, with B1 a low emissions scenario, AID medium and A2 high emissions. All temperatures are increase temperature in degrees Fahrenheit showing a range of temperature increases by 2050 from a low of 1.5 f to a high of 6.37 f

Mid-century (2050s)

Model	*B1*	*A1B*	*A2*
bccr_bcm2_0.1	3.85	4.99	4.83
cccma_cgcm3_1.1	2.96	4.11	4.16
cnrm_cm3.1	3.91	5.29	4.71
csiro_mk3_0.1	1.84	2.68	2.98
gfdl_cm2_0.1	3.37	5.66	5.57
gfdl_cm2_1.1	3.05	4.88	4.47
giss_model_e_r.1	3.26	4.09	4.36
inmcm3_0.1	3.61	4.99	5.21
ispl_cm.41	4.67	6.35	5.53
microc3_2_medres.1	4.44	6.12	6.06
miub_echo_g.1	2.84	4.30	4.59
mpi_echam5.1	4.22	5.07	4.16
mri_cgcm2_3_2a.1	3.00	4.24	3.61
ncar_ccsm3_0.1	4.10	5.17	5.26
ncar_pcm1.1	1.50	3.29	2.56
ukmo_hadcm3.1	5.16	6.37	5.34

Late century (2080s)

Model	*B1*	*A1B*	*A2*
bccr_bcm2_0.1	4.08	6.34	7.12
cccma_cgcm3_1.1	3.61	5.05	6.54
cnrm_cm3.1	5.09	7.92	8.67
csiro_mk3_0.1	2.32	4.66	5.76
gfdl_cm2_0.1	5.19	7.58	8.79
gfdl_cm2_1.1	4.37	6.69	7.76
giss_model_e_r.1	4.19	6.28	8.07
inmcm3_0.1	4.83	6.21	7.54
ispl_cm.41	6.14	8.30	9.85
microc3_2_medres.1	6.12	8.82	10.05
miub_echo_g.1	4.73	6.74	6.99
mpi_echam5.1	5.14	7.10	8.11
mri_cgcm2_3_2a.1	4.48	5.74	6.23
ncar_ccsm3_0.1	3.49	6.41	8.40
ncar_pcm1.1	2.89	4.55	4.34
ukmo_hadcm3.1	6.61	8.29	9.49

The maps and regression models provided by Climate Wizard are attached at pp.6-7.

Water temperatures at Granbury Lake could exceed operating temperatures

Water coming from Granbury is probable to be at temperatures above safe tolerances.

With additional potential increases in air temperature that might result from global warming, it is likely that the water temperature will also increase, thus making the feed water intake temperature close or above the 101 degrees that resulted in the La Salle Nuclear plant reducing generation in the summer of 2010.

The Lake Granbury Watershed Protection Plan notes how susceptible to the lake temperature is to air temperature:

"Temperature changes are rapid, especially in winter and early spring when cold, dry polar air replaces warm, moist tropical air. Periods of cold weather are short and occur mostly in January; fair, mild weather is frequent. High daytime temperatures prevail for a long period in the summer when the maximum temperature reaches or exceeds 90°F daily. July is the hottest month with an average daily maximum temperature of 95°F.

Watershed Protection Plan

Table 4. Monthly Temperature, Precipitation and Evaporation of the Lake Granbury Watershed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Temperature Data (1971-2000)													
Mean Minimum Temperature (°F)	29.0	33.9	41.3	49.6	59.5	67.4	71.3	70.1	62.8	51.4	40.4	31.7	50.7
Mean Maximum Temperature (°F)	54.2	59.5	67.8	75.8	82.7	90.1	95.2	95.2	88.0	78.1	65.6	56.9	75.8
Mean Temperature (°F)	41.6	46.7	54.6	62.7	71.1	78.8	83.3	82.7	75.4	64.8	53.0	44.3	63.3

http://www.brazos.org/gbWPP/8-3-2010-2.0-Lake-Granbury-Watershed-Overview.pdf

Lake Granbury Watershed Protection Plan Revision Date: 2010-07-07 2.2.3 Climate, pg 14

There may also be questions about the amount of water available in the Brazos River Basin for recharge of Lake Granbury

Since 1997 the EPA has been warning that;

"A warmer and drier climate would lead to greater evaporation, as much as a 35% decrease in streamflow, and less water for recharging groundwater aquifers"

EPA United States Environmental Protection, Office of Policy, Planning and Evaluation (2111)
EPA 230-F-97-008qq September 1997 Climate Change and Texas

The efficiency of thermal power plants, fossil or nuclear, is sensitive to ambient air and water temperatures; higher temperatures reduce power outputs by affecting the efficiency of cooling.

There is a high likelihood that water shortages will limit power plant electricity production in many regions. Future water constraints on electricity production in thermal power plants are projected for Arizona, Utah, Texas, Louisiana, Georgia, Alabama, Florida, California, Oregon, and Washington state by 2025.

Bull, S.R., D.E. Bilello, J. Ekmann, M.J. Sale, and D.K. Schmalzer, 2007: Effects of climate change on energy production and distribution in the United States. In: *Effects of Climate Change on Energy Production and Use in the United States* [Wilbanks, T.J., V. Bhatt, D.E. Bilello, S.R. Bull, J. Ekmann, W.C. Horak, Y.J. Huang, M.D. Levine, M.J. Sale, D.K. Schmalzer, and M.J. Scott (eds.)]. Synthesis and Assessment Product 4.5. U.S.

http://www.climatescience.gov/Library/sap/sap4-3/final-report/sap4-3-final-water.pdf

A recent report entitled **Impact of Global Warming on Texas** published by the Houston Advanced Research Center found that:

"....(T)he question stated at the outset (is) whether Texas water supply is potentially vulnerable to climate changes on the order of those projected for a greenhouse-warmed scenario. The answer is clearly affirmative. Taking flows to the coast as a measure of river-basin impact, the net effect statewide of the assumed greenhouse climate change, a 3.6°F increase in air temperature and a 5% decrease in precipitation, is to reduce these flows by about 25% under normal conditions and by 42% under drought conditions, relative to the already reduced flows under 2050-projected water-use demands. The 2050 projected flows to the coast are 70% of the 2000 normal values under normal conditions with the effect of a greenhouse climate imposed, and 15% of 2000 normal under drought conditions. In general, the effect of climate on water demands and watershed processing of rainfall is to amplify the changed-climate signal, because the causal connections are nonlinear and reinforcing."

The following charts paint a picture of the impact of drought on the demand for water. Note the 5-24% decrease in precipitation, the 10-32% increase in lake evaporation, and the 280% increase in use of water by steam electric plants. We would question whether this plant is sustainable given the high likelihood of reduced water flows in the central Texas region.

Table 8

Central Region water budget components for various scenarios, as fraction (per cent) of present normal

	Normal climate		*Greenhouse-warmed normal*		*Drought*		*Greenhouse drought*
Precipitation	100		95		80		76
Evapotranspiration	100		96		85		81
Runoff	100		81		42		34
Recharge	100		95		80		76
Lake evaporation	100		120		110		132
	Water-use scenario year						
	2000	2050	2000	2050	2000	2050	2050
Human water uses:							
Surface-water							
M&I	100	193	106	205	101	195	207
agriculture	100	132	134	176	110	145	189
electric	100	274	130	356	107	294	368
Groundwater							
M&I	100	178	106	189	101	179	190
agriculture	100	119	134	159	110	131	171
electric	100	278	130	360	107	297	373
Return flows							
M&I	100	188	106	199	101	190	201
agriculture	100	126	134	168	110	138	181
Steam-electric circulation	100	274	104	286	101	276	288
Downstream flow to:							
Texas coast	100	94	71	64	24	22	26

Impact of Global Warming on Texas Chapter 3 George Ward, University of Texas pg 28

http://www.texasclimate.org/Home/ImpactofGlobalWarmingonTexas/tabid/481/Default. aspx

Nuclear Power has been curtailed worldwide due to high temperatures and it has been costly to replace the power!

France, Germany and Spain were forced to shut down dozens of nuclear plants due to a prolonged heat wave and low water levels. Scientists say climate change was a contributing factor to all of these events, which had far-reaching business impacts. (pg1)

The electric power industry requires a consistent supply of water, and accounts for 39 percent of total freshwater withdrawals in the U.S.65 Fossil fuel plants and nuclear power plants require about 140 liters and 200 liters of water per kilowatt-hour of electricity produced, respectively.66 Water scarcity and uncertainty about the reliability of supply due to climate change may

have significant impacts on operations (see Box 10). In summer 2007, prolonged drought conditions forced the Tennessee Valley Authority to partially shut down its Brown Ferry nuclear plant in Alabama due to the high temperature of the cooling water drawn from the Tennessee River. Furthermore, heated discharges from power plants have a harmful effect on water quality and local ecosystems, which is only exacerbated as water levels drop. Electricite de France had to shut down a quarter of its 58 nuclear plants due to water shortages caused by a record setting heat wave. The closures triggered price spikes of 1,300 percent and about €300 million in losses for the French utility. (pg 8)

Nuclear plants in the southeastern U.S. faced a similar threat in 2007 when one nuclear plant was partially closed and several others were threatened by drought-induced water shortages. "Water is the nuclear industry's Achilles heel," says Jim Warren, executive director of the North Carolina Waste Awareness and Reduction Network. Nuclear plant closures in the southeastern U.S. would have adverse impacts on businesses due to the higher cost of replacement power. "Currently, nuclear power costs between $5 to $7 to produce a megawatt hour," says Daniele Seitz, an energy analyst with New York-based Dahlman Rose & Co. "It would cost 10 times that amount if you had to buy replacement power – especially during the summer." (pg9)

Sources: Marc Levinson et al., "Watching water: A guide to evaluating corporate risks in a thirsty world," JPMorgan
Global Equity Research, March 31, 2008.
Mitch Weiss, "Drought Could Force Nuke-Plant Shutdowns," Associated Press, January 24, 2008

Water Scarcity & Climate Change: Growing Risks for Businesses & Investors

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A recent study on Comanche Peak examined the impact of high cooling water temperatures and found when temperature exceed 95 plant production decreased and above 101 F required shut down. Supplemental cooling water systems were not cost effective!

For the simulation year chosen, intake temperatures exceeded 95 F more than 80 days. Plant production decreases once the intake temperature goes above 95 F and ultimately needs to be shut down at 101 F when the condenser pressure reaches 5.0 in. HgA

The supplemental cooling options that were analyzed for the study were: Oriented Spray Cooling Systems (OSCS), Mechanical Draft Cooling Towers (MDCT), and Water Garden Steps (WGS). The option of increasing the SCR surface area by 5% to enhance the surface heat exchange was also considered. These supplemental cooling systems were designed to cool 25% of the intake water. To increase the overall effectiveness of these systems, a dike enclosing the intake was designed to restrict the mixing of the cooled water and the hot reservoir water.

Results

The SCR's response to the designed supplemental cooling system was found to be favorable. On the other hand, the increased surface area did not contribute much to decrease the intake temperature. The supplemental cooling systems lowered the intake temperatures by up to 5 F making the occurrence of the "greater than 95 F" event almost non- existent. While effective, **these supplemental cooling systems increased the house load by a considerable amount. <u>This increased house load alone rendered the MDCT and WGS systems ineffective in terms of capital and operational costs to benefit ratio.</u>** OSCS resulted in an increased power generation but was associated with high capital cost. A minimal return on investment of 2% was not justifiable economically and thus became the basis for subsequent rejection of the OSCS system

http://www.crm-smg.com/TXU%20Comanche%20Peak.pdf

ERM's Surfacewater Modeling Group (SMG) develops and applies multi-dimensional hydrodynamic, transport, and fate models to every type of waterbody. Model applications are made in support of point source discharge permit applications, optimization of cooling water systems, oil spill damage assessments, contaminated sediment management, water quality investigations, water supply development, and TMDL studies. Clients include Federal agencies including the Corps of Engineers, EPA, Bureau of Reclamation, and the USGS and electric utilities (fossil, nuclear and hydropower http://www.erm-smg.com/index.html

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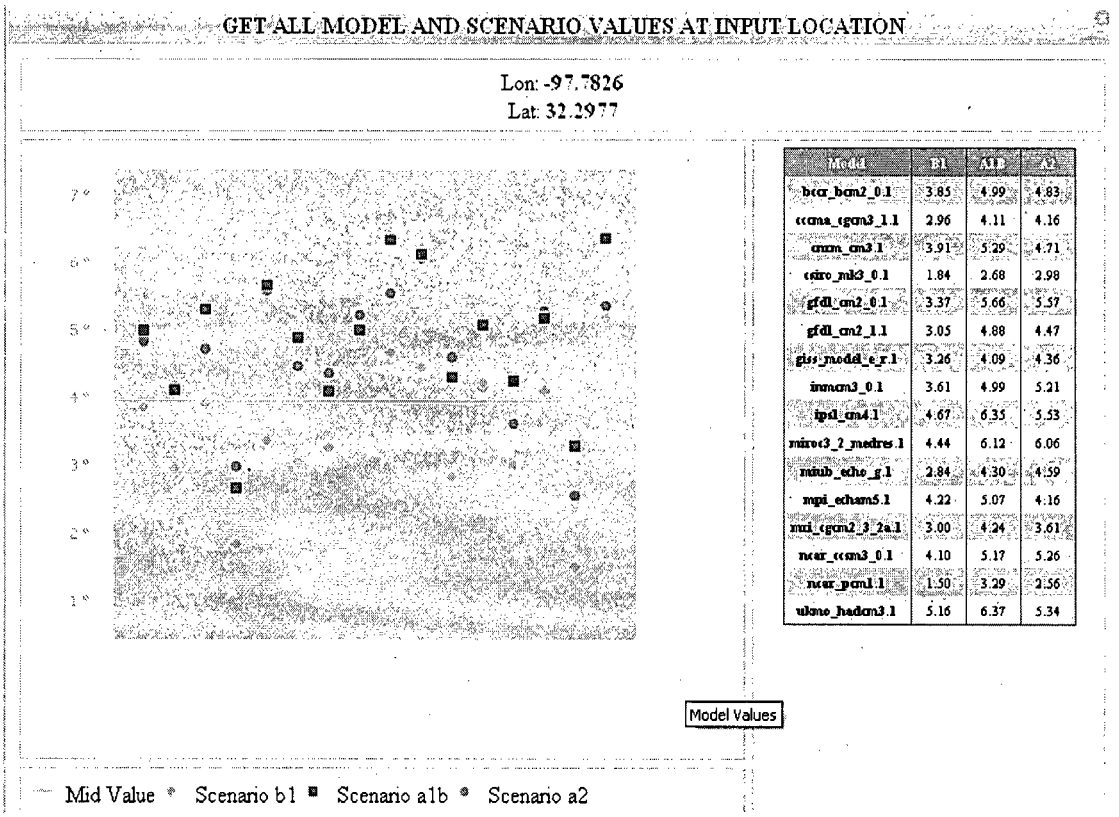
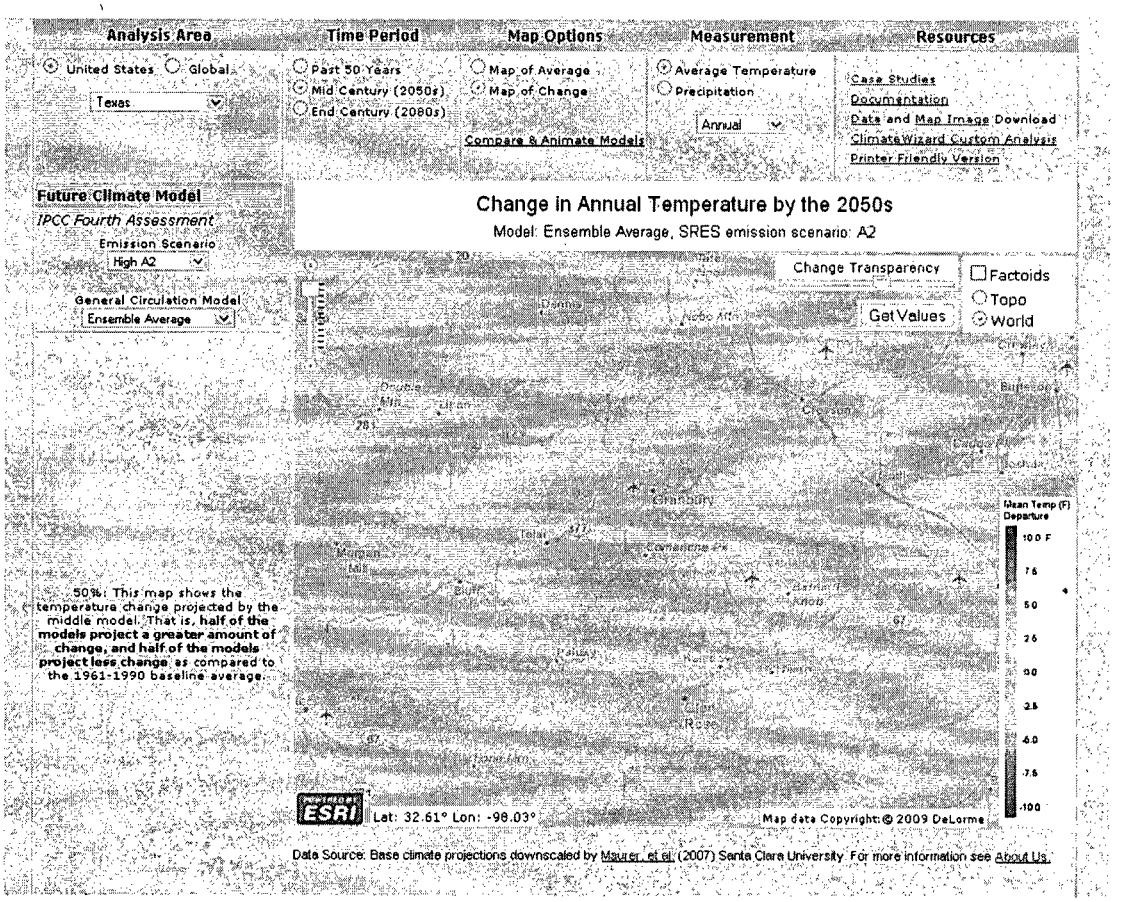
Mid century models (2050s)



Model	B1	A1B	A2
bcc_bcm2_0.1	3.85	4.99	4.83
cccma_cgcm3_1.1	2.96	4.11	4.16
cnrm_cm3.1	3.91	5.29	4.71
csiro_mk3_0.1	1.84	2.68	2.98
gfdl_cm2_0.1	3.37	5.66	5.57
gfdl_cm2_1.1	3.05	4.88	4.47
giss_model_e_r.1	3.26	4.09	4.36
inmcm3_0.1	3.61	4.99	5.21
ipsl_cm4.1	4.67	6.35	5.53
miroc3_2_medres.1	4.44	6.12	6.06
mdub_echo_g.1	2.84	4.30	4.59
mpi_echam5.1	4.22	5.07	4.16
mri_cgcm2_3_2a.1	3.00	4.24	3.61
ncar_ccsm3_0.1	4.10	5.17	5.26
ncar_pcm1.1	1.50	3.29	2.56
ukmo_hadcm3.1	5.16	6.37	5.34



Analysis Area

United States / Global

Texas

Time Period

Past 50 Years

Mid Century (2050s)

End Century (2080s)

Map Options

Map of Average

Map of Change

Compare & Animate Models

Measurement

Average Temperature

Precipitation

Annual

Resources

Case Studies

Documentation

Data and Map Image Download

ClimateWizard Custom Analysis

Printer Friendly Version

Future Climate Model

IPCC Fourth Assessment

Emission Scenario

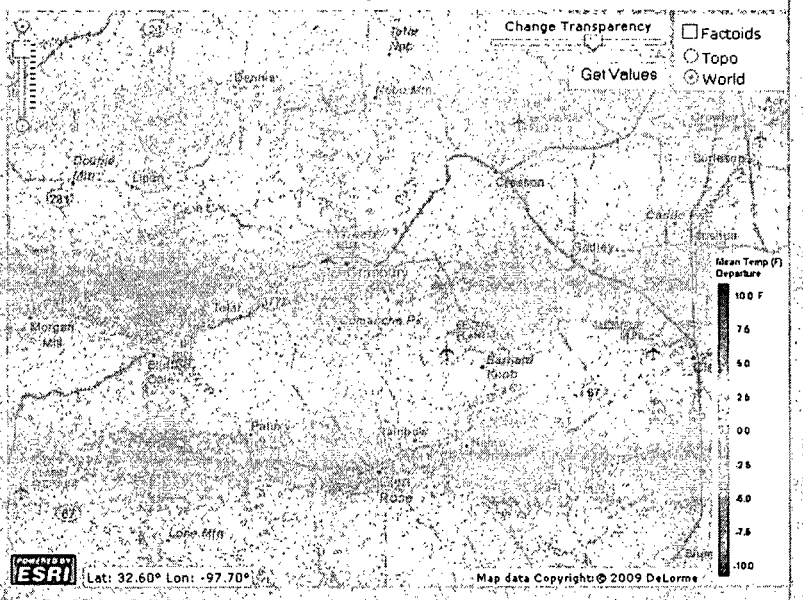
Low B1

General Circulation Model

Ensemble Average

Change in Annual Temperature by the 2050s

Model: Ensemble Average, SRES emission scenario: B1



50%: This map shows the temperature change projected by the middle model. That is, **half of the models project a greater amount of change, and half of the models project less change** as compared to the 1961-1990 baseline average.

Data Source: Base climate projections downscaled by Maurer, et al. (2007) Santa Clara University. For more information see About Us.

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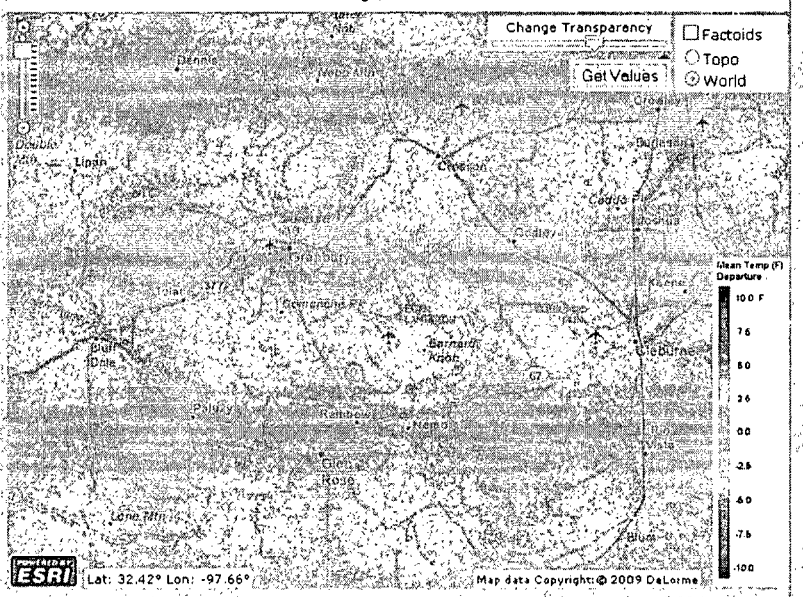
Model: Ensemble Average, SRES emission scenario: A1B



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Data Source: Base climate projections downscaled by Maurer, et al. (2007) Santa Clara University. For more information see About Us.

Comments Regarding Draft Environmental Impact Statement for Combined Licenses (COLs) for Comanche Peak Nuclear Power Plant Units 3 and 4

By David Power
Public Citizen's Texas Office

I have reviewed the Nuclear Regulatory Commission's Draft Environmental Impact Statement for Combined Licenses for Comanche Peak Nuclear Power Plant, Units 3 and 4, and I offer the following comments regarding the revision based on my best professional judgment.

Summary

After reviewing the draft, it is my professional judgment that the NRC Staff has committed numerous errors in the calculation of the need for power.

The DEIS failed in the need for power discussion to adequately consider reductions in demand for power and additional capacity from renewables, additional capacity already planned for the ERCOT market and the ability to cost effectively provide significant quantities of additional power through simple modifications to the existing natural gas generation. Additionally, the market conditions make it unlikely that proposed Comanche Peak Units 3 and 4 would be able to operate competitively in the ERCOT market. [1]

The DEIS has also failed to calculate the significance of climate change on the environment, the methods of calculating the global climate change emissions from the proposed nuclear generating facility, the significance of the emissions from this plant compared to alternatives and the impact of climate change on the operations of this plant.

These issues are discussed below.

The NRC Staff's DEIS is flawed because it failed to do a thorough analysis of the need for power[2].

NRC Staff failed to adequately consider:

Net Revenue Analysis The Ercot 2009 State of the Market Report by POTOMAC ECONOMICS, LTD (ERCOT market monitor) performs an analysis of the ERCOT market: Net revenue is defined as the total revenue that can be earned by a new generating unit less its variable production costs. It represents the revenue that is available to recover a unit's fixed and capital costs. Hence, this metric shows the economic

---

1 2009_ERCOT_SOM_REPORT_Final.pdf, Page XX.

2 Standards for critiquing the need for power section are from Draft NUREG-1937 D-54 March 2010:
Affected states or regions may prepare a need for power evaluation and assessment of the regional power system for planning or regulatory purposes. A need for power analysis may also be prepared by a regulated utility and submitted to a regulatory authority, such as a state public utility commission. However, the data may be supplemented by information from other sources. The determination for the need for power is not under NRC's regulatory purview. When another agency has the regulatory authority over an issue, NRC defers to that agency's decision. The NRC staff will review the need for power and determine if it is (1) systematic, (2) comprehensive, (3) subject to confirmation, and (4) responsive to forecasting uncertainty. If the need for power evaluation is found to be acceptable, no additional independent review by the NRC is needed. The information provided in this comment will be considered to determine whether it significantly affects the forecast on which the applicant relied for its need for power analysis.

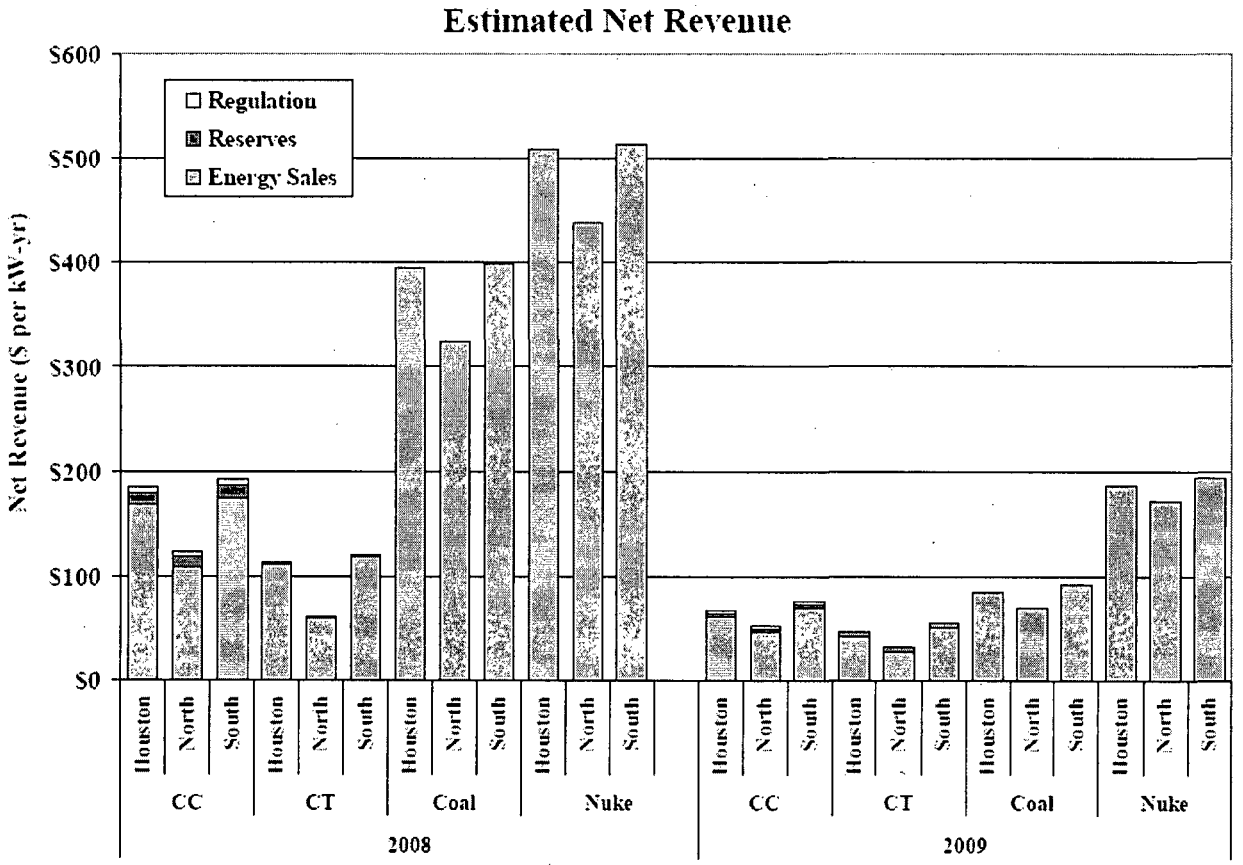
signals provided by the market for investors to build new generation or for existing owners to retire generation. In long-run equilibrium, the markets should provide sufficient net revenue to allow an investor to break-even on an investment in a new generating unit, including a return of and on the investment. In the short-run, if the net revenues produced by the market are not sufficient to justify entry, then one of three conditions likely exists:

(i) New capacity is not currently needed because there is sufficient generation already available;

(ii) Load levels, and thus energy prices, are temporarily low due to mild weather or economic conditions; or

(iii) Market rules are causing revenues to be reduced inefficiently.

1) Likewise, the opposite would be true if the markets provide excessive net revenue in the short-run. Excessive net revenue that persists for an extended period in the presence of a capacity surplus is an indication of competitive issues or market design flaws. The report estimates the net revenue that would have been received in 2008 and 2009 for four types of units: a natural gas combined-cycle generator, a simple-cycle gas turbine, a coal unit, and a nuclear unit.



The figure above shows that the net revenue decreased substantially in 2009 compared to each zone compared in 2008. Based on our estimates of investment costs for new units, the net revenue required to satisfy the annual fixed costs (including capital carrying costs) of a new gas turbine unit ranges from $70 to $95 per kW-year. The estimated net revenue in 2009 for a new gas turbine was approximately $55, $47 and $32 per kW-year in the South, Houston and North Zones, respectively. For a new combined cycle unit, the estimated net revenue requirement is approximately $105 to $135 per kW-year. The estimated net revenue in 2009 for a new combined cycle unit was approximately $76, $67 and $52 per kW-year in the South, Houston and North Zones, respectively.

These values indicate that the estimated net revenue in 2009 was well below the levels required to support new entry for a new gas turbine or a combined cycle unit in the ERCOT region. Prior to 2005, net revenues were well below the levels necessary to justify new investment in coal and nuclear generation. However, high natural gas prices through 2008 allowed energy prices to remain at levels high enough to support new entry for these technologies. The production costs of coal and nuclear units did not change significantly over this period, leading to a dramatic rise in net revenues. With the significant decline in natural gas and energy prices in 2009, these results changed dramatically from recent years. For a new coal unit, the estimated net revenue requirement is approximately $190 to $245 per kW-year. The estimated net revenue in 2009 for a new coal unit was approximately $93, $84 and $70 per kW-year in the South, Houston and North Zones, respectively. For a new nuclear unit, the estimated net revenue requirement is approximately $280 to $390 per kW-year. The estimated net revenue in 2009 for a new nuclear unit was approximately $194, $187 and $172 per kW-year in the South, Houston and North Zones, respectively. These values indicate that the estimated net revenue for a new coal and nuclear unit in the South, Houston and North Zones was well below the levels required to support new entry in 2009. " This calls into question the validity of the NRC staff's determination on 8-1 line 43 that market conditions justify Luminant's proposal.

2) Peaking energy rather than base load is required: On page 43 of the Potomac report the conclusions state that peaking energy rather than base load (as stated by Lumiant) is on the increase and that while average loads increased from 2006 to 2008 and decreased in 2009 it was the top 5% of high demand hours that increased significantly, more than double than 2008.[3] This trend is predicted to continue and significant additional capacity is expected to be needed that will operate less than 5% of the hours in a year or less.[4] In addition, the implementation of PRR 776 allowed quick start turbines, which had been participating in the non-spinning reserve market to offer their capacity into the balancing energy market increasing their ROI and providing additional balancing energy.

3) Underestimating the continued growth of the wind generation market in Texas: at page 9-21, lines 3 thru 8, Luminant concluded that it would take more than 10,000 MW of wind to replace the base load capacity provided by the proposed CPNPP units 3 and 4. Texas has now "officially" exceeded the 10,000 MW of installed wind capacity threshold (with 10,030 MW) based on information on ERCOT's Renewable Energy Credit (REC) Program website[5]. Texas has already exceeded the goals set for its renewables program for the year 2025.

Technology Type	REC Gen Accts	Offset Gen Accts	New MW Capacity	Offset MW Capacity	Total Current MW Capacity
Biomass	6	0	40.3	0.0	40.3
Hydro	3	2	33.1	178.5	211.6
Landfill Gas	14	1	80.3	3.3	83.6
Solar	3	0	1.2	0.0	1.2
Wind	77	3	9914.6	115.8	10030.4
Total (rounded)	103	6	10,069.5	297.6	10,367.1

Based on this information there is currently enough wind power alone to provide the necessary

3 2009_ERCOT_SOM_REPORT_Final.pdf page 43
4 2009_ERCOT_SOM_REPORT_Final.pdf page 45
5 ERCOT'S 2009 ANNUAL REPORT ON THE TEXAS RENEWABLE ENERGY CREDIT TRADING PROGRAM

capacity according to Luminant's calculations.

4) The DEIS analysis does not account for increases in wind carrying capacity: ERCOT has also increased their estimate of wind carrying capacity reported in their March 2010 report from 708 MW to 793 MW in May or a 12% increase in just 2 months and an additional increase of 115 MW6 by 2015[6]. This does not take into account any increases in effective load carrying capacity (ELCC) factor that coastal or off shore wind developments might add or the addition of large scale storage in the market to time shift the energy provided by wind or solar generation assets.
5) More efficient deployment and dispatch: With the nodal deployment in December of 2010 there should be significant reductions in congestion based dispatch of generation resources. The West Energy Zone in ERCOT transitioned from a net importer in 2006 to a net exporter in 2008 and 2009. This reflects the significant increases in the installed capacity of wind resources in the West Zone that occurred over this time period. The bifurcated process of resolving zonal and local congestion can at times lead to reliability conflicts that are difficult to resolve within the relatively inflexible framework of the zonal market design.
   The nodal market will provide many improvements, including unit-specific offers and shift factors, simultaneous resolution of all transmission congestion, actual output instead of schedule-based dispatch, and 5-minute instead of 15-minute dispatch, among others. These changes should help to increase the economic and reliable utilization of scarce transmission resources well beyond that experienced in the zonal market, and in so doing, also dispatch the most efficient resources available to reliably serve demand.
6) The increase of responsive reserves: Ercot currently acquires 1,150 MW of load acting as a responsive reserve (LaaRs) but as of December 2009, over 2,200 MW of capability were qualified as LaaRs[7].
7) The ability of natural gas generation units to inexpensively increase capacity: ERCOT currently calculates EFDH (equivalent forced de-rated hours) of its natural gas turbine fleet due to the decrease in energy output based on weather conditions (increase in inlet air temperature decreases the output of the turbine).

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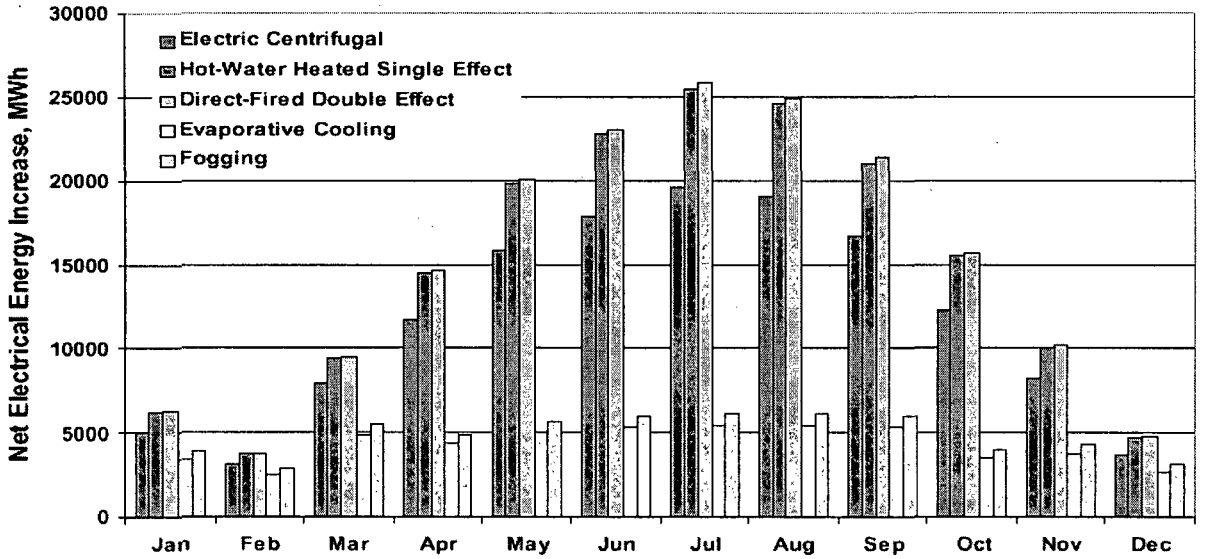
6 This is ERCOT's effective load carrying capacity (ELCC) of additional wind generation expected to be available from planed units installed by 2015. The ERCOT Effective Load Carrying Capacity is an estimate calculation by ECROT on the availability of wind recourse to carry firm load for an extended period of time. In effect it takes the most conservative approach to de-rate the amount of energy that wind provides to the market. It does not take into account the availability of wind generation to provide energy to the market but is a obsolete worst case calculation that is used to perform generation planning. On 3/25/2010 ERCOT reported on a new study to revise these calculations as the old capacity factor has become dated with the installation of thousands of MW new wind generation all across the ERCOT market that have substantially different generation profiles than originally calculated. In addition the original calculation did not take into account all hours of the year but used a statistical sampling, a low number of iterations were used to simplify the calculation and only randomized days were modeled for each month. The new calculation should provide a higher ELLC that more accurately characterizes the generation capability provided by the wind generation recourses. However it will not take into consideration the deployment of energy storage and other technologies being deployed to optimize delivery of the energy generated. From the ERCOT report dated 3/25/2010 they will be addressing these shortcomings for the 2012 projections and realize that this adjustment will have to be updated to account for additional generation as it is deployed.

7 2009_ERCOT_SOM_REPORT_Final.pdf



An example of monthly incremental electrical energy provided by various TIC options for a 316-MW Cogeneration system in Pasadena, TX (Punwani 2001)8

Adding Turbine inlet cooling (TIC) can provide significant increase in energy during the peak load months when it's needed while reducing emissions for a low cost. A national study showed that the reduction in capacity exceeded 29,000 MW in the summer months[9], on average, that could be restored by proper application of this technology. The hot southern states have a greater impact in reduction due to climate conditions of this sort.

8) The much lower cost of energy efficiency: As an example, recent reports by Nexant[10] in a study of the San Antonio demand side management program show that their energy efficiency program has significant energy savings at very low cost. They stated in their report to San Antonio, "As programs expand, CPS Energy should continue planning for the resources necessary to support large-scale deployment of DSM program portfolio and to achieve both short-term and long-term goals." The overall cost of the program as defined for the energy efficiency programs only is: "Cost of Saved Energy = $0.032/kWh." This does not take into account the additional reduction in peak costs that their load management programs achieved. The combined programs were determined to have achieved a reduction of 44.7 MW of peak energy with an expected energy savings of 86,712,978 kwh. The Texas Public Utility Commission has issued a modification of the state's energy efficiency incentive program and has released a rule that will change the goal of the program. The proposed rule will increase the annual reduction from the current standard of 20% of new growth in demand to 25% and then to 30% of new growth in demand. Using the published ERCOT consumption data[11] this would reduce energy consumption in the regulated areas of the state starting in 2012 and increasing every year annually would reduce the need for the projected additional generation. ERCOT does not currently use energy efficiency other than those based on Texas HB3693 in its projections and is currently shown to be calculated at only 242 MW annually this savings will increase to approximately 300 MW annually and will total an additional 580MW saved that are

8 "TICA WhitePaper_2009Nov24.pdf," 12.

9 "TICA WhitePaper_2009Nov24.pdf,"

10 Jim Herndon, Senior Project Manager Energy and Carbon Management CPS Nexant Measurement and Verification of CPS Energy's 2009 DSM Program Offerings 4/26/2010

11 Ercot May 2010 load forecast and reserve margin update.

not shown in the DEIS table 8-1. In Addition ERCOT's current long term demand forecasting does not include future increases in savings from improved building codes, the many large municipalities that are introducing programs that go above the current required code (Dallas, Austin etc). It does not include weatherization or energy efficiency programs implemented by municipally owned utilities, Austin and San Antonio have set aggressive goals in this regard. New appliance standards, solar and other distributed generation and DSM programs (Austin Energy s current program controls between(100-160 MW) of load at peak) will all have an effect of reducing the need for new generation.

9) Texas Non-wind RPS: The PUC is considering adding an additional renewable energy mandate to the state's existing Renewable Portfolio Standard. This has been assigned a project #35792 and a straw-man has been issued.[12] This would provide an additional 500 MW of generating capacity in the ERCOT market.

10) New Building codes: The State Energy Conservation Office (SECO) has announced that the state will be adopting the IECC 2009 building code. The International Energy Conservation Code (IECC) is a national, consensus-based, model code. The 2009 IECC is expected to result in significant energy savings and related emissions reductions estimated at 12 to 15% annual improvement for average homes. In a report examining the potential for energy efficiency in Texas, the American Council for an Energy Efficient Economy estimates that with this new code Texas could save 10,533 kilowatt hours of electricity annually and 2,362 megawatts annually of peak summer demand by 2023.[13][14] These new standards have significant increases in the requirements for energy savings that are required for all new construction.[15] According to the Building Code's Assistance Project (BCAP)[16] when Texas begins implementing the 2009 IECC and Standard 90.1-2007 statewide in 2011, businesses and homeowners would save an estimated $785 million annually by 2020 and $1.605 billion annually by 2030 in energy costs (assuming 2006 prices). Additionally, implementing the latest model codes would help avoid

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12 The hearing on this rule was held 4/30/2010, final comments were filed 5/11/2010, rule would apply starting in 2011 at 100MW and ramp to 500 MW by 2015

13 House Energy Resources Subcommittee for Energy Efficiency and Renewables April 2, 2009, Written Testimony of Kate Robertson, Energy Efficiency Specialist Environmental Defense Fund

14 ACEEE, *Potential for Energy Efficiency, Demand Response, and Onsite Renewable Energy to Meet Texas's Growing Electricity Needs* (Report Number E073), March 2007.

15 SUBCHAPTER E. TEXAS BUILDING ENERGY PERFORMANCE STANDARDS 34 TAC §19.53
"The Comptroller of Public Accounts proposes new §19.53, concerning building energy efficiency performance standards. The new section is created in compliance with Health and Safety Code, §388.003(b-1), which authorizes the State Energy Conservation Office (SECO) to adopt equivalent or more stringent energy codes than those adopted in Health and Safety Code, §388.003(a) and (b).
New §19.53(a) adopts the energy efficiency provisions of the International Residential Code as they existed on May 1, 2009, as the energy code for single family residential dwellings, as that term is defined in Health and Safety Code, §388.002(12). New §19.53(b) adopts the International Energy Conservation Code as it existed on May 1, 2009, for all other residential, commercial, and industrial construction in this state.
§19.53.Building Energy Efficiency Performance Standards.
(a) Single-family residential construction. Effective January 1, 2012, the energy efficiency provisions of the International Residential Code as they existed on May 1, 2009, are adopted as the energy code in this state for single-family residential construction as it is defined in Health and Safety Code, §388.002(12).
(b) All other residential, commercial, and industrial construction. Effective January 1, 2011, the International Energy Conservation Code as it existed on May 1, 2009, is adopted as the energy code for use in this state for all residential, commercial, and industrial construction that is not single-family residential construction under subsection (a) of this section.
This agency hereby certifies that the proposal has been reviewed by legal counsel and found to be within the agency's legal authority to adopt.
Filed with the Office of the Secretary of State on March 11, 2010."

16 http://bcap-energy.org/

about 213.9 trillion Btu of primary annual energy use by 2030 and annual emissions of more than 15.6 million metric tons of CO2 by 2030.[17]

11) The new study on Energy Efficiency in the South found that fewer new power plants would be needed with a commitment to energy efficiency.[18] The analysis of nine illustrative policies shows the ability to retire almost 25 GW of older power plants – approximately 10 GW more than in the reference case. The nine policies would also avoid over the next twenty years the need to construct 49 GW of new plants to meet a growing electricity demand from the RCI sectors.[19] Further, the industrial sector offers the greatest energy efficiency potential in Texas. In 2020, savings from all three sectors is about 10% (1,180 TBtu) of the total energy consumed by the State in 2007. Electricity savings constitute 668 TBtu of this amount. With these policies, the generation of electricity from the equivalent of 17 power plants of 500-MW each could be avoided in the year 2020.[20]
12) Additional Federal Incentives: In addition to the $218 million in funding from the American Recovery and Reinvestment Act, additional federal incentives for energy efficiency programs recently passed in the House of Representatives in HB5019 and would provide over $6 billion in energy efficiency retrofit incentives further reducing the need for new generation.
13) Compressed Air Energy Storage: Significant advances in energy storage technologies are being made and several examples were listed in the report. The DEIS omitted the well publicized project that Luminant has announced. "Shell WindEnergy Inc. and Luminant, a subsidiary of TXU Corp., announced today a joint development agreement for a 3,000-megawatt wind project in the Texas Panhandle and to work together on other renewable energy developments in Texas. Shell and Luminant will also explore the use of compressed air storage, in which excess power could be used to pump air underground for later use in generating electricity. This technology will further improve reliability and grid usage and becomes more economical with large-scale projects, such as proposed for Briscoe County.Recent testimony by Shell before the Public Utility Commission of Texas demonstrated the Briscoe County project could deliver the lowest-cost wind energy for consumers. This low cost is driven by excellent wind resources and the comparatively lower cost to bring that energy to market from the Texas Panhandle region."Shell is constantly looking for solutions to deal with climate change and increasing our energy diversity. Wind is part of the answer. Our approach is a cost-effective solution for consumers," said John Hofmeister, president of Shell Oil Company."Luminant is committed to providing Texans with clean sources of energy, and this agreement with Shell is a real next step in delivering on that commitment" said Mike Childers, CEO of Luminant Development."Luminant is already the state leader in wind-energy purchases, and co-developing this project would take us a long way toward our goal of doubling our portfolio." "Shell and Luminant will also explore the use of compressed air storage, in which excess power could be used to pump air underground for later use in generating electricity. This technology will further improve reliability and grid usage and becomes more economical with large-scale projects, such as proposed for Briscoe County." should not be overlooked.[21]
14) As discussed in the "Comments Regarding Luminant's Revision to the Comanche Peak Nuclear Power Plant" by Raymond H. Dean, Ph.D, there has been considerable additional information on the conclusions of combining new generation power sources with storage that would also apply in this instance. Natural gas, wind, solar; and energy storage either individually or in

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[17] http://bcap-ocean.org/state-country/texas

18 April 13, 2010 Georgia Institute of Technology and Duke University STATE PROFILES OF ENERGY EFFICIENCY OPPORTUNITIES IN THE SOUTH: TEXAS

19 Id

20 Id

[21] "Luminant - News Release," http://www.luminant.com/news/newsrel/detail.aspx?prid=1087.

combination, are viable alternatives that could both produce base-load power and be environmentally preferable to nuclear generation.

Conclusion

When considering all reductions in demand, due to efficiencies, distributed generation and DSM programs that are implemented by municipally owned utilities, the forecast reflects a likely decrease in the total need for energy by 2020. This reduction in demand, combined with the anticipated additional non-nuclear generation, including increased capacity for wind, solar, geothermal and other renewables, makes the addition of Comanche Peak Units 3&4 unnecessary to meet base-load needs. Then, if the industrial customers follow the recommended guidelines[22], an additional 8,500 MW of reduction could be achieved. Any need for additional generation to serve the market at this time would have to be in doubt.

22 Industrials do not currently participate in the State energy efficiency programs