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Austin Generation Resource Planning Task Force
Austin City Hall
301 West 2nd St.
Room 1029
Austin, Texas 78701

Re: A Critique of some of the assumptions used in the Austin Energy Resource Plan

Dear Board Members:

My qualifications are that I am a registered professional engineer in Texas with a Ph.D. in Electrical Engineering from The University of Texas, specializing in energy systems. I am currently doing wind power studies as a private consultant. I retired from Austin Energy in 1998. While at Austin Energy, I performed generation planning studies that led to Austin participating in the Fayette coal plant and the South Texas Nuclear Project.

The purpose of this letter is to convey my comments about the input assumptions used in the current resource plan and discuss other issues important to Austin's future.

I will be referring to the Pace Data Source document dated 7-15-09. I agree with most of the assumptions. My comments are directed to the assumptions I believe are in error.

1) **The 20 year study period is too short.** A longer study period is needed to show the benefits of large capital intensive projects that have a high payback.

2) **The wind capacity factors in Exhibit 9 are much too high.** They should be no greater than 33% and possibly less than that based on recent ERCOT experience.

3) **The 1000 MW block size for nuclear in Exhibit 10 is much too large.** The block size should be in 200 MW increments. The 200 MW size could be either participation in a larger unit or one of the smaller nuclear plants now being offered for smaller utilities. The cost of the smaller nuclear units is about the same as the cost numbers listed in the table.

4) **The solar PV costs in Exhibit 12 are overly optimistic at the end of the study period.** Even if PV cell costs were to drop to zero, the other hardware and installation costs would result in a higher cost for PV than those assumed.

5) **The world oil supply in Exhibit 45 is too optimistic.** World oil production is currently peaking. Old wells are decreasing in their production. New oil is deep and far out into the oceans requiring ever increasing costs to obtain the new oil. The increasing oil price will cause oil demand to decrease with time so that the dwindling oil supplies match the amount of oil consumers are able to pay for.

6) **Coal power risks are understated in this study.** The coal industry is in a period of great risk. Sequestration is unproven. Its costs are unknown. Do you think the two Fayette units Austin owns 50% interest in can pump 3 million lbs of CO2 per hour into the ground without CO2 leakage or well water contamination?

Here are some simple energy cost ratios from various renewable energy sources:

Remote large scale renewable projects such as solar, wind, and nuclear need new transmission to bring the power to Austin. For example, a 1000 MW 345 kV line costing $2 million/mi 500 miles long adds **$1/watt** to the cost of the remote projects.

Nuclear costs $5/watt + $1/watt transmission and can run 24/7. Let this be the reference.

Wind costs $2/watt + $1/watt transmission and runs $1/3^{rd}$ of the time. Therefore, the energy cost of **wind is** (3/6)(3) = **1.5 times the cost of nuclear** and is not dispatchable.

Large scale tracking solar costs $6/watt + $1/watt transmission and runs $1/4^{th}$ the time. Therefore, the energy cost of **centralized solar is** (7/6)(4) = **~5 times the cost of nuclear** and is not dispatchable. If storage is added, the cost per watt is higher.

Rooftop (fixed panel) solar costs $8/watt and produces about half the energy of a solar tracking system; therefore, the energy cost of **fixed rooftop solar is** (8/6)(8) = **~10 times the cost of nuclear** and is not dispatchable.

Based on the above ratios, a lowest cost long range generation plan will include some new nuclear power in its overall mix. Only coal can compete with nuclear for serving base load. However, coal will soon become prohibitively expensive when retrofitted with CO2 capture equipment. NASA climatologist Dr. James Hansen, who has been warning about the effects of CO2 for years, recommends we build 4^{th} generation nuclear plants[1]. These plants are safer and remove the nuclear waste problem. Opposition to all nuclear plants is tantamount to encouraging more coal plants because wind and solar cannot serve the base load function. The rapid buildup in coal power since the mid 1980's when nuclear power fell into disfavor is the primary driver of the global warming trend, which is setting the stage for destroying the planet's life systems.

Sincerely,

Eugene G. Preston, PhD, PE[2]

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[1] http://bravenewclimate.com/2008/11/28/hansen-to-obama-pt-iii-fast-nucl

[2] This report is posted on http://egpreston.com.

Referenced Exhibit Items As Shown In The Pace Document (and _my_ comments)**:**

Exhibit 9: AE Contract Parameters

Plant Name	Primary Fuel	Contract Begin	Contract End	Capacity	Capacity Factor*
				MW	%
LCRA Wind	Wind	9/1/1995	9/1/2020	10	40.85%
King Mountain Wind	Wind	9/1/2001	9/1/2011	76.3	42.37%
Sweetwater 2 Wind	Wind	2/1/2005	2/1/2017	91.5	40.76%
Sweetwater 3 Wind	Wind	12/1/2005	12/1/2017	34.5	40.76%
Whirlwind wind	Wind	12/31/2007	12/31/2027	60	45.24%
Hackberry	Wind	12/1/2008	12/1/2023	165	38.81%
Sunset Farms	LFG	12/1/1996	12/1/2021	4	85.00%
Tessman Road	LFG	9/1/2002	9/1/2012	7.8	85.00%
Nacogdoches Biomass	Bio	1/1/2012	12/31/2031	100	90.00%
Solar 3	Solar	1/1/2010	12/31/2034	30	25.97%

*Capacity factors are estimates based on hourly profiles or a Pace generic modeling parameter.

Source: AE

In 2006 the overall West Texas wind capacity factor was 33%. In 2007 it was 25% because the wind didn't blow as much in 2007. In 2008 the overall wind capacity factor was 30%. Transmission curtailments reduced the capacity factor a few percent in 2008.

Exhibit 10: New Resource Technology Parameters (2007$)

Technology	Early Capital Cost	Mid Capital Cost	Late Capital Cost	VOM	FOM	Heat Rate	Block Size
	$/kW	$/kW	$/kW	$/MWh	$/kW-yr	Btu/kWh	MW
CC (FA)	833	823	814	2.90	7.37	7,400	263
CC (FB, H)	811	802	792	2.90	11.23	7,000	400
CT (LM6000PD)	799	763	755	3.65	6.32	10,600	48
CT (LMS 100)	771	762	753	3.65	6.32	10,117	99
Coal - Supercritical	1,822	1,805	1,788	4.87	14.19	9,300	583
IGCC*	2,558	2,791	3,049	6.49	36.33	9,300	770
IGCC w/Seq*^	3,355	3,659	3,998	8.76	45.62	10,883	745
Nuclear*	5,518	5,903	4,502	2.63	74.58	10,434	1,090
Biomass - AD	6,659	6,753	6,850	15.20	50.68	17,962	<2
Biomass - Comb.	2,893	2,857	2,821	3.04	131.77	15,513	25
Land Fill Gas	2,835	2,799	2,764	5.07	46	11,569	<2
Wind 1.5 MW	2,232	2,200	2,169	0.00	20.55	na	50
Wind 5 MW	2,111	2,090	2,061	0.00	20.55	na	50
Solar PV - S - Si	5,122	3,643	2,574	0.00	6.02	na	< 1
Solar PV - L - Si	3,270	2,326	1,643	0.00	6.02	na	>20
Solar PV - S - Thin	4,000	3,399	2,879	0.00	6.02	na	< 1
Solar CSP - Trough	4,373	4,252	4,132	0.00	30.41	na	63
Solar CSP - Tower	5,995	5,852	5,688	0.00	30.41	na	63
Geothermal - S	5,182	5,218	5,255	2.28	45.61	na	<5
Geothermal - M	4,425	4,456	4,488	2.28	45.61	na	5-30
Geothermal - L	3,782	3,809	3,836	2.28	45.61	na	>30

* Cost estimates are highly uncertain due to technology development status, regulatory uncertainty, and variance in locational operating characteristics. Cost assumptions for nuclear and IGCC resources can vary widely, but assumptions used in this study are within the limits of uncertainty given the current status of their development.
^ Although not shown here, Pace includes a $4/MWh cost estimate for transporting CO_2. This number can vary significantly, depending on plant location.

Source: Pace

The 1090 MW size entered into the planning model is too large and will be uneconomical. For planning purposes, the incremental size should have been 200 MW. The 400 MW offer from NRG that Austin turned down should have been tested in the model at 200 MW with an approximate $1 billion price tag.

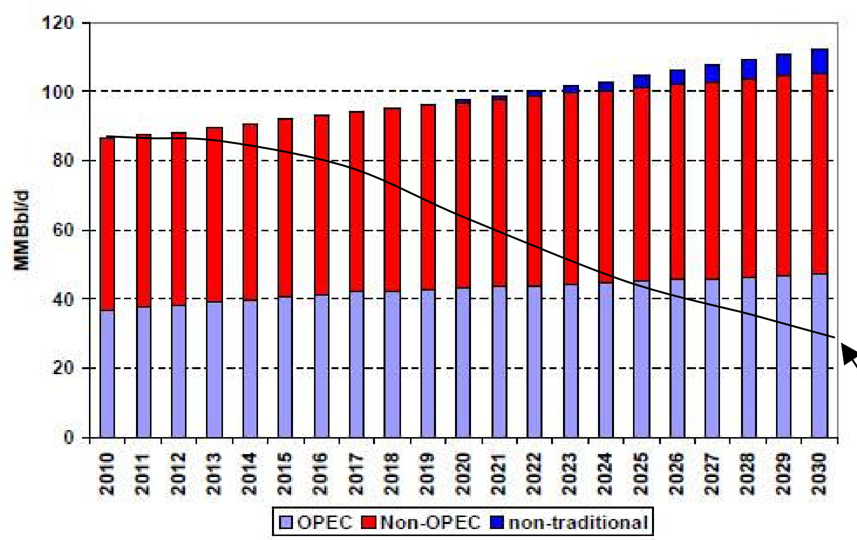
Exhibit 12: Annual Solar PV Cost Projections (2007$)

Year	Solar PV - Small	Solar PV - Large
2009	5,899	3,766
2010	5,619	3,587
2011	5,352	3,417
2012	5,098	3,255
2013	4,855	3,100
2014	4,625	2,953
2015	4,405	2,812
2016	4,196	2,679
2017	3,997	2,552
2018	3,807	2,430
2019	3,626	2,315
2020	3,454	2,205
2021	3,290	2,100
2022	3,133	2,001
2023	2,985	1,906
2024	2,843	1,815
2025	2,708	1,729

Source: Pace

Much of the cost of solar are other costs than the PV cells themselves. Thin film is lowest at about ~$1 per watt, but requires much more surface area, thus increasing the other supporting hardware costs. There are also the electronic equipment and installation costs. The above table is too optimistic that all the costs will be reduced, i.e. the PV array cost, the other hardware cost, and the labor costs will all need to be reduced; which is too optimistic in my opinion.

Exhibit 45: Forecast of World Oil Supply



Source: Pace

other references:
http://www.lifeaftertheoilcrash.net/ (*this forecast is laid on top of the above graph*)
http://www.abc.net.au/4corners/special_eds/20060710/
http://evworld.com/article.cfm?storyid=1729
Charles Gibson talks about the sources and cost of oil. The important point is that the new oil requires going ever deeper and deeper into the ocean, thus raising the costs:
http://www.google.com/search?hl=en&q=charles+gibson+20%2F20+oil&aq=f&oq=&aqi=
http://egpreston.com/WorldOilTimeline.pdf (*from the 2008 U. Texas Renewables Conference*)

References and calculations for the cost per watt data:

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Remote large scale renewable projects such as solar, wind, and nuclear need new transmission to bring the power to Austin. For example, a 1000 MW 345 kV line costing $2 million/mi 500 miles long adds **$1/watt** to the cost of the remote projects.

Transmission cost per watt = (2e6 $/mi)(500 mi)/(1e9 watts) = 1 $/watt

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Nuclear costs $5/watt + $1/watt transmission and can run 24/7. Let this be the reference.

Nuclear cost per watt = (2e9 $)/(400e6 watts) = $5/watt

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Wind costs $2/watt + $1/watt transmission and runs $1/3^{rd}$ of the time. Therefore, the energy cost of **wind is** (3/6)(3) = **1.5 times the cost of nuclear** and is not dispatchable.

Assume 1 Watt nuclear runs for 1 hour and 1 Watt wind runs for $1/3^{rd}$ hour on average.
Ratio wind/nuc energy cost = (3 $/watt wind/.333 h)/(6 $/watt nuclear/ 1 h) = 1.5

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Large scale tracking solar costs $6/watt + $1/watt transmission and runs $1/4^{th}$ the time.
See http://www.electricenergyonline.com/?page=show_news&id=110003
Therefore, the energy cost of **centralized solar is** (7/6)(4) = **~5 times the cost of nuclear** and is not dispatchable. If storage is added, the cost per watt is higher.

Assume 1 Watt nuclear runs for 1 hour and 1 Watt solar runs for $1/4^{th}$ hour on average.
Ratio wind/solar energy cost = (7 $/watt solar/.25 h)/(6 $/watt nuclear/ 1 h) = 4.67

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Rooftop (fixed panel) solar costs $8/watt and produces about half the energy of a solar tracking system; therefore, the energy cost of **fixed rooftop solar is** (8/6)(8) = **~10 times the cost of nuclear** and is not dispatchable.

Assume 1 Watt nuclear runs for 1 hour and 1 Watt solar runs for $1/8^{th}$ hour on average.
Ratio wind/solar energy cost = (8 $/watt solar/.125 h)/(6 $/watt nuclear/ 1 h) = 10.67

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Note that rebates are not included in the above rates because all customers must pay for the money that is given in rebates, thus all the customers must eventually pay for the total cost of these systems. There is no free ride.