Luminant's Big Brown plant near Fairfield, TX *Tom Fox/Staff photographer Dallas Morning News*

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Too Costly to Continue

Introduction

Texas policy makers are wrestling with a big question: How do we keep electricity flowing when our oldest coal plants will have to be retired or spend billions on emissions technology to meet new, ambitious federal pollution standards. Coal plants supply about one third [1] of Texas's energy and 37 %[2] of the energy sold within Texas's electrical grid operator, known as ERCOT. Coal plants have offered low-cost energy for years, but at a high price for our health, environment and climate. Coal plants are the state's most significant industrial contributors to ozone-generating nitrogen oxides (NOx), haze-creating sulfur dioxide (SO_2), and heavy greenhouse gas emissions that bring climate change.

Now our coal plants are being forced to clean up. In November, the EPA unveiled stronger rules for both ozone and haze, and in June the EPA announced its proposed Clean Power Plan, which will work to slow climate change by cutting carbon dioxide (CO_2) emissions from Texas's 22 coal power facilities.[3] Together, the new EPA rules will lower health care costs and slow climate change, but since coal plants are so highly polluting, upgrading them to meet the new regulations will cost billions for technology installation alone and more than $2 billion in annual operating costs (*see page 8*). During the EPA's Jan. 29, 2014 public hearing in Arlington, located in the Dallas-Fort Worth metro area, the agency sought comment on the proposed new ozone rules.

Upgrading a coal plant facility with effective pollution control devices is expected to be so expensive that certain vertically-integrated utilities outside of ERCOT may seek legislative authorization to use "securitization" as a means of financing the capital investment. Essentially, the scheme passes on to consumers the risk of debt taken on to finance pollution-control upgrades.

As the cost of reliance on Texas's 30- and 40-year-old coal plants rises, public health and environmental advocates, government agencies and even private investors are approaching agreement: Coal is too costly to continue. Meanwhile, clean energy alternatives, which are inherently safe for the public and the environment, are becoming cheaper. As one Texas resident said about adding scrubbers to old coal plants to meet current and proposed pollution rules, "You can put lipstick on a pig, but it's still a pig." He made the comment during testimony at a January EPA hearing on haze held in Oklahoma City.[4]

This report compiles and interprets several recent reports on the high cost of coal and the increasingly less expensive, safe alternatives offered by solar and wind power, geothermal, energy efficiency and energy storage. For Texas policy makers, this report offers a clear choice: They can count on coal to dirty our air and water, cook our climate and cost billions for upgrades. Or they can help Texas make the transition to a cleaner, safer and economically sustainable energy future.

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1 EIA. Electric Power Industry Generation by Primary Energy Source, Texas State Data, 2012: Total electric industry: 429,812, 510, coal power, 138, 088, 223. http://www.eia.gov/electricity/state/texas/

2 ERCOT Quick facts December18, 2014. http://www.ercot.com/content/news/presentations/2014/ERCOT_Quick_Facts_121814.pdf

3 Sourcewatch. www.sourcewatch.org/index.php/Category:Existing_coal_plants_in_Texas.

4 Comment from Texas resident Bob Fusinato during Jan. 15, 2015 regional haze hearing in Oklahoma City.

The Price of Old Coal Plants: Pollution, Climate Change

With the exception of five units that have come on line since 2009, all of the boilers at Texas's 22 coal power facilities started operating between 1971 and 1992 – well before the most effective emissions control technologies were available. [5] Out of the 25 most highly polluting coal power facilities in the United States, eight were located in Texas as of 2011. [6]

Much of Texas's coal-plant pollution comes from three plants – Luminant Energy's legacy coal facilities, the Big Brown, Monticello, and Martin Lake plants in East Texas near Dallas-Fort Worth. The three facilities are "among the leading emitters of air pollutants and greenhouse gases in Texas," [7] according to a 2013 report by Rice University Environmental Engineer Dr. Daniel Cohan. In 2011, they emitted 30,200 tons of nitrogen oxide, which contributes substantially to ozone levels in Dallas-Fort Worth that are both unhealthy and above federal standards.[8] (In 2011, the Dallas-Fort Worth area exceeded federal ozone standards on more days than the Houston-Galveston area, which once had the worst ozone pollution in the nation.)[9]

The three plants emit 44% of the state's SO2, which can worsen both respiratory and heart diseases, and 21% of its NOx, which also can exacerbate respiratory problems, particularly asthma. The three plants generate 16% of Texas's CO2, and 19% of its mercury.[10] They are among the nation's top five emitters of mercury, a "potent neurotoxin linked to IQ impairment and other developmental problems in children," according to the Cohan report.[11] The Martin Lake facility and its coal mine emitted 2600 pounds of mercury in 2011 – more than any other plant in the nation.[12]

These coal-plant pollutants pose a serious risk to public health, which, in turn, exacts a high price in related health care costs and economic losses owing to premature mortality. During the Jan. 29 EPA hearing in Arlington, a leading Dallas epidemiologist cited a study that examined how much could be saved in health care and labor losses by reducing ozone in ten North Texas counties. (Much of the ozone in those counties is generated by Luminant's Monticello, Big Brown, and Martin Lake coal plants.) During the hearing, Dr. Robert Haley – former president and board chairman of the Dallas County Medical Society and current member of the Texas Medical Association's House of Delegates – said epidemiologists and geographic information specialists experts developed a computer model to estimate the impact that reducing ozone levels would have on hospitalizations and their costs and on premature deaths and their economic costs. The

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5 Daniel Cohan. "Addressing Pollution from Legacy Coal Power Plants in Texas, June 2013. p 23.

6 Environment Texas. "Dirty Energy's Assault on our Health" Jan. 2011, pg. 16. http://archive.environmenttexas.org/uploads/c9/28/c92893a211a1efc7f15e154d2389117c/TXE-Mercury-Report.pdf

7 Cohan report, pg. ii.

8 Ibid.

9 New York Times. "2011 Proving to be a bad year for air quality in Texas." www.nytimes.com/2011/12/11/us/2011-proving-to-be-a-bad-year-for-air-quality.html.

10 Cohan, pg.32.

11 Ibid, ii.

12 Environment Texas. "Dirty Energy's Assault on Our Health." pg. 9. http://archive.environmenttexas.org/uploads/c9/28/c92893a211a1efc7f15e154d2389117c/TXE-Mercury-Report.pdf

study, which used 2008 as its sample year, showed that if ozone standard had been reduced from the current 75 parts per billion (ppb) to 65 ppb, there would have been 320 fewer hospitalizations, $10 million less in hospitalization costs, 77 fewer premature deaths, and $617 million less in economic loss from premature death.[13]

"These numbers show the great health benefits of reducing the ozone standard by 10 ppb in a moderate ozone year," Dr. Haley said during his testimony. "These benefits would recur year after year; they would be greater with an even lower standard, say, to 60 ppb; and even greater in high ozone years such as 2012 and 2013."

That level of reduction is supported by data from the Clean Air Task Force, a national nonprofit which analyzed the costs of coal-plant pollution in all of Texas. The study, which was conducted in 2010 but predicted costs for 2012, said that coal-plant pollution in Texas could cause an estimated 330 deaths and 692 hospitalizations for conditions such as asthma, cardiovascular disorders, and respiratory illnesses. Related health care costs and losses due to premature death were expected to amount to about $2.5 billion. [14]

New EPA Rules on Ozone, Haze, and Carbon Pollution

Under new or pending EPA rules, levels of those pollutants are projected to decline. The EPA's new ozone rule – under the national ambient air quality standards (NAAQS) – will require ozone levels to stay within 65 to 70 parts ppb, compared to the current 75 ppb. Over the long term – by 2025 – the new rules will "yield significant health benefits" valued at $6.4 billion to $13 billion annually, if the standard is strengthened to 70 ppb, and $19 to $38 billion annually, if it's strengthened to 65 ppb," according to the EPA. The new rule would update the primary ozone standard, to protect public health, and the secondary standard, to protect public welfare. Both would be eight-hour standards set within the 65 to 70 parts per ppb. The EPA is also seeking comment on a health level as low as 60 ppb. [15]

EPA data indicates upgrades for haze rules at six coal power facilities will cost as much as about $3.2 billion

Under the EPA's new haze rule, 15 units at eight of Texas's coal-fired power facilities will be required to reduce SO2. That would cut about 230,000 tons of SO2 emissions per year, which will improve visibility in national parks, such as Big Bend and Guadalupe Mountains in Texas, and in wilderness regions in neighboring states. It will reduce the brown-white haze hovering over Texas cities, providing important health benefits to their residents. [16] The fine particle pollution generated by SO2 is unusually dangerous, because it can penetrate deeply into the lungs, worsening emphysema and bronchitis, and aggravating heart disease. Airborne fine particles are linked to increased hospital admissions, missed days of work or school, and

[13] Dr. Robert W. Haley, Dallas County Medical Society. "Testimony before the EPA's Public Hearing on Proposed Updates to the National Air Quality Standards for Ozone." Arlington, Texas, Jan. 29, 2015.
[14] Clean Air Task Force. Data collected from interactive database www.catf.us/fossil/problems/power_plants//.
[15] EPA. "Overview of EPA's proposal to update the air quality standards for ground-level ozone." Nov. 25, 2014, pgs 1-2. www.epa.gov/glo/pdfs/20141125fs-overview.pdfourn.
[16] EPA. "EPA Plan Will Reduce Pollution and Improve Visibility in Texas, Oklahoma," Nov. 24, 2015. http://yosemite.epa.gov/opa/admpress.nsf/0/93E58193B1FBBAA785257D9A0066A15B.

premature death, according to the EPA. [17](The EPA rule rejects parts of the Texas Commission on Environmental Quality's (TCEQ) own haze plan, because its mid- and long-term reductions were not strong enough to meet legal requirements. [18])

Other new or recently strengthened federal pollution rules will reduce levels of mercury in water and ensure that coal ash from power plants is disposed of safely. Those rules include:

- The Mercury and Air Toxic Standards (MATS), the first national limits on mercury, arsenic, chromium, nickel and acid gases from power plants. The EPA estimates the standards will prevent up to 1,200 premature deaths in Texas while creating up to $9.7 billion in health benefits in 2016. [19] [20]
- The Cross-State Air Pollution Rule (CSAPR), which requires states to significantly improve air quality by reducing power plant emissions that contribute to ozone and/or fine particle pollution in other states. "The final rule yields $120 to $280 billion in annual health and environmental benefits, including the value of avoiding 13,000 to 34,000 premature deaths," according to the EPA. [21]
- The Cooling Water Intake Structures Rule (316b), which regulates the design and operation of structures used by industrial and power facilities to take water from lakes, ponds, rivers and estuaries to cool their plants.[22]
- The Coal Combustion Residuals Disposal Rule, which requires coal-fired power plants to dispose of their coal ash in a manner that does not damage the environment or risk public health. [23]
- Steam Electric Power Generating Effluent Guidelines, which help reduce dangerous pollutants, including mercury, arsenic, lead, and selenium, which are released into America's waterways by coal ash, air pollution control waste and other waste from steam electric power plants. [24]

Reducing nitrogen oxides under the EPA ozone rule will cost Luminant's East Texas-area coal plants nearly $1 billion; annual operating costs will run to $170 million annually

Dallas County Medical Society Report on Luminant Plants

But as stronger pollution rules protect the environment and public health, the long-term economic prospects for Texas's coal power industry decline. For example, the 2013 Cohan study, which was released by the Dallas County Medical Society, estimated costs for Luminant's three East Texas coal plants of adding selective catalytic reduction (SCR), which reduces nitrogen oxide emissions by at least 90 percent. **Using EPA data, the Cohan report calculated that installing**

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17 Ibid.

18 Dallas Morning News, "EPA rejects Texas plan to cut haze-causing pollution from coal plants," Nov. 24, 2014. www.dallasnews.com/news/state/headlines/20141124-epa-rejects-texas-plan-to-cut-haze-causing-pollution-from-coal-plants.ece.

19 EPA. "Mercury and Air Toxic Standards," Dec. 21, 2011. http://www.epa.gov/mats/whereyoulive/tx.html.

20 Midwest Energy News, "Federal Judges Uphold mercury and Toxics Standards," April 16, 2014. www.midwestenergynews.com/2014/04/16/federal-judges-uphold-epa-mercury-and-toxics-standards/.

21 EPA. "Cross-State Air Pollution Rule," Nov. 21, 2014. http://www.epa.gov/crossstaterule/.

22 EPA. "Cooling Water Intakes," Nov. 12, 2014. http://water.epa.gov/lawsregs/lawsguidance/cwa/316b/.

23 EPA. 2014 Final Rule: Disposal of Coal Combustion from Electric Utilities," Dec. 19, 2014. http://www2.epa.gov/coalash/coal-ash-rule.

24 EPA. "EPA Proposes to Reduce Toxic Pollutants Discharged into Waterways by Power Plants, Apr. 19. 2013. http://yosemite.epa.gov/opa/admpress.nsf/0/8F5EF6C6955F6D2085257B52006DD32F.

SCR at Martin Lake, Big Brown and Monticello would come to $936 million.[25] **The report estimated the annual operating costs for the SCRs at nearly $170 million.** "Applying EPA's assumed capital charge rate of 12%/year and adding in variable and fixed operating and maintenance costs, the annual costs of the SCRs would total $168 million/year based on year 2011 operating conditions or about $9,200/ton, several times the market prices typically experienced in cap-and-trade programs."[26] The need for expensive upgrades comes as EFH is amid bankruptcy proceedings.[27]

Using data from the Swiss bank UBS, the Cohan report also estimated the cost of reducing both NOx and SO2 at the three Luminant plants, using selective non-catalytic reduction (SNCR) instead of SCRs. (SNCR is less expensive than SCR technology, but it is also not likely to reduce NOx enough to allow the Dallas region to meet current and future federal ozone standards.) Controlling NOx and SO2 with SNCRs would cost the company $364.5 million in capital costs and $137 million in annual operating costs, according to the Cohan report.[28] The report said the retrofits would add about 0.33 cents per kilowatt hour (kWh) to generating costs. The report added that if SCRs are used (instead of SNCRs), the total costs of retrofits would be about 0.57 cents/kWh – a substantial amount compared to the historically low 2.5 cents/kWh wholesale price that EFH reports for power in the North Hub (one of four electricity consumption zones) in 2012."

TCEQ Cost-Analysis for Haze Rules

In its press release on the new EPA haze standards, the TCEQ said they would require additional pollution controls – full scrubbers or upgrades to existing scrubbers – at 14 units at seven highly polluting coal power facilities over the next three to five years.[29] The plants include Luminant's Martin Lake (3 units), Monticello (3 units), and Big Brown (2 units), as well as Sandow 4 (1 unit); Limestone (2 units); Coleto Creek (1 unit), and Tolk (2 units). **The total costs, according to TCEQ, will come to at least $2 billion.**

EPA Cost-Analysis for Haze Rules

A December EPA cost-analysis suggests a higher price for complying with the haze rule.[30] The EPA analyzed costs for six facilities, some of which overlap with the TCEQ study. The EPA analysis included Big Brown, Monticello, Coleto Creek, Tolk but also Welsh and W.A. Parish *(see table 32)*. The EPA report i ncludes estimates for relatively inexpensive pollution-control technologies: Dry Sorbent Injection (DSI), Spray Dryer Absorber (SDA). But that technology is significantly less effective. For example, DSI scrubs as little as 50 percent of sulfur dioxide (SO2) emissions, while the most effective technology, wet flue gas

EPA's new haze rules and its Clean Power Plan could result in retirement of half of ERCOT's coal-power generation.

25 Cohan, pg 35
26 Ibid.
27 Dallas Morning News. "Judge allows EFH to continue with Oncor auction, but with greater oversight." Nov. 3, 2014.
28 Cohan, pgs 35-36
29 TCEQ. "Response to EPA's Proposed Action on Regional Haze," Nov. 24, 2014. www.tceq.state.tx.us/news/releases/11-14-eparegionhaze. www.epa.gov/region6/6xa/pdf/tx_regional_haze_proposed_action_112414.pdf.
30 Environmental Protection Agency, EPA, R06-OAR-2014-0754, Dec. 24, 2014, pgs 216-217. www.epa.gov/region6/6xa/pdf/tx_regional_haze_proposed_action_112414.pdf.

desulfurization, or Wet FGD, consistently scrubs over 90 percent and as much as 98 percent. [31]

However, assuming use of the most effective technology, Wet FGD, installation alone will amount to about $3.2 billion for the six plants.[32] In addition, operating costs – assuming the technology is used 100 percent of the time —will amount to about an annual $415 million.[33] In both cases, the figures represent an astounding amount of capital to invest in plants that in many cases are nearing the end of their expected lifespan.

Table 32. Summary of DSI, SDA, and Wet FGD Cost Analysis

Facility	Unit	Control	Control level (%)	SO_2 reduction (tpy)	$/ton reduced	Capital Cost	Annualized Cost
Big Brown	1	DSI	50.0	15,334	$2,223	$19,096,000	$34,086,871
		DSI	90.0	27,600	$2,996	$33,357,000	$82,684,241
		SDA	95.0	29,134	$1,377	$226,656,000	$40,104,566
		Wet FGD	98.0	30,054	$1,255	$256,032,000	$37,708,999
	2	DSI	50.0	15,407	$2,201	$19,035,000	$33,909,822
		DSI	90.0	27,733	$2,994	$32,965,000	$81,649,586
		SDA	95.0	29,273	$1,373	$229,544,000	$40,185,893
		Wet FGD	97.9	30,169	$1,257	$259,141,000	$37,909,708
Monticello	1	DSI	50.0	8,933	$2,728	$17,137,000	$24,364,819
		DSI	90.0	16,079	$3,420	$23,580,000	$54,991,417
		SDA	95.0	16,972	$2,012	$224,262,000	$34,154,932
		Wet FGD	97.0	17,328	$1,937	$250,804,000	$33,558,169
	2	DSI	50.0	8,215	$3,086	$17,057,000	$25,351,370
		DSI	90.0	14,786	$3,845	$23,468,000	$56,850,489
		SDA	95.0	15,608	$2,254	$227,409,000	$35,183,025
		Wet FGD	96.8	15,907	$2,170	$254,177,000	$34,523,884
Coleto Creek	1	DSI	50.0	8,030	$2,792	$15,888,000	$22,416,218
		DSI	90.0	14,453	$3,460	$21,863,000	$50,001,685
		SDA	93.5	15,012	$2,356	$240,408,000	$35,366,916
		Wet FGD	95.7	15,361	$2,278	$262,435,000	$34,996,979
Tolk	171B	DSI	50.0	5,016	$3,084	$13,938,000	$15,465,578
		DSI	90.0	9,028	$3,592	$19,179,000	$32,426,429
		SDA	91.7	9,195	$3,178	$218,306,000	$29,218,836
		Wet FGD	94.4	9,474	$3,204	$243,048,000	$30,352,765
	172B	DSI	50.0	5,517	$2,828	$13,873,000	$15,600,155
		DSI	90.0	9,931	$3,221	$19,090,000	$31,985,880
		SDA	90.8	10,015	$2,998	$226,957,000	$30,022,609
		Wet FGD	93.8	10,355	$3,019	$252,559,000	$31,257,301

Table 32. Summary of DSI, SDA, and Wet FGD Cost Analysis
continued

Facility	Unit	Control	Control level (%)	SO_2 reduction (tpy)	$/ton reduced	Capital Cost	Annualized Cost
Welsh	1	DSI	50.0	4,042	$,3718	$14,888,000	$15,026,538
		DSI	80.0	6,467	$4,019	$18,901,000	$25,992,966
		SDA	88.7	7,169	$3,489	$201,549,000	$25,009,785
		Wet FGD	92.5	7,474	$3,508	$221,282,000	$26,216,294
	2	DSI	50.0	4,128	$3,611	$14,775,000	$14,906,814
		DSI	80.0	6,605	$3,879	$18,758,000	$25,622,166
		SDA	88.2	7,285	$3,438	$202,108,000	$25,045,518
		Wet FGD	92.2	7,608	$3,454	$221,821,000	$26,276,805
	3	DSI	50.0	4,305	$3,690	$15,023,000	$15,884,663
		DSI	80.0	6,887	$3,998	$19,071,000	$27,531,831
		SDA	88.7	7,634	$3,368	$204,177,000	$25,713,148
		Wet FGD	92.5	7,959	$3,379	$224,298,000	$26,895,390
W. A. Parish	5	DSI	50.0	7,079	$2,559	$15,227,000	$18,111,990
		DSI	90.0	12,741	$2,995	$20,953,000	$38,161,382
		SDA	92.5	13,095	$2,441	$240,112,000	$31,970,651
		Wet FGD	95.0	13,449	$2,389	$260,195,000	$32,124,808
	6	DSI	50.0	7,654	$2,699	$15,934,000	$20,660,436
		DSI	90.0	13,776	$3,229	$21,924,000	$44,478,086
		SDA	93.1	14,251	$2,401	$248,503,000	$34,220,158
		Wet FGD	95.4	14,603	$2,334	$270,350,000	$34,085,705
	7	DSI	50.0	6,168	$2,805	$14,641,000	$17,301,527
		DSI	90.0	11,102	$3,296	$20,145,000	$36,594,402
		SDA	92.7	11,432	$2,559	$211,443,000	$29,250,022
		Wet FGD	95.1	11,733	$2,542	$233,698,000	$29,821,127

Source: Table 32, drawn from EPA's Regional Haze Implementation Plan (R06-OAR-201400754)

Note: Capital Cost column reflects installation costs and Annualized Costs reflects yearly operating cost. Capital Cost for Wet Flue Gas Desulfurization at all of the facilities = $3,209, 840,000. Annualized costs for Wet FGD at all of the facilities = $415,727,961.

ERCOT Report on Complying with Six New Rules

In December, ERCOT released an analysis of the cost for its entire generation fleet to comply with six of the new rules – MATS, CSAPR, the steam effluent rule, the cooling water intake rule, the coal ash rule and the haze rule. The report concluded that of all of its electricity generating facilities, coal plants will be most significantly affected. ERCOT said the EPA's new haze rules and Clean Power Plan, "in combination with other regulations," could result in retirement of up to 8,700 megawatts (MW) of coal power" – about half of ERCOT's total coal power generation – and more than 13 percent of its overall thermal generation resources. [34] Even without taking into consideration the Clean Power Plan, 3,000 megawatts to 8,500 megawatts of coal-fired capacity in ERCOT "can be considered to have a high to moderate risk of retirement," due primarily to the costs of cleaning up enough to meet the EPA's proposed haze rules.[35] Further, CSPAR, is likely to require a capacity reduction

[31] Ibid.
[32] Capital cost (installation cost) for Wet FGD at all units at the six facilities named in the chart equals $3,209,840,000, or about $3.2 billion.
[33] Annualized cost (annual operating cost) for Wet FGD at all units at the six facilities named in the chart equals $415,727,961.
[34] ERCOT. "Environmental Regulations and Future Electric Reliability, December 2014. www.ercot.com/content/news/presentations/2015/EPAandGenerationUpdate-FINAL-Dec2014.pdf.
[35] ERCOT. "Impacts of Environmental Regulations in the ERCOT Region." Dec 16, 2014, pg ii. www.ercot.com/content/news/presentations/2014/Impacts%20of%20Environmental%20Regulations%20in%20the%20ERCOT%20Region.pdf.

of 3,000 to 6,000 megawatts of coal-powered energy during off-peak months and 1,200 to 1,400 during peak months. [36]

The study did not provide a dollar figure for the cost of complying with the ozone rule or the Clean Power Plan, which will require Texas coal plants to reduce carbon emissions by 34 % by 2020 and achieve a total reduction of 39 % by the year 2030. [37] [38].

However, ERCOT has estimated the cost of CO2 reduction at about $20 a ton in 2020. [39]Given that Texas's coal plants generated 144.31 million metric tons of CO2 in 2012, [40] and they must reduce that by 34% (or about 49 million metric tons) to meet the 2020 goal, the approximate cost of compliance would be about $980 million annually. [41] Once that goal is reached, annual cost will drop dramatically, since Texas will only have to reduce CO2 emissions by another 5 % to reach the final goal of 39 % reduction. ERCOT predicts that because of those costs, many coal plants – 6500 MW of coal power generation – will be retired. The cost of carbon reduction also is expected to decline over the course of the Clean Power Plan as carbon-intensive plants are retired and replaced with gas and renewables, and demand is reduced by energy efficiency.

ERCOT predicts that a CO2 reduction cost of $20 per metric ton would result in an addition of 2,800 MW of wind power and an addition of 12,600 MW of solar power. If CO2 reduction costs $25 a metric ton, there will be an increase in wind power of 3500 MW and an increase in solar power of 13,500 MW, according to ERCOT. [42]

The EPA's Coal Combustion Rule

Under the new Coal Combustion Residuals Disposal Rule, the cost of disposing of all toxic coal ash would also make continued operation of coal plants highly expensive. In Texas, coal ash currently is disposed of in unlined pits, which pollutes groundwater with toxic, heavy metals like selenium, thallium, and mercury. Under the new rules, EPA provides a comprehensive set of requirements for safe disposal of coal ash, which address "leaking of contaminants into ground water, blowing of contaminants into the air as dust, and the catastrophic failure of coal ash surface impoundments." The rules also include recordkeeping and reporting requirements as well as rules for posting specific information to a publicly-accessible website.

Using data from 2012, ERCOT's estimated cost for an average U.S. coal power facility to comply with that rule would be between $31 million and $36 million annually per coal plant. Applying that data to Texas, where 22 coal power facilities operate, the cost estimate for complying with the coal ash rule comes to an annual $682 million to $792 million.[43]

A rough estimate of total annual operating costs under some of the rules can be gleaned by adding the following costs:

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36 Ibid., pg 3

37 Climate Central. "Basis for Clean Power Plan Cut a 'Mystery,'" June 30, 2014. www.climatecentral.org/news/epa-clean-power-plan-emissions-co2-mystery-17666.

38 Houston Chronicle. "EPA proposes deep carbon cuts for Texas power plants." June 2, 2014. www.houstonchronicle.com/news/science-environment/article/EPA-proposes-deep-carbon-cuts-for-Texas-power-5523479.php.

39 ERCOT. "Impacts of Environmental Regulations in the ERCOT Region." Dec. 16, 2014, pg. 13

40 U.S. Energy Information Administration. Electric power industry emissions estimates, 1990-2012, Table 7. www.eia.gov/electricity/state/texas/.

41 Calculation: 144, 307,000 metric tons CO2 X 39% reduction = 56,279,730 metric tons X $25 per metric ton cost of CO2 reduction = $1,406,993, 250.

42 ERCOT "Analysis of the Impacts of the Clean Power Plan." Nov. 17, 2014, pg 6, Tables 2 and 3.

43 Tennessee Environmental Coalition. "Study Gallatin Coal Plant." Nov. 14, 2012. www.ucsusa.org/clean_energy/coalvswind/c01.html#.VLhZaRA5v0Q - http://tectn.org/wp-content/uploads/2013/02/SST-Gallatin-Coal-Plant-Powerpoint-Helen-Li-022213.pdf

- Complying with coal combustion rule (Public Citizen estimate): $682 to $792 million
- Complying with the Clean Power Plan (Public Citizen estimate): $980 million
- Complying with the haze rule using Wet FGD (EPA estimate): $415 million
- Reducing nitrogen oxides using SCRs (Cohan estimate): $170 million

Total $2.247 to $2.357 million

Coal Pollution and Health Care Costs

Coal plants cost $2.5 billion in polluted related illnesses

Coal plants also exact a high price in pollution related illness and premature mortality. Coal-plant pollution costs Texans over $2.5 billion annually in treatment of related conditions, such as chronic bronchitis and asthma, and for the costs of hospital admissions and premature mortality associated with coal-plant pollution, according to data from the national nonprofit Clear Air Task Force (*see table below*).[44] The study, which was conducted in 2010 but projected costs for 2012, indicates that the bulk of the costs are from palliative care related to premature deaths due to coal pollution.

Many pollutants could be dramatically reduced with pollution-control technology, but at a high price. For example, the chart "*Ozone Impacts of Old Power Plants on 2018 SIP"* demonstrates that installing SCRs at these plants (at a cost of nearly $1 billion) could put Dallas-Fort Worth into compliance with current ozone standards and very close to compliance with the new standards.[45] Since SCRs reduce NOx by at least 90%, adding hem at the facilities would decrease their NOx emissions of 2.68 ppb recorded at Denton Airport South (*see yellow bar at bottom of chart*) by 2.41 ppb. That, in turn, would bring the total recorded emissions at Denton Airport South to about 74.25 – below the 75 ppb level required under the 2008 standards and at least close to the new standards of 65 to 70 ppb. That same 90% reduction would put Parker County under the 70 ppb standard and Kaufman under the 60 ppb standard.

Impact	Cost
Heart attack	$53,508,000
Asthma attacks	$309,000
Hospital admissions	$5,581,000
Chronic bronchitis	$92,941,000
Asthma ER visits	$131,000
Premature deaths	$2,380,878,000
Total	**$2,533,348,000**

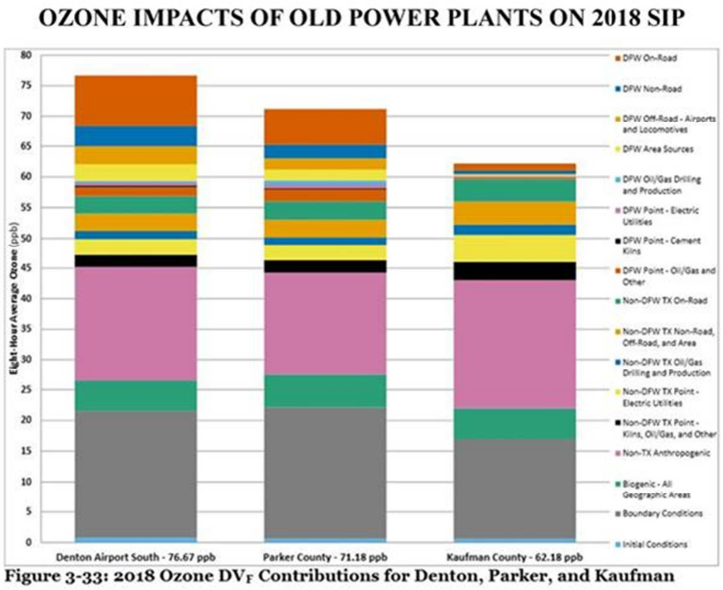

Figure 3-33: 2018 Ozone DV_F Contributions for Denton, Parker, and Kaufman

Geographic Area and Source Type	Denton Airport South (ppb)	Parker County(ppb)	Kaufman County (ppb)
Non-DFW TX Point - Electric Utilities	2.68	2.66	4.56

Source: Texas Commission on Environmental Quality Fort Worth Attainment Demonstration State Implementation Plan Revision for the 2008 Eight-Hour Ozone Standard Non-Attainment area Project Number 2013-015-SIP-NR.

[44] Clean Air Task Force, Data are collected from interactive database www.catf.us/fossil/problems/power_plants//.

[45] TCEQ. "Texas Commission on Environmental Quality Fort Worth Attainment Demonstration, State Implementation Plan Revision for the 2008 eight-hour ozone standard non-attainment area," Project number 2013-015-SIP-NR, pg. 3.73. www.tceq.texas.gov/assets/public/implementation/air/sip/dfw/dfw_ad_sip_2015/AD/DFWAD_13015SIP_pro.pdf.

"Securitization" – A Big Bailout

Anticipating the costs of cleaning up coal plants, the Texas Public Utility Commission (PUC), during a Dec. 1 open meeting, suggested that the legislature might want to "consider new laws that would permit vertically-integrated utilities (companies out of the ERCOT competitive wholesale market) to use securitization" as a means of financing the types of capital investment that would be needed for upgrading coal plants to meet new environmental rules.[46] The PUC suggested that the mechanism might be used for coal plants that are near borders, have the least effective pollution control technology and, as a result, affect air quality in other states.

Some of the facilities that meet those criteria include Harrison County's Pirkey facility, Lamb County's Tolk facility, Titus County's J. Robert Welsh facility, and Potter County's Harrington Station facility. According to the PUC, "securitized cost-recovery provides for a type of financing that, in comparison to conventional financing, lowers the amount of interest charges paid by ratepayers." However it shifts the risk of making a bad business decision on whether adding pollution controls would increase the cost of running these old and dirty plants away from the private utilities to the PUC with the cost borne by consumers. Under the financing mechanism, the cost of the upgrades could be assessed as a fee on every customer's utility bill. Texas has used securitization to bail out utilities with nuclear plants that produced energy that was too expensive to sell, and that has been costly. In previous cases the PUC added more than $7 per month to consumers' bills to pay for nuclear power plants that costs too much to build and couldn't compete.[47]

For consumers and policy makers, the important issue is that investor-owned utilities, facing investment of hundreds of millions of dollars into decades-old coal facilities, might decide they're too costly to upgrade and operate and retire them. However, if utilities believe they can avoid the risk and fall back on a ratepayer-funded bailout, a form of corporate welfare, they may opt for continuing to rely on coal plants that are not sustainable in an unsubsidized free market.

Cheaper Alternatives: Wind and Solar

Compared to the cost of continued reliance on Texas's old coal plants – technology upgrades to meet new pollution rules and the indirect costs of an unhealthy public – renewable energy and demand side energy reduction look increasingly appealing. These alternatives are clean and much safer than continuing to rely on coal. If carbon emission offsets under the EPA's Clean Power Plan are added into the mix, these old plants become more costly than alternatives, such as natural gas, wind, solar and geothermal.

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46 TPUC. Open Meeting, Environmental Compliance Costs, Dec. 1, 2014, pg. 5, section D. (Control no. 42367) http://interchange.puc.texas.gov/WebApp/Interchange/application/dbapps/filings/pgSearch_Results.asp?TXT_CNTR_NO=42367&TXT_ITEM_NO=7

47 Texas Coalition for Affordable Power. "Deregulated Electricity in Texas," February 2014. pg. 66. http://tcaptx.com/wp-content/uploads/2014/02/TCP-793-Deregulation2014-A-1.6.pdf

The chart drawn from the Cohan report (*see June 2013 Costs and Emissions per MWh from Retrofit and Energy Replacement Options)* [48] shows:

- Line 1: The cost of energy produced by Luminant's Monticello, Big Brown and Martin Lake facilities under the Clean Power Plan; the final five columns reflect the indirect costs of the plants in terms of emissions of public-health threatening pollutants (SO_2, NO_x, CO_2, and Hg (mercury), as well as heavy water use.
- Line 2: The cost of energy produced by those plants after factoring in Swiss bank UBS' estimate of expenditures for pollution-control technology.
- Line 3: The cost of energy produced by those plants after factoring in the cost of adding the most effective technology, SCRs, to reduce nitrogen oxides.
- Lines 4, 5, 7, 7, and 8: The cost of natural gas and renewables alternatives. With incentives factored in, the cost of alternatives becomes competitive with coal, especially considering the lack of indirect costs in emissions of dangerous pollutants.

June 2013 Costs and Emissions per MWh of from Retrofit and Energy Replacement Options

		Cost	Cost w/ incentives	**Cost w/ incentives + $25/ton CO_2**	SO_2 (lb)	NOx (lb)	CO_2 (lb)	Hg (10^{-5} lb)	Water use (gal)
1	Legacy coal 2011	$39.63	$39.63	**$66.34**	9.18	1.48	2,137	8.9	300
2	Coal w/ UBS Retrofits	$42.89	$42.89	**$70.02**	4.36	1.23	2,170	0.9	309
3	Coal w/ SCRs	$45.29	$45.29	**$72.42**	4.36	0.59	2,170	0.9	309
4	Natural gas	$65.90	$65.90	**$79.51**	0.01	0.36	1,089	0.0	270
5	Geothermal	$76.10-$88.20	$65.10-$77.20	**$65.65-$77.75**	0.17	0.00	44	0.0	5
6	Coastal wind	$51.00-$83.40	$40.00-$72.40	**$40.00-$72.40**	0.00	0.00	0	0.0	1
7	Solar	$140.30	$77.90-$101.18	**$77.90-$101.18**	0.00	0.00	0	0.0	26
8	Energy Efficiency	$35.00	$35.00	**$35.00**	0.00	0.00	0	0.0	0

In May 2014, Austin's city-owned utility Austin Energy submitted data to the Austin Generation Resource Planning Task force, formed by the Austin City Council to investigate energy costs. The data also showed the cost-competitiveness of wind and solar. With the exception of solar in central Texas, the levelized average costs of wind ($36.75, $44.00) and solar ($52.26) (*see chart, "May 2014 Costs in $ per MWh for Renewable Energy and Demand-Side Energy Management"*) and are far lower cost than the costs of energy from retrofitted coal plants ($70.02, $72. 42) and natural gas ($79.51) (*See Cohan chart, "June 2013 Costs…")* when pollution CO2 reduction is factored in. [49] Levelized averages are the lifetime cost of the energy source, including capital costs, operations and maintenance and fuel. Higher land values and fewer solar resources in the central Texas area make solar in that area more expensive, however that price is also coming down. As solar prices continue to decline and energy storage begins to play a role in the ERCOT

[48] Cohan, pg 47. www.dallas-cms.org/news/coalplants.pdf.

[49] Austin Energy. "Investing in a Clean Energy Future," Presentation to the Austin Generation Resource Planning Task Force. May 7, 2014. Pg 14. www.austintexas.gov/edims/document.cfm?id=210178.

market, the transition from coal to renewable energy will become even easier, but it is already a financially attractive option today.

May 2014 Costs in $ per MWh for Renewable Energy and Demand-Side Energy Management

Technology	Levelized (average)	Levelized (low end)	Levelized (high end)
Onshore Wind (West Texas)	36.75	26.25	61.55
Onshore Wind (South Texas)	44	36	75.41
Solar Photovoltaic (>50 MW West Texas)	52.26	45	114.23
Solar Photovoltaic (<20 MW Central Texas)	112.91	90.33	213.3
Natural Gas Advanced Combined Cycle	69.99	61.53	91.38

Geothermal: Texas's Untapped Energy.

Texas has great potential for developing geothermal energy, in which energy from within the earth is used to generate electricity, and much of those resources are in the same areas of East Texas where large lignite coal plants now operate. Once the cost of retrofitting and paying carbon offsets is factored in, geothermal plants could replace generation of power at those old coal facilities at a lower cost, according to the Cohan report. The report cites work by Maria Richards at Southern Methodist University and Bruce Cutright at the University of Texas Bureau of Economic Geology, who have extensively studied potential geothermal resources in Texas and associated costs. [50]"Based on geothermal gradients and the permeability of reservoirs, Texas has far more geothermal resources than would be needed to supply the 5,495 MW of capacity" that the Luminant plants generate, the report says. [51]Once geothermal is installed, its operating cost is competitive with or lower than the Luminant facilities' coal energy – $65.65-77.75/MWh for geothermal compared to $70.02/MWh or $72.92/MWh for the Luminant facilities (*see Cohan report chart, "June 2013…"*), once pollution-control technology and carbon offsets are factored in. [52]

Alternatives Could Provide Savings of 21 % to 24 %

In fact, a blend of alternatives – geothermal, renewables like solar and wind, and some natural gas – can replace dirty coal-powered energy and save money at the same time. Public Citizen used new Austin Energy data on levelized energy costs (*see chart on page 12, "May 2014…."*) and Cohan's estimate for the cost of retrofitted coal (*see chart on pages 11 and 12, "June 2013…"*) to draw a comparison between the two. The data show that on an annual basis, alternatives would cost as much as about 24 % less than coal, once upgrades for the EPA's ozone rule and CO2 reduction under the Clean Power Plan are factored in.

For example, the roughly 34 million megawatt hours of energy generated for consumption by the three plants in 2013 [53]could be replaced by solar (about 3.9 million MW/h), West Texas wind (about 4.5 million), coastal wind (about 11.6 million), natural gas (about 5.2 million), and geothermal (about 8.7 million). On an annual basis, the mix of alternatives would cost about $585

[50] Cohan, pg. 41.
[51] Ibid.
[52] Ibid. pg 47

[53] EPA. "Air Markets Program Data." Dec. 17, 2014. http://ampd.epa.gov/ampd/

million less than coal power generation, once adding SCRs to cut ozone emissions and reducing CO2 are factored in. That means using alternatives would reduce the cost of producing 36 million MW/h by about 24 %. The same mix would cost about $503 million less than coal, if CO2 reduction is factored in and cheaper but less effective SNCRs are used. As such, using the blend of alternatives would reduce costs by about 21 %. Even using the much higher cost of Central Texas solar ($112.91) as part of the mix, alternatives would cost about $345 million (14%) less than coal power generation, once adding SCRs to cut ozone emissions and reducing CO2 are factored in. The same mix would cost $264 million (11 %) less than coal, if CO2 reduction is factored in and cheaper but less effective SNCRs are used.

Cost of producing 36 million MW/h of energy at Luminant's three East Texas plants compared to cost using blend of alternative sources.

Energy Source	Cost per MW/h*	Hours of energy that can be produced annually	Cost	TOTAL COST
Natural Gas	$69.90	5,212,200.00	$364,332,780.00	
Solar	$52.26	3,942,000.00	$206,008,920.00	
West Texas wind	$36.75	4,485,120.00	$164,828,160.00	
Coastal wind	$44.00	11,650,800.00	$512,635,200.00	
Geothermal	$71.70	8,760,000.00	$628,092,000.00	*$1,875,897,060.00
Coal w/SCRs & CO_2 reduction	$72.42	33,974,974.45	$2,460,467,649.67	$2,460,467,649.67
Coal w/SNCRs & CO_2 reduction **	$70.02	33,974,974.45	2,378,927,710.99	$2,378,927,710.99

* Dollar figures drawn from Austin Energy and Cohan report charts
** UBS estimate

Savings using alternatives rather than coal

	Savings
Alternatives instead of coal with SCRs and CO2 reduction	**$584,570,589.00 or 23.76 %**
Alternatives instead of coal with SNCRs and CO2 reduction	**$503,030,650.99 or 21.15 %.**

Those savings don't include the savings that would accrue because renewables do not generate coal ash. Under the EPA's new coal combustion rule, coal plants in Texas will have to spend an estimated $31 million to $36 million per plant on an annual basis to dispose of coal ash in a manner that does not engager public health or the environment (*see page 8, footnote 43)*. Nor do those cost-reductions include savings for the public in the form of reduced pollution-related health expenses and labor losses because of sick days and premature mortality. According to data from the Clean Air Task Force, the three Luminant plants cost about $1 billion annually in health care expenses, hospitalization, lost work time, and premature mortality because of pollution-related conditions such as asthma, bronchitis, and heart attacks. The $1 billion breaks down to about $426

million for Big Brown[54], about $234 million for Monticello, and about $372 million for Martin Lake.[55] The $1 billion also accounts for about 40 % of the total $2.5 billion in costs related to coal-plant pollution, according to the Clean Air Task Force's data.

With Luminant's parent company EFH amid bankruptcy proceedings, these findings are vital. After filing for bankruptcy last April, EFH continues to struggle to get its reorganization approved.[56] EFH, or whoever ends up owning Luminant, could replace dirty, expensive coal generation at its three East Texas plants with alternatives that would save the company as much as $585 million, while saving the public $1 billion in health care costs and economic losses. Further, if Luminant's new owners act before the end of 2016, the firm could take advantage of federal tax credits that would cover 30 percent of the cost of building solar power facilities [57] and 10 percent of the expense of building geothermal plants.[58]

Conclusion

Study after study shows that the many of Texas' oldest coal plants are too costly to continue due to pending federal regulations and competition from lower cost renewable energy and energy efficiency. As one commentator said about trying to clean up old coal plants, "You can put lipstick on a pig but it's still a pig" The time has come for Texas to develop a market-based plan to replace the power produced by these old plants and allow new, lower-cost ways of generating or saving energy to take their place. Retiring the old Luminant coal plants also would reduce the liabilities that parent company EFH is carrying into its bankruptcy proceedings. But instead of embracing healthy change, Texas's political leadership is fighting to prop up old coal by fighting federal regulations and offering to shift the costs of pollution controls to consumers. Texas has been an internationally recognized leader in development of renewable energy and its leaders should advance – not inhibit – this evolution. It's time for Texas leadership to look at the health care costs and the cost of cleaning up old coal plants and conclude that this increasingly obsolete source of energy is too costly to continue

[54] Clean Air Task Force. "Find your risk from power plant pollution." http://www.catf.us/fossil/problems/power_plants
[55] Ibid.
[56] Reuters. "Bankruptcy judge to rule on Energy Future's Oncor unit sale." Oct. 27, 2014. http://www.reuters.com/article/2014/10/27/energyfutureholdings-bankruptcy-oncor-idUSL1N0SM28Q20141027
[57] Solar Energy Industries Association. "Solar Investment Tax Credit." http://www.seia.org/policy/finance-tax/solar-investment-tax-credit
[58] Walter-Furnace. Federal Tax Incentives for Commerical Geothermal Heat Pumps. www.architectmechanical.com/pdf/**Tax**InfoCommercial.pdf

Dedication

This report is dedicated to Hillary Corgey (1987-2015), whose commitment to environmental justice and contributions to this report were invaluable.

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