On the Decrease in Texas' CO_2 Emissions from 2000 to 2005

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Executive Summary

On January 29, the Environmental Defense Fund, together with the UK Consulate, hosted a climate conference at the capitol: "Texas' Changing Economic Climate." At the beginning of the conference, we heard a personal message from Prince Charles of Wales to the State of Texas imploring Texans to lead the US, and hence the world in climate mitigation. At the end of the conference, one of our elected officials suggested Texas may in fact already be a leader in carbon emissions mitigation while at the same time increasing the gross state product. And if Texas has been taking this leadership role by promoting things like a business-friendly environment and a deregulated electricity market, then perhaps other states, and countries, should look to Texas for how to mitigate carbon emissions.

Are those claims true? Is Texas a leader in reducing carbon emissions while increasing economic productivity?

On the surface, it seems plausible. From 2000 to 2005, total CO_2 emissions in the state decreased 4.4 percent while economic output increased 16.5 percent. But dig deeper, and claims of real leadership on climate mitigation evaporate. It turns out that global energy prices were major drivers of those changes, not because of any coordinated state CO_2 regulatory environment or business initiatives. Much of the CO_2 reduction came from decreased natural gas use by the chemical industry as a result of the rising cost of natural gas and possibly NOx emissions regulations. Electricity deregulation in Texas fostered the increased use of natural gas combined cycle technology for electricity generation – helping to maintain relatively steady electric sector CO_2 emissions since 2000. Much of the rise in the state's economic output is attributable to the oil and gas industry, buoyed by the same rise in global energy prices.

It is a mistake to think that significant steady and long term CO_2 emissions reductions, together with increased gross state product, can be achieved by simply continuing actions of the past five to ten years.

This report examines the data behind claims that Texas has been a leader in reducing carbon emissions while increasing economic productivity. The data show that one external economic factor, higher energy prices, was a driver in decreasing emissions in Texas from 2000 to 2005, not our pro-business or deregulatory policies. Additionally, during this time, the requirement that certain NOx point source emitters reduce NOx emissions may have opted to reduce natural gas consumption and sell NOx permits to within the industrial sector. Texas must prepare for the future. Federal climate legislation is on the horizon. This legislation is likely to impose constraints on the Texas economy that will demand even greater reductions in emissions. Texas and the rest of the US states should work to understand how specific industries and consumers will be affected by a federal CO_2 constraint and potentially high fuel prices. By promoting those businesses that are well-positioned and facilitating restructuring for those ill-positioned, Texas can successfully transition to and maintain leadership within the new carbon-constrained energy economy.

Texas CO_2 emissions data

In looking at aggregated data from the Energy Information Administration of the Department of Energy, from 2000 to 2005, the CO_2 emissions of Texas went from 654 million metric tons ($MtCO_2$) to 625 $MtCO_2$ – a decrease of 4.4%[1]. By looking at the data in Figure 1, one can see that the peak year for Texas CO_2 emissions was 2002 at 672 $MtCO_2$. Emissions in both 1999 and 2001 were less than in 2000 with the decrease from 1999 to 2005 being only 0.2%, as Texas' CO_2 emissions in 1999 are listed at 626 $MtCO_2$. Thus, in thinking about a specific baseline year for CO_2 emissions, the choice can have a large impact. This fact provides reasoning for using a running average that can level out short-term fluctuations in the economy and energy prices.

The evidence for the emissions decrease is revealed by looking one level deep into the data – emissions from the industrial sector (see Figure 2). In 2005, the Texas industrial sector was responsible for 179 $MtCO_2$ compared to 218 in 2000 – a 17.6% decrease. As a comparison, the drop in the overall US industrial sector emissions was only 6.4%. No other major sector, transportation or electric power, decreased in emissions in Texas during the 2000-2005 span. Furthermore, the Texas industrial sector is dominated by the consumption of natural gas as they are correlated very closely: Texas total consumption of natural gas dropped 21% from 2000 to 2005.

[1] http://www.eia.doe.gov/oiaf/1605/ggrpt/excel/tbl5.xls

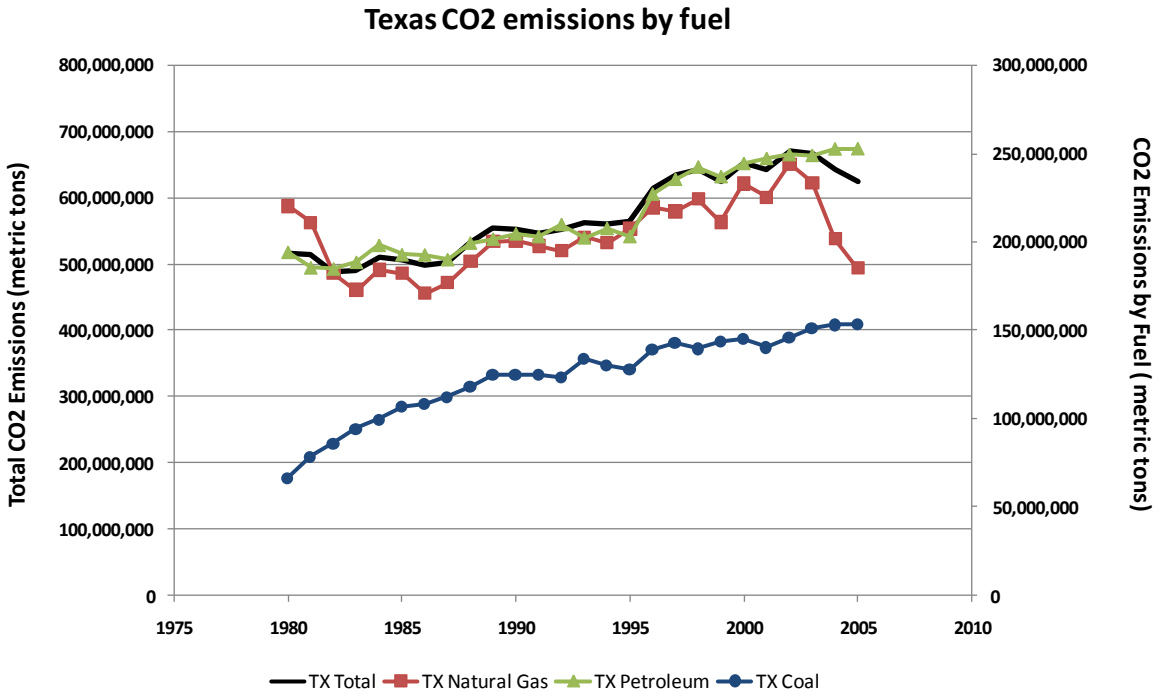

Figure 1. Texas' CO_2 emissions by fuel.

Figure 2. Texas' CO_2 emissions by sector.

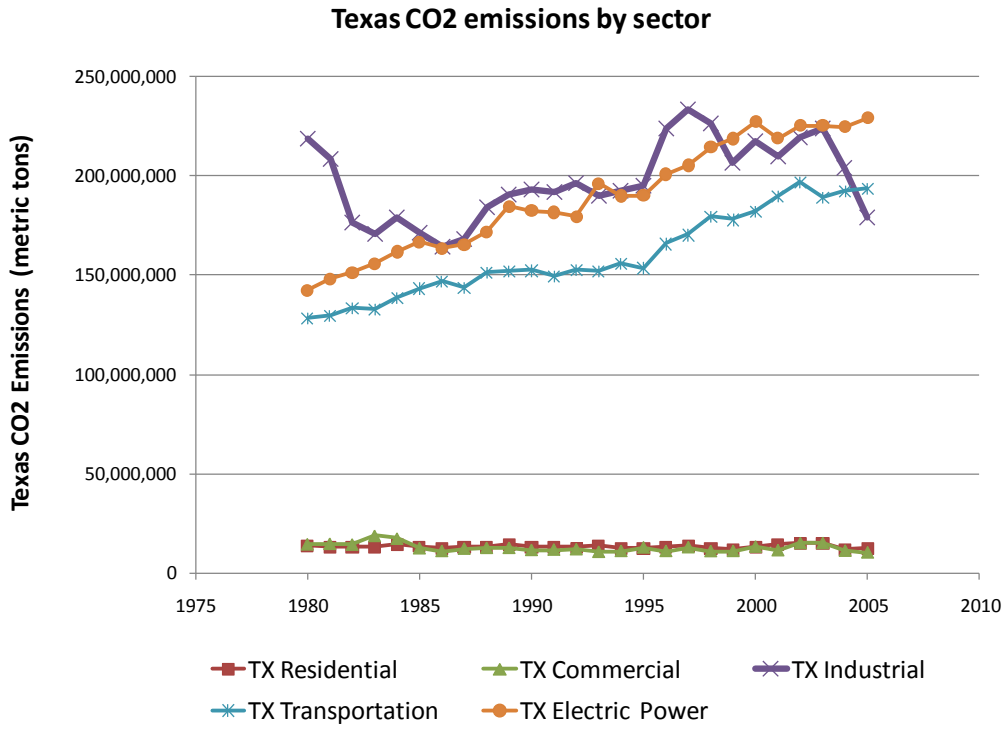

Table 1. Comparison of US and Texas CO_2 emissions from 2000 to 2005.

Emissions in Texas and the US ($MtCO_2$)

	US Total [a]	TX Total [b]	US Industrial[c]	TX Industrial[b]	TX Natural Gas[b]
2000	5,893	654	1,786	218	233
2005	6,032	625	1,672	179	186
% change 2000 to 2005	2.4 %	-4.4 %	-6.4 %	-17.6 %	-20.5 %

Data from Energy Information Administration:
a: http://www.eia.doe.gov/oiaf/1605/ggrpt/excel/tbl5.xls
b: http://www.eia.doe.gov/oiaf/1605/state/excel/TX_05_details.xls
c: http://www.eia.doe.gov/oiaf/1605/ggrpt/excel/tbl9.xls

Table 1 presents a comparison of Texas and total US CO_2 emissions. From the 2000 to 2005 time span, US emissions increased 2.4% and Texas emissions decreased 4.4% such that in 2005, Texas accounted for 10.3% of US CO_2 emissions. With an estimated population of just over 24 million, Texas residents are approximately 8% of total US population. As is often noted by Texans, their disproportionately high emissions per capita has much to do with a large industrial base that exports products and fuels to the rest of the US and the world.

Interpreting Texas CO_2 emissions data

There is an important question to ask in terms of interpreting the data showing a drop in industrial natural gas usage and subsequent emissions: Did the industries in Texas quit making as many goods or find a way to make the same amount, or even more, goods while consuming less natural gas?

From 2000 to 2005, the Texas Comptroller of Public Accounts[2] shows that the gross state product increased from $850 billion to $989 billion in constant 2005 dollars. This is a 16.5% increase in economic output. During that same 2000-2005 span, Texas' total industrial output dropped a few percent before coming back to 2000 levels[3] (see Figure 3). The only industries with substantial economic growth were oil and gas extraction, refining, and primary metals (not shown). The real price of oil and natural gas[4] rose 40% from 2000 to 2005 – and roughly doubled from 1999 to 2005, providing substantial income and revenue to the Texas oil and gas sector, as well as the state budget. However, the chemical sector, which uses substantial quantities of natural gas as a feedstock was down 11%, perhaps tied to the increase in cost of natural gas. Additionally, a 13% drop in employment in the chemical industry from 2000 to 2005 provides some evidence to a drop in the number of chemical goods produced[5].

[2] http://www.window.state.tx.us/ecodata/teufall04/
[3] http://www.dallasfed.org/data/data/tipi2sic.htm
[4] http://www.eia.doe.gov/emeu/steo/pub/fsheets/real_prices.xls
[5] http://www.bea.gov/regional/REMDchart/default.cfm#chart_top

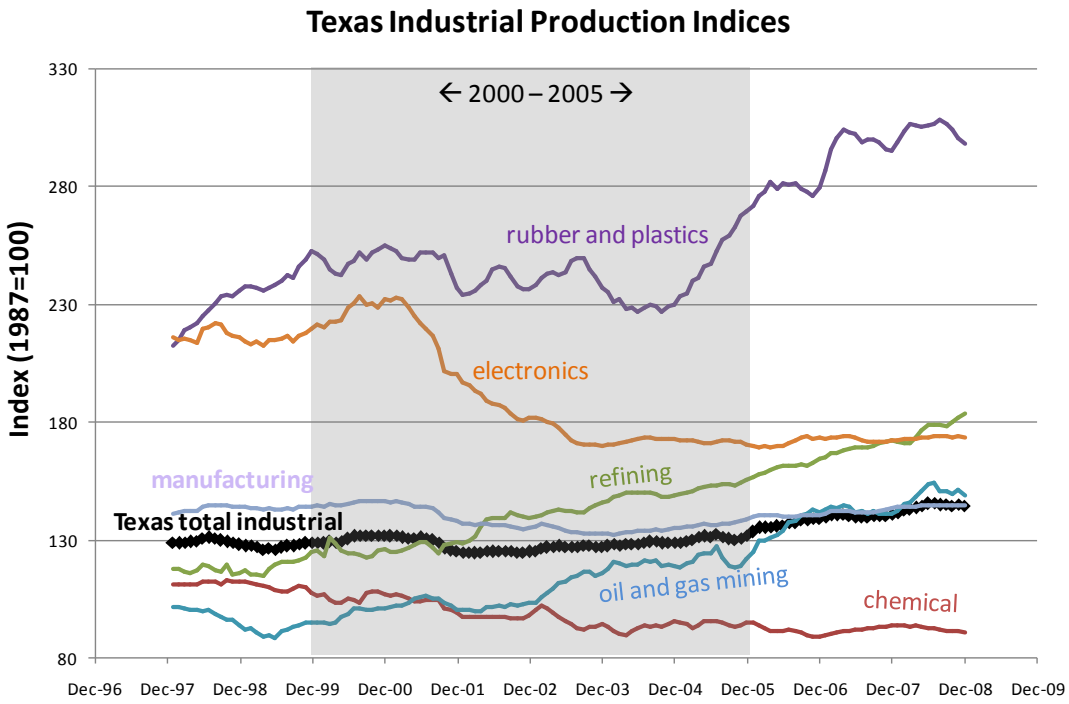

Figure 3. Industrial productions indices for Texas.

One can still ask what industrial energy efficiency improvements occurred early this decade in Texas. At the beginning of 2000, approximately 10.3 MW of cogeneration was installed in Texas. By the end of 2005, this was 17.5 MW – a 71% increase in capacity in six years[6]. This is important because cogeneration, also commonly known as combined heat and power facilities, get more useful energy out of the same amount of fuel. Generating electricity and heat from more efficient systems decreases fuel consumption and emissions when it displaces less efficient systems.

However, electricity generation within the industrial sector was relatively constant from 2000 to 2005. Electricity generation from combined heat and power (CHP) facilities increased from 70 to 97 million MWh from 2000 to 2002, and then decreased to 85 million MWh by 2005. Overall, CHP generation increased 21% from 2000 to 2005, practically all outside of the industrial sector. Thus, many CHP facilities were installed, but the demand for their services did not seem to hold up.

[6] http://www.eia.doe.gov/cneaf/electricity/page/eia860.html

The signing of SB 7 in 1999 began the deregulated electricity market in Texas. This change in policy ended up launching a tremendous increase in the installation and use of natural gas combined cycle units (NGCC) for electricity generation (see Figure 4). However, the move to NGCC generation technology had already begun in the early 1980's. The NGCC units use the excess heat from a combustion turbine to generate steam for a steam turbine. This combination makes NGCC power generation much more efficient than generating electricity from either the steam or combustion turbine alone. Amazingly, Figure 4 shows the clear impact that deregulation policy had on the strategy in the electric power sector. From 2000 to 2005 the installations of NGCC units increased by 400%.

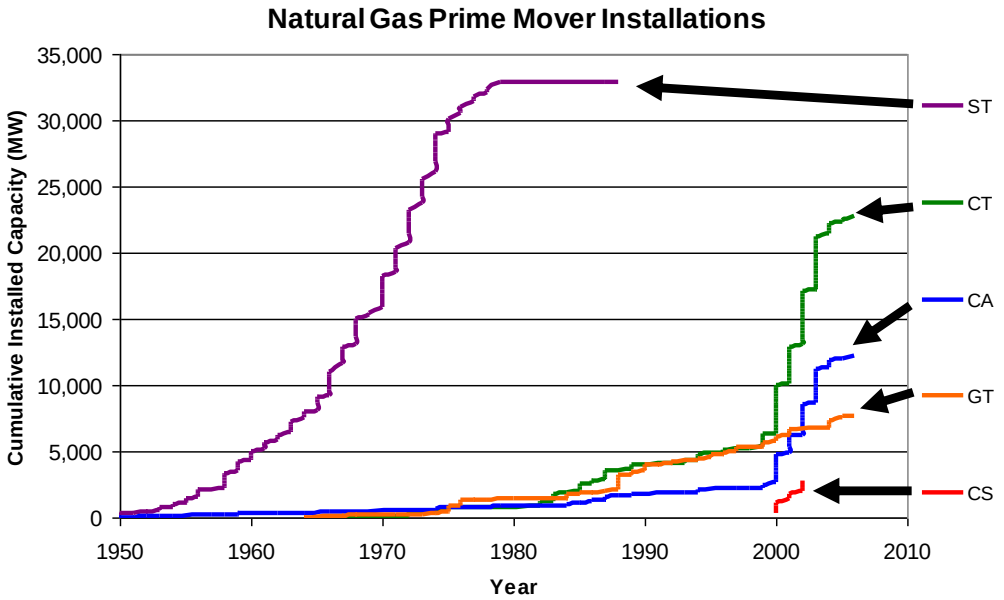

Figure 4. The cumulative installed capacity of natural gas plants in Texas shows that installation of combined cycle plants increased significantly starting in 2000[7]. ST = steam turbine operating stand-alone, CT = combustion turbine of an NGCC plant, CA = steam turbine of a NGCC plant, GT = gas combustion turbine operating stand-alone, and CS = an NGCC plant where the combustion turbine and steam turbine are connected mechanically.

The employment situation in the industrial manufacturing sector shows a marked contraction (see Figure 5). Employment in the chemical and plastics industry was representative of the overall Texas manufacturing employment trend from 2000 to 2005. Employment in the oil and gas extraction industry was slightly up from 2000 to 2005, and followed the continually climbing energy prices through 2007. Interestingly, even in some industries that saw economic growth during the time span of interest due to an increase in prices for the manufactured good, employment went down (e.g. primary metals). Also, industries that experienced decreasing employment are many of those that are energy and natural gas intensive.

[7] King, Carey W.; Duncan, Ian J.; and Webber, Michael E. **2008**. Water Demand Projections for Power Generation in Texas. Submitted to the Texas Water Development Board, and available at: http://www.twdb.state.tx.us/wrpi/data/socio/est/final_pwr.pdf

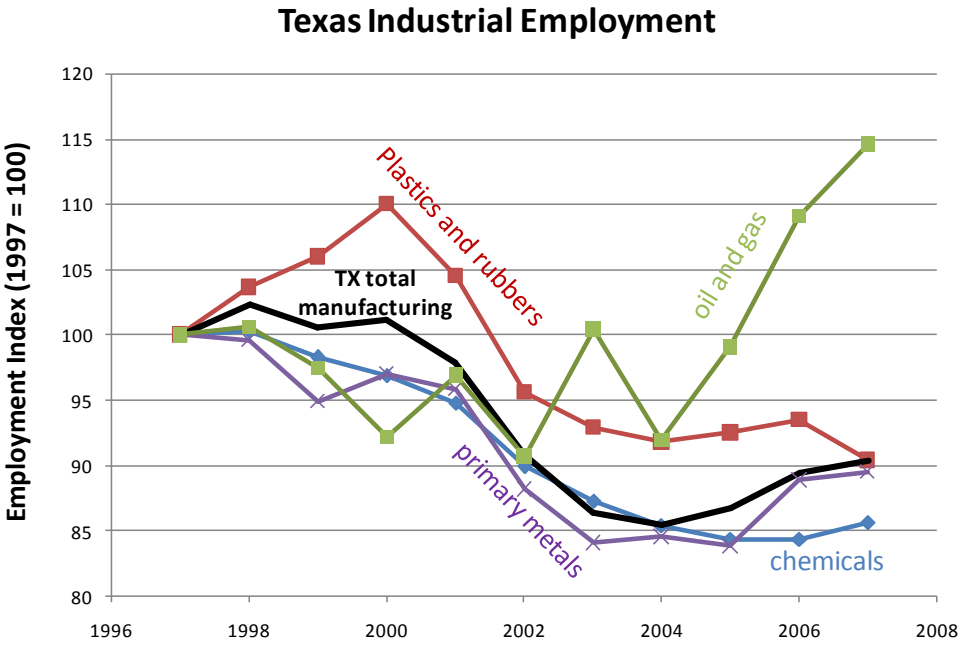

Figure 5. Employment indices for the overall Texas manufacturing sector as well as selected industries.

Potential Factors in Natural Gas Consumption decline

During the early parts of this decade, many industrial facilities were required to reduce nitrogen oxides (NOx) emissions. Due to these new environmental constraints, some industrial facilities that rely heavily upon natural gas inputs, for energy or feedstock, may have shut down production and chose to sell NOx credits to other emitters. This analysis has not yet analyzed the full relative impacts of natural gas prices and NOx reduction targets on industrial production, but these impacts are very important to understand going forward.

The decline in production of methyl *tert*-butyl ether (MTBE) since 2000 seems like a possible explanation for industrial production drop[8]. MTBE is an additive to reformulated gasoline designed to reduce smog-forming emissions, but it has been found to contaminate groundwater. State and now federal regulations have been phasing out MTBE in lieu of using ethanol as the new additive for reformulated gasoline. Since Texas accounted for almost 70% of the nation's MTBE production, and hence also the often-used feedstock of methanol from natural gas, it might seem to have significantly decreased Texas industrial natural gas consumption. However, the associated drop of natural gas consumption turns out to be negligible on the scale of the natural gas drop from 2000 to 2005.

[8] http://tonto.eia.doe.gov/dnav/pet/pet_pnp_oxy_dc_nus_mbbl_m.htm

Conclusions

What this analysis shows are a few major points regarding Texas gross state product and CO_2 emissions from 2000 to 2005: (1) the major growth of the Texas gross state product increased during the first half of this decade due to a rise in global energy prices and increased value of chemical products, (2) the boom in natural gas cogeneration installations does not nearly account for the 32% drop in natural gas consumption in the industrial sector as the generation from these facilities only slightly increased from 2000 to 2005, and (3) a drop in industrial cogeneration output from 2002-2005 together with a drop in output from the chemical industry likely accounts for a large portion of the decrease in CO_2 emissions from natural gas consumption - driven in part by higher natural gas prices and NOx emission reduction regulations. Understanding the choices made by industrial producers due to NOx regulations could provide insight for responses to CO_2 regulations.

It is a mistake to think that significant steady and long term CO_2 emissions reductions, together with increased gross state product, can be achieved by simply continuing actions of the past five to ten years. High energy prices benefit some Texas industries while hurting others, and there is evidence to suggest that higher energy prices have been influential in decreasing emissions from 2000 to 2005. Impending federal climate legislation will impose constraints on the economy that go beyond the reductions in emissions that have occurred in Texas as a consequence of external factors rather than by directed policy. Texas and the rest of the US states should work to understand how specific industries and consumers will be affected by a CO_2 constraint. By promoting those businesses that are well-positioned and facilitating the restructuring for those ill-positioned, Texas can successfully transition to and maintain leadership within the new carbon-constrained energy economy.