Achieving the Clean Power Plan 2030 CO_2 target with the new normal in natural gas prices

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EXECUTIVE SUMMARY

This journal article asks the question: what will US electricity sector CO_2 emissions be in 2030 if today's inexpensive natural gas and renewable energy subsidies persist? The answer is necessary in order to determine the impact of the US EPA's Clean Power Plan (CPP) announced on August 3, 2015, which aims to reduce CO_2 emissions from the US electricity sector. While the CPP is focused at the state-level, the reported nationwide target for 2030 is a 32% reduction in sector-wide CO_2 emissions from 2005 levels. We find that inexpensive gas and current renewable subsidies will drive CO_2 emissions down by 26% by 2030 with no additional policy interventions so that the required incremental measures to meet the CPP may be much smaller than previously thought.

We begin our analysis by trying to understand the recent decline in US sector-wide CO_2 emissions that began around 2007 and continued into 2015. Part of this is driven by large shifts in between technologies and fuels used to produce electricity (e.g. coal, oil, gas, hydro, nuclear, and renewables). We define and explore two distinct mechanisms that determine the evolving generation patterns. First, system operators can ramp up or scale down existing power plants in response to prevailing economic conditions, termed *capacity utilization*. We observe large changes in utilization after 2007 when gas prices declined dramatically following the US shale boom. As a result, gas power plants now operate much more frequently, squeezing out coal-fired ones. Utilization is

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occurring now in the short-term and goes a long way towards explaining the decline in sector-wide emissions (gas is about half as CO_2 intensive than coal). In fact, as of 2013, sector-wide CO_2 emissions are already 14.6% less than the 2005 baseline, largely driven by the utilization mechanism. The second mechanism for changing generation patterns is *capacity expansion* where system operators can retire old plants and construct new ones. Because of regulations and decreased returns, coal and oil-fired plants are being retired and replaced by (now) inexpensive gas plants and subsidized renewable capacity. This happens over the long-run and will likely continue, which means ever sector-wide emissions out to 2030. Answering the question "What might emissions will be and how close will we be to the 32% target?" requires capturing the utilization and expansion mechanisms and their interdependency (via *returns to capacity*) as well as validating these mechanisms separately and jointly to lend confidence in our numerical results.

The novel and innovative methodology presented in this journal article captures utilization, expansion, and their interdependency in the US electricity sector and performs well against observed historical values for both generation and capacity expansion. To address our research question, we assume that inexpensive gas is the "new normal" and gas prices remain at 2014 levels and existing renewable policies remain unchanged out to 2030. We find that increased utilization of gas drives up returns to gas capacity. Combined with continued growth in wind and solar, we see steady expansion to a gas and renewable dominated future electricity sector. Given our assumptions, **we project the reduction in US electricity sector CO_2 emissions to be 26% in the absence of the CPP. Thus the US nearly reaches the 32% CPP target, without any new policy intervention**. This result means that the economic impact is likely smaller than previous thought. The result also provides fodder for questions regarding whether the CPP target could be made stricter as well as whether reductions in electricity emissions would be off-set by leakage in gas supply chain, which other studies indicate may be quite high.