

Rejoinder to VCCER's Response to Our Original Critique of their Clean Power Plan Compliance Cost Estimates

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In July of 2015, the Weldon Cooper Center published a critique (Shobe 2015) of a 2014 study done by the Virginia Center for Coal and Energy Research (VCCER 2014) for the Virginia Department of Mines Minerals and Energy on the cost to Virginia of complying with the EPA rule limiting greenhouse gas emissions from existing power plants, a rule known as the Clean Power Plan. VCCER has made a reply to our critique (VCCER 2015), which is available online. In this rejoinder, we evaluate each of the claims that VCCER made in its reply.

After a review of the VCCER reply, we conclude the following:

- a. The VCCER mistake in under-valuing the social cost of carbon estimate appears to amount to about a 12.5 percent error rather than the 40 percent error we originally calculated.
- b. The VCCER asserts that it used a 1.4 percent relative price deflator for future electricity costs rather than the 3.2 percent described in the text. *If so, then this discounting error was not as we described in our critique.* We cannot draw a conclusion on whether the 1.4 percent deflator is reasonable, since no mention of it is made in the text, and we do not know whether it was an appropriate choice. But, since this calculation was part of the double counting error, this adjustment does not change our conclusions about the study's reliability.
- c. *In every other respect, the VCCER reply is either unresponsive or unsuccessful in responding to our original points.* We present brief rejoinders on each point.
- d. We have identified three significant, additional mistakes in the economic impact analysis used in the study. A mistake in the calculation of the job intensity of electricity generation, an error in the calculation of job losses in the coal industry and the use of a non-standard multiplier for the coal sector. Since VCCER defends its methodology, we comment briefly on the inappropriate use of input-output analysis as applied to this case and provide citations to the relevant literature.

➔ **All of the main conclusions from our original critique remain.** The report sets faulty baselines, presents bloated costs in its compliance scenarios, double counts compliance costs, and misstates the economic impact of the costs (as estimated) through both numerical errors and a poor choice of methodology. In sum, the VCCER reply does not change our conclusion that the original report grossly overstates costs of compliance and fails to provide guidance to policy makers on key policy design choices.

The faulty baseline

Throughout its report, VCCER compares compliance scenarios to its Scenario 2. And yet, it is clear in both the original report and in the reply to our critique that VCCER failed to construct Scenario 2 so that it could serve as a valid baseline against which to measure the cost of complying with the federal regulation. Nothing in their reply to our critique changes this conclusion. *VCCER's implication that its baseline scenario need not reflect the likely outcome that would occur in the absence of the policy (and this is made very explicit in its reply) defies logic and calls into question the value of the analytical exercise.*

VCCER it was incorrect to set future renewables and efficiency to zero in the Scenario 2.

As we have already pointed out, there were considerable amounts of renewables and efficiency expected even without the CPP. These belong in the baseline. This did not require any assumptions about action by the legislative and executive branches of state government. It is a first principle of policy analysis that establishing a reasonable baseline scenario is essential for correctly estimating compliance costs. Throughout its report, VCCER uses Scenario 2 as the baseline against which it estimates cost of compliance. To not have reasonably anticipated the renewables generation and efficiency savings that would have occurred without the rule, clearly **overstates cost of compliance** as estimated in the report.

VCCER confirms that the baseline NGCC capacity factor assumptions are not correct as a baseline.

VCCER's use of a low NGCC baseline in Scenario 2, inflates their estimates of compliance costs due to the shift from coal to natural gas that occurs once the plants start to produce. Since these plants did not result from compliance with the Clean Power Plan, then *not running them for the baseline and then running them for the compliance scenarios incorrectly inflates estimated compliance costs.*

VCCER had access to data showing that Dominion's electricity demand growth estimate was on the high side, but chose to ignore that data.

Data available to VCCER at the time of their study clearly indicated that a 1.51% annual growth rate over the 18 years between 2012 and 2030 would be unlikely. In fact, Dominion was revising its estimates downward as VCCER was doing its report. An appropriate approach would have been to point out that this growth estimate is on the high side, given recent experience, and that this would tend to give higher estimates of compliance costs than if growth rates trend lower, as they have been in recent years.

Cost calculations

VCCER authors claim that they did not double count costs but are wrong on this point.

The original report from VCCER contained a serious (and compound) error in estimating compliance costs. First, they overestimated the cost to the electric utility of implementing the changes needed to comply with the new rule, then they added to this another separate measure of the same thing. In their reply to this critique, the authors claim that they did not double count and explain why they believe this. This claim is incorrect. We show here that the authors are making a very elementary mistake.

Suppose EPA implements a regulation that costs a utility \$100 in compliance costs (i.e. labor, concrete, fuel-switching, etc.). If the utility cannot increase the price of electricity to reflect the increase costs, then the firm must absorb the costs. So, the costs fall on shareholders and on the firms that sell inputs for generation. This is the case of zero pass-through of costs. The full incidence of the costs falls on the firm and its suppliers; customers do not face increased costs of electricity.

If, as is the case in Virginia, the utility can recover most (if not all) of the increased costs, then some (most) of the compliance costs get passed through to customers in the form of increased electricity rates. Note well, the costs of compliance have not changed! But now, the utility is passing some of the \$100 in costs along to consumers. What the VCCER authors do not appear to recognize is that the increase in costs to buyers of electricity also reflects a reduction in the share of compliance costs paid by the utility. We still have the same \$100 in costs, but now they are paid by different people.

VCCER's "worst case scenario" (for electricity buyers) of 100 percent pass-through is the best case scenario for the seller, since now the seller pays zero compliance costs. The pass-through rate is a measure of the *incidence* of costs, that is, how the costs are shared as between sellers and buyers.

For example, take heat rate improvements at coal plants. VCCER included this in their compliance scenarios. EPA also assumed heat rate improvements as one of the things states would do to achieve compliance. So, when EPA calculates the increased electricity rates to consumers, they are including the portion of the cost of heat rate improvements that gets passed through to consumers. (Again, this will be high in Virginia.) If you add VCCER costs to the costs derived from EPA's rate increase measure, you are obviously double counting heat rate improvement costs. This same logic applies to the other elements of compliance cost. They are double-counted.

VCCER used a relative price inflator in calculating "business and consumer costs", so the size of the error caused by misusing these costs is smaller than we stated in our critique.

If it is true that VCCER used an estimate only of the rate at which electricity prices rise over the expected rate of inflation, *then we must give them a pass on this one*, even if we do not believe that even the most careful reader could have figured this out from the

VCCER text. *While this does not eliminate the double counting, it does mean that VCCER did not incorrectly inflate the dollar amounts before double counting them.*

On the other hand, if electricity prices are rising 1.4 percent faster than average for goods and services, then it makes even more unlikely continued growth in demand at 1.51 percent per year, but we have dealt with this issue elsewhere. There is also a question about whether the 1.4 percent increase has built into it expectations of future limits on greenhouse gas controls. If any of the 1.4 percent forecast real increase in electricity prices is due to controls that would be driven by the CPP, then this part of the costs is double counted. We can't make an assessment on this point, since VCCER never mentions the 1.4 percent in their report or where they came up with it.

Economic impact analysis

VCCER makes numerous generic statements about the Virginia coal industry, none of which justify its unrealistically high estimates of the sensitivity of the industry to this regulation.

A substantial share of the reduced steam coal consumption in Virginia will come from reduced imports of coal from West Virginia. VCCER is effectively asserting that the loss of sales by West Virginia mines will result in a 1 for 1 loss of sales in Virginia mines. If it were true, *and it would be pretty remarkable if it were*, then they should be able to demonstrate this with data. They have certainly not done so either in their original report or since. This error *compounds* with the errors of setting the baseline and double counting costs.

The VCCER assumptions about the low productivity of Virginia coal mines does not justify an unrealistic 93 percent share of Virginia coal to reductions in coal use in Virginia power plants. Furthermore, the argument that Virginia coal is at a competitive disadvantage and that its price will respond strongly to these competitive pressures is, by itself, an argument that VCCER used an incorrect methodology for estimating economic impacts. Standard input-output analyses such as theirs require that relative prices remain constant (or nearly so), an assumption violated here.

VCCER's economic impact analysis makes at least two serious errors in calculating job effects and choses an inappropriate analytical methodology.

The original report cites a study by Chmura Economics and Analytics, but VCCER has declined our request for a copy of that report. We do not know what details the economic study contains, but there is enough of a description in the VCCER study of the economic impact analysis for us to be able to spot a number of errors and to identify a number of ways in which the methodology was misapplied.

Job intensity of renewables:¹ The economic impact starts with a very serious mistake in calculating the employment and follow-on effects of adding renewables, which invalidates all of the results that follow. The original VCCER report contains the following quote:

Employment in renewable plants was estimated using the following methodology. Firstly, employment data from JobsEQ indicate that total power generating jobs in renewable plants in Virginia was less than 90 in 2012, including jobs in hydroelectric and wind plants. In 2012, the total renewable electricity output in Virginia was 2.36 million mWh. Secondly, those data imply that each renewable job is associated with 26,600 kW annual electricity output. Thirdly, using that assumption, new renewable jobs can be estimated based on expanded generating capacities in renewable sources.

VCCER used the Chmura JobsEQ software to calculate the renewable jobs in hydroelectric and wind plants. The U.S. Energy Information Administration (EIA) indicates that there was no significant wind generation in Virginia in 2012. This means that the 89 jobs in “renewable plants” were in hydroelectric facilities.

VCCER estimates 2012 renewable electricity generation in Virginia as 2.36 gWh. EIA lists 1.04 gWh of hydroelectric output, zero solar PV, zero wind energy, and 1.44 gWh from biomass (a renewable fuel) for 2.48 GWh of renewables in 2012 (pretty close to what VCCER assumes). VCCER incorrectly left biomass jobs out of the estimate of jobs in renewables. So, they use hydro and biomass to calculate generation for the numerator but only hydro jobs in the denominator. The corrected calculation (1,040,000 kWh in hydro/89 jobs in hydro) gives one hydro job for each 11,685 kWh. *It follows then that this key input for evaluating scenario economic costs and benefits due to employment changes is wrong by about half due to this one error.*

The kWh/job ratio in hydroelectric dams is **not** a good estimate for the ratio in biomass, wind, or solar PV. These other renewable technologies will be much more job intensive than operating a completed hydroelectric dam. *For non-hydro renewables, labor intensity will be two to three times higher*, driving the jobs figures for renewables in the compliance scenarios up by large amounts. This underestimate of the job intensity of anticipated renewables adds to the overstatement of costs.

Using the input-output multiplier: When you use an i/o model to estimate an effect, the total effect is the size of the original effect times the multiplier **inclusive**. That is, the original effect is included in the total effect. Adding back in the original effect after applying the multiplier (as VCCER does on page 169) is to double count it. To be specific, if the multiplier is 4, then the total effect is 3,305 times 4, including the initial effect, so here: 13,220. VCCER authors added to this the original 3,305 to get their total. This would be double counting the original effect.

As for the multiplier used, this is not consistent with the standard IMPLAN multipliers for the coal industry in Virginia. We calculate the coal industry multiplier to be 2.6, not 4. *This choice of multipliers requires a very clear justification.*

¹ Overestimating the kWh/job in renewables, as VCCER does here, makes the economic impacts of job losses in coal look much worse than they really are.

The choice of methodology: VCCER makes a vigorous defense of their use of the model. However, it is well-known that simple, static i/o model such as the one applied here, cannot give good economic impact estimates in cases such as this. One of the main defenses in VCCER's reply is that i/o models are the best models we have available, so we should use them until another model comes along. It has been known since the 1970s that the standard i/o model is not appropriate for cases such as the one modeled here where, among other things:

1. Relative prices of the goods change (as they do here),
2. Technology in the energy industry changes (as it does here), and
3. Workers retire, receive transfer payments, retrain, move elsewhere in the state (also true here).

Misapplied as they are here, static i/o models give consistently biased results even in the short run, but the mistakes get larger as the time horizon expands (Miller and Blair 2009; see chapters 9, 10 and 14). As a result, many new techniques have been developed to correct some of the weaknesses in these models. *That there was not the time, expertise, or money to develop a better model does not make the old-style model any more correct.* Used in the way VCCER uses them, input-output models will overestimate the costs of compliance by large amounts.

Miscellaneous

VCCER made multiple mistakes in calculating the “Benefit from reduced social cost” estimates, although the magnitude of this error may be lower than our original estimate.

In our original analysis, we claimed that VCCER double discounted the SCC before adding it to the benefits measure. Their discounting mistake did not cause as large an error as our earlier estimate. In fact the mistake amounted to a 12.5 percent understatement of benefits rather than a 40 percent understatement.

By discounting the 2015 SCC estimate from \$39 to \$36, what they have actually done is to take a value that is given in 2011 dollars and discount it by 3 years at about 3 percent, which, by the way, is more than the average rate of inflation during this period. Now, the figures are given in their version of 2008 dollars although the authors appear to be under the impression that the values are expressed in 2012 dollars and, in fact, add these values to other values expressed as 2012 dollars. (See Table 8-23.)

In our original evaluation, we assumed, based on the description provided, that the authors discounted from the year of the SCC value to the present. This was not correct. Instead, what they apparently did, and we have to infer here, is to discount **all** values by three years at three percent; equally unjustifiable, but a smaller error than our original estimate.

VCCER claims that, since the building of North Anna 3 isn't certain, it should not be considered in compliance scenarios.

The VCCER response on this point amounts to the assertion that since the building of NA3 is not certain, we should not consider it as a possible compliance scenario. This, in spite of the fact that this was Dominion's *preferred* resource plan. VCCER gives an excuse, not a reason. **All compliance scenarios are speculative.** The licensing of NA3 could hardly be seen as any more speculative than any of the other highly speculative compliance scenarios chosen by VCCER.

Should NA3 be built by Dominion because of its attractive properties for the state's electricity supply (as Dominion asserts in its IRP), then it would represent a *zero compliance cost option* because its costs would not be attributable to the CPP and yet the state would end up in compliance as a result. Costs may actually be less than zero due to the opportunities to sell emission reductions to other states. This absolutely belongs as a compliance scenario. That VCCER did not include a North Anna 3 scenario is a glaring defect in the information provided to policy makers.

VCCER authors still seem not to understand that by ignoring multi-state solutions, they overestimate compliance costs.

If the objective of the report was to give realistic measures of compliance costs, then VCCER should have noted that the cost estimates were very likely exaggerated, since the estimates they present implicitly assume no multi-state compliance arrangements. This issue has been under discussion in the literature, since long before the development of this regulation began. To ignore this is to ignore an essentially universal conclusion by academics, industry, and private consultancies. *VCCER should have clearly stated that their compliance cost estimates were most likely too high because they did not estimate likely savings from interstate compliance strategies.*

VCCER stands by its mischaracterization of the GAO report on EPA use of SCC estimates and cites pro-coal interest groups in its own critique of the SCC.

The wording in the original VCCER report was clearly intended to imply that the GAO had accused EPA of doing something inappropriate. Any fair reader of the GAO report can easily see that this implication is inaccurate. VCCER provides no defense on this point. If VCCER does not like the value used for the SCC, then it is the Interagency Working Group on Social Cost of Carbon it needs to mention as responsible for the estimate. The Interagency Working Group on Social Cost of Carbon was convened by the Office of Management and Budget under Executive Order 12866. Member agencies included the Council of Economic Advisers, the Council on Environmental Quality, the Department of Agriculture, the Department of Commerce, the Department of Energy, the Department of Transportation, the Environmental Protection Agency, the National Economic Council, the Office of Management and Budget, the Office of Science and Technology Policy, and the Department of the Treasury.

VCCER suggests that there are credible critiques of EPA’s use of the SCC. In support of this assertion, the authors only cite three pro-coal advocacy groups. There is much careful academic work attempting to make sense of how the global SCC should be estimated and used. **VCCER failed to reference any of the published, peer-reviewed studies in this area.** The citations given are from the American Coalition for Clean Coal Electricity, the Institute for Energy Research, and the U.S. Chamber of Commerce. The first two are comments on the OMB docket concerning the development of the SCC. The third is a general brochure on regulatory burdens from the Chamber.

The VCCER report mixed short tons and metric tons.

See Table 8-23. The figures in the “Increased [c]ost to utilities” column are from Table 8-3 and appear to be listed there as being based on “short tons”, while the “Benefits from reduced social costs” column uses metric tons. The difference between the measures is about 10 percent.

References

Miller, Ronald E., and Peter D. Blair (2009). *Input-Output Analysis, 2nd ed.* Cambridge University Press: Cambridge.

Shobe, William M. (2015). *Report on Appendix A-1 of the Virginia Energy Plan: Impacts of Proposed Regulations under Section 111(d) of the Clean Air Act.* Weldon Cooper Center: Charlottesville.

Virginia Center for Coal and Energy Research (VCCER) (2014). *Virginia Energy Plan Item 8: Impacts of Proposed Regulations under Section 111(d) of the Clean Air Act* [Published by the Virginia Department of Mines Minerals and Energy under the heading: *Appendix A-1 of the Virginia Energy Plan: Impacts of Proposed Regulations under Section 111(d) of the Clean Air Act.*]. Blacksburg.

Virginia Center for Coal and Energy Research (2015). *VCCER Response to Critique from Dr. William Shobe Regarding the VCCER Report “Appendix A-1 of the Virginia Energy Plan 2014”.* Blacksburg.