

Comments on Transportation Climate Initiative Cap-and-Invest Draft Framework

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Summary

I am writing in response to the October 1, 2019 Georgetown Climate Center announcement that the framework for a draft regional Transportation Climate Initiative (TCI) policy to reduce greenhouse gas pollution from the transportation sector was available and requested all interested parties to provide input and feedback on the draft framework. The attached comments specifically address the proposal to use a cap-and-invest approach. I propose that instead of funding the programs from auction proceeds as suggested in the framework that the funding come from a tax and that all proceeds be invested as suggested in the cap-and-invest approach. There are too many differences between historical market trading programs that successfully reduced emissions and what is proposed for the TCI to expect that the proposed program will work as well. In addition, there are advantages to a tax which can be summed up as simpler is better.

I am a retired air quality meteorologist with extensive relevant experience. I became familiar with transportation planning and modeling when I modeled the air quality impacts of transportation projects including the Ted Williams tunnel in Boston. I have extensive experience with air pollution control theory and implementation having worked every cap and trade program affecting electric generating facilities in New York including the Acid Rain Program, Regional Greenhouse Gas Initiative (RGGI) and several Nitrogen Oxide programs. I have [written extensively on RGGI](#) and follow the investment proceeds reports and allowance holdings status. My opinions in these comments do not reflect the position of any of my previous employers or any other company I have been associated with, these comments are mine alone.

Theory and Practice

The TCI Meeting Summary notes:

Submissions from a wide variety of interested people pointed out that a program that puts a price on carbon emissions from transportation and enables participating jurisdictions to invest the proceeds would open new opportunities to address long-standing transportation challenges (including congestion in urban areas and access to jobs, healthcare and other necessities in rural areas), reduce harmful air pollution, and alleviate inequities in access to good transportation and exposure to pollution. Business interests and climate activists alike encouraged TCI to set a data-driven, evidence-based cap on emissions that drives progress in emissions cuts while generating sufficient proceeds to support those investments.

The overall plan to control emissions by setting a cap and price on CO₂ emissions and then developing a [market trading program](#) is, theoretically, an efficient way to implement emission reductions. It has been my experience however that when theory meets reality problems occur. It is necessary to review historical performance of other market-based programs to determine why they were successful and whether we can reasonably expect a similar result in this application.

Let me first point out that there is a fundamental difference between the way affected sources operate in emissions trading markets and the way economic theory predicts they should operate. [I believe that](#) electric generating affected source allowance management is different than theory because the affected sources do not treat allowances as a storable commodity or a financial asset in the usual sense of rational economic theory. Instead allowance management is overwhelmingly driven by regulatory requirements for the current compliance period. i.e., do I have enough allowances to cover expected emissions? Financially it is simply another cost of operating and not a potential profit center. The important difference is that the academic economic theory holds that affected sources are looking at a multiple-year planning horizon, but in reality, there is no such long-term time horizon for affected sources. The allowance quantity decision is driven by their expected operations in the period between auctions and, at most, the entire 3-year compliance period and to include a small margin for operational variations and regulatory compliance. Consequently, I have little faith in the models that predict future allowance margins. Importantly, I believe that the state fuel suppliers proposed as the regulated entity will operate the same as the electric generators.

The [Acid Rain Program](#) (ARP) was undoubtedly a [successful program](#) because it lowered emissions more than expected at far lower costs than predicted. This program was open and transparent so all emissions and allowance data are available. In order to meet the emission cap target of a 50% reduction, affected sources were awarded half of their historical emissions. Although it is common practice to vilify this program for giving away the allowances for free the rationale is still valid today. The concept for the acid rain program was that power plants would install SO₂ control equipment and if they over-controlled their emissions, they could sell the excess allowances earned to other facilities that could not install the control equipment as cost-effectively. This approach incentivizes over-control because affected sources can subsidize control investments they made by selling allowances and the cost reduction efficiency brings down overall costs. [It turned out](#) that fuel switching and technological improvements were so effective that far greater than expected reductions occurred. Fuel switching occurred because technology to burn lower sulfur coal was developed and railroad de-regulation opened the market to transporting coal cost-effectively over very long distances. Another subtle point is that the ARP allowance bank was earned, that is to say excess allowances in the bank represent over-controlling emissions lower than the cap limits.

The Regional Greenhouse Gas Initiative (RGGI) is a cap-and-invest program that has been touted as a model for a TCI cap-and-invest trading program because of its “success”. I have addressed this claim [elsewhere](#). Although the RGGI states claim that the program is open and transparent the fact is that there is no allowance ownership information available. There is no question that CO₂ emissions have come down in the RGGI states since the inception of the program but it is important to determine why they have come down. I will address that point later on. There is a fundamental difference in the way that affected sources treated RGGI as opposed to ARP, namely ARP was considered a control program and RGGI was considered a tax. Because there are no cost-effective add-on controls for CO₂ at existing power plants there are limited options to meet the cap. Plant control programs to reduce CO₂ through efficiency were not implemented because allowances all have to be purchased and the incremental cost was low. The allowance bank does not represent earned reductions below the cap limits. Instead the

bank is made up of allowances purchased at auctions and on the market. The RGGI states in their program reviews were very concerned that the allowance bank was large and have taken steps to adjust the allowances sold at auction to force the bank smaller. In the naïve belief that RGGI investments significantly reduced emissions the RGGI states have also reduced the cap going forward. As a result, RGGI going forward is going to be significantly different that RGGI in the past and that has ramification on its value as a model for TCI.

I noted above the distinction between the ARP “earned” allowance bank and the RGGI allowance bank. Because the ARP affected sources over-controlled emissions below their cap levels, they earned the allowance bank. That means the bank represents surplus allowances that are not needed for compliance so it does not matter who owns them. On the other hand, all RGGI allowances were purchased at one time or another by anyone who offered a high enough price at an auction or on the market. Because allowance ownership is not transparent, we only know the number of allowances owned in the following three categories:

- Compliance-oriented entities are compliance entities that appear to acquire and hold allowances primarily to satisfy their compliance obligations.
- Investors with Compliance Obligations are firms that have compliance obligations but which hold a number of allowances that exceeds their estimated compliance obligations by a margin suggesting they also buy for re-sale or some other investment purpose. These firms often transfer significant quantities of allowances to unaffiliated firms.
- Investors without Compliance Obligations are firms without any compliance obligations.

To this point in 2019 the affected sources with compliance obligations have been able to get the allowances needed to cover their emissions from auctions and the market. However, at some point going forward this will change and it will make a difference. I have addressed the status of RGGI emissions and allowances [elsewhere](#) but briefly because the allowance cap is being reduced so much, the affected sources are going to have to go to the investors without compliance obligations. This is uncharted territory and, at a minimum, I expect that the allowance prices will spike upwards. Note that this price spike provides no dividends for CO2 reduction investments because the dividends are earned at the initial sale. But it could be even worse if the entities without compliance obligations withhold allowances and create a shortage such that affected sources do not have enough allowances to run.

RGGI supporters who claim it is successful point to emission reductions of 40 to 50%. In order to evaluate the RGGI emissions reduction claims I used data from the Environmental Protection Agency Clean Air Markets Division [air markets program website](#). Emissions data from the electric generating unit (EGU) sector are available from before RGGI started to the present, so I downloaded all the EGU data for the nine states currently in RGGI from 2006 until 2018. In order to establish a baseline, I calculated the average of three years before the program started. As shown in Table 1 the total emissions have decreased from over 127 million tons prior to the program to just under 75 million tons in 2018, for over a 40% decrease.

Table 1: RGGI Nine-State EPA CAMD Annual CO2 Emissions Data by Primary Fuel Type

Year	Coal	Oil	Other Fuels	Natural Gas	Total
2006	74,482,225	14,216,973	2,429,844	37,048,932	128,177,974
2007	75,223,761	15,440,978	3,482,193	39,607,929	133,754,861
2008	67,977,062	10,472,201	3,509,366	37,452,817	119,411,446
Baseline	72,561,016	13,376,718	3,140,468	38,036,559	127,114,761
2009	57,324,247	7,419,112	2,998,324	40,602,093	108,343,776
2010	59,736,642	9,088,692	2,611,729	46,987,412	118,424,476
2011	43,871,136	5,755,660	3,256,356	51,801,174	104,684,325
2012	29,096,542	7,559,969	3,666,797	55,084,597	95,407,904
2013	31,759,050	5,441,067	2,770,525	48,973,865	88,944,508
2014	31,060,039	6,308,721	3,433,662	48,531,158	89,333,579
2015	23,279,018	6,271,650	3,615,647	52,983,907	86,150,223
2016	20,929,372	3,660,965	3,913,249	53,932,828	82,436,414
2017	13,522,351	1,568,617	3,415,221	49,092,154	67,598,342
2018	14,471,264	2,720,734	3,434,826	54,285,738	74,912,563

However, when you evaluate emissions by the primary fuel type burned it is obvious that emissions reductions from coal and oil generating are the primary reason why the emissions decreased. Note that both coal and oil emissions have dropped over 80% since the baseline. Natural gas increased but not nearly as much. I believe that the fuel switch from coal and oil to natural gas occurred because natural gas was the cheaper fuel and had very little to do with RGGI because the CO2 allowance cost added to the plant's operating costs was relatively small. There is no evidence that any affected source in RGGI installed add-on controls to reduce their CO2 emissions. The only other option at a power plant is to become more efficient and burn less fuel. However, because fuel costs are the biggest driver for operational costs that means efficiency projects to reduce fuel use means have always been considered by these sources. Because the cost added of the RGGI carbon price was relatively small I do not believe that any affected source installed an efficiency project as part of its RGGI compliance strategy.

As a result, the only reductions from RGGI that can be traced to the program are the reductions that result from direct investments of the RGGI auction proceeds. Information necessary to evaluate the performance of the RGGI investments is provided in the RGGI annual [Investments of Proceeds](#) update. In order to determine reduction efficiency, I had to sum the values in the previous reports because the most recent report only reported lifetime benefits. In order to account for future emission reductions against historical levels the annual reduction parameter must be used. Table 2 lists the sum of the annual avoided CO2 emissions generated by the RGGI investments from three previous reports. The total of the annual reductions is 2,818,775 tons while the difference between the baseline of 2006 to 2008 compared to 2017 emissions is 59,508,436 tons. The RGGI investments are only directly responsible for less than 5% of the total observed reductions!

Table 2: Accumulated Annual Regional Greenhouse Gas Initiative Benefits

Time Period	RGGI Investments (\$)	Avoided CO2 (Short tons)	Electric Energy Savings (MWhr)	Energy Savings (mmBtu)
Cumulative (2008-2014)	\$ 1,365,479,614.73	1,700,000	2,400,000	5,300,000
2015	\$ 410,158,329.31	298,410	505,761	1,500,000
2016	\$ 436,397,470.69	382,266	409,630	1,600,000
2017	\$ 315,600,000.00	438,099	699,019	1,424,199
Annual Totals	\$ 2,527,635,414.73	2,818,775	4,014,410	9,824,199
	Cost Efficiency	(\$/ton)	(\$/MWhr)	(\$/mmBtu)
	Cumulative (2008-2014)	\$ 803.22	\$ 568.95	\$ 257.64
	2015	\$ 1,374.48	\$ 810.97	\$ 273.44
	2016	\$ 1,141.61	\$ 1,065.35	\$ 272.75
	2017	\$ 720.39	\$ 451.49	\$ 221.60
	Annual Total	\$ 896.71	\$ 629.64	\$ 257.29
Time Period	Source			
Cumulative (2008-2014)	https://www.rggi.org/sites/default/files/Uploads/Proceeds/RGGI Proceeds Report 2014.pdf			
2015	https://www.rggi.org/sites/default/files/Uploads/Proceeds/RGGI Proceeds Report 2015.pdf			
2016	https://www.rggi.org/sites/default/files/Uploads/Proceeds/RGGI Proceeds Report 2016.pdf			
2017	https://www.rggi.org/sites/default/files/Uploads/Proceeds/RGGI Proceeds Report 2017.pdf			

In order to argue that RGGI emission reduction programs are a good investment relative to the expected societal cost of CO₂ emissions the Social Cost of Carbon (SCC) parameter can be used. SCC values range widely depending on assumptions, but if you use a discount rate of 3% and consider global benefits like the Obama-era Environmental Protection Agency (EPA) did then the 2020 SCC value is \$50. Table 2 lists the data needed to calculate the RGGI CO₂ reduction cost per ton. From the start of the program in 2009 through 2017 RGGI has invested \$2,527,635,414 and reduced annual CO₂ emissions 2,818,775 tons (Table 2). The result, \$897 per ton reduced, is 18 times than the current EPA SCC value for United States benefits.

The authors of the TCI framework are basing the proposed cap and dividend program on RGGI's auction allocation approach. As currently proposed the point of regulation will be state fuel suppliers or, in other words, the distributors between the refineries and the retail outlets. With regards to control options, there is an important difference between cap and trade programs for SO₂ and nitrogen oxides (NO_x) emissions and cap and invest programs for GHG emissions. There are add-on control options for SO₂ and NO_x whereas there isn't any cost-effective option for CO₂. In the ARP the affected sources could directly control their compliance. In RGGI there were limited direct options for the affected sources and, going forward especially, they are going to have to rely on indirect reductions, i.e., someone will build a zero-emitting plant that displaces enough output from a fossil plant that enough allowances are available to cover the affected source requirements. The ultimate RGGI control strategy is to run less and hope power is available from somebody else.

In the TCI I cannot imagine that the state fuel suppliers are going to attempt any direct controls. They have no real stake in compliance with the cap and minor options to directly meet the cap. All they are going to do is to sell as much fuel as they have allowances to sell. They will sell their fuel with this cost added in exactly the same as if it were a tax.

The results of the Acid Rain Program and the Regional Greenhouse Gas Initiative are no guarantee of the success of a TCI market-based program. Based on my evaluation of the theory and practice of the ARP and RGGI I do not think we can expect that a TCI cap and dividend program will work well. In the first place I am suspicious of any modeling of the TCI market because it assumes that affected sources act rationally but the reality is that compliance obligations override rational actions. ARP was successful because affected sources could control their own compliance destiny by direct action. RGGI's emission reduction success was primarily due to the ability of affected sources and the electric generation system to switch fuels to directly reduce emissions. The RGGI auction dividends were directly responsible for only 5% of the total reductions. The TCI state fuel suppliers have no direct stake in compliance so will comply by simply purchasing the fuel they can get and only selling the amount that complies. As a result, all the TCI reductions will have to come from auction investments. Because the TCI suppliers will simply be treating this program like a tax you might as well just make it a tax.

Tax Advantages

Choosing to do a carbon tax-and-invest approach instead of a cap-and-invest program is not just appropriate because the history of the ARP and RGGI emissions market trading programs do not suggest success. There are advantages of a carbon tax and invest approach.

One big advantage of a tax is that the funding stream is known with more certainty and can be maintained. Revenues will always vary depending on the market in the cap-and-dividend approach. That makes it hard to provide funding guarantees for the investments. More importantly, as the investments reduce demand the amount of fuel sold will go down so the dividend proceeds will also go down. I believe that it will be more costly to get the last reductions of the jurisdiction's targets than the initial reductions so you have to maintain the funding to keep up the rate of reductions needed. Therefore, a tax has a big advantage for this concern.

Implementing any emissions marketing program is a tough logistical effort. RGGI built on the ARP model and emissions reporting system. A TCI program will have to develop its own emissions reporting system, allowance management system, and train a whole new segment of users how to use them. Anyone selling fuel already knows how to pay fuel taxes so this is an advantage. I also have to believe that developing the logistical programs will be more expensive than simply implementing a tax. During the RGGI stakeholder process the development of the cap was controversial and time-consuming. The tax avoids that whole process saving time and effort.

Another advantage to a tax is that it can be implemented at the point of sale. This removes the complication of getting allowances for a fuel tanker coming from a distribution tank farm from a jurisdiction outside the TCI.

The cap-and-invest program is necessarily complicated and is so we can expect unanticipated consequences. As noted previously we have no experience what will happen yet to a cap-and-invest program that has to depend upon non-compliance entity allowance holdings for compliance needs. At a minimum, consumers will pay more as a result of the carbon tax but that increase will not come back to society as a dividend investment. In this instance a tax is cheaper than the cap and invest program.

I imagine some will say that the carbon tax-and-invest approach does not guarantee reductions. With all due respect I submit that the TCI modeling that has to be done to determine the size of the cap, the cap reduction over time and the price collar values is highly speculative. We don't have much experience estimating the reduction benefits from mobile source investments. The investments from the tax will result in emission reductions and you get what you get. If the emissions are not on track then the tax can be adjusted. I think it is imperative for the credibility of this program to avoid any threat that the TCI create a fuel shortage system if the cap is incompatible with the dividend investment reduction results. A tax removes that threat.

There is a major uncertainty related to the TCI emission reduction goals. We really don't know what price will stimulate the changes needed. It isn't just a matter of reducing emissions in the transportation sector, it's about a change to the entire transportation system including behavior change, alternative fuel vehicle subsidy and new infrastructure. It seems to me that the tax can be more easily adjusted to prevent a mismatch in the timing and cash flow.

New York State recently promulgated the Climate Leadership and Community Protection Act with very aggressive reduction targets. It is not clear to me that the rest of the TCI states would want to meet the

same target levels. In the tax-and-invest approach New York could simply have a higher tax and should expect larger reductions. Trying to incorporate a different target in New York as opposed to the rest of the TCI region in the proposed cap-and-invest approach seems to me to be impossible.

Conclusion

I personally disagree with the need to limit CO2 emissions from the mobile source sector. But if such a program is implemented then I recommend that a tax-and-invest approach be used instead of the cap-and-invest approach proposed in the framework. There are too many differences between the market trading programs that successfully reduced emissions and what is proposed for the TCI to expect that the proposed program will work as well. In addition, there are advantages to a tax which can be summed up as simpler is better.

Final note:

I am willing to talk about the concepts presented in these comments to any regulatory agency staff who have questions.

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