Caiazza Comments on
Proposed Part 496 Statewide Greenhouse Gas Emission Limit
October 23, 2020

Introduction

This rule-making is necessary because the Climate Leadership and Community Protection Act ("Climate Act") specifies, § 75-0107, that statewide greenhouse gas limits shall be established by the Department of Environmental Conservation (DEC) as a percentage of emissions in New York State in 1990 no later than one year after promulgation of the law. There also is a requirement that "in order to ensure the most accurate determination feasible, the department shall utilize the best available scientific, technological, and economic information on greenhouse gas emissions and consult with the council, stakeholders, and the public in order to ensure that all emissions are accurately reflected in its determination of 1990 emissions levels". Unfortunately, DEC has failed to provide sufficient information to document the 1990 inventory and justify the values chosen. The references provided are limited and do not cover the state of methane emissions inventory issues nor does the documentation adequately describe the rationale for the changes that have nearly doubled Greenhouse Gas (GHG) emissions over the previous inventory. Finally, the RIS does not consider the importance of the actual effects of methane relative to carbon dioxide on global warming due to the greenhouse effect.

I am following the implementation of the Climate Leadership and Community Protection Act (Climate Act) because I believe it will affect the affordability and reliability of New York's energy. I am a retired utility meteorologist with nearly 45 years air pollution meteorology and emission inventory development and assessment experience. The opinions expressed 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.

Typographical Errors

For your information I found the following typographical errors in the Regulatory Impact Statement:

- In Table 8: the sum of the IPPU Sector Greenhouse Gas Emissions in 1990 is 2.6 not 2.26
- In the paragraph before Table 7: "For the purposes of comparison, Table 6 provides a comparison of methane loss" should read "For the purposes of comparison, Table 7 provides a comparison of methane loss"

Reporting Requirements

In § 75-0105, the Climate Act mandates a statewide greenhouse gas emissions report. No later than two years after the law was promulgated, and each year thereafter, the DEC must issue a report on statewide greenhouse gas emissions from all greenhouse gas emission sources in the state. The report is required to "include an estimate of what the statewide greenhouse gas emissions level was in 1990". It is supposed to be a "comprehensive evaluation" not only of direct emissions but also include an "estimate of greenhouse gas emissions associated with the generation of imported electricity and with the extraction and transmission of fossil fuels imported into the state". There are explicit requirements to ensure it is high quality: "The statewide greenhouse gas emissions report shall utilize best available science and methods of analysis, including the comparison and reconciliation of emission estimates from all sources, fuel consumption, field data, and peer-reviewed research" and "shall clearly explain the methodology and analysis used in the department's determination of greenhouse gas emissions and shall include a detailed explanation of any changes in methodology or analysis, adjustments made to prior estimates, as needed, and any other information necessary to establish a scientifically credible account of change". Finally, it requires DEC to hold at least two public meetings to seek public input regarding the methodology and analysis.

The next section in the Climate Act, § 75-0107, Statewide greenhouse gas emissions limits, mandates that "No later than one year after the effective date of this article, the department shall, pursuant to rules and regulations promulgated after at least one public hearing, establish a statewide greenhouse gas emissions limit as a percentage of 1990 emissions, as estimated pursuant to section 75-0105 of this article". There also is a requirement that "in order to ensure the most accurate determination feasible, the department shall utilize the best available scientific, technological, and economic information on

greenhouse gas emissions and consult with the council, stakeholders, and the public in order to ensure that all emissions are accurately reflected in its determination of 1990 emissions levels".

There is a contradiction in these two sections. How can § 75-0107, Statewide greenhouse gas emissions limits, establish a limit estimated pursuant to § 75-0105 which is due later than this requirement? Both sections mandate the use of the "best available" information and consultation with the public, but the timing requirements preclude that from happening. As my comments show the documentation is insufficient to meet the "best available" standard.

Inventory Differences

The Climate Act includes requirements that significantly affect the greenhouse gas (GHG) emission total for the State. According to the latest edition of the NYSERDA GHG emission inventory (July 2019) Table S-2 New York State GHG Emissions 1990–2016, the New York State 1990 GHG emissions were 236.18 $MMtCO_2e$. The proposed Part 496 regulation 1990 emissions inventory total is 401.38 $MMtCO_2e$ for an increase of 165.20 $MMtCO_2e$.

The July 2019 emission inventory relied primarily on Intergovernmental Panel on Climate Change (IPCC) methods. The Part 496 inventory differs primarily because of two Climate Act mandates. Both of these increase the methane emissions component of the 1990 inventory. The larger change requires the inclusion of GHG emissions that occur outside of the boundaries of New York State if they are associated with the use of energy within the State. Another big factor is changing the global warming potential time horizon from 100 years to 20 years. Both of these mandates particularly affect natural gas methane emissions. To a lesser extent using different sources as primary references for some of the parameters caused changes.

DEC has failed to provide sufficient information to document the proposed 1990 inventory and justify the values chosen. In order to be complete, the RIS or another source of documentation must provide for each value listed in the inventory the emission factor, activity factors or throughput and the reference. Furthermore, footnotes 16 and 19 state "To be provided in an updated Patterns and Trends report" but as of the date of these comments that report has not been published.

There is another aspect of the Department's use of the IPCC protocols except when they differ from the Climate Act requirements that should be addressed. I compliment the Department for publishing in Tables 1 and 2 the 20-year and 100-year global warming potential emission values. In order to provide complete information, both the in-state only component and the total including certain emission sources located outside New York that is consistent with the Climate Act emission values should be published. The Part 496 inventory will represent the best estimate of New York emissions and should provide both values so that the Part 496 inventory can be compared to inventories in other jurisdictions.

Documentation

The Part 496 Regulatory Impact Statement (RIS) is the only documentation provided for the proposed Part 496 inventory. As I noted in my interim comments, given the significant departure from IPCC protocols, the documentation is inadequate. There are a limited number of references provided that address methane emissions from natural gas. In addition, "NYSERDA utilized consultant support to run federal life cycle models to derive emission factors that could be applied to EIA fuel data for New York" but does not provide documentation from that work.

I estimate that there are only six references directly related to natural gas related methane emissions and no general discussion of the state of the science. In order to show by example what I believe is the minimum level of documentation I have prepared the attached Methane References Summary. It contains a set of references that I believe should have been included in the documentation for Part 496. For each reference I include a link to the paper and, where available, the abstract and other supporting information.

Reading the RIS gives the impression that methane inventorying is without controversy. However, as shown in the references I provide, this clearly is not the case. M. Saunois et al.2020: The Global

Methane Budget 2000–2017 notes in the abstract: "The relative importance of CH4 compared to CO2 depends on its shorter atmospheric lifetime, stronger warming potential, and variations in atmospheric growth rate over the past decade, the causes of which are still debated. Two major challenges in reducing uncertainties in the atmospheric growth rate arise from the variety of geographically overlapping CH4 sources and from the destruction of CH4 by short-lived hydroxyl radicals (OH)".

Furthermore, the RIS and the inventory itself indicate that emissions from the oil and gas industry are major methane sources in the global and New York inventories. Because of the importance of this factor on the proposed 1990 inventory the controversy over that presumption must be addressed in the documentation. Saunois et al., 2020 states (p. 1573):

> "The shale gas contribution to total dry natural gas production in the United States reached 62 % in 2017, growing rapidly from 40 % in 2012, with only small volumes produced before 2005 (EIA, 2019). The possibly larger emission factors from the shale gas compared to the conventional ones have been widely debated (e.g. Cathles et al., 2012; Howarth, 2019; Lewan, 2020). However, the latest studies tend to infer similar emission factors in a narrow range of 1 %–3 % (Alvarez et al., 2018; Peischl et al., 2015; Zavala-Araiza et al., 2015), different from the widely spread rates of 3 %–17 % from previous studies (e.g. Caulton et al., 2014; Schneising et al., 2014)."

At an absolute minimum, the RIS must incorporate each of these references in the documentation and explain why the ultimate values used were chosen. Instead, the RIS only references Alvarez et al., 2018 and another reference not even included in Saunois et al., 2020 in the applicable section of its documentation.

DEC worked closely with NYSERDA to develop the emissions used in the inventory. However, that work is not documented. NYSERDA used consultant support to run federal life cycle models to derive emission factors for imported petroleum products, coal, and natural gas. Because of the importance of these parameters on the emissions inventory the supporting information used in this work must be provided.

Alternative Methane References

The major difference in this inventory compared to previous NYS inventories is due to changes in the methane inventory. I believe that the changes in the inventory due to methane can be traced to Dr. Robert Howarth. He not only helped draft the Climate Act but is also now a vocal member of the Climate Action Council. While this accounts for his outsized impact on the inventory that does not necessarily mean that his views justify the changes. In the Howarth 2020 paper he claims "Some evidence indicates that shale-gas development in North America may have contributed one-third of the total global increase in methane emissions from all sources over the past decade (Howarth 2019)." This paper and other similar papers claim that "methane emissions can contribute significantly to the GHG footprint of natural gas, including shale gas". Also note that in his comments at the October 20, 2020 public hearing he claimed his work justified increasing the draft Part 294 inventory values. There is a problem however, because much other evidence contradicts his claims.

In Howarth et al, 2011 he claims that 3.6% to 7.9% of the methane from shale-gas production escapes to the atmosphere in venting and leaks over the lifetime of a high-volume hydraulic fracturing well in a paper arguing that natural gas was not a good substitute for coal. Natural gas is composed primarily of methane so the first red flag warning is the expectation that a well owner is going to accept that level of loss of the product he wants to sell. Cathles et al., 2012 found serious flaws in Howarth paper noting that "they significantly overestimate the fugitive emissions associated with unconventional gas extraction, undervalue the contribution of "green technologies" to reducing those emissions to a level approaching that of conventional gas, base their comparison between gas and coal on heat rather than electricity generation (almost the sole use of coal), and assume a time interval over which to compute the relative climate impact of gas compared to coal that does not capture the contrast between the long residence time of CO2 and the short residence time of methane in the atmosphere."

Lewan in review 2020 evaluates the claim in Howarth 2019 that "shale-gas development in North America may have contributed one-third of the total global increase in methane emissions from all sources over the past decade". The abstract states:

> "The ideas and perspectives presented by Howarth (2019) on shale gas being a major cause of recent increases in global atmospheric methane are based on his notion that stable carbon isotopes of methane ($\delta^{13}C_1$) of shale gas are lighter than that of conventional gas based on a meager and unrepresentative data set. A plethora of publicly available data show that the $\delta^{13}C_1$ values of shale gas are typically heavier than those of conventional gas. This contradiction renders his ideas, perspectives, and calculations on methane emissions from shale gas invalid."

Although I have been involved with emissions inventories for over 45 years, I do not have specific experience with natural gas production emissions. However, over that time I learned early on that the gold standard check on any emissions inventory is comparison of the inventory estimate with observed ambient monitoring. If there is a high quality, long-term monitoring network that measures the pollutant in the inventory and those measurements do not reflect the trend in the inventory then the inventory is wrong.

Lan et al., 2019 evaluated data from the National Oceanic and Atmospheric Administration Global Greenhouse Gas Reference Network and determined trends for 2006–2015. This covers the period when Pennsylvania shale-gas production increased tremendously. According to the plain language summary for the report:

> In the past decade, natural gas production in the United States has increased by ~46%. Methane emissions associated with oil and natural gas productions have raised concerns since methane is a potent greenhouse gas with the second largest influence on global warming. Recent studies show conflicting results regarding whether methane emissions from oil and gas operations have been increased in the United States. Based on long-term and well-calibrated measurements, we find that (i) there is no large increase of total methane emissions in the United States in the past decade; (ii) there is a modest increase in oil and gas methane emissions, but this increase is much lower than some previous studies suggest; and (iii) the assumption of a time-constant relationship between methane and ethane emissions has resulted in major overestimation of an oil and gas emissions trend in some previous studies.

As a result of the fact that the relevant high quality, long-term monitoring network does not show a trend consistent with the work of Howarth I believe that unequivocally supports Dr Lewan's conclusion that his ideas, perspectives, and calculations on methane emissions from shale gas are invalid.

Methane Accounting

As it presently stands methane is given outsized importance relative to carbon dioxide in the Climate Act inventory. As shown above the presumptions that drive that over-emphasis are refuted by other work. Additionally, there are other considerations for methane relative to carbon dioxide as it relates to global warming due to the greenhouse effect that should influence the choice of priorities in this inventory.

I don't believe that methane should be a primary driver of New York energy policy to address global warming from the greenhouse effect. As more greenhouse gases are added to the atmosphere, they reduce the amount of upward thermal radiation or heat from the surface that an escape the atmosphere. The effect of each greenhouse gas depends on the properties of each greenhouse gas relative to thermal radiation and their concentration in the atmosphere. A recent report explains that "For current concentrations of greenhouse gases, the radiative forcing at the tropopause, per added CH4 molecule, is about 30 times larger than the forcing per added carbon-dioxide (CO2) molecule". That is the rationale that the Climate Act used to incorporate the mandates for changes to the inventory. However, when you consider the concentration in the atmosphere, the potential effect is much less significant. The paper notes: "The rate of increase of CO2 molecules, about 2.3 ppm/year (ppm = part per million), is about 300 times larger than the rate of increase of CH4 molecules, which has been around 0.0076 ppm/year since the year 2008. So, the contribution of methane to the annual increase in forcing is one tenth (30/300) that of carbon dioxide." The report concludes "Proposals to place harsh restrictions on methane emissions because of warming fears are not justified by facts."

Last summer the European Union (EU) proposed an initiative to reduce methane emissions. Myles Allen, a professor of Geosystem Science and head of the Climate Dynamics Group at Oxford Martin, University of Oxford submitted comments that offer a different perspective on the issue of methane accounting that is relevant to New York. Their work is based on the life-time difference between carbon dioxide and methane. Carbon dioxide is long-lived and accumulates over time because it stays in the atmosphere. Methane is a short-lived (10 to 12 years) pollutant that lasts in the atmosphere less because "methane undergoes hydroxyl oxidation and becomes carbon dioxide and water vapor. The resulting carbon dioxide is recycled and returned to the atmosphere, ending methane's warming".

Allen notes that the EU methane policy represents "an opportunity to clarify the definition of climate neutrality". Because methane is being destroyed relatively quickly as it's being added, its warming impact isn't determined by how much is being emitted but by how much more or less methane is being emitted over a period of time. In this case the period since 1990 is the appropriate metric.

Allen's primary concern was the effect of the global warming potential on agriculture. He argues that as long as the size of ruminant herds remain constant, they should not be targeted for reductions. I think that this is also relevant for methane associated with natural gas operations. If there is really such a large problem with fugitive methane emissions in the natural gas transmission and distribution system it represents an opportunity to provide meaningful reductions when those leaks are found and fixed.

Conclusion

In order to meet the "best available science and methods of analysis" criteria of the Climate Act, the documentation should address the current methane debate by summarizing articles on both sides of methodology differences, explain how those differences affect the Part 496 1990 emission inventory relative to previous inventories, and then provide the rationale for picking one approach over the other. Because this level of detail is not provided, the Part 496 inventory should be re-proposed with that information.

In order to provide meaningful comments on the re-proposed regulation three things need to be provided. Because of the magnitude of the effect of the methane changes in the Climate Act inventory, the current controversy over alternative explanations for recent changes in methane measurements should be incorporated in the documentation. Additional supporting documentation describing in more detail the life cycle model assumptions and modeling also need to be provided. Given the importance of this inventory for future regulatory action it is also necessary to document the emission factor, activity factors or throughput and the references for each value provided in the inventory.

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