NJ DRAFT EMP COMMENTS

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The EMP Has Already Failed Unless it Declares a Moratorium on New Fossil Fuel Projects

Climate change is an existential threat to New Jersey and the world. The 2108 IPCC report stated that change is occurring faster than previously thought and the world has about 10 years to make substantial cuts in greenhouse gases to avoid the worst impacts of climate change. This means at least stopping new fossil fuel projects that will make the situation worse and lock us in to increasing GHGs for years. The draft EMP states:

> There is near unanimous scientific consensus that the global threat of climate change is grave and that it demands swift local action and focused state leadership. However, there is also evidence that New Jersey's current trajectory and efforts will be insufficient to reach the goals we have established to address climate change.

Yet despite this recognition and the Governor's promise to address this issue in the EMP, the document is completely silent on how to handle the dozen or so new fossil fuel projects underway or in various planning stages. These projects have the potential **to increase NJ's GHGs by about 30% annually** and will, if built, **make it virtually impossible to achieve even the GWRA's weak objectives** (which, unfortunately, are outdated and insufficient to meet the IPCC's goals).

This is insanity. Every percent cut in GHGs will be challenging and difficult, yet the Governor and the BPU and DEP are willing to allow increases, which will make this effort even more difficult. On top of this, the latest GWRA legislation (S3207) allows the DEP to spend 2.5 years planning before taking action to cut GHGs.

The bottom line is that **without a moratorium now, the EMP has already failed**. The BPU can just pack up and go home because you are doomed to spend years defending your failure to meet its objectives.

Other states, counties and cities have effectively used moratoriums and ordinances to ban fossil fuel projects completely or provide time to establish effective regulations. A few examples are:

- Oregon passed a five year moratorium on fracking.
- King County, Washington passed a six-month moratorium on new major fossil fuel infrastructure in unincorporated parts of the county.

- Portland, Oregon passed an ordinance that prohibited new bulk fossil fuel terminals with a capacity greater than 2 million gallons and capped the size of existing terminals.
- Baltimore banned the construction of crude oil terminals and the expansion of existing ones.
- Oakland, Calif. banned a terminal intended for coal exports.
- Vancouver enacted land use reforms that prohibit the construction of new crude oil facilities.
- Hoquiam, Washington adopted zoning changes to prevent the construction of large crude oil storage facilities, effectively ending the threat of future oil industry development plans.
- The City of Los Angeles directed the Los Angeles Department of Water and Power to not upgrade three coastal gas-burning power plants with new gas technology but to replace them with an array of renewable energy sources and storage.
- Arizona state regulators extended a moratorium until August (originally put In place in March 2018) on new natural-gas power plants with capacities of 150 megawatts or greater. The purpose of the moratorium was to give the Arizona Corporation Commission time to study a plan that calls for 80% clean energy by mid-century.

We must stop digging our GHG hole deeper while we take many many months to ponder solutions. If the final EMP plan shows that building more new fossil fuel projects is the optimal path to achieving its goals then we can proceed to build them. Many of us are betting this is not the case. Would the EMP planners like to put serious personal money into such a bet?

EMP/GWRA Objectives Fail to Support Critical IPCC Goals

The 2018 IPCC report, which is focused on preventing global warming from exceeding 1.5^{o}C calls for reducing GHGs by 45% over 2010 levels by 2030 and achieving net zero emissions by 2050. For NJ, the IPCC 2030 goal of a 45% reduction translates to reducing GHGs to 61.9MMT (from the current level of 102.7MMT).

By contrast the EMP/GWRA has no goal for 2030 and calls for a reduction in GHGs to 80 percent below 2006 levels by 2050. As stated in the EMP, the GWRA goal will still allow GHG emissions of 25.7MMT in 2050, although it sets an objective of being carbon neutral, employing some as yet unknown types of offsets to the 25.7MMT amount. This is a dangerous assumption and the EMP should explore scenarios to reduce GHG emissions to zero by 2050.

While the IPCC's goals are global and NJ's GHG emissions have a different profile, it is clear that NJ must make very substantial reductions in GHG emissions by 2030 to support the IPCC's goals. In fact, given that the US is one of the most prolific

emitters of GHGs it would not be unreasonable for the US as a whole and for every state to have to exceed the IPCC reduction of 45% by 2030 in order to support the global effort. Moreover, the IPCC points out that GHG reductions in the next 10-12 years are the most crucial, yet NJ has no comparable goal in line with the need to keep global warming below 1.5°C. **The EMP must set a goal for GHG reduction in 2030 that supports the IPCC goal.**

The EMP Must Consider the Global Warming Power of Black Carbon

The EMP report needs to include the impact of black carbon and other super pollutants which may have shorter lives than CO2 but much more potent impacts over those short periods. See EDF summary of the six most important takeaways from the 2018 IPCC report above which states:

> **Cutting methane, black carbon, and other 'super-pollutants' vastly increases the chances of staying below 1.5 °C.**

Black carbon, or soot, only lasts a week but its net effect is a million times more powerful in its warming impacts than CO2. Black carbon's heating effect is more complex than that of CO2 or methane. Black carbon alone is estimated to have a 20-year Global Warming Potential (GWP) of 4,470, and a 100-year GWP of 1,055–2,240. Fossil fuel soot, as a result of mixing with cooling aerosols and particulate matter, has a lower 20-year GWP of 2,530, and a 100-year GWP of 840-1,280.

However, soot particles heat the air by absorbing sunlight, warming the atmosphere by emitting that energy through heat (infrared) radiation and conduction to the air around them. This differs from GHGs like CO2, which allow sunlight to pass through, but absorb the Earth's heat radiation and reemit it to the air. Soot is therefore, far more effective at absorbing energy than CO2. On a mass basis, these properties mean that an ounce of black carbon particles can absorb over a million times more radiant energy than an ounce of CO2 (Jacobson, 2009).

The EMP must either include this in its calculations of GHGs or clearly demonstrate why this is not significant.

NJ's Goal Must Be 100% Clean Energy from Class I Renewables, Not 100% Carbon Neutral

Governor Murphy's EO 28 stated, "This 2019 Energy Master Plan (the "2019 Plan") shall provide a comprehensive blueprint for the total conversion of the State's energy production profile to 100% clean energy sources on or before January 1, 2050."

The draft 2019 EMP redefined "100% clean energy by 2050" to mean 100% carbon neutral electricity generation. Carbon-neutrality is further defined as having a net

zero carbon footprint by eliminating carbon emissions or balancing carbon emissions with carbon removal.

Unfortunately, carbon neutral mechanisms include nuclear energy, biomass, biofuels, incineration (waste to energy), purchasing offsetting carbon credits, carbon removal and sequestration. The draft EMP also supports the intent to continue to use liquid fuels by referring to these fuels as "renewable" and as examples of "clean vehicle technology." Examples of such "cleaner liquid fuels" are described as "renewable natural gas" (p. 32), "Sustainable Aviation Fuel" and "renewable diesel." (p. 34-5). The Plan "cloaks" the natural gas and petroleum based biofuels in the language of renewable and sustainable energy sources to make them appear consistent with Governor Murphy's executive order and with greenhouse gas reductions, when, in fact, they are not. Biomass as a source of power generation is assumed to be a renewable source because it "burns" or uses organic materials that can be replaced. Biomass generators have been fueled by wood (in the form of pellets produced from clear cut forests), railroad ties and even rubber tires. Is this something the State intends to do as a part of its renewable energy plan?

Each of these has its problems, mainly that they may, at best be truly neutral but the urgent need today is rapid reduction of carbon and GHG's, not maintenance of the status quo. Every GHG emitting technology allowed in the EMP must be clearly proven to be absolutely necessary and unable to be replaced by renewable technologies, while also proving their carbon-neutrality. Offsetting credits are often fraudulent and at best, still allow recipients to continue to emit GHGs. Other problems include the lack of a proven technology such as underground sequestration or reliance on planting trees which have limited ability to absorb carbon and eventually release it all back into the environment.

The EMP should revise its definition of Clean Energy to be Class I renewable sources such as sunlight, geothermal, wind and ocean waves. If it continues to use carbon neutral as its definition of clean energy it must clearly define and examine each carbon neutral technique and produce credible reports as to its need versus renewable alternatives and efficacy (both in terms of actually remaining neutral and capturing carbon and in terms of financial advantages).

The EMP Must Model 100% Renewable Energy Scenarios

As described above, the EMP has already abandoned the idea or objective that New Jersey can migrate to 100% Class I renewable energy technologies across the entire economy by 2050. This is a poor way to plan for several reasons:

- We have no idea what energy technologies will look like in 2050. Assuming they will not be able to support this objective is a bad unsubstantiated assumption.

- There is nothing wrong with setting a very high bar, doing everything possible to achieve it, but failing due to obstacles that are inherently very difficult. Isn't this what we teach our kids? We will never reach this goal unless we try.
- Abandoning this approach without even modeling it hurts the EMP's credibility. The public needs to see what this model looks like in terms of costs, infrastructure turnover, jobs, etc. in order to understand its risks and benefits – and so do EMP planners.

The next version of the EMP must include a full scenario for reaching 100% renewable energy infrastructure in the electricity production sector by 2035 and the total economy by 2050 while reducing GHGs to meet the IPCC's goals. Let's see how big this obstacle really is.

Importance of Appropriately Accounting for the Global Warming Potential (GWP) of Methane in the EMP[1]

The EMP's improper accounting for the GWP of methane is an invisible error that dooms it to failure. The EMP's policy on natural gas alone will cause it to fail to meet its objectives.

Carbon dioxide (CO2) and methane (the major component of natural gas) are both greenhouse gases (GHGs) but have different lifetimes and different capacities to block infrared radiation (IR) from escaping back into space. This blocking effect is what powers global heating. A molecule of methane, during its relatively short life in the atmosphere will power much more global warming than one molecule of CO2. However, there are multiple ways to view the global warming power of methane and use it to calculate total GHG emissions, which has caused some controversy.

Methane remains in the atmosphere for 8-12 years before it is broken down into CO2. For those ten years or so, methane is 104 times as effective at powering global warming, as is CO2. The Global Warming Potential (GWP) is the ratio of any GHG's power to block infrared radiation versus that of CO2. In the case of methane over a ten year period the ratio is104:1. Thus the value of methane's GWP over ten years is 104. While CO2 always has a GWP value of 1, there are multiple values for methane because of its short lifetime that are used in different analyses.

The different values of GWP are written as GWP_H in which H stands for the number of years over which the global warming potential is averaged. Three values for methane GWP_H are:

- $GWP_{10} = 104$
- $GWP_{20} = 86$
- $GWP_{100} = 25$

After ten years, on average, the methane molecule is gone, with no further warming effect as methane, although it converts to CO2, which continues to power global warming. However, a molecule of CO2 released simultaneously with one of methane continues to power global warming for centuries. The GWP of CO2 is 1 because it is the most common GHG. It is the basic unit of global warming potential to which all other GHGs' GWPs are compared.

If the global warming power of methane in its ten years of life is averaged over twenty years and compared to the power of CO2 over those same twenty years, the GWP_{20} of methane is 86. Over a 100-year horizon, the GWP_{100} of methane is much lower, generally somewhere between 28 and 34, although the US EPA and the NJ EMP use a value of 25.

International agreements usually define global greenhouse gas emissions as a basket of greenhouse gases expressed as CO2e (carbon dioxide equivalent) assuming a 100-year global warming potential. The US primarily uses the 100-year GWP as a measure of the relative impact of different GHGs, to be consistent with global studies and particularly in long-term analyses, where such use is consistent with the timeframes of the analyses. However, while the 100-year GWP is most commonly used by government and industry, according to the IPCC: *"There is no scientific argument for selecting 100 years compared with other choices. The choice of time horizon is a value judgment because it depends on the relative weight assigned to effects at different times."*
Effectively, the IPCC is saying that the time frame of an analysis should dictate the use of the GWP value, not common international conventions.

The math involving the use of GWP's and the computation of CO2e is very straightforward. It simply involves multiplying the actual amount of a gas like methane (usually measured in metric tons) by the GWP_H factor and adding it to the amount of CO2 to get the total CO2e. For example, assume a country emits the following amounts of GHGs in one year:

- 500 metric tons of CO2
- 30 metric tons of methane

If it uses the GWP_{20} factor for methane, the total GHG CO2e is 500 (CO2) + 86*30 (methane) = 3,080 metric tons of CO2e. If the GWP_{100} factor of 25 is used for methane then the total CO2e is only 1,250 metric tons. As can be seen from this example, methane has a much larger impact per ton on the total CO2e result than CO2 and the GWP timeframe factor also has a very large impact on the total amount of methane converted to CO2e.

The EMP uses GWP_{100} which results in the following distortions:

- It understates CO2e emissions from all sources today.
- Quantifying Global Warming Response Act (GWRA) goals of reducing GHGs in terms of GWP_{100} CO2e results in less total reduction of GHGs. CO2e is much lower when using GWP_{100} than GWP_{20}.

The table below shows total US GHG emissions from CO2 and methane in 2017 (source: EPA). CO2 comprises about 82% of total GHGs and methane (using GWP_{100}) contributes another 10% (the remainder is nitrous oxide and fluorinated gases). The total CO2e using GWP_{100} is 5,940 million metric tons (MMT). The actual amount of methane is only about 26MMT (646MMT CO2e divided by the GWP_{100} value of 25). However, when looking at this over a 20-year period (using GWP_{20} for methane) the total GHG CO2e is 7,515MMT (which is 1,576MMT more than the total using GWP_{100}, an increase of 27%) and methane comprises 30% of this total rather than the 10% using the GWP_{100} factor.

	Total CO_2e (CO_2 + Methane) MMT (GWP_{100})	MMT CO_2 (82%)	MMT CO_2e Methane (10%) (GWP_{100})	Actual Amount of Methane (MMT)	CO_2e From Methane (GWP_{20})	Total CO_2e MMT (GWP_{20})	Percent of Total CO_2e From Methane (GWP_{20})
US GHG Emissions 2017	5,940	5,295	646	26	2,221	7,516	30%

Thus, on a realistic 20-year basis, methane causes 30% of global warming in the US.

The EMP's calculations of GHGs and CO2e must use the GWP_{20} factor for the following reasons:

- Assumptions and data in any plan must correspond to the time period of the plan or else the results are invalid. The EMP is a 20 to 30 year plan, not a 100-year plan.
- Policy based on use of the 100-year GWP to convert methane to CO2 equivalent emissions inherently amounts to effectively ignoring over 70% of climate warming impacts of anthropogenic methane emissions over the first ten years of such policy. In a 2015 letter to President Obama, Professors Payne, Redmond and Lemly strongly criticized the use of GWP_{100} and urged the use of GWP_{10} stating, "Using the 100-year GWP convention leads to the conclusion that global methane emissions from 2008 to the present have amounted to 84 gigatons (about 16 ppm) CO2e, when the actual warming impact (using 10-year GWP) would be 312 gigatons (about 60 ppm)."
- Using GWP_{100} for methane **understates by about 27% total GHG emissions today and understates by a similar amount, the total GHG reductions needed to meet the EMP's goals. This is an extremely serious mistake when we need to focus on reducing GHGs over the next 10 years.**
- The average lifetime of methane is 10 years, which corresponds closely to the IPCC timeframe for reducing and controlling GHG emissions to avoid climate catastrophe. Using GWP_{100} when dealing with the necessity to act in 10 years and planning to meet carbon neutral/free objectives in 30 years is either incompetent or politically motivated or both.

GWP_{100} greatly downplays the warming potential of methane in its short lifetime by spreading it out over a century, for most of which methane has no warming effect at all besides the small amount converted to CO2 from its decay. All credible climate authorities say that the future of our living earth will be decided by what happens in the next ten to thirty years. **Writing numbers on a piece of paper to minimize the problem or imply objectives are being met when this is not the case, does not change the physics of the atmosphere. The EMP must use the GWP20 factor for methane in its calculations to ensure it has an accurate understanding of NJ GHG emissions and has the most effective reduction strategies. Given the controversy over the use of different GWP numbers, the EMP should require all scenarios and computations to be done using both GWP values for methane so that the differences are clearly visible.**

Importance of Focusing on Methane Emissions and Leakage in the EMP

As demonstrated above, pound for pound, methane has a much larger impact on global warming in the short term than CO2. In fact, as stated in Empower New Jersey's recent report *EMPOWER NJ: STOP FOSSIL FUEL PROJECTS, FIGHTING Climate Change in NJ: The Urgent Case for a Moratorium on all Fossil Fuel Projects,* "Contrary to popular perception, producing electricity from fracked-gas is worse for climate change than coal. Methane leakage along the gas supply chain more than doubles the lifecycle emissions of gas compared to counting emissions only from gas combustion. A 2011 Cornell University study, comparing GHG potency, showed that shale (fracked) gas is worse than conventional gas, is worse than coal and worse than oil."

Therefore, it makes sense to focus heavily on methane in the near term. This is not to say that CO2 reductions are not important. There are many factors that affect the feasibility and cost of GHG reductions. However, **the importance of making every effort to reduce methane volumes cannot be overstated and the EMP must make this a priority.**

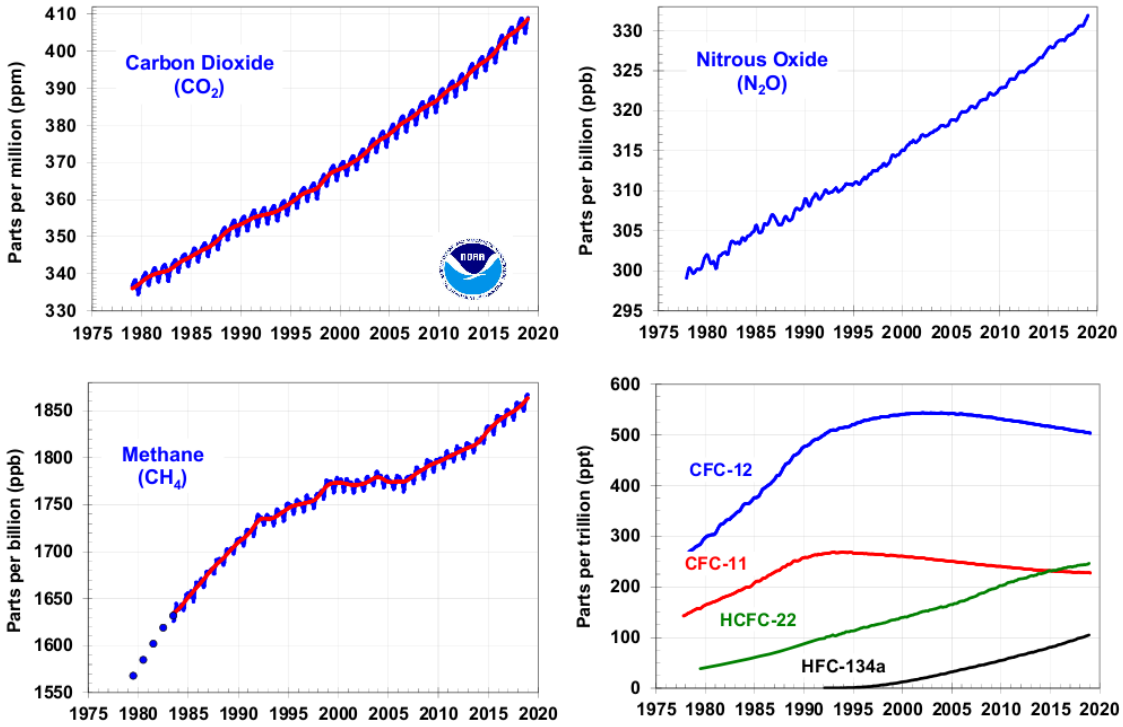
To further drive home this point, the following analysis compares results from reductions in equal amounts of emissions by weight using the same values as in the table above for CO2 and methane emissions in 2017 in the US. The table below compares the results of reducing both CO2 and methane by 10MMT (actual weight, not CO2e weights) each.

	Total CO_2e (GWP_{100})	Percent Reduction (GWP_{100})	Total CO_2e (GWP_{20})	Percent Reduction (GWP_{20})
10MMT reduction CO_2	5,930	-0.2%	7,506	-0.1%
10MMT reduction methane	5,690	-4.2%	6,656	-11.4%

The results are really just another way of demonstrating the power of the differences in GWP values. A 10MMT reduction of methane using GWP_{100} reduces total CO2e by 4.2% compared to only a 0.2% reduction from an equal amount of CO2. (The methane

reduction in CO2e is 25 times that of CO2). Using the methane GWP_{20} factor, the same change results in an 11.4% reduction in CO2e for methane compared to a negligible 0.1% reduction in CO2e from CO2. (The methane reduction in CO2e is 86 times that of CO2).

The rate of emissions of methane also supports this strategy. The NOAA charts below show global concentrations of GHGs from 1979 to 2019. Both methane and CO2 are increasing at a dramatic and similar pace. Given its GWP values, New Jersey and the rest of the world must skew reduction efforts towards methane, especially in the short run.



Source: NOAA https://www.esrl.noaa.gov/gmd/aggi/aggi.fig2.png

It is also worth noting that while the total volumes of methane emissions in the US are not disputable, there are different positions on the amounts contributed from different sources. Prof Robert Howarth at Cornell attributes the rise in methane levels to the fossil fuel supply chain and fracking in particular as shown in the table below.

Sources of Methane Emissions (Howarth 2019)	All Sources (MMT)	Percentages (All Sources)	Human Influenced Sources (MMT)	Percentages (Human Influenced Sources)
Natural Sources	220	37%		
Natural Gas and Oil	157	26%	157	42%

Coal	32	5%	32	9%
Animal Agriculture	74	12%	74	20%
Rice Cultivation	44	7%	44	12%
Landfills and Sewage	41	7%	41	11%
Biomass Burn	27	5%	27	7%
Total	**595**	**100%**	**375**	**100%**

Estimated annual global methane emissions in MMT.

Empower New Jersey's abovementioned report researched several sources on the volume of methane from leaks in the natural gas cycle and found that a reasonable, yet conservative value for methane leakage over its full life cycle is 2.6% (± 1.2%) of the total volume of methane in gas infrastructures. (More recent studies have found that a full life cycle of 4.1% emissions from shale gas over the past decade is quite plausible.)

Applying this leakage factor (2.6%) to the global methane emissions from gas and oil (the great bulk of these emissions are from natural gas) generates 4MMT, which is equivalent to 100MMT of CO2e using GWP_{100} and 344MMT of CO2e using GWP_{20}. Thus, focusing on strategies to reduce methane and take advantage of its high GWP must concentrate on significantly reducing emissions from this source in order to be successful. While the EMP mentions the need to instruct gas utilities to prioritize replacement of pipelines leaking methane and incorporate advanced leak detection technology, there is no mention of any enforcement or oversight policies other than encouraging voluntary reporting to the NJBPU. Moreover, methane also escapes from gas-fired power plants. The original estimate of this volume for the North Bergen Liberty Generating Station was 73 tons/year or 6,278MMT of CO2e using GWP_{20}. The EMP makes no mention of this impact and has no policies to reduce these emissions. In fact it states the following:

> "Natural gas burned in plants with state of the art technology has been an important transition, or "bridge," fuel that has helped wean the state off the heaviest polluting fuels, like coal, while also reducing emissions and lowering the cost of electricity. Natural gas also contributes important reliability services to the grid."

The EMP document does not provide any measure of the volume of GHG emissions due to methane, both leaked and that escaping from the combustion process. Nor does it provide any estimate of the increase in this problem that will occur if more gas infrastructure projects are completed.

Methane, unlike the other major GHGs, has a redeeming quality. Its residence time in the atmosphere is so short that its role in the greenhouse effect could be changed for the better within ten to twenty years after ambitious mitigation begins. The bright side of methane is that its short life allows more near-term leverage of its globe-heating properties than strategies to reduce CO2 or N2O. Also, methane, unlike CO2 and N2O,

has real monetary value that can make preventing leaks more profitable than capturing CO2.

If total annual methane emissions were to steadily decrease for ten years, this would actually have a cooling effect on the planet. Reducing CO2 volumes by the same amount over the same period of time would not produce a cooling effect as the amounts that had been emitted before this decline would continue for decades to add to global warming. Even a total cessation of CO2 emissions would still not stop the continued increase in global temperatures. It would just slow the rate of increase. (19% of CO2 emitted today will still be around in 1,000 years.) **Unfortunately, none of this analysis is reflected in the EMP's strategies.**

The 2018 IPCC report focuses on the need to prevent global warming from exceeding 1.5°C. The EDF summary[2] of the six most important takeaways from the 2018 IPCC report states:

> **3. Cutting methane, black carbon, and other 'super-pollutants' vastly increases the chances of staying below 1.5 °C.**
> The likelihood that we will reach the 1.5 °C warming threshold **is highly dependent upon the emission pathways of non-CO_2 climate pollutants, such as methane and black carbon.** If the emissions of non-CO_2pollutants are not curbed, there is a 66% likelihood of surpassing the 1.5 °C threshold, **regardless of reductions to carbon dioxide**.
> Reducing methane and black carbon emissions is also crucial for limiting the rate of warming in the near-term. It is clear that we must reduce emissions of these pollutants in addition to CO_2, and several broad mitigation measures in areas such as the energy sector tackle the reduction of both.

The EMP must include creative ways to reduce fugitive emissions from existing gas infrastructure, stop allowing new gas infrastructure and find creative ways to replace existing gas infrastructure. One way to reduce the amount of methane lost in extraction and distribution is to put a rising price on natural gas. An upstream carbon fee would help, providing an incentive not to lose or flare methane. Better yet is to combine a campaign against fugitive emissions and leaks centered on safety and health with a radical cutback in the rate of extraction motivated by a rising price and the spread of renewable energy resources. Clearly, any and all strategies to reduce methane must not be undermined by new pipelines and new natural gas facilities.

The bottom line on the EMP and its treatment of methane is that the EMP demonstrates very little understanding of the global warming and cooling issues caused by methane. It uses the wrong time factor to measure methane's global warming power, understating by about 27% total GHG emissions today and those needed to meet the EMP's long term goals and fails to understand the short term cooling power of methane reductions. The EMP must focus on reducing methane and other non-CO2 GHGs in order to maximize GHG reductions and the probability of remaining at or below a 1.5°C increase in global temperature.

The EMP is Not a Plan

The EMP is not a plan. The draft EMP document is a compendium of strategies for reducing GHG emissions in New Jersey that frankly could have been written by well-informed high school AP students. While it does provide indications of strategies and tactics that may be employed it has no forecasts (year-by-year or other timeframes) or milestones of any of the multitude of parameters involved in this effort and no significant discussions or any forecast of any financial parameters such as expenses, capital investments, savings or revenue for any stakeholders. It contains no discussions of tradeoffs or decisions. It contains no forecasts of technology including price performance on which non-existent plans are based. It contains one chart with two assumed GHG pathways. The one area in which it does make assumptions is the future ability to offset GHG emissions with carbon capture technologies as its target in 2050 is to be carbon-neutral. As discussed below this is dangerous wishful thinking, not supported by current trends. In summary it is virtually devoid of the elements of a true plan. To praise this document as a "bold plan" to combat the challenge of climate change as stated by Mr. Fiordaliso, is nonsense.

The EMP Failed to Meet Administrative Obligations of EO 28

Executive Order 28 states:

> The Energy Master Plan Committee shall prepare, complete and deliver a new Energy Master Plan, consistent with the provisions of N.J.S.A. 52:27F-14, et seq., and this Order on or before June 1, 2019.
> This **2019 Energy Master Plan** (the "2019 Plan") ***shall*** **provide a comprehensive blueprint** for the **total conversion** of the **State's energy production** profile **to 100% clean energy sources on or before January 1, 2050**, and ***shall*** further **provide specific proposals** to be implemented over the **next ten (10) years** in order to achieve the January 1, 2050 goal.

As stated above, the document produced on June 10 (missed deadline) did not have anything in the way of a comprehensive plan for accomplishing anything. It had no specific proposals with any levels of detail for the next 10 years or any other timeframe. Yet there was no pushback from the Governor on this failure and administration supporters praised it with nary a word of critique.

Natural Gas is Not Renewable

On page 32, the EMP makes the erroneous statement, "Clean vehicle technology, such as electric, hydrogen, or renewable natural gas, all have the potential to further improve net greenhouse gas and air pollutant impacts." As stated above, in terms of its impact on climate change, burning natural gas is worse than burning coal or oil because of methane leakage. Transitioning from gasoline to natural gas not only increases the volume of GHGs (in terms of CO2e) but adds a cost to transportation

that will have to be stranded if we are going to truly reduce GHGs. **The EMP must treat natural gas as a GHG polluting fossil fuel and develop plans to eliminate it from the energy mix in New Jersey.**

Market Forces that Work Against GHG Goals Must Be Controlled

While the EMP document includes numerous examples of situations in which market forces can be used to drive beneficial behaviors, it must not allow market forces that work against GHG goals to dictate. A prime example of this is the economic power that companies derive from building fossil fuel infrastructures with the aid of guaranteed rates of return from FERC and then being able to compete more effectively against clean/renewable energy solutions because they only have to cover incremental costs. Allowing this behavior to control energy decisions can derail progress towards GHG goals for years. **The EMP must consider these forces when developing rules for allowing construction and ensuring that clean/renewable energy solutions are competitive, if not mandated.**

EMP Strategies Must Consider Revolutionary Technologies and Behaviors

The EMP states, "Given current economic conditions, natural gas is expected to remain the predominant electricity fuel source in the near future without a change in state, regional, or federal policies."

Compare this to the following two statements:

- A DESMOG article (February 22, 2019) entitled *The Death of Natural Gas as a 'Bridge Fuel'***,** stated, **"**According to Greentech Media, energy industry analysts at Wood Mackenzie say the combination of renewables with battery systems **can currently replace approximately two-thirds of U.S. natural gas turbines — right now**. Estimates predict the cost of storage alone could drop 80 percent by 2040."
- **A Forbes article (July 1, 2019) entitled *New Solar + Battery Price Crushes Fossil Fuels, Buries Nuclear*, stated, "**Los Angeles Power and Water officials have struck a deal on the largest and cheapest solar + battery-storage project in the world, at prices that leave fossil fuels in the dust and may relegate nuclear power to the dustbin. Later this month the LA Board of Water and Power Commissioners is expected to approve a 25-year contract that will serve 7 percent of the city's electricity demand at **1.997¢/kwh for solar energy and 1.3¢ for power from batteries."**

While New Jersey is still in the early thinking stage of transitioning to green energy, **t**he NYC Climate Mobilization Act already requires an assessment of the feasibility of replacing the City's gas-fired power plants with battery storage powered by renewable energy sources.

Others are forecasting that the combination of autonomous cars and dropping solar and storage costs could end private car ownership as we know it in 10 years and replace it with car services utilizing EVs for about one ninth the cost of private car ownership. (See first video at https://www.nfrpp.org/climate_change_and_the_economy). This would have enormous impacts on traffic, air pollution, GHG emissions, gasoline consumption, electricity needs, car industry employment, etc.

None of New Jersey's existing nuclear power plants are licensed to operate in 2050. This means that between nuclear and gas, over 90% of New Jersey's current energy sources must be replaced in the next 30 years. The EMP states its concerns for keeping new energy costs reasonable. In order to do so, the replacement energy must cost about the same or less as the cost of the new infrastructure plus its operating costs. The only way to achieve this is with new, lower cost per BTU energy sources from new technology. The EMP must constantly monitor the cost of energy technology and rapidly adopt the most effective technologies.

Two types of change are happening fast – bad change and good change. Bad change is the increasing rate of actual and forecasted damage from climate change. Good change is the increasing improvement in price performance in technology that can stop bad change. This second type of change can accelerate quickly when compelling economics combine with technical innovation. The EMP must, at a minimum, demonstrate it is examining such potential changes and understands the risks of including them (or not including them) in its forecasts. Planners are not used to making 30-year forecasts in such an environment (not to mention the inherent problem that all 30 year forecasts are wrong). **The EMP must become a living document that is updated frequently to ensure we don't plan ourselves behind the curve and end up with high cost infrastructures.** Be bold, get ahead of the curve and don't accept conventional wisdom.

NJ Must Form Partnerships with Construction Unions

Several states, notably Maine, Washington and Colorado have shown leadership by obtaining construction union support for their green energy policies.

- Maine's Green New Deal bill requires employers constructing grid scale generation facilities to hire certain percentages of apprentices to work on the construction beginning in 2021.
- Washington's bill establishes state tax incentives for clean energy projects that are contingent upon certain job-quality criteria including a 75 percent tax exemption for projects that "compensate workers at prevailing wage rates determined by local collective bargaining."
- Colorado created the Just Transition Office in the Division of Employment and Training in the Department of Labor to provide benefits and access to job training for coal workers and grants to eligible entities in communities that want to diversify their economies. At a jobs and climate caucus in 2018,

> the Colorado unions came to the position that "climate change is real and needs to be addressed and we have to make sure fossil-fuel dependent workers are fairly treated in this transition," said Dennis Dougherty, executive director of the Colorado AFL-CIO.

Other states have taken steps such as New Mexico which has allocated $40 million for economic development, severance and retraining for people who will lose their jobs after the closure of facilities (such as coal plants). Starting in 2026, the NM bill also requires that 25 percent of workers employed during the construction of new electricity generation facilities come from to-be-established apprenticeship programs.

Today, without the benefit of any similar programs in New Jersey, construction unions are playing a strong role in perpetuating fossil fuel infrastructure projects due to their political contributions and abilities to get out the vote. In effect, they are, in some cases, dictating our energy choices. These efforts have no relationship to the need to fight climate change and improve air quality. **The EMP must find ways to partner with the construction unions so that both support the same clean air and clean energy goals.**

The EMP Must Clearly Define Rules for New Pipelines, Power Plants and Other Infrastructure (e.g., LNG)

Governor Murphy has promised many times that guidance and rules for constructing new gas power plants and pipelines/compressor stations would be clearly laid out in the EMP. This is a complex issue and, unsurprisingly, the draft document completely ignores this subject and effectively allows such projects to proceed. As documented in the Empower NJ report this could result in a total GHG increase of 30%, which will make it much more difficult if not impossible for New Jersey to achieve its clean energy and GHG reduction goals. The time to fulfill the Governor's many promises on this topic is now. **The next version of the EMP must clearly define the rules for deciding on these types of projects, including an analysis of their need versus alternative renewable technology solutions. It must also take into account their likely effect on GHG emissions if allowed to proceed.**

EMP Roadmap Milestones Must Be Specific and Complete

The EMP document clearly states that it is not a complete plan and that forecasts and road maps will be provided by December, at the earliest. It also does not address the additional time that will be required to pass any necessary bills and write regulations to implement the roadmap. At the same time the facts on climate change clearly demonstrate the need to act quickly to reduce GHGs. This enormous dichotomy between the actual implementation of actions and the urgency of the problem clearly demonstrates the need for a moratorium. To do otherwise is simply

reckless and irresponsible. **The December roadmap must include specific milestones for all key actions needed to initiate GHG reductions as well as annual milestones that can clearly measure the effectiveness of this plan.**

The EMP Must Walk the Talk on Environmental Justice

Throughout the EMP there is mention of activities to address the use of electric vehicles in low income communities (price incentives) and for power generating plants to be "steered away from flood zones and other areas deemed vulnerable to climate change." (p. 50). For example, the Plan observes that "fossil fuel power generators are often located in or near environmental justice communities, placing additional burdens on them in the way if disproportionally contaminated air." (p. 82). In fact, Governor Murphy's Executive Order #23, directs the NJDEP to "develop guidelines on how all state departments can incorporate environmental justice into their actions, including NJBPU, NDEP, NJDCA and NJTransit to ensure that they are actively participating in opportunities to reduce energy use and implement clean energy initiatives." (p. 81). This includes the creation of a Community Energy Planning grant program through NJDCA and the administrator of 75 NJ municipal opportunity Zones.

Yet, despite this emphasis upon incorporating environmental justice into all plans, NJ continues to consider applications to place power plants in or adjacent to environmental justice communities, flood zones and other areas "vulnerable to flood zones." **The EMP and EO 23 cannot be viewed as credible until laws and regulations are put in place to meet their stated objectives.**

The EMP Program Must Continually and Transparently Demonstrate Progress

The EMP program must develop a set of metrics and an update schedule in order to credibly demonstrate it is effectively meeting milestones. It is recommended that these metrics reports be generated at least quarterly. Since new metrics will be needed as strategies change, there must also be publicly visible target dates for publication of these metrics.

Measurements of the Energy Master Plan progress should clearly indicate the status of activities, tracked energy statistics, communications and progress for each of the key strategies identified in the EMP as well as the overall transformation that must occur in order to meet the goals of 80X50 and the percentage of energy from clean sources versus objectives.

Without public metrics, there is no visibility and accountability for progress (or lack of it), no ability to support changes that must occur in order for the goals to be met, no ability to course correct any initiatives not making progress and no possibility of meeting EMP goals. **The next version of the EMP must clearly describe plans for**

periodically, continually and transparently demonstrating progress or explain the lack of it.

EMP Periodic Metric Reports Must Be Timely and Have Credibility

Data shown in the Draft EMP document is from 2016 and are estimates. **The latest GHG data on the DEP website is for 2015 and most of the data is estimated.** Based on this approach, most metrics are expected to be severely out of date by the time they are published. Data several years out of date will prevent the EMP program from actively adjusting to rapidly changing dynamics and will be viewed as deliberately putting a blind eye to politically favorable developments such as increasing natural gas expansion. Given the difficulties of cutting GHGs already being built into the system there will be a great temptation on the part of the Administration and DEP to "cook" the data in order to meet objectives. Transparency is the key to credibility.

Moreover, estimates do not inspire confidence and can be easily manipulated to tell any story desired. For example, the GHG data showing recent reductions from converting from coal to gas do not count all GHGs because they use the GWP100 factor and therefore show less GHGs from gas than are really occurring. Any metrics published must also be compared to reports of actual results from utility companies. When estimates are used, the process for producing these estimates must be clearly explained. GHG values must be based on both frequent air sampling at many locations (especially EJ communities) and point source emission expectations. BPU and DEP processes including actual air sampling (including actual GHG emissions from monitored sources) must be reviewed and improved as needed to ensure accurate and credible publications. **The next version of the EMP must describe the plan for producing credible up-to-date reports.**

The EMP Team Must Demonstrate a Structure That Promotes Flexibility and Adaptability

There are many factors that make the EMP an extremely complex undertaking. Other sections of this comment have identified some of these such as the rate of change of climate impacts and the rapid changes in technology costs and effectiveness. The EMP cannot be a "*set it and forget it*" plan. It must have the means to react quickly and nimbly to new opportunities and risks as they appear. Responsibility for executing EMP strategies and achieving its overall goals is currently segmented across multiple independent agencies, each of which is presumably adjusting to the new 2050 goals. The EMP needs a credible management structure such as a program management approach, that facilitates working across agencies to prioritize, coordinate, project realistic target dates for multi agency initiatives and effectively allocate resources as required for each strategy. **Without such a management approach the 2019 EMP will fail.** This management structure must be visible in order to gain broader support and

engagement from the public, municipalities and the legislature. **The next version of the EMP must describe its management structure and processes developed for ensuring flexibility and adaptability.**

The EMP Must Include Public Awareness and Education

The EMP process must include strong efforts to create public awareness of its importance and benefits. The energy transition described in the EMP will need public support. Education and incentives such as special add-on incentives for low-income populations need to be developed. **The next version of the EMP must describe its public awareness and education strategies, tactics and processes developed for ensuring public buy-in.**

The EMP Must Assess the Hydrogen Energy Economy

The EMP is largely silent on this issue. It only mentions hydrogen in connection with vehicles and does not include any specific plans for its use. Hydrogen has many advantages such as:

- Can be generated anywhere.
- Can be used as a form of energy storage to offset peaks and valleys of other electricity generation.
- The exhaust from hydrogen is H2O when using fuel cells.
- New emerging technologies using nanoparticle technology enables sunlight direct conversion of water into hydrogen and oxygen. This enables hydrogen generation at residences, fueling stations, power plants and business settings.

Europe, UK, Japan, Australia, China and California are heavily investing in hydrogen to become the main component for a smart distributed energy infrastructure. **The EMP must assess hydrogen as a potential component of its solution for New Jersey and either adopt or reject it based on a public presentation of its findings and decision factors.**

The EMP Should Encourage Non-Residential "Behind the Meter Demands"

The EMP describes many benefits from "behind the meter" energy storage supported by renewable energy sources, mainly solar. Energy storage can be an ideal solution for facilities to cut energy bills. Benefits include reduction of GHGs when paired with renewable energy and resiliency. Behind the meter energy storage also provides opportunities for the commercial and industrial sectors of the economy to enhance their bottom line. Facilities subject to demand charges on their energy bills can mitigate these expenses with on-site energy. Demand response for commercial and industrial facilities traditionally involves ratcheting down usage at times of peak demand. Energy storage can enable participation in demand response markets without impacting on-site energy use or operations. Energy storage

systems can shift consumption of electricity from expensive periods of high demand to periods of lower cost electricity during low demand. Non-residential sites equipped with on-site energy storage can become sites for grid energy to vehicle transfer thereby encouraging EV sales and providing economic benefits to employees. The draft EMP focuses on residential solar. **It should develop programs to encourage non-residential DER development and usage.**

The EMP Must Ensure DER Projects Result in Fulfilling its Clean Energy and GHG Reduction Objectives

NJ EMP's overarching strategy No. 2 is "Accelerate Deployment of Renewable Energy and Distributed Energy Resources". "Distributed Energy Resources (DER) are on-site systems, equipment, or processes that are appropriately sized, modular, and decentralized, as compared to larger, centralized power plants, that also include transmission and distribution systems. DER can be either grid-connected or off-grid energy systems located in or near the place where energy is used." However, acceleration of DER deployment as defined by the EMP does not necessarily result in fulfilling NJ Clean Energy or GHG emission reductions objectives.

"Behind the meter" on-site energy storage with PV Solar for commercial and industrial facilities has significant resiliency and financial advantages. These facilities are often critical facilities in the event of major storm recovery. As these are expected to proliferate it is strongly recommended that before finalizing microgrid architectures, each community should be required to ensure the deployment of renewable technologies to maximize production of clean energy.

It is recommended that "Distributed Energy Resources" be redefined to mean distributed renewable generation resources, energy efficiency, energy storage, electric vehicles, and demand response technologies." (This definition is similar to that used by California.)

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[1] The descriptive explanations of GWP and its implications described in this section and the one that follows are based on two papers written by Dr. Stephen Shafer of New York. http://www.anchorageromneys.com/2019/06/insurmountable_opportunity/ http://www.anchorageromneys.com/2019/06/over-heaters-anonymousthe-methane-diet/

[2] http://blogs.edf.org/climate411/2018/10/08/six-takeaways-from-the-new-climate-report/?utm_source=google&utm_campaign=edf_none_upd_dmt&utm_medium=cpc&utm_id=1539712623&&gclid=Cj0KCQjwj_XpBRCCARIsAItJiuRGYh4VMhGVOEVEnMoikIWjXSUFKexauDpe1tueyjIGKhwwMarpvQ8aAoxtEALw_wcB