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To: DEP Rule Comments
Cc: Bill Smith
Subject: Testimony for Chapter 127-A: Advanced Clean Cars II Program

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February 5th, 2024

Members of the Board of Environmental Protection,

I contact you concerning the mandate related to electric vehicles up for review.

I went to the BEPs website and found the report "Scientific Assessment of Climate Change and Its Effects in Maine" written under the guidance of the Maine Climate Council Scientific and Technical Subcommittee.

https://www.maine.gov/future/sites/maine.gov.future/files/inline-files/GOPIF_STS_REPORT_092320.pdf

On page 10 of the report is stated:

"Much like Maine's air temperatures, the water temperatures of rivers, streams and lakes have been increasing over the last several decades. Because Maine's stream and lake temperatures have increased, winter ice thickness and duration have correspondingly decreased over time. Warming temperatures in rivers, streams, lakes and wetlands can alter which species thrive in those environments and eliminate cold-water adapted species.

"Surface temperatures of lakes in northern New England increased 1.4°F (0.8°C) per decade from 1984-2014 – faster than the worldwide average – with smaller lakes warming more rapidly than larger lakes. Maine lake surface temperatures have warmed on average by nearly 5.5°F (3°C)."

You'll note these measurements are between "1984-2014" which as a side note is the latter half of a historically warm period globally. To note as a result of this scientific fact the IPCC updated the Total Solar Irradiance dataset used in CMIP6 to be more present than the older dataset used in CMIP5 which was more warm due.

Returning to the measurements and models sighted in the report. They are performed locally to the New England region and the conclusions are based upon assumption the system is linear in its behavior over periods of time longer than the data the work is based upon.

On page 11 it is stated:

"The temperature of Gulf of Maine has exhibited considerable decadal variability, with a notable warm period in the mid-20th Century and a strong warming trend over the last 15 years, particularly in the late summer and fall. Recent warming has been punctuated by strong "marine heatwaves" in 2012 and 2016. Under all climate scenarios the climate (30-year average) of the Gulf of Maine will continue to warm through at least 2050."

This implied assumption of linearity of the system model is flawed. The system is discussed assuming to be contained within a local system in which the inputs are well understood and explicitly represented and the fairly local behavior in time is assumed to express the overall system behavior.

For more than two decades a cold water circulatory system, the Beaufort Gyre, has been acting in a way that is unusual from its pseudo-periodic "historical normal" behavior. It is estimated it's store and release of fresh, cold water in to the north Atlantic is ~ 7.9 years.

But at present the system has not released it's cold water for over three of these cycles.

So what is the impact of this continual storage of cold water? I propose it is highly probable it would result in the assumed unprecedented "rapid" and linear in nature warming of the ocean and air systems in the region.

More than one research team has shown that the Gyre is showing signs that it will release relatively soon, one such article being "First Observational Evidence of Beaufort Gyre Stabilization, Which Could be Precursor to Huge Freshwater Release":

<https://www.whoi.edu/press-room/news-release/first-observational-evidence-of-beaufort-gyre-stabilization-could-be-precursor-to-huge-freshwater-release/>

and "Recent state transition of the Arctic Ocean's Beaufort Gyre":

<https://www.nature.com/articles/s41561-023-01184-5>

and "Labrador Sea freshening linked to Beaufort Gyre freshwater release":

<https://www.nature.com/articles/s41467-021-21470-3>

Recent computer models estimate that when it does release this massive flow it will be directed along the coast of eastern Canada and Maine cooling all of the coast.

Additionally the result of the Gyre finally releasing could be that it will cause not only cooling in the region:

<https://www.washington.edu/news/2021/02/24/record-high-arctic-freshwater-will-flow-through-canadian-waters-affecting-marine-environment-and-atlantic-ocean-currents/>

... but this event could cause cooling in the ocean and atmosphere of the entire northern hemisphere.

"Tom Armitage, a polar scientist at NASA, stated that the release of excess freshwater into the Atlantic Ocean could potentially slow down its circulation, affecting the climate of the entire hemisphere and the western part of Europe in particular."

<https://www.universal-sci.com/headlines/2020/2/7/the-beaufort-gyre-ocean-current-is-becoming-more-turbulent-due-to-melting-arctic-ice>

We can look to a study "Glacial abrupt climate change as a multi-scale phenomenon resulting from monostable excitable dynamics" to understand how, as in many non-linear dynamical systems, small noise like variations in energy can cause changes in phase position stability and, as a result, show how, like melting glacier, the release of a large mass of cold, low-in-salinity water from the Beaufort Gyre could act as the impetus for such noise in the northern hemisphere system to change from cooling to warming or, in our near future case, warming to cooling in only decadal time spans.

<https://arxiv.org/pdf/2303.04063.pdf>

The researchers developed a model which:

"... comprises the mutual multi-scale interactions between four dynamical variables representing Arctic atmospheric temperatures, Nordic Seas' temperatures and sea ice cover, and the Atlantic Meridional Overturning Circulation (AMOC). Crucially, the model's atmosphere-ocean heat flux is moderated by the sea ice variable, which in turn is subject to large perturbations dynamically generated by fast evolving

intermittent noise. If supercritical, these perturbations trigger interstadial-like state space excursions seizing all four model variables."

This research was a successful attempt at describing:

"... temperature reconstructions from Greenland ice cores [which] reveal high northern latitude warming events of up to 16°C on decadal time scales, [and] associated impacts [which] extend across the globe. These so-called Dansgaard-Oeschger (DO) events are followed by phases of relatively mild temperatures termed interstadials, which exhibit gradual cooling over several hundred to a few thousand years prior to a final phase of abrupt temperature decrease back to cold stadials."

"The model proposed here dynamically generates DO events and convincingly reproduces the subsequent interstadial phase... From a physical modelling point of view, the results presented ... suggest that the DO events may have been caused by complex multi-scale interactions between several climate subsystems acting on separate time scales: the ocean circulation, the sea ice, the large-scale atmosphere, and intermittent atmospheric or oceanic events, ordered from slow to fast characteristic time scales."

I propose the additional sub-system, the Beaufort Gyre, could cause the state transition describes and that its current storage behavior could result in warming and its releasing of cold water will cause multi-regional cooling.

To be clear I do not propose this simply after reading articles online and finding models to raise your attention to science that counters your conclusions. I hold a Master's degree in Applied Mathematics with an emphasis in fluid dynamics and non-linear dynamical systems in real and complex analysis and have done systems development, communications research and development and mathematical modeling for over 25 years. Additionally I have been studying the modeling, recommendations and results of the CMIP models and related solar and climatic models.

What I have found to be most clear is that many of the scientists doing work are level headed and have written extensively that our current climate science is far from complete. For instance in 2017 the results stated in AR5 were summarized by the lead of the report after the report admitted the error terms in the work were extremely large that policy makers needed to not make unsubstantiated claims of "the end of the world" because it was eroding the confidence of the science in the general public. I agree that this is an important message to be learned.

CMIP6 has seen improvement on CMIP5. But recommendations have been made for inclusion of missing solar forcings in to CMIP7 as a result research over the last decade on the impact on solar behavior on the Earth's climate:

<https://gmd.copernicus.org/preprints/gmd-2023-100/>

<https://www.opastpublishers.com/open-access-articles/from-behavioral-climate-models-and-millennial-data-to-agw-reassessment.pdf>

If you are going to follow good practice in using scientific models in order to develop appropriate policies you must acknowledge the lack of these forcing vectors in CMIP6 and the review of the scientific material I present as an alternative to the view presented in your report.

I have accumulated a good amount of additional research discussing these and other related matters pertinent to our climate and environment. I hope you look at scientific research counter to your standing views before making decisions that will impact hundreds of thousands of Maine citizens.

Sincerely,

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