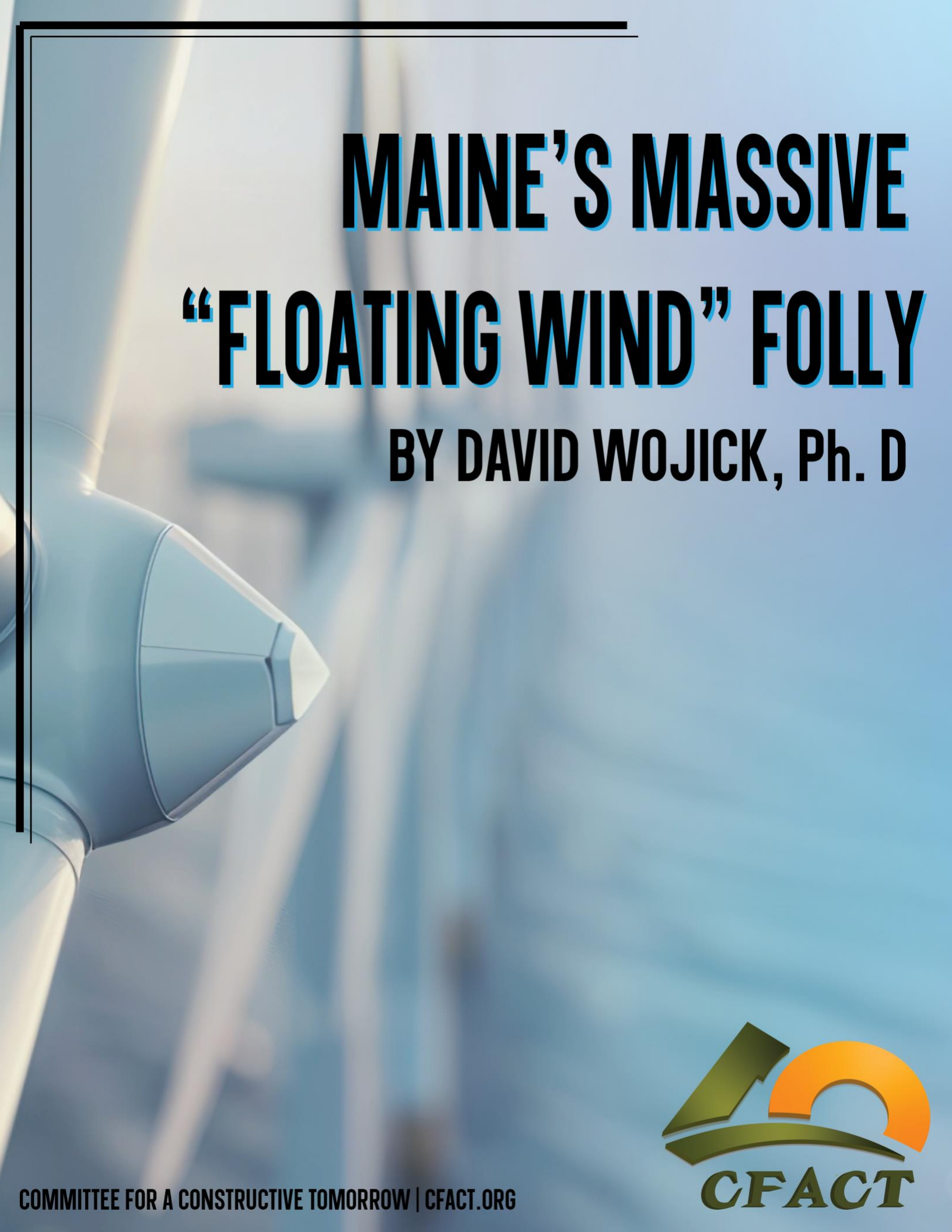

MAINE'S MASSIVE "FLOATING WIND" FOLLY

BY DAVID WOJICK, Ph. D

CFACT

EXECUTIVE SUMMARY

This report examines several fundamental aspects of the State of Maine's offshore wind development plan. It is divided into two parts. Part 1 examines certain economic issues, such as feasibility, cost, and progress to date. Part 2 explores the proposed development as it relates to the entire Gulf of Maine, namely because the project has not advanced to the point where the State of Maine's responsibilities have been defined.

The offshore wind plan calls for development of 3,000 MW of generating capacity, an amount that is roughly double Maine's average electricity usage. The viability of Maine's offshore wind plan depends entirely on the massive transformation of the state's grid from fossil fuel use to electrification. It is clear that the citizens of Maine have not been informed of this vast transformation requirement. They have certainly not approved it.

The offshore wind facilities will consist of great numbers of "floating turbines" operating at a scale and degree of reliability that hasn't been verified to work in the real world. Such an assumption makes the entire plan not only technologically speculative, but also enormously risky.

Extrapolating today's small scale facility cost would make the price tag for this project around $100 billion. That could rise significantly once large scale, hurricane-proof technology is developed and adopted, if it ever is. It is important the citizens of Maine be made aware of such great costs, as well as the far greater cost of the required electrification to place them into operation.

The state of Maine has initiated development of a facility to manufacture the floating wind turbines. This effort appears to depend entirely on getting a nearly half billion-dollar grant from the U.S. Department of Transportation. But this grant is likely illegal as the program is for funding highway projects, not offshore wind development. We will explore that in this report.

On the environmental impact side of the equation, the Bureau of Ocean Energy Management (BOEM) is in the process of leasing 15,000 MW of offshore wind development sites in the Gulf of Maine. The State of Maine's proposed 3,000 MW development would come from some of these sites.

BOEM's Environmental Assessment of this leasing program does not include the impact of building and operating the 15,000 MW of generating capacity. They say that impact will only be assessed for individual leaseholds. This approach is mistaken as the full life cycle impact needs to be assessed prior to leasing, including the combined impact of all the leases taken together. A cumulative impact assessment is vital because it might affect the viability and nature of the leases.

The crucial need for a "cumulative impact" is also especially needed to assess the project's impact on endangered whales, notably the endangered North Atlantic Right Whale. The Gulf of Maine is designated as critical habitat for Right Whales under the Endangered Species Act.

The Environmental Assessment does include the leasehold sonar surveys prior to construction. Recent analysis has determined such surveys are likely responsible for numerous whale deaths along the Atlantic Coast. It is therefore imperative the BOEM and NOAA carefully assess the potentially lethal impact of leasehold surveys on whales before any surveys are approved.

The above points are explained in the main report.

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PART 1. ECONOMIC ISSUES

I. MAINE'S BIG PLANS FOR "FLOATING" WIND

The government of Maine has big plans for floating wind. Since floating wind power is key to the state's efforts to achieve "net zero," it is worth taking a close look at the merits of this Green vision.

A. THE TECHNOLOGY DOES NOT EXIST

Floating wind is more akin to a fad than it is an established technology. While having been tested, it has yet to be built at utility scale or vetted by a hurricane. The world's largest floating wind system that is connected to a grid is only a tiny 50 MW facility that just came online off Scotland.

The cost of floating wind is necessarily much greater than fixed wind. A fixed wind tower sits on a simple monopile, while a floating tower is placed on a huge complex structure called a "floater." This size is enormous, consisting of massive 500-foot towers, 1,000-ton turbines, and 300-foot blades to catch the wind.

The floater needs to be very large to keep its enormous tower from tumbling over. And its size must additionally be expanded even greater to contain enough air to keep the structure buoyant. Finally, it also requires anchoring to the ocean floor with many different mooring lines, in water a half mile or deeper. That this can all be done in a technologically sound manner, as well as at an affordable price, is far from clear.

The small floating generator systems which presently exist cost around three times what fixed wind costs per MW. If these are buttressed to become “hurricane proof” generators, they will assuredly cost more. Over a hundred designs have been proposed, which reveals just how immature floating wind technology is at present.

B. MAINE'S GREEN DREAM

This brings us to Maine's floating wind proposal specifically, a costly plan that will likely end in failure. With respect to electricity use, Maine is a relatively small state with average generation of approximately 1,500 MW. Given this reality, it is difficult to image why the state passed a law pledging to buy 3,000 MW of floating wind in the first place.

How do officials justify buying so much floating wind? Simple, it is based on a “political,” not an economic, objective – namely, to push Maine into becoming a “net zero” state. The Governor’s Energy Office (GEO) produced a *115-page "Maine Offshore Wind Roadmap*" explaining this in more detail.

To be sure, the plan is a radical one. It starts with shuttering all existing combustion generators, which mostly burn either gas or wood. Maine is 90% forest, so there is a lot of wood. Then it calls for electrifying all the other forms of combustion. For example, 60% of homes heat with fuel oil, so they will be required to switch to electric heat pumps or something similar. Of course, all the state’s cars and trucks are targeted to become all electric as well.

The problem is there is no indication the people of Maine realize the floating wind project is part and parcel of a broader attempt to move them to an “all electric” lifestyle. It is rarely if ever mentioned in any press coverage or government press releases. This burdensome requirement is only found buried in a 115-page so-called “Roadmap,” and there is no cost estimate given for this essential energy transformation.

C. THE COST IS ENORMOUS

The projected cost of the 3,000 MW of floating wind is outrageously expensive. Using the reported three times fixed wind figure mentioned above, ratepayers should expect to cough up a rough

estimate of $50 billion for construction, an equal amount for financing and profit, or a total cost around $100 billion. This is staggering in and of itself, but it's just for starters.

Costs could escalate significantly once large scale, hurricane-proof technology is developed and adopted, a scenario which seems likely. And then there is the much larger cost of going "Net Zero" which should be factored in – because without it the floating wind is simply not viable.

Amazingly, the astronomical cost of the floating wind project is never publicly mentioned. Not in the law, the press, or the roadmap and its various technical support documents. The "creation of new jobs" is frequently mentioned, but not its costs. Of course, even the category of "new jobs" could be viewed as a "cost," not a "benefit," to ratepayers.

D. THE PROJECT HAS STARTED

Because of its costs and technological challenges, floating wind development may never occur. But the State of Maine seems happy to roll the dice and see what happens. Indeed, the state has started the process of building a huge new port specifically to handle its floating wind fantasy.

With fixed offshore wind, a waterfront facility is merely a marshaling yard where the turbine parts are held until barged out to the offshore site for assembly. There are just four big pieces: the monopile, tower, turbine and blade set.

Floating wind is completely different. This is because the huge floater is built at the port. The tower, turbines, and blade set are mounted on a floater in the port as well. When completed, the whole assembly is towed to the site and anchored to the sea floor using three or more mooring lines.

In some respects, a floating wind onshore facility is more akin to a highly specialized shipyard "floater factory", not a true port. To operate, it will have to contain one or more dry docks to build the huge floaters, plus a great deal of specialized equipment, especially cranes. Reportedly, steel floaters for a 15 MW turbine could weigh 3500 to 4500 tons, while concrete floaters would be in the range of 17,000 to 22,000 tons.

The actual configuration of the factory is completely unknown until the floater design is finalized. Also of note is that a shipyard might only be in operation for the few years it takes to build 3,000 MW worth of floating wind generators.

The estimated cost of Maine's shipyard/port for floating wind is slightly under a billion dollars, but it could easily be more depending on the complexity of its final design. The cost of a unique new system tends to climb when the engineering is actually undertaken.

Starting a billion-dollar port project at this time is reckless. It is highly probable that the required energy transition will not occur, as it is failing in many parts of the country. The electricity the turbines produce will be very expensive, with estimates likely four to five times present costs. The technology is untested, and even its developers have offered no clear idea what it will look like or how it will perform. This is even assuming it can be made to work in the tempestuous waters off Maine.

The people of Maine are unlikely to accept such onerous costs and conditions, nor should they be required to. The whole project needs to be reconsidered.

II. THE TITANIC SCALE OF FLOATING WIND QUANTIFIED

Floating wind generators are much greater in size than fixed offshore wind turbine assemblies because there is a big float attached. This makes floating wind far more expensive than fixed wind which is already far more expensive than reliable fuel fired electric power.

Simple physics reveals that placing a 1,000-ton generator on top of a 500-foot tower with three 300-foot wings attached to a boat is inherently unstable. Even more problematic, building it to stand upright in hurricane force winds means it will have to be a very big boat.

Philip Lewis, from strategic analyst *Intelatus*, has put some numbers on this matter in "Offshore Engineer."

- *Addressing the Challenges of Developing Floating Wind at Scale*, by Phillip Lewis
- *Preparing for Floating Wind Leveraging the Oil Gas Supply Chain*, by Phillip Lewis

Of course, these are just estimates based on proposed designs, not true measurements. Also keep in mind that no one, anywhere, has ever built one of these titanic contraptions. Governments around the world are oddly comfortable setting huge aggressive near-term targets for a technology that does not exist. Floating wind is a political fad, not an engineering reality.

Based on UK permit applications, a colossal individual floater has a footprint of around 160,000 square feet – roughly three football fields. Regarding weight, Lewis suggests up to 4,500 tons of steel

or 22,000 tons of concrete per float. Keep in mind, 4,500 tons of steel floater will not keep 1,000 tons on a tall pole upright. These designs are what are called "semi-submersible." This means the titanic float is something like half full of water. There is enough air to float it, but also a lot of water to hopefully weigh it down. I have yet to review the math supporting all this, but I have my doubts about its viability with what is reported.

Not unexpectedly, such huge floaters make floating wind power extremely expensive. As mentioned previously, a best guess is at least three times as much as the already hefty costs associated with fixed bottom offshore wind power. It could be a lot more.

These enormous numbers are based on 15 MW turbines, which are the biggest built today. But bigger are coming, with designs for 18 MW turbines on order and even 20 MW turbines being advertised. Floater size and weight scale exponentially with turbine weight and height, so the above-mentioned numbers, huge though they are, may actually turn out to be understated.

As an engineer, I would build a few of these monster floating assemblies and run them through a few hurricanes to see how they did, especially to test whether or not they survive. But the federal government is doing no such thing.

Indeed, the Bureau of Ocean Energy Management is selling 15,000 MW of floating wind leases in the Gulf of Maine. California just announced a 25,000 MW floating wind target with 5,000 MW already leased by BOEM.

Reviewing the numbers, to generate 40,000 MW of electricity would require just under 3,000 monster-sized 15 MW floaters. In addition to filling up a lot of surface ocean, each floating platform has to be anchored to the sea floor with at least three mooring cables, more likely eight. In addition, each platform has a live wire cable transmitting its energy output.

Lewis says the depths involved to anchor them are formidable: "*In the U.S., the first commercial scale projects will be off California (500-1,300 meters). Future activity is planned off Oregon (550-1,500 meters), the Gulf of Maine (190-300 meters) and the Central Atlantic (over 2,000 meters).*" A mile is roughly 1,600 meters.

So, we have many millions of feet of mooring cables and hot wires filling the ocean between the floaters and the sea floor. This is a whole new form of potential marine life harassment that needs to be authorized under the Marine Mammal Protection Act.

III. HIGHWAY FUNDS ILLEGALLY USED FOR MAINE'S FLOATING WIND FACTORY

The administration appears to be illegally redirecting hundreds of millions of dollars in highway grant money to fund construction of floating wind manufacturing facilities.

The funding mechanism is the INFRA Grant Program in the U.S. Transportation Department. To begin with here is how the website describes the Program:

> *"What is the INFRA program?*
>
> *INFRA (the Nationally Significant Multimodal Freight & Highway Projects program) awards competitive grants for multimodal freight and highway projects of national or regional significance to improve the safety, efficiency, and reliability of the movement of freight and people in and across rural and urban areas."*
>
> *Projects typically range from as little as $8 million up to $200 million. Here is a list of eligible projects, a list that is quite clear and simple:*
>
> *"Eligible projects:*
>
> *A highway freight project on the National Highway Freight Network*
>
> *A highway or bridge project on the National Highway System*
>
> *A freight intermodal, freight rail, or freight project within the boundaries of a public or private freight rail, water (including ports), or intermodal facility and that is a surface transportation infrastructure project necessary to facilitate direct intermodal interchange, transfer, or access into or out of the facility*
>
> *A highway-railway grade crossing or grade separation project*
>
> *A wildlife crossing project*
>
> *A surface transportation project within the boundaries or functionally connected to an international border crossing that improves a facility owned by Fed/State/local government and increases throughput efficiency*
>
> *A project for a marine highway corridor that is functionally connected to the NHFN and is likely to reduce road mobile source emissions*
>
> *A highway, bridge, or freight project on the National Multimodal Freight Network"*

Amazingly, INFRA recently awarded a whopping $426,719,810 for the Humboldt Bay Offshore Wind MVP (Minimum Viable Port) in Northern California. This is not a port in the transportation sense – a place where freight and people get on and off ships. It is where energy companies are going to build a bunch of floating wind turbines, which are then towed out to sea and anchored in a big federal offshore wind lease area. In short, what is being subsidized is a big boatyard, a place where they make boats, or in this case, colossal floats.

A boatyard is clearly not eligible for INFRA funding given the above list. Even clearer is this eligibility statement from the website:

> *"To be eligible under INFRA, a project within the boundaries of a freight rail, water (including ports), or intermodal facility must be a surface transportation infrastructure project necessary to facilitate direct intermodal interchange, transfer, or access into or out of the facility and must significantly improve freight movement on the NHFN."*

NHFN is the National Highway Freight Network, a network with which the Humboldt Bay production facility has nothing to do. It certainly is not going to "significantly improve freight movement on the NHFN" which is the big INFRA grant requirement. In fact, bringing in the hundreds of thousands of tons of steel or concrete needed to make the floaters for the giant turbines is likely to *increase* freight congestion!

Surely it is illegal for a federal agency to take money that Congress has allocated for a specific program like INFRA and spend it on something else. And it seems clear that is what is happening here.

Maine' Department of Transportation has an application in for an even bigger $456,000,000 grant to build the Sears Island floating wind production site. Maine's is dubbed the Dirigo Atlantic Floating Offshore Wind Port, even though it too is not a port in a transportation sense. Dirigo is a boatyard, a place where they make boats – in this case, giant turbine floaters. (*Dirigo* is Latin for "I lead" and is Maine's state motto.)

In sum, the push for floating offshore wind energy is likely illegally diverting money, nearly a billion dollars of it, from INFRA. That means a lot of worthwhile highway projects do not get funded. Moreover, there are more floating wind production facilities in the planning stages to go with the numerous deep-water leases in the works.

An investigation should be undertaken to take a hard look at INFRA offshore production facility grants and stop them if they are in fact illegal. If the administration wants to throw billions at offshore wind production, then Congress must first provide the funds. That is how the American system works.

PART 2. ENVIRONMENTAL IMPACT ISSUES

IV. FEDS SAY, "DAMN THE WHALES!" IN THE GULF OF MAINE

The Bureau of Ocean Energy Management (BOEM) proposes to build a huge amount of floating offshore wind in the Gulf of Maine. As required by law it has published for public comment a draft Environmental Assessment of the area designated for this enormous project. But amazingly there is no assessment of the project itself, just of the area without the project.

This location is properly called the Wind Energy Area (WEA) because that is where the wind energy will be harnessed. BOEM plans to issue eight leases initially, with a development potential of 15,000 MW. Given that 15 MW is the biggest turbine currently available, that amounts to 1,000 or more huge turbines. A second phase might add another thousand or more.

Maine's goal of 3,000 MW is included in this initial offering. Clearly the result could be much larger, although some of this output will likely go to Massachusetts and New Hampshire, which also border the Gulf of Maine.

The potential adverse impact of this offshore wind project on whales is enormous. In fact, the Gulf of Maine is designated as critical habitat under the Endangered Species Act for the desperately endangered North Atlantic Right Whale. Clearly the situation calls for caution.

The draft Environmental Assessment simply ignores this enormous threat to Right Whales. In fact, BOEM says any potentially horrendous impacts will only be considered on a lease-by-lease basis -- and then only when specific development plans have been submitted. So, for now, it is, "Damn the whales, full speed ahead."

Here is BOEM's incredible statement, a single sentence: "The analysis did not consider construction and operation of any commercial wind power facilities within the Gulf of Maine WEA, the latter of which would be evaluated as part of a separate National Environmental Policy Act (NEPA) process if a lessee submits a Construction and Operations Plan (COP)."

V. ENVIRONMENTAL IMPACT ASSESSMENT MUST COME BEFORE LEASING

It seems not to have occurred to BOEM that a careful impact assessment under NEPA is essential before any leases are offered. A proper assessment might conclude that some of these leases should not be let. Or it might call for restrictions on development of some leases. These leases are likely to sell altogether for several billion dollars and the buyers can expect to get their money's worth. It will be too late to impose major restrictions.

Moreover, there should be a cumulative impact assessment of the entire multi-lease project according to the Endangered Species Act. Given the critical habitat designation for Right Whales, this project may not be legal, and that determination must be made before the leases are let. The key concept in NEPA assessment is that impacts are "reasonably likely" -- and with respect to the 15,000 MW platforms, they are certainly that. This assessment must come before the agency decision which means letting the leases.

The details of construction are unlikely to change the impact assessment very much. While there are many competing floating wind designs, they are all basically the same. A turbine tower sits on a floater that is anchored to the sea floor by mooring lines. The shape and construction of the floaters is the primary variable and that is minor compared to the adverse impact of a thousand of them.

In short, BOEM has the decision logic backwards. Careful adverse impact assessment under NEPA and species protection plans under the Endangered Species Act must precede and guide the activity of leasing sites for floating wind development. The draft Gulf of Maine WEA Environmental Assessment and numerous related documents can be found online.

VI. OFFSHORE WIND SERIAL WHALE DEATHS CONFIRMED BY STATISTICAL ANALYSIS

Systematic statistical analysis finds that offshore wind development has been killing lots of whales since it began around 2016. This long-standing conjecture that wind kills whales has now been clearly confirmed. Assessment of the proposed massive Gulf of Maine development must now be done using this new information.

Call it forensic statistical epidemiology. The epidemic is the huge number of Northwest Atlantic whale deaths, which were first officially observed by NOAA in 2016-17 and have continued to this day. It is forensic because killing whales can be highly illegal.

This math feat was performed by Apostolos Gerasoulis, a Rutgers professor emeritus of computer science. This is a computer math problem, not a biological one, so he is exceptionally qualified.

Professor Gerasoulis has confirmed with profound statistical evidence the widespread conjecture that offshore wind sonar surveys have been killing whales. There is now no reasonable doubt that the extensive sonar harassment authorized by NOAA since 2016 has caused the massive increase in whale deaths that NOAA first flagged in 2016-17.

A lengthy article by Donna Anderson provides some of that compelling evidence.

Given that I and others have been complaining to NOAA about this for two years, it is not a stunning discovery to us, just tragic proof that we were right. For example:

How to kill whales with offshore wind, by David Wojick

Evidence says offshore wind development is killing lots of whales, by David Wojick

I have repeatedly pointed out that the overall Humpback Whale death rate doubled when sonar blasting began. Gerasoulis finds that in the region where the surveying was most active, the death rate jumped to an astonishing five times greater.

It took a computer guru to do this pioneering work because it is a complex computation problem. He geographically logged all of the deaths and all of the sonar blasting routes over time, then looked at the correlations, which are profound. It is statistically impossible that these correlations between sonar blasting and dead whales are just a coincidence.

Note that the sonar blasting does not kill the whales outright. It is predicted by NOAA that sonar can change a whale's behavior in such a manner as to increase its likelihood of getting struck by a ship. If the decibels are loud enough, it is actually anticipated by NOAA that some whales will be deafened.

Here is a telling analogy. A firecracker thrown at a dog causes it to run into the street and be struck by a car. The car killed the dog, but the firecracker caused the death. In science this is called the first cause (firecracker) versus the final cause (car strike) of the dog's death. Sonar blasting, for whales, is like an endless string of firecrackers going off, lasting for hours or even days.

The press has consistently ignored the warnings, never reporting the potentially adverse effects of "harassment," as it is officially called. That widespread acoustic harassment is actually *predicted* and *authorized* by NOAA is never even mentioned. Even worse, NOAA never mentions it in their online material on the whale death crisis, despite it being pointed out to them repeatedly.

VII. THE DEADLY IMPACT OF SONAR SURVEYS IN THE GULF OF MAINE MUST NOW BE ASSESSED

Now that we know that authorized sonar survey harassment causes widespread death, something must be done to stop the carnage. If NOAA continues to authorize deadly harassment, and the wind developers continue doing it, then each whale death is a willful violation of the Marine Mammal Protection Act. Gerasoulis's statistical model may even tell us when this happens.

BOEM's Environmental Assessment of its proposed massive development in the Gulf of Maine includes the expected sonar site surveying for each lease. The Gerasoulis statistical method should be used to project the deadly impact of this surveying on protected marine mammals before any leases are let. This includes Maine's desired 3,000 MW.

It is entirely possible that the projected deadly impact precludes the proposed leasing altogether.

PART 3. FINDINGS AND CONCLUSIONS

The economic impacts of this reports central findings and conclusions are these:

1. Maine's offshore wind plan calls for development of 3,000 MW of generating capacity, roughly double Maine's average electricity usage. The viability of Maine's offshore wind plan depends entirely on a massive transformation of the entire state from fossil fuel use to electrification. This is enormously costly, and it is unlikely the citizens of Maine have been informed of how this vast transformation requirement will impact them.

2. The offshore wind facilities will consist entirely of great numbers of floating turbines operating at a scale and degree of reliability that does not presently exist. This assumption may not be feasible, thus rendering the entire plan technologically speculative.

3. Extrapolating today's small scale facility cost enables us to tabulate a total cost estimate for the plan of around $100 billion. And it will likely be considerably more once large scale, hurricane-proof technology is developed.

4. The state of Maine has initiated development of a facility to manufacture the floating wind turbines. This effort appears to depend entirely on getting a nearly half billion-dollar grant from the U.S. Department of Transportation. However, spending this grant to pay for such construction is legally questionable, as the program is for funding highway projects, not offshore wind projects.

Regarding environmental impacts, our central findings and conclusions are these:

1. The Bureau of Ocean Energy Management (BOEM) is in the process of leasing 15,000 MW of offshore wind development sites in the Gulf of Maine. The State of Maine's 3,000 MW development plan would be drawn from some of these sites.

2. BOEM's Environmental Assessment of this leasing program does not include the impact of building and operating this 15,000 MW of generating capacity. Officials say that impact will be assessed for individual leaseholds.

3. This approach is mistaken as full life cycle impact must be assessed *prior to leasing* because it might affect the viability or nature of the leases. This is especially true for endangered whales, including the desperately endangered North Atlantic Right Whale, for which the Gulf of Maine is designated as critical habitat under the Endangered Species Act.

4. The Environmental Assessment does include the leasehold sonar surveys prior to construction. Recent analysis has determined that such surveys are responsible for numerous whale deaths along the Atlantic Coast.

5. It is therefore imperative the BOEM and NOAA carefully assess the potentially lethal impact of leasehold surveys on whales before any surveys are approved.

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