New Hampshire Site Evaluation Committee
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Re: Chariot Solar Project Docket No. 2021-04

ATTN: Daniel C. Goldner, Chairman, Site Evaluation Committee and Commissioner, Public Utilities Commission.

Please accept the following preliminary comments regarding the Chariot Solar Project.

Qualifications:

I reside in Wendell, Massachusetts where I am involved in a number of activities regarding forest protection and climate change.

I have a Bachelor of Arts and a Masters Degree in Biology from the University of California at Riverside and a Doctorate in Biology from the Department of Organismic and Evolutionary Biology at Harvard University. I conducted post-doctoral work at the University of Utah on the evolutionary biology of sex and the origins of sociality.

My scientific work has been focused in two main areas. The first of these is the systematics, behavior, and ecology of Aculeate Hymenoptera, a major group of insects characterized by a highly modified ovipositor (egg-laying organ) that functions as a sting capable of injecting venom to subdue prey or ward off predators. This group includes ants, bees, and many kinds of wasps. My ongoing work with such a large and diverse group of insects and their interactions with other organisms has provided a rich and detailed acquaintance with the living diversity of New England. The other area of my scientific work concerns sex-ratio evolution and related problems in evolutionary biology. Much of this work has been of a theoretical and mathematical nature giving me a working understanding of dynamical models in population genetics and ecology that are closely related to current modeling efforts in connection with the intertwined emergencies of climate disruption and biodiversity loss.

I am currently retired and spend my professional time applying my scientific training and expertise to increase public understanding of the essential role that natural ecosystems play in maintaining human existence. I am involved with a number of volunteer groups, including Forest Facts, Wendell State Forest Alliance and the Massachusetts Sierra Club Forest Protection Team. I am also part of a subcommittee that drafted new bylaws for the Town of Wendell relating to solar energy and energy storage projects, which have now been adopted by the town. I have devoted much time and effort to the study of how forests and wetlands can help address the climate crisis in New England.

I have witnessed first hand the challenges facing municipalities that attempt to limit the loss of forests and wetlands by ground-mounted solar energy installations that are subsidized by the Commonwealth's SMART solar program in Massachusetts.

Preliminary comments for your consideration.

This project has not yet been submitted to the Site Evaluation Committee. A pre-application public information session was held on October 18, 2021. On May 24, 2022, the developer notified the Committee of a delay in submitting its application. By offering these comments at this time, I hope to further the Committee's statutory mandate to provide "full and timely consideration of environmental consequences" while avoiding "undue delay" as stated in the enabling legislation Section 162-H:1Declaration of Purpose. My remarks touch upon the following areas of concern recognized therein: "the environment of the state, ... air and water quality, the use of natural resources, and public health and safety."

Description of Project:

Based on the public information session noted above and news reports (Audette, 2021: Bolan, 2021), a 50 Megawatt solar array located in Hinsdale, New Hampshire, is to be proposed. The project would be comprised of nine separate arrays totaling about 265 acres with 140,000 panels to be constructed in a large swath of land divided by Lipscomb Brook, which flows into the Connecticut River. Most of the land is currently managed for production of wood products. The project area includes two hay fields already cleared of trees together with 245 acres of currently forested land where all trees would be removed. Each of the nine proposed arrays would be surrounded by fencing with a six-inch gap underneath to allow free movement by small animals. Larger animals would be completely excluded from the fenced arrays.

The project has an expected lifetime of 20 years, after which the area would either be recommissioned or allowed to revert to its previous use. It is clear, however, that it would take many decades for the existing forest to return to its current state.

The arrays are to be arranged around wetlands, streams and vernal pools with only minimal buffer zones. The area along Lipscomb Brook is classified by the state as Highest Ranked Habitat in New Hampshire. The bulk of the project would be located on land classified as Highest Ranked Habitat in the Biological Region or associated Supporting Landscape (See https://www.wildlife.state.nh.us/maps/wap/hinsdale8x11scoring.pdf). A list of sensitive species that may be impacted provided by the New Hampshire Fish and Game Department is available under Hinsdale here: https://www.wildlife.state.nh.us/maps/wap.html .

The project area currently provides significant wildlife habitat supporting neighboring protected areas. The project is located in close proximity to both Pisgah State Park (13,300 acres) and Mount Wantastiquet State Forest (520 acres). The boundary of Pisgah State Park is directly across the road from the project. The high-quality habitat along and near Lipscomb Brook

provides a critically important wildlife corridor connecting these areas with much larger protected in the northern portion of Hinsdale.

The electricity generated by the Chariot Solar Project is to be sold to multiple towns in Massachusetts that participate in a state-sanctioned aggregate buying program to purchase electricity at a lower rate than New Hampshire residents pay (Audette, 2021). These towns have been aggregated by NextEra, the developer of the Chariot Solar Project, with selling points that include assuring the towns that this is "green" energy, without mention of any negative impacts that would likely affect the environment of Hinsdale, New Hampshire. Please see: https://www.nexteraenergyservices.com/aggregations/massachusetts/massachusetts-community-choice-aggregation

The Dual Emergencies of Climate Disruption and Biodiversity Loss

*We face multiple planetary emergencies of unprecedented scale, including the intertwined threats of climate disruption and biodiversity loss (*Rockström *et al. 2009;* Steffen *et al. 2015). The climate crisis is caused by the build up of greenhouse gases (GHGs) in the atmosphere, mostly CO2 from the burning of fossil fuels. Now at levels never previously experienced by humans, GHGs are having profound effects on global climate. At the same time, the world faces alarming rates of biodiversity loss with disturbing consequences for the ecological services necessary for our continued survival.*

Forests and other natural systems capture and store vast amounts of carbon, and they play an equally vital role in maintaining the complex web of life upon which human survival depends. The protection of forests and wetlands is of critical importance in preventing biodiversity loss and the risk of ecological collapse. Forests contain an enormous fraction of terrestrial diversity and their continued vitality is critical to maintaining ecological integrity.

Deforestation for whatever reason results in the loss of forest benefits. Climate mitigation and biodiversity protection are of critical importance, but forests provide many other benefits as well, including water filtration, flood mitigation, evaporative cooling, outdoor recreation, nature study, tourism, enhanced physical and mental health, and spiritual replenishment. These benefits should be readily available to all residents of New Hampshire, and their protection for current and future generations is a major contribution to public welfare.

Climate Disruption

The latest report from the Intergovernmental Panel on Climate Change (IPCC) released in 2021 raised the alarm over the accelerating climate emergency to the highest level yet. Without exaggeration, UN Secretary General António Guterres referred to the report as "code red for humanity."

According to the IPCC, a global average temperature rise of more than a dangerous 1.5°C is already certain, whatever we do. Under all scenarios, the planet will likely cross this limit within the next decade or two. The only reasonable hope for a livable future is to act now to eliminate emissions of CO2 from burning fossil fuels and to remove vast quantities from the atmosphere. If both of these things are done, the IPCC consensus is that it would still be possible to pull globalsign temperature back to a relatively safe level after exceeding 1.5°C for a brief period.

A variety of technologies for carbon capture and storage are under development, but they are all in their infancy, and the prospect of deploying them on a planetary scale is highly problematic and enormously costly. The only available means for achieving the removal of CO2 from the atmosphere at anywhere near the scale required is to enhance accumulation of carbon in natural ecosystems, especially forests and wetlands. If protected from human intervention, forests here in New England could capture and store more than twice as much carbon as they do now, and continue to do so far into the future (Nunery and Keeton 2010, Keeton *et al*. 2011, Leverett *et al.* 2021).

The IPCC (2019) reports that natural sinks alone are likely not sufficient to stabilize the climate and that new technology will also be needed. What is clear is that failure to protect natural sinks will guarantee a more dangerous future. This requires that we keep forests as forests and minimize the harm we inflict on them.

It is estimated that covering a mere 0.3% of the Earth's land surface with solar arrays using existing technology could supply all the energy that humans now use (Bond *et al.* 2021). Given its location and variable weather, New Hampshire may need several times that much in order to be self-sufficient but still only a small fraction of total land area needs to be covered in panels. .

New Hampshire does not have to give up its forested or agricultural land in order to generate electricity to be sold to Massachusetts for it to reach its climate goal of net zero by 2050. Massachusetts can meet most of its energy needs by putting solar energy systems on parking lots, south-facing roofs and walls, as well as land already degraded by landfills or industrial pollution, and not export its land-use problems to New Hampshire.

Some assert that replacing forests with solar arrays is a net positive for the climate because solar arrays decrease CO2 emissions through the reduced use of fossil fuels by an amount that is larger than the amount that would have been removed from the atmosphere if the forest had been allowed to continue growing. This is misleading in at least two important respects. First, any advantage of reduced emissions evaporates unless each additional increment of solar power is matched by actual reduction of power generated by burning fossil fuels. Merely growing the supply of electricity does nothing to reduce emissions. Second, and more importantly, greenhouse gas emission reduction and CO2 removal are both essential, and one cannot be substituted for the other without compromising our ability to achieve net-zero emissions.

A reasonable and prudent energy policy requires that we invest our limited funds and effort in reducing greenhouse gas emissions as much and as fast as we can, while we expand and protect natural carbon sinks such as forests and wetlands at the same time.

Biodiversity Loss

Forests and other natural ecosystems are also central to the global crisis of biodiversity loss. Extinction rates from human activities are increasing and already far exceed those of the recent geological past. Protecting ecosystems from further degradation is of critical importance for a fully functioning biosphere and our own survival.

Forests are the terrestrial equivalent of coral reefs in terms of the biodiversity they support. It is often suggested that some 80% of terrestrial species are dependent on forests for their ongoing survival. There is no doubt that a great percentage of terrestrial species depend on forests. It is often suggested that some 80% of terrestrial species are dependent on forests for their ongoing survival, but such a specific figure suggests a measure of accuracy that exceeds current knowledge. A few examples are sufficient to show the critical importance of forests as bastions of biodiversity. Some 5000 amphibian species (80% of all known species), 7500 bird species (75%), and 3700 mammal species (68%) all depend on forest habitat around the globe (Vié, Hilton-Taylor, and Stuart 2009). Similar estimates could be cited for organisms spanning the tree of life; if they live on land, they probably live in a forest.

Anthropogenic extinction and the attending threat of ecological collapse constitute a planetary crisis with impacts on human well-being even worse than the threat of climate disruption (Rockström et al. 2009; Steffen et al. 2015). Extinction rates are now comparable to those of the five mass extinction events of the geological past. This alarming situation is often referred to as the Sixth Extinction (e.g. Leakey and Lewin 1995 and Kolbert 2014). It has been estimated that current extinction rates are some 1000 times the background rate and increasing (Pimm et al. 2014). Barnosky et al. (2011) noted difficulties with comparing current extinction rates with those in the geological past, but, nonetheless, concluded (p. 56) that “there are clear indications that losing species now in the ‘critically endangered’ category would propel the world to a state of mass extinction that has previously been seen only five times in about 540 million years.” The UN panel on biodiversity and ecosystem services (IPBES 2019) reported that a million species are at risk of imminent extinction.

Terrestrial vertebrates are especially well-studied and provide a clear indication of the extinction crisis we face (Ceballos et al. 2015, Ceballos, Ehrlich, and Dirzo 2017, Ceballos, Ehrlich, Raven 2020). Extinction rates of terrestrial vertebrates are appallingly high, and patterns of invertebrate extinction are “equally dire” (Dirzo et al. 2014). Declines in abundance typically precede extinction, and it is therefore concerning that North America has experienced a net loss of nearly 3 billion birds since 1970, a 29% decline (Rosenberg et al. 2019). It is sobering to note that the total global biomass of humans and their livestock now dwarfs that of all amphibians, reptiles, birds, and mammals combined (Bar-On, Phillips, and Milo 2018).

Insects comprise a large fraction of terrestrial diversity and play essential roles in all terrestrial ecosystems. It is therefore noteworthy that long-term sampling of insect populations has often revealed dramatic declines, especially in agricultural areas, so much so that we hear of an Insect Apocalypse (for accessible summaries, see Goulson 2021 and Milman, 2022). Although many insect species are thriving and some actually benefit from climate change, the overall trends are downward and alarming (Wagner 2020; Wagner *et al.* 2021).

There is little appreciation of just how little we know about the living world. A widely cited attempt to estimate the number of species on Earth came up with a total of 8.7 (±1.3) million species, of which 2.2 (±0.2) are marine (Mora *et al*. 2011 and commentary by May 2011). These authors estimated that about 1.2 million species have been described, suggesting that some 86% of existing species on Earth still await description. Striking as this is, assigning names is only the barest beginning of what we need to know
in order to understand the ecological interactions among the millions of species with which we share the Earth. The most important thing we can do to stem the tide of extinction and guarantee ecological integrity for future generations is to act now to reduce human impacts on natural ecosystems.

As noted in the press release for the joint report from IPBES and the IPCC (2021), "Any measures that focus too narrowly on climate change mitigation should be evaluated in terms of their overall benefits and risks, such as some renewable energies generating surges of mining activity or consuming large amounts of land."

Climate Goals and the Role of Forests and Wetlands

Irrefutable scientific evidence of an evermore dangerous and costly climate emergency demands immediate action to maintain a livable future. This means we must both greatly reduce greenhouse gas emissions and remove vast quantities of CO2 from the atmosphere. The only available means for removing CO2 at anywhere near the required scale is to enhance carbon accumulation in natural ecosystems, especially forests and wetlands. This requires that we protect these critical ecosystems and minimize the harm inflicted upon them by human actions. Given its statutory mandate to provide "full and timely consideration of environmental consequences," the Site Evaluation Committee must address the loss of both biodiversity and critical climate mitigation services as an essential part of its comprehensive evaluation process.

The complete removal of forest cover to install ground-mounted solar arrays on an industrial scale is a large and growing threat to the ecological integrity of New England. In its *Losing Ground 2021 Report*, Mass Audubon reported that between June 2012 and June 2017 large-scale, ground-mounted solar installations accounted for about 6000 out of a total of 24,700 acres of natural land lost to development based on a statewide land-use data set compiled by Boston University. Most of this solar energy development was on previously forested land that Massachusetts needs for carbon accumulation and biodiversity protection. This is a growing problem throughout New England and constitutes a grave threat to our natural landscape. The

fundamental importance of protecting natural systems is not adequately recognized in Massachusetts regulatory programs on industrial solar siting. While Massachusetts grapples with this issue, the problems of large-scale solar installations should not be exported to the State of New Hampshire.

Deforestation for large-scale solar development is unnecessary. There is plenty of sunlight for all of us if we use our collective wisdom to site solar energy installations where they best serve the welfare of all people and not just a few profiteers.

New Hampshire must use its powers to protect natural ecosystems, and especially forests and wetlands, so they can continue to accumulate carbon and provide other ecological services essential for a habitable world. This is a matter of grave concern at this time when governing bodies at state, national, and international levels continue to falter in their efforts to ensure a livable future for humanity. Indeed, the protection of ecosystems and the organisms they contain is the most effective and least expensive means now available to mitigate the dual emergencies of climate disruption and biodiversity loss (Moomaw *et al*. 2019). Ensuring such protection should be a central goal of land-use policy in New Hampshire and around the world.

J. William Stubblefield, PhD
June 9, 2022

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