Footprint to Wings

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Prepared Comment on the New Jersey Energy Master Plan

EMP Hearing September 7, 2018

Thanks for the opportunity!

Thank you to Governor Murphy, the New Jersey Board of Public Utilities ("BPU"), Commissioners, and fellow citizens for the opportunity to comment on the Energy Master Plan ("EMP"). Thank you to the Governor for leadership in issuing Executive Order 28 calling for the BPU to write a new EMP to...

> ...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 ... further provide specific proposals to be implemented over the next ten (10) years in order to achieve the January 1, 2050 goal.

About us:

I am Rezwan Razani, founder of Footprint to Wings Inc, a 501c3 nonprofit organization based in New Jersey that is launching, coaching and tracking the race to be the first net zero carbon state in America. Per recent ranking by EIA[1], New Jersey is in 13th place in the race, emitting 12+ metric tons (MT) of carbon per person. New York is in first place with about 8 MT. The national average is about 16 MT. Our goal is to coach all states to zero carbon, but we do hope our home state of New Jersey gets there first! More at fp2w.org.

Comments and Recommendations

Shifting Goalposts

We are delighted to see the progress that has been made since we last commented on the EMP in August of 2015. Back then, we were told our goal of "Net Zero Carbon" ("100% clean") was an outlier, that the state target was 80% at most. That said, it's time to shift the goalpost again:

- Move the goal line forward to 100% by 2040. In light of the most recent IPCC report[2], we have less time than we thought.

[1] http://www.eia.gov/environment/emissions/state/analysis/images/figure_5-lg.jpg

[2] http://www.ipcc.ch/report/sr15/ Per the NYT: "A landmark report from the United Nations' scientific panel on climate change paints a far more dire picture of the immediate consequences of climate change than previously thought and says that avoiding the damage requires transforming the world economy at a speed and scale that has 'no documented historic precedent.'" The date of no return is given as 2040.

100% of What?

The Governor has asked for a "blueprint for the total conversion of the State's energy production profile to 100% clean energy sources". This seems clear, yet it's ambiguous. We recommend:

- **Clarify the energy category.** Does the "State's energy production profile" refer to all energy used in the state, including the power sector, transportation and heating? OR does it refer only to the present power sector (electricity only), excluding transport? I assume the former, but would like confirmation;
- **Clarify how much energy that is.** In other words, 100% of *what*? How much energy do we use in New Jersey, and, if we were to supply this energy with electricity, how much do we need to supply (in kwh)? It's important to have this baseline information at the start of any conversation about clean energy. Based on many of the comments at the hearing ("we can do it with rooftop solar alone!") it appears that folks don't realize just how much energy New Jersey uses. If this is the case, they may be advocating for things based on misinformation.

How Should Clean Energy Be Defined?

The BPU published Discussion Points in advance. The first question was: *"How should clean energy be defined?"* We applaud the Governor and the BPU for inviting the citizens of New Jersey to grapple with this question up front.

As you might be able to tell from our key project, the "Race to Zero Carbon," we embrace a definition of clean energy that is focused on the ends (net zero carbon emissions) and not the means (a specific energy choice). We think the "Zero Carbon" approach is inclusive and practical. It was clear from the hearing that many stakeholders are resistant to that approach, and insist on the stricter approach of 100% renewables only.

Don't sugarcoat 100% renewables

Given that we have one year to turn the tide, and a decade or two at the most to get to zero carbon, we need to fire on all cylinders. Restricting the state to one approach is a luxury that may prevent us from reaching our goal in time.

The 100% renewable supporters mean well, and we suspect you can get pretty far with renewables on the way to zero carbon. At the same time, we don't think the advocates realize how ambitious a goal this is and how difficult to scale all the way. The BPU should work to help people understand what is involved in a 100% renewable plan for New Jersey. The easiest way to do this is via supplying a baseline back of the envelope blueprint. Good news, Mark Jacobson of the Solutions Project has already drafted a blueprint for the state.[3] The EMP should highlight

[3] http://thesolutionsproject.org/infographic/#nj

this proposal - validate the numbers, adjust as necessary - and then make this information explicit and prominent in any public conversation about energy in New Jersey.
Here's a link to a video I made to illustrate the Jacobson estimate/proposal: https://youtu.be/p4ECGpXvjxY?t=1383 Here is a screengrab of the numbers he uses in his estimate:

														Offshore
NJ														
State land area (km2)	19,211.00													
State water area (km2)	3,377.00													
												Additional installation needed to reach 2050		
Energy Technology	LCHB MWe per MW installed	HCLB MWe per MW installed	Rated power of one plant or device (MW)	End use power delivered (GWe)	End use power delivered (TWh/yr)	Total nameplate capacity needed (MW)	Installed nameplate capacity in 2013 (MW)	Additional capacity needed (MW)	Cost ($million)	% of capacity already installed	Number of new plants or devices needed	Footprint area (km2)	Spacing area (km2)	
Onshore wind	0.22	0.20	5	3.29	28.84	15,938	9.000	15,929	$ 23,226.58	0.06%	3,185.7	0.04	1416.15	
Offshore wind	0.41	0.37	5	18.27	160.04	47,005	0.000	47,005	$ 170,100.76	0.00%	9,401.1	0.12	4179.05	
Wave device	0.22	0.21	0.75	0.26	2.31	1,217	0.000	1,217	$ 7,756.17	0.00%	1,622.6	0.85	40.56	
Geothermal plant	0.86	0.84	100	0.00	-	0	0.000	0	$ -	#DIV/0!	0.0	0.00	0.00	
Hydroelectric plant	0.54	0.51	1300	0.00	0.02	4	4.00	0	$ 0.01	99.93%	0.0	0.00	0.00	
Tidal turbine	0.26	0.24	1	0.03	0.29	134	0.000	134	$ 578.82	0.00%	133.9	0.04	0.50	
Res. roof PV system	0.14	0.14	0.005	1.17	10.21	8,345	488.500	7,857	$ 24,795.35	5.85%	1,571,382.4	58.77	0.00	
Com/gov roof PV system	0.16	0.15	0.1	0.92	8.07	5,917	244.250	5,673	$ 13,592.49	4.13%	56,730.5	42.44	0.00	
Solar PV plant	0.18	0.17	50	8.97	78.59	51,510	244.250	51,266	$ 85,657.36	0.47%	1,025.3	383.49	0.00	
CSP plant	0.38	0.35	100	0.00	-	0	0.000	0	$ -	#DIV/0!	0.0	0.00	0.00	
				32.92	288	130,071		129,081	$ 325,708	0.00%		*Total*		
									$ 2.52	$million/MW		*Hydro*		
												New land = Land - Roof - Offshore		
NM														

Here are key points everyone in New Jersey who supports 100% renewables should (but often doesn't) know:

- **The breakdown:** Jacobson calls for 3.5% of the state's energy to come from residential rooftop solar, 2.8% from commercial/government rooftop, 27.3% from solar PV plants (solar farms); 10% from onshore wind; 55.5% from offshore wind, and the rest is negligible.
- **100% of what?** Jacobson estimates that New Jersey will require 32.92 GWe of power to run the state. That's end use delivered power. He estimates about 130 GW of nameplate capacity for renewables to deliver that.
- **What will this look like on the ground?** The percents are nice, but how many wind turbines is "55.5%"? How much area will be covered by 27.3% solar farms? Jacobson has this answer:
    - **Rooftop Solar:** No new land used. But note that when you max out solar rooftop for both commercial and residential buildings, you get 3.5 + 2.8% = **only 6.3% of the state's energy use.**
    - **Solar PV Farms:** 383 km2 of land use. That's about the size of Essex county, paved over with solar panels. Note the BPU needs to double check this estimate. According to David MacKay, solar farms aren't as land efficient as Jacobson calculates. Jacobson uses 23 watts per square meter (w/m2) for a solar farm, while MacKay estimates 5 to 10 w/m2. Based on our calculations of Tinton Falls solar farm output, we get 7 w/m2. Using the 7 w/m2 number, **the area required is closer in size to Morris county**. This is a big difference.
    - **Onshore Wind:** How many turbines? 3185 of 5MW turbines. How much land? The spacing area is given as 1416 km2, which is about **the area of Atlantic county**.

- **Offshore Wind:** How many turbines? 9401 of 5MW turbines. (If people say, we'll use bigger turbines, fine, just recalculate. i.e., 4,700 x 10MW turbines). What area is required? 4179 square kilometers. But it may be easier to put this in terms of turbines per mile of coast. The New Jersey coast is 130 miles long, so 9401 turbines divided by 130 miles is **72 wind turbines per mile. Down the entire coast**.

All this infrastructure will have an effect on the landscape. There will be NIMBY. When things are abstract, the 100% renewable supporters dismiss challenges. But when things are concrete, 100% renewables don't pass the "Mom Test"[4], not even for the activists supporting it.

Exhibit A: The Six Flags solar farm. Six Flags decided to go Solar, but, rather than put panels on their parking lots, they opted to cut down some forest - which is cheaper. Activists sued. The judge sided with Six Flags because solar is good. After 3 years, a settlement was reached. Instead of 90 acres of forest/15,000 trees being clear cut, 40 acres are being cut. To recap: this solar farm initiative led to three years of legal battle (spearheaded by activists who are also 100% renewable energy supporters), a compromise, a loss of 40 acres, all for 23 MW of nameplate capacity, which at a 17% capacity factor is 4MW end use delivered.

Keep in mind, per Mark Jacobson, our state consumes 32,900MWe of energy. 4MW is one-8,225th of that.

Recommendation: Deploy the "Mom Test"

A recent VOX article reports that "Utilities have a problem: the public wants 100% renewable energy and quick"[5] We suspect this is because the public is not getting a true picture of what's involved. Most environmentalists only gloss over the solutions.[6] People are lulled into thinking the bugs have all been worked out. This is great for inspiring action, but can lead to regret and recrimination down the road. It also delays the process of recognizing we have gaps in our solutions, and figuring out what we need to do to fill those gaps.

The BPU can help create clarity by deploying the "Mom Test".[7] It's all in the way you ask the questions. Asking:

> "Do you want Six Flags to cut down 90 acres of forest adjacent to natural preserve to install a solar farm, and then multiply that by 9000 other similar installations because the

[4] https://medium.com/zero-carbon-playbook/does-your-preferred-climate-solution-pass-the-mom-test-2a7c0b749cae
[5] https://www.vox.com/energy-and-environment/2018/9/14/17853884/utilities-renewable-energy-100-percent-public-opinion
[6] https://medium.com/zero-carbon-playbook/coaching-al-gore-the-climate-reality-project-21acaca21488
[7] http://momtestbook.com/

> Six Flag thing is only about 4MW delivered power and your state needs 32,000MW for a 100% renewable solution?"

...is different from asking: "Do you want 100% renewables?"

The first question shows you what's actually involved, and leads to the more honest answer ("Heck no, and here's 3 years of lawsuits to stop you, and OMG, all that for just 4MW?").

The second question is more abstract, so it's easy to say "yes."

It is the job of the EMP writers to frame their questions with the Mom Test in mind. That will help people more quickly understand what's involved and what' at stake. This, in turn, will result in us making decisions we can live with.

More obstacles to clarify

Another troubling piece of information. In Legal Pathways for a Massive Increase in Utility-Scale Renewable Generation Capacity, Michael Gerrard:

> ...discusses the four most important legal processes and **obstacles** involved in this enormous project: site acquisition and approval; **the National Environmental Policy Act**; state and local approvals; and **species protection laws**. It also presents recommendations for lowering the obstacles and briefly discusses several corollary actions that are needed.

People don't know about this. We need the BPU to help make this clear. We need our eyes open for the decisions ahead. The citizens of New Jersey can handle it.

Alternatives to 100% Renewables

If we don't use 100% Renewables, what percent renewables do we use? How far can we go on renewables alone? What is the resultant gap? How will we fill that gap to get to zero carbon? The EMP needs to clarify the other options on the table, including things like energy efficiency, nuclear power, and supporting the transition to a minimalist economy with universal basic income. There are many ideas that might have been considered off the table before. It's time to get them on the table. Be bold in the inclusion of options!

The Purpose of an Energy Master Plan in the days of Climate Change

We live in extraordinary times. Never before in history have so many people been as technologically empowered and connected as we are. And never before have we been faced with a global level problem that requires a fundamental rethinking of our energy supply and demand habits. We can take, at this moment, any one of several roads into our future. The rest of our

civilization hinges on the choices we make now. These choices need to be informed with the best possible data, put in perspective.

The Purpose of an EMP in the days of Climate Change is to help citizens grasp what's at stake, to understand the full implications of the options they face, to enable them to make choices that reflect their true values and preferences.

In order to fulfill its purpose, the EMP should be written as candidly and accessibly as possible. Put everything on the table and help people appreciate the full impact of any given decision.

Footprint to Wings would be delighted to help in this process

There is a real opportunity here to make this EMP process the springboard for a profound conversation in the State, and thereby the country. To come up with a plan that everyone can support.

The way we see it, the Energy Master Plan is basically the official Zero Carbon Playbook for the state of New Jersey, geared to policy makers and planners.

Here at Footprint to Wings, we're writing the more vibrant, user friendly version of the Zero Carbon Playbook geared to everyone. And we're developing materials (videos, blog posts, a whole Zero Carbon Coaching Clinic) to help people (citizens, stakeholders, policy makers and experts alike) truly *grok* what's at stake. To move from frustrating stakeholder meetings to immersive, hands on, public fact finding and decision making social events.

Now more than ever, it's important to get people to SEE what's involved in these choices.

Footprint to Wings' approach is designed to, as quickly as possible, get as many decision makers as possible on the same page about the implications of their choices, and to help them iterate as quickly as possible to ultimately settle on something we can all be happy about, and swiftly deploy!

More about our approach here: https://medium.com/zero-carbon-playbook/are-you-ready-to-get-disruptive-solve-this-climate-change-thing-once-and-for-all-aeea3502adbf

We are standing by to help the state and our fellow citizens quickly develop a blueprint that everyone loves. Contact information below.

To zero carbon and beyond,

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