DE 16-576

State of New Hampshire

HOUSE OF REPRESENTATIVES

CONCORD

NHPUC 20APR'17PM4:27

April 18, 2017

Ms. Debra A. Howland, Executive Director
New Hampshire Public Utilities Commission
21 South Fruit Street, Suite 10
Concord, New Hampshire 03301-2429

RE: Docket No. DE 16-576, Development of New Alternative Net Metering Tariffs and/or Other Regulatory Mechanisms and Tariffs for Customer-Generators

Dear Ms. Howland:

At the March 30 proceeding at which public comment was taken, I expressed my concern about the potential loss of jobs in other energy sectors as solar jobs increase. Chairman Honigberg invited me to submit follow up information on this concern of mine, which I am doing with this submittal.

Thank you for your time and attention.

Richard W. Barry

Representative Richard W. Barry, Chairman
House Science, Technology and Energy Committee
On my own behalf

Analysis

The following analysis will show, in part, that currently it takes about 50 solar employees to produce the same amount of electricity as just one coal, natural gas, or nuclear employee, on average. Even though this lopsided ratio will probably decrease over time as the solar industry matures, the order of magnitude of the difference indicates that solar labor costs will remain much higher compared to more traditional sources of electricity for the foreseeable future.

For each source of energy used to generate electricity, it is possible to calculate a jobs per gigawatt-hour metric. This metric, beyond just being a measure of the source's labor efficiency in generating electricity, can also be used to roughly approximate the degree to which jobs associated with such source may increase or decrease with changes in generation.

Table 1 provides this metric for four different sources of electrical generation. Jobs associated with generation, fuel extraction and mining, and transportation are included. Only direct jobs provided by the stated activities are counted.[1] All data used is national in scope.

Table 1: Jobs per GWh (percentage of total source jobs in parentheses)

Power Source	2016 GWh Production[2]	Generation Jobs[3] [4]	Fuel Extraction & Mining Jobs[5] [6]	Fuel Transport Jobs[7]	Total Jobs	Jobs Per GWh
Coal	1,230,422	86,035 (47%)	66,658 (37%)	29,136 (16%)	181,829	**0.147778**
Nat Gas	1,280,316	52,125 (29%)	113,801 (64%)	11,684 (7%)	177,610	**0.138724**
Nuclear	805,327	68,176 (89%)	8,595 (11%)	*unknown*	76,771	**0.095329**
Solar[8]	56,221	373,807 (100%)			373,807	**6.6489**

[1] U.S. Department of Energy, *U.S. Energy and Employment Report (USEER)*, January 2017, pg. 11, "A direct job is created by the firm specific to the industry, while indirect jobs support these firms via supply or contracting services. Induced jobs are a result of the economic impact of direct and indirect employees spending their earnings."

[2] U.S. Energy Information Administration, *Monthly Energy Review,* March 2017, pgs. 110, 158.

[3] *USEER*, pg. 29.

[4] *USEER*, pg. 20, "Electric Power Generation covers all utility employment across electric generating technologies including fossil fuels, nuclear, or renewable energy technologies. Also included in the employment totals are any firms engaged in facility construction, turbine and other generation equipment manufacturing, as well as wholesale parts distribution of all electric generation technologies."

[5] *USEER*, pg. 20 "Fuels employment encompasses all work related to fuel extraction and mining, including petroleum refineries and firms that support coal mining, oil, and gas field machinery manufacturing."

[6] See attached Table 2.

[7] See attached Table 3.

[8] *USEER*, pg. 13, "... the direct job category of interest is defined as the solar industry generally, including utility-scale solar, residential and commercial installations, as well as the manufacturing, professional services, and wholesale trade that make up the sector. However, the indirect jobs that support this industry are not included, such as polysilicon production (the raw material used in solar panels), aluminum production and extrusion activities for frame manufacturing, or other aspects of the solar value stream."

It is a reasonable assertion that generation by non-solar sources will, as a whole, be negatively affected if solar generation increases over time. For example, if overall generation remains flat, but solar generation has increased, then other sources of generation must have decreased in some combination.

If, for example, solar installations were to double from 100 MW (the current net metering cap) to 200 MW in New Hampshire, that would result in approximately 124 GWh of additional generation each year.[9] Non-solar sources would, in total, decrease from what they would have been by a corresponding amount. The depressive effect that this additional supply would have on coal jobs (assuming all the effect was focused on coal) could be estimated as follows:
124 GWh x 0.14778 Jobs/GWh = 18.3 jobs.

As can be seen from Table 1, the generation of electricity from solar is much more labor intensive than when electricity is derived from coal, natural gas, or nuclear fuel, by about a factor of 50.[10] This can partly be explained by the current rapid growth in solar. Many workers are required to construct and install facilities, both utility scale and distributed, as well as to work within the associated wholesale trade.[11] The installed base for solar generation is not nearly as mature as that of traditional generation, since significant solar installations only began over the past 4 or 5 years.[12] Over time, it would be expected that the jobs/GWh metric for solar will decline as the base of installed solar capacity increases, thereby creating greater annual GWh production even if employment were to remain constant.

Closing

The bottom line is that creating an abundance of solar jobs comes at a cost in the form of higher electric rates which everyone must pay, except perhaps those who may be insulated from such rates through net metering. The additional downside is that jobs in other sectors are lost due to an increase in solar generation. For example, the coal industry has already lost 60,000 non-office jobs since 2011[13] and should not be further harmed through subsidy programs such as net metering.

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[9] 100 MW x 8,760 hours per year x 14.1% capacity factor ÷ 1000 MWh/GWh = 123.5 GWh per year. 14.1% capacity factor taken from ISO New England Final 2016 PV Forecast.
[10] (373,807 solar jobs/56,221 solar GWh) / ((181,829 + 177,610 + 76,711 non-solar jobs) / (1,230,422 + 1,280,316 + 805,327 non-solar GWh)) = 50.55
[11] *USEER*, pg. 37
[12] U.S. Energy Information Administration, "U.S. Electric Generating Capacity Increase On 2016 Was Largest Net Change Since 2011," *Today in Energy*, Feb. 27, 2017.
[13] Nashua Telegraph, "Wyoming Workers Energized," April 2, 2017.

Additional Tables

Table 2: Fuel Extraction and Mining Jobs

Fuel	Total Fuel Jobs (non-transport)[14]	Production Associated With Total Fuel Jobs[15]	Amount To Generation Plants[16]	Percent To Plants	Fuel Jobs Associated Generation Plants
Coal	74,084	738,700,000 tons	664,657,000 tons[17]	90.0%	**66,658**
Natural Gas	309,993	26,390 billion ft^3	9,688 billion ft^3	36.7%	**113,801**
Nuclear	8,595[18]				**8,595**

Table 3: Fuel Transport Jobs

Fuel	Jobs calculation
Coal[19]	169,394 rail jobs x 17.2% total revenue from coal = 29,136 coal transport jobs. 70% of coal is transported via rail (www.eia.gov/todayinenergy/detail.php?id=25092). Waterway and truck transport not included.
Natural Gas	29,580 pipeline jobs[20] x 39.5% of delivered gas used for generation[21] = 11,684 natural gas transport jobs
Nuclear	Unknown

[14] *USEER*, pg. 29.

[15] For coal: www.eia.gov/outlooks/steo/report/coal.cfm
For natural gas: www.eia.gov/outlooks/steo/report/natgas.cfm

[16] U.S. Energy Information Administration, *Monthly Energy Review,* March 2017, Table 7.3b.

[17] Amount to generation plants decreased by 9.8 million tons to account for imports going to generation plants (www.eia.gov/outlooks/steo/report/coal.cfm).

[18] Assumption is made that all jobs are related to providing fuel to U.S. nuclear power plants. Job number may be high as a result.

[19] Association of American Railroads, *Class I Railroad Statistics*, May 3, 2016.

[20] www.bls.gov/oes/current/naics4_486200.htm

[21] U.S. Energy Information Administration, *Natural Gas Monthly: March 2017*, Table 2.
(9984 ft^3 for electric power) / 25,265 ft^3 total delivered = 39.5%