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2014 Draft State Energy Plan Comment

The 2014 Draft State Energy Plan: *Business as Usual*: Continue Burning Fossil, Nuclear Fuels & Continue the 'Freeze' Renewable Energy

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1 Summary

New York State Draft Energy Plan is not a road map to a renewable energy future in New York State. It ignores discussing global warming and climate change; ignores discussing the serious problem methane poses to global warming; ignores – in its entirety – discussing New York State's immense now-in-place-and-functioning renewable energy infrastructure; ignores discussing the 'frozen' nature of New York State's total renewable energy production; ignores discussing the serious problems posed by hydrofracking; ignores comparing the economics of shale gas with renewable energy; ignores discussing the impending problems communities and workers will face as coal plants close; ignores discussing possible funding sources for the gradual transition to renewable energy; ignores discussing the immense wealth within New York State that could fund the transition.

In short, the NYS Draft Energy Plan is a moldy old road map for the purpose of continuing on the fossil/nuclear fuel potholed – bumpy – expensive – pathway were currently on.

This report from the WNY Peace Center's Renewable Energy Task Force discusses all that is ignored by the NYS Energy Board.

Enjoy reading – and thinking...about our upcoming renewable future.

2 Introduction

The NYS Draft Energy Plan is an proposed outline New York State should follow in the years ahead in generating electricity.

The NYS Draft Energy Plan, 'Shaping the Future of Energy', comes in two volumes: Volume I is sub-titled 'New York State Energy Plan' (67 pages) and volume II consists of 3 documents: 'Impacts & Considerations' (230 pages), 'Sources' (242 pages) and 'End-Use Energy' (146 pages).

The draft energy plan was written by the 14 members of New York State Energy Planning Board, and/or their unnamed designated staff. They are:

1. John Rhodes, President of NYSERDA (Chair of Energy Planning Board)
2. Audrey Zibelman, Chair of Public Service Commission
3. Joseph Martens, Commissioner of Environmental Conservation
4. Kenneth Adams, President of Empire State Development
5. Joan McDonald, Commissioner of Transportation
6. Dr. Nirav Shah, Commissioner of Health
7. Cesar Perales, Secretary of State
8. Peter Rivera, Commissioner of Labor

9. Jerome Hauer, Commissioner of Homeland Security and Emergency Services
10. Richard Ball, Acting Commissioner of Agriculture and Markets
11. James Winebrake, Appointee of the Governor
12. Hon. Amy Paulin, Appointee of the Speaker of the Assembly
13. Thomas Coakley, Appointee of the Temporary President of the Senate
14. Stephen Whitley, President and CEO of New York Independent System Operator (non-voting)

3 Critique of NYS Draft Energy Plan

3.1 Greater Transparency Needed

In the years ahead, the final version of New York State's Energy Plan will have a huge impact on the energy sector. Therefore, all 14 members of the NYS Energy Board should disclose any ties they have with the energy industry. Do they own energy stocks? If so, declare those holdings. Do they have spouses and/or relatives working for an energy company? If so, list their relationship to the board member and the company they work for. Did the Planing Board out source any of the writing, or hire to a private company for consulting? Is so, name the contractor. Does any NYS Energy Plan Board member sit on the board of any corporation involved in any aspect of energy? If so, name the company(s).

3.1.1 ....Including Staff Members

Article 6 §6-102 of the Energy Law, paragraph 1, says any of the above board members may designate staff to act on their behalf: *Members of the board may designate an executive staff representative to participate on the board on their behalf.*[8] Those designated staff members become defacto board members. Hence, they should be listed and abide by the same transparency suggestions I outlined above.

3.2 Absence of Specific Targets for Fossil, Nuclear & Renewable Energy

On page 7, volume I begins boldly –

> *[NYS Energy Plan] outlines new strategies to achieve our objectives of providing clean, reliable, and affordable power; creating jobs; and producing the other economic and environmental benefits that flow from a clean energy economy. It creates a framework to enable sustainable growth, balancing the need to harness proven technologies with the flexibility to adapt to future insights and innovation.*

I searched vol I in vain for those *'...new strategies to achieve...a clean energy economy'*. I find no strategies in any of the 67 pages of volume I.

Formed strategies are backed by numbers,especially in plans dealing with energy. So I searched instead for those hallmarks...numbers you can easily find in any bonafide energy plan (see later)....and find virtually none in NYS Energy Plan, vol. I:

- 'kW·h' appears zero times
- 'gW·h' appears once (without numbers)
- 'MW·h' appears 7 times (without numbers)
- 'TW·h' appears zero times
- '$' appears 10 times (3 times w/o numbers),
- 'kW' appear 4 times in relation to 4 solar array projects totaling 100 kW.
- 'Conservation' appears only once, on page 31, in regard to the title of a NY agency that took part in creating the draft energy plan: Department of Environmental Conservation.
- 'Fossil' appears 4 times – all w/o numbers.
- 'Nuclear' appears zero times
- 'Oil' appears 7 times, each w/o numbers

- 'Coal' appears zero times.
- 'Efficiency' appears 38 timesc̀arbon' appears 4 times

The NYS Energy Board is not following the Energy Law that created the structure. The word *conservation* appears only once, and that is in regard to the name of one its authors: NYS Department of Environmental Conservation. NYS Energy Law, article 6, §6-104 states:

The state energy plan shall include: (a) forecasts for a minimum period of ten years, and for such other periods as the board may determine, of: (i) demand for electricity, natural gas, coal, petroleum products, including heating and transportation fuels, and alternate fuels, including ethanol and other biofuels, to the extent possible, taking into account energy conservation...[7].

The absence of any discussion about energy conservation in NYS Draft Energy Plan indicates the board is not following the law.

Furthermore, the absence of discussion of ramping up renewables and gradually discontinuing fossil and nuclear indicates NYS policy is essentially a freeze on current levels of renewable energy.

In summary, the New York State Energy Plan plans to continue '*Business as Usual'* ...producing electricity using very dangerous sources of energy, and neglect renewable sources of energy.

3.3 Absence of Success Stories: New York State has no Wind Farms!

In the section entitled "Success Stories", the only success stories that New York State Energy Plan board could find in the Empire State are 3 solar projects, totaling 100 kW, and 23 Brooklyn homeowners that desire to place solar on their roofs. One would conclude from the Energy Plan's 'Success Stories' that New York State has no wind farms, a paltry 100 kW of solar PV, and 23 Brooklyn homeowners desperately wanting rooftop solar PV.

While we cheer the Brooklyn homeowners and 3 solar arrays, the rest is nonsense.

Apart from the Long Island Solar Farm, the New York State Independent System Operator (NYISO) does not publish a summary of energy production form its ground-mounted and rooftop solar arrays, so the public must rely on unofficial sources for such information. One such source reports the state has a minimum number of 1,601 solar array installs totaling 129.5 MW – on roofs and in fields – representing an investment of $526.6 million[22]. And the Solar Foundation says 30,840 New York State homes have roof top solar panels[14]. Under NY Sun Initiative, New York State has installed a total of 211 MW of PV[28]. Assuming a $4.29 per watt capex[28], residents of New York State have invested a approximately $905 million in solar PV.

New York State has much more wind generating capability. The state has 993 wind turbines on 20 wind farms, totaling 1,730 MW generating about 3,541 gW·h[37] of clean electrical energy in 2013. Furthermore, New York State wind capital investment (capex) totals $3.4 billion. Wind companies pay lease payments to landowners totaling $4.7 million and average $4,700 per turbine[21].

The combined investments in wind and solar total $4.3 billion.

It's irresponsible for the NYS Energy Planing Board to fail to mention – in their 'Success Stories' – a multi-billion dollar investment in wind and solar PV in New York State

3.4 Absence of Historical Information about NYS Energy Production

The NYS Draft Energy Plan fails to give a clear picture of the past and present electrical energy production. Figure 1 shows such information. The dominating sources of energy are methane (generated by plants that can only burn methane) and methane + others (plants that can use either methane or another fuel, such as oil, jet fuel, or butane) and nuclear.

While Ontario Canada shut down its last coal plant in April 2014[18], NY State increased its coal usage by 5% from 4,281 gW·h in 2012 to 4,494 gW·h in 2013. This is a dramatic upturn given the decline in coal usage by 500% over the past 7

years (see figure 1). And we continue to use nuclear and methane as we have before.

Figure 1 also shows the goals Marc Jacobson and his colleagues have set for NY State renewable generation in 20 years (red triangles). The NYS Energy Board should direct its attention to such goals.

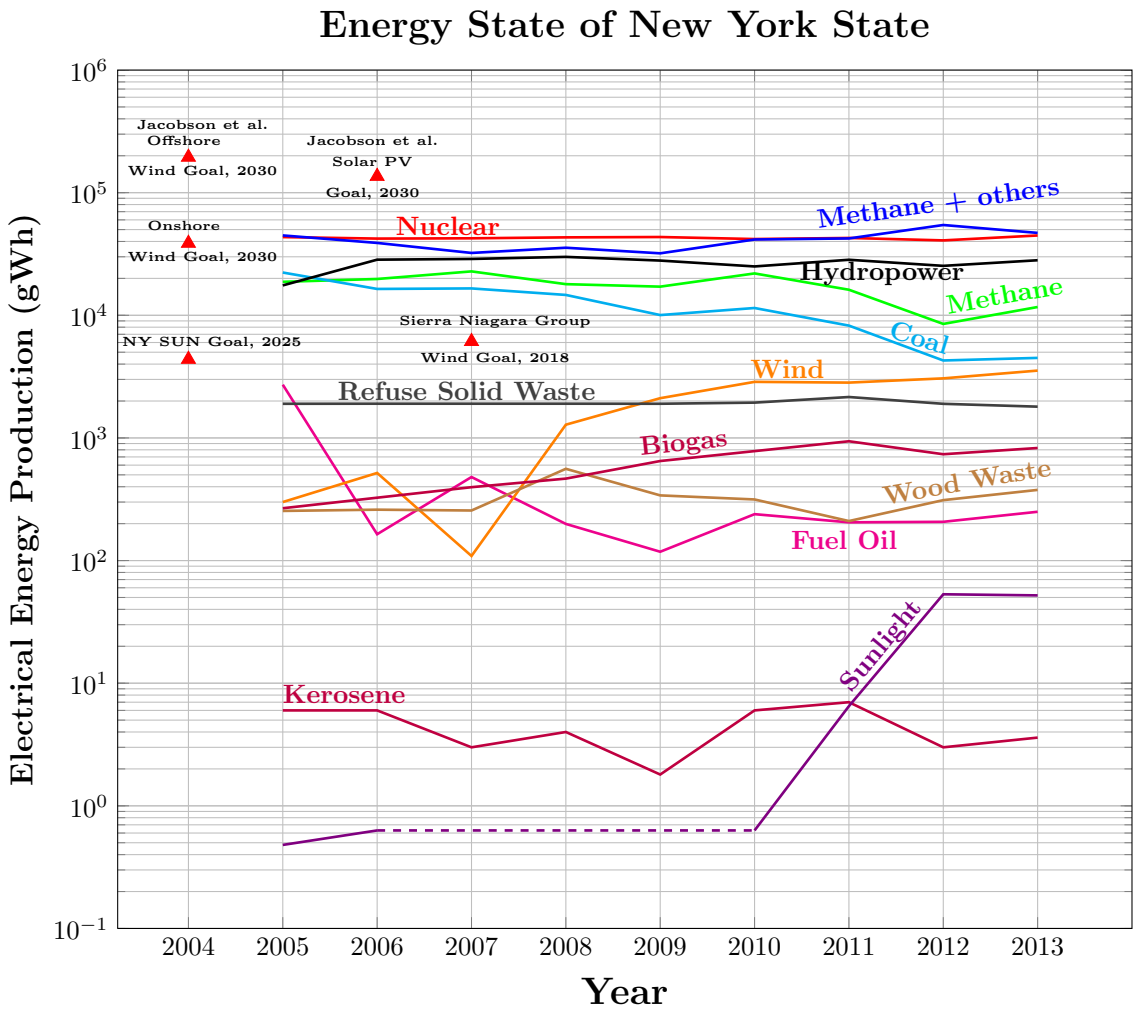

Figure 1: Recent history of renewable energy production in NYS & future goals. Except for wind generation and solar PV, which are still too insignificant to show up as affecting our renewable generation, we have not changed our mix of fuels for energy generation in 8 years. We have reduced coal over the last 7 years, but we used 5% more coal in 2013. Dominating renewable energy source is conventional hydropower followed by wind energy second and solid waste refuse. Solar PV is under represented as the NYISO reports list only the Long Island Solar Farm. Red triangles: Renewable energy benchmarks created by Marc Jacobson and colleagues[32] are shown, as well as the Sierra Club-Niagara Group's goals for wind and the NY-SUN Initiative's solar goals. Onshore wind energy, offshore wind and solar PV assumed capacity factors: 22%, 35% and 10%, respectively. Data source: NYISO Gold Books for the years indicated.

3.5 Energy Board's Outdated & Meaningless Methane Data

New York State's Greenhouse Gas Inventory[20], released in April 2014 uses an outdated GWP for methane, neglects methane's always increasing GWP, and misrepresents methane's GWP because NYS Greenhouse Gas Inventory does not give a time span over which the number is valid. A GWP number without a companion time span over which the GWP is valid — is meaningless.

Methane's GWP has been increasing dramatically since 1996. See Table 1: 1

The 2014 NYS Greenhouse Gas Inventory uses the IPCC 2007 figures for methane's global warming potential (GWP). At that time, methane's GWP was 25 times that of CO_2 (with no time span given in the Greenhouse Gas Inventory). The IPCC 2007 report indicates that number refers to a 100 year time span[5]. Six years later, the most recent IPCC 2013[10],

released a year before NYS Greenhouse Gas Inventory Report, lists methane's GWP 34 times that of CO_2 over the same 100 year span (see Table 1).

While anthropogenic methane is about 1.8 parts per million in the atmosphere - 200 fold less than CO_2 – methane is responsible for $\sim 45\%$ of the global change in temperature[30]. **Methane is a very powerful driver of global warming!** The current role of methane in global warming is large, contributing 1.0 watts/m^2 out of the net total 2.29 watts/m^2 of radiative forcing[1]
The NYS Energy Planing Board should use the most up-to-date information, and formally recognize the rapidly growing danger methane poses to global warming.

3.6 Shale Gas Royalties will End – eventually, unlike Wind & Solar

The draft energy plan does not exclude the use of shale gas in the New York State Energy Plan, and does not rule out shale gas production in New York State.

Apart from the increasingly dangerous aspects methane poses to global warming[31], NYSERDA should look south of our state's border into Pennsylvania and note the ever-dwindling royalty payments to landowners. Such payments are tied to shale gas production – subsequent sale, minus costs to bring it to market. Production by Marcellus legacy wells[2] is decreasing $\sim$60% annually[24]. Hence, the royalty payments to landowners are also decreasing by $\sim$ 60% annually. Eventually, the costs to transport the gas to market will squeeze profits and the well will be caped (hopefully). At that point the royalty payments to the landowner will cease, and the landowner will be left with a millions of gallons of highly toxic frack water below his/her property – a *Love Canal*. Banks will take notice of that underground toxic brew and likely decide unfavorably on a prospective purchaser's loan.

3.7 Economics of Renewables vs Shale Gas

The Buffalo News published a series of wonderfully detailed articles on hydrofracking[42,43,44]. The first focused on a PA farm owned by Mr. Van Blarcom in Bradford County, PA, just 16 miles south of Chemung NY[33].

A dozen years ago, Van Blarcom and 150 other landowners formed an organization to negotiate with the gas companies[27]. Together they owned 15,000 acres. The Van Blarcom Dairy Farm welcomed the Canadian-based shale gas company – Talisman Energy USA, Inc – on their 500 acre property and is very pleased with the royalties received since February 2010[33]. There are 9 shale gas wells on the Van Blarcom property, located on two pads (figure 2). Five wells were spudded (first drilled) in November 2009 and 4 more wells in June 2010. Van Blarcom receives gas royalties and invests them in new equipment and expanded operations.

Figure 2 shows an overview of the Van Blarcom farm's two pads.

[1] Quoting from Wikipedia: *'Radiative forcing...is defined as the difference of radiant energy (sunlight) received by the Earth and energy radiated back to space. A positive forcing (more incoming energy) warms the system, while negative forcing (more outgoing energy) cools it.'* The radiative forcing is a positive 2.29 watt/m^2 [30]

[2] Legacy wells are defined by the EIA as wells that are one month old

Table 1: Global warming potential (GWP) for methane. The Intergovernmental Panel on Climate Change (IPCC) reports show increasing importance of methane to global warming. NY State Greenhouse Gas Inventory[20], released in April 2014, uses IPCC 2007 data for the 100 year time span and ignores IPCC 2013 report data. Percent increase is relative to IPCC 1996 GWP levels.

Report/Year	GWP_{20yr}	GWP_{100yr}	%Increase 20yr	%Increase 100yr
IPCC 1996[30]	56	21	—	—
IPCC 2007[5]	72	25	29%	19%
IPCC 2013[10]	86	34	53%	62%
NYS Greenhouse Gas Inventory 2014[20]	—	25	—	—

Van Blarcom Dairy Farm

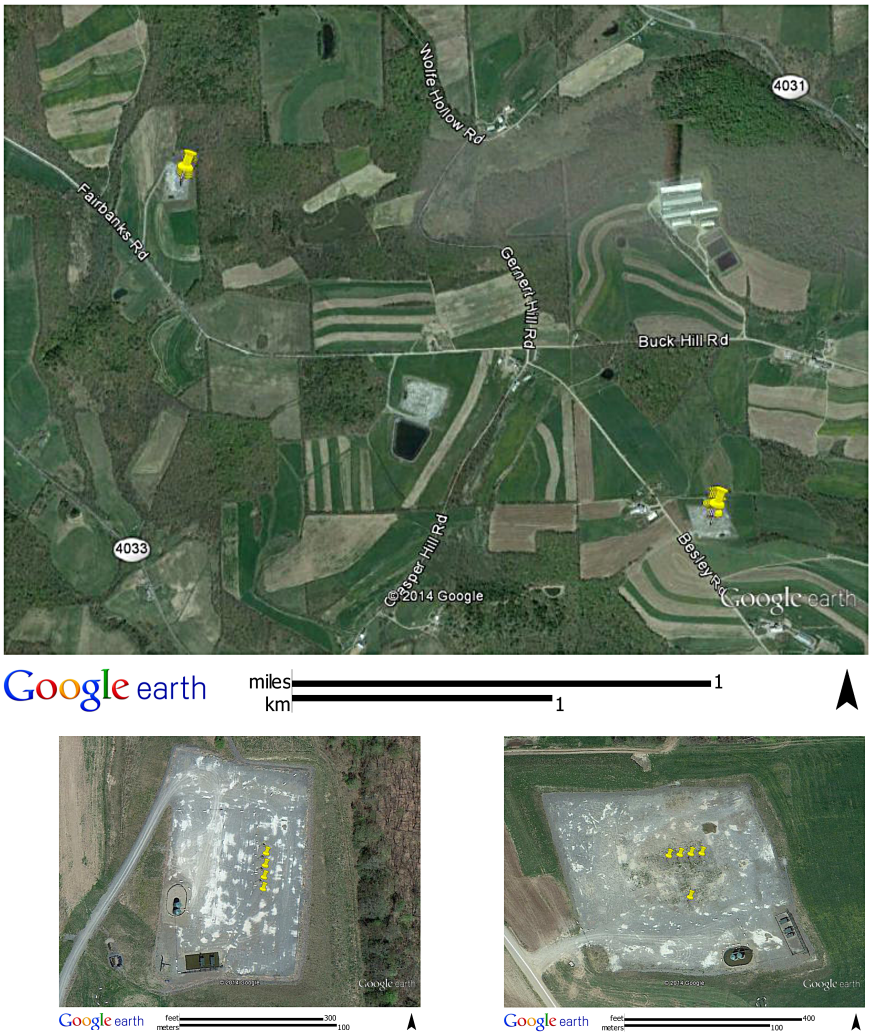

Figure 2: Van Blarcom Farm's two shale gas pads...a third well pad appears to be in the center of the upper photograph, but is not owned by the Van Blarcom Farm. The farm's property boundaries are not shown. Yellow pins mark the location of the shale gas wells. Geolocation data source: Pennsylvania Department of Environmental Protection [4]

Suppose, however, Van Blarcom was given a choice in 2009 what to do with his 500 acre property....a choice between selling the rights to his shale gas or building a solar farm. There are tradeoffs to consider: selling the rights to the shale gas would probably not affect his farming, at least in the near future (and that appears to be the case, so far). He continues what he loves to do: farming, earning farm income and now, shale gas income. If he allowed a solar company to build a 500 acres solar array, he would not be able to continue farming, as he has done for many years. However, there would be no potential for large scale pollution of the aquifers, and he would continue to own the land and collecting solar royalties, and the land could be easily restored to its previous state, if needed. The 9 wells used at least 18 million gallons of water with half of that remaining underground, and half returning to the surface. The 9 million gallons of toxic frack water is always under pressure, always searching for a route to the surface, or overlaying aquifers – and that will happen at some point in the future.

Using publicly available resources, let's follow the money. How do shale gas and solar royalties compare?

Figure 3 shows gas volume versus time from those 9 wells (with the exception of the first point, which reflects gas production from 4 wells). Note that gas production is continually decreasing and the dashed line predicts gas production will terminate sometime in the fall of 2017 (9/11/2017 is a very, very rough estimate of the ending date). Figure 3 shows shale gas is a finite resource, and obviously, finite royalty income.

Figure 4 shows an estimate of the royalties paid to the Van Blarcom Farm. I used US average well-head prices published

by the EIA[3], not well-head price determined by Talisman Energy US Inc, so royalties shown are only approximate. In 2010, the Pennsylvania Supreme Court ruled that gas companies can charge landowners 12.5% of the post-production costs bringing the gas to market[26,40]. Gas companies determine that cost and *when the shale gas is declared to be brought to market*. I presume the post-production cost Van Blarcom pays Talisman Energy is $\sim$ 25% of the well-head price[26]. The present value of the gas royalties paid Van Blarcom approximate $9.9 million over 9 years, the predicted lifetime of the shale gas wells.

Some Bradford County PA landowners have had significant reductions in royalty checks since the 2010 PA Supreme Court decision to allow post-production costs to be deducted from royalty checks[26]. Some royalty payments have been reduced by half or 1/4 since the decision. The post-production cost issue seems not be an issue at the Van Blarcom Farm[33].

If Van Blarcom instead allowed a solar company to build a 125 MW solar array on his 500 acre property – dairy farm acreage in PA average $2,700/acre[11] plus $\sim$ $250,000 for buildings (I'm guessing here) – he would need a minimum of $0.01132/kWh as he would lose his farm income. Farmers in England receive lower rents for land when solar companies lease their property for utility-sized solar arrays[38]. So perhaps I'm overestimating Van Blarcom's land value, if dairy farmland in England is valued similarly. However, England has a financial structure to support such payments to farmers: a Feed-in-Tariff.

I'm avoiding the important social issue of removing productive dairy farm land for power generation, and only focus here on the economics of shale gas vs solar. NY State has enough abandoned farm land to produce all its power from renewable sources of energy – NYS would not have take any active farm land for energy production (discussed later).

And I have avoided the issue of methane production from cow manure...which must be huge on Van Blarcom's 500 acres dairy farm. Each cow's manure averages 80 ft^3 of methane production per day, and each cow's manure could produce 300 watts of electricity[41]. The Van Blarcom Farm has 560 cows[27], so there is a potential for 168 kW of power ($\sim$ 736 MWh, 50% capacity factor) from 16.3 million ft^3 of manure-produced methane. That's equivalent to the methane production from 260 billion households[4]. Apparently there are only 1.9 billion households worldwide[5]

The Van Blarcom Farm, and many others like it, is producing methane equivalent to 137 household-Planet-Earths.

With all these caveats, royalties received over 9 years by Van Blarcom Solar Farm would total $13.2 million vs $9.9 million for shale gas. Of course, solar lease contracts extend out to 20 or 25 years. Over 20 years, Van Blarcom Solar Farm would receive a total of $31.9 million (present value)...and then the lease could again be renewed again...Van Blarcom's descendants will honor him.

Of course, after shale gas royalties end, Van Blarcom could build his solar farm (or lease his land to a solar company) and retire from farming.

Other combinations of land usage are possible. Van Blarcom could use half his land for dairy farming and the other half for a solar farm....these economics can be visualized easily from figure 4.

Finally, what about a wind farm option? Unlike solar energy production, the amount of wind energy production depends strongly on the shape of the boundaries of the Van Blarcom dairy farm. I don't have ready access to that knowledge so let's calculate the maximum and minimum amount of possible wind energy.

If the Van Blarcom farm is a 500 acre square with 4,700 ft sides, the area could support 13 wind turbines, 1.5 MW each, and each occupying 37 acres[1]. Energy produced would be 47 gW·h. The maximum possible wind energy would be produced if Van Blarcom 500 acre farm was 100 ft x 40 miles long, and aligned perpendicular to the prevailing wind direction. In this highly unlikely scenario, the property could support 131 turbines, each having 232 ft diameter rotor, and a 7x rotor-diameter spacing. The 197 MW wind farm would produce 430 gW·h, dwarfing the solar farm's 94 gW·h.

What would be Mr. Van Blarcom's wind royalty? The economics are different from solar because a wind option would allow him to continue farming, unlike the solar option described above. Hence, his wind royalties would be much less than solar's because farming could continue. If wind royalties are 1/2 solar's royalties ($0.01132/kWh, figure 4), the annual royalty would range between $\sim$ $0.266 million and $2.4 million. Mr. Van Blarcom's choice between wind, solar or shale

[3] Excel spreadsheet named: ng_pri_sum_dcu_nus_m.xls from EIA.gov
[4] http://www.epa.gov/cmop/resources/converter.html#two
[5] http://wiki.answers.com/Q/How_many_households_are_there_in_world?#slide=2

gas depends strongly on the boundaries of Mr. Van Blarcom's farm.

In summary, the Van Blarcom family would be far better off financially if in 2009 they contracted for a solar farm (or possibly wind farm) on his property, instead of selling his shale gas. This is due to the fact that solar (and wind) royalties are essentially constant, predictable – and likely will remain so for 1,000's of years – after the shale gas is long-gone. Finally, banks love long-term-very-well-defined predictability which is characteristic of renewables sources of energy.

Based on financial considerations alone, there's more than enough reason for the NYS Energy Planning Board to exclude shale gas from any consideration of future energy production.

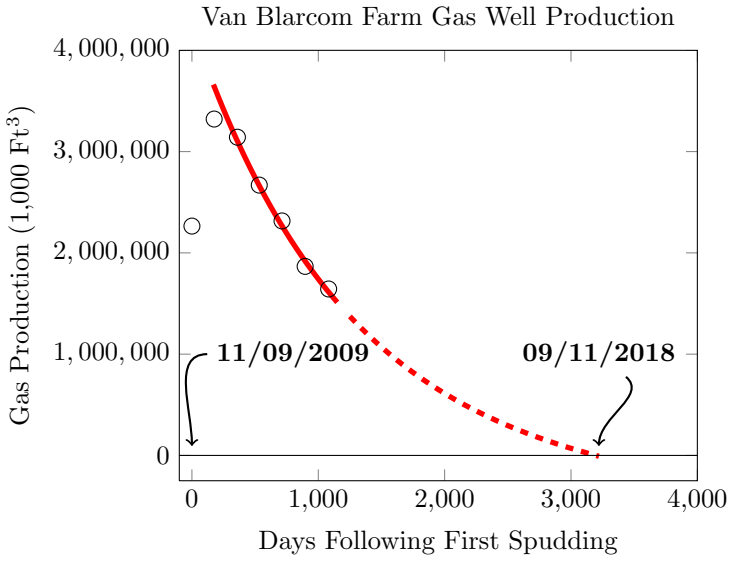

Figure 3: Marcellus Shale Gas extracted at the Van Blarcom Farm, Bradford County, PA. The Van Blarcom Farm is located 16 miles south of Elmira, NY. Total gas production from 9 hydrofracked wells. Well permit numbers: 015-20440, 015-20441, 015-20442, 015-20443, 015-20467, 015-20851 015-20852, 015-20853, 015-20854. The last 4 wells were spudded on June 2 - 4, 2010, and the first 5 wells Nov 17 - 21, 2009. Red line is a fit to the gas data using an exponential decrease and a straight line, a method used by the National Energy Board of Canada [6] to predict shale gas well production in Alberta Ca: Gas Volume = 3.1e6 *exp(-((day-360)/1181)) - 100*(day-360) + 2500. Initial parameter guesses determined using Fitness [17]. Fitness' final fit was tweaked by hand. The analytical expression predicts gas production at this site will end on 9/11/2018, but there that is only a rough estimate of the ending date given the amount of extrapolation. Whether or not this site will then again be hydrofracked is unknown. Gas production data from publicly available sources, the Pennsylvania Department of Environmental Protection [4]

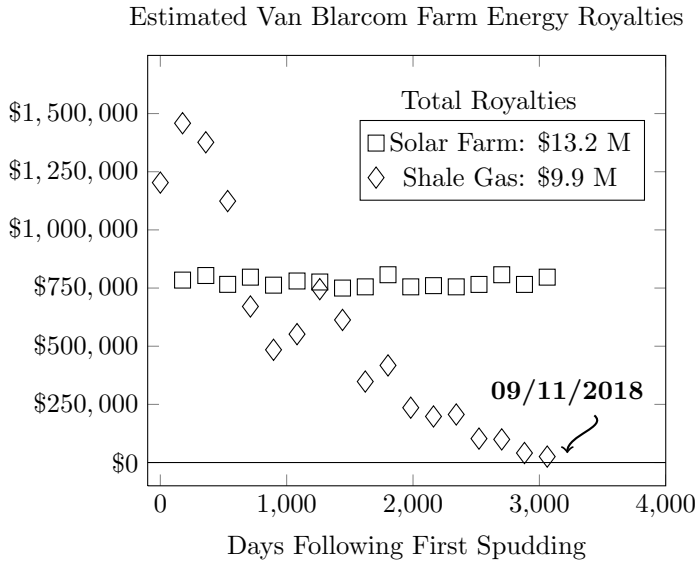

Figure 4: Estimated royalties (present value 2010 $) calculated from known and estimated future well-head prices. Well-head gas price is known for the first six points with dates ranging between February 2010 and August 2012. Subsequently, well-head gas price is chosen randomly between $3.40 and $5.50 per 1000 cubic feet of gas. The random choice may more or less reflect the unpredictable variations in shale gas prices. I assumed the fracking spacing unit is $\sim$ 500 acres, Van Blarcom Farm's acreage occupies 90% (450 acres) of the 500 acre spacing unit which houses 9 wells, the farm receives a royalty 15%[27] of the well-head price. PA Supreme Court ruled that 12.5% of the cost to bring the gas to market should be paid by the landowner. I presume the farm-market cost Van Blarcom pays is 15% of the well-head price, deducted from the royalty payments. Solar PV: assumed 500 acres given over to a solar farm (no more farming), 4 acres/MW, and 15% capacity factor, 0.86 DC-AC conversion factor, resulting in 141.3 GWh annual production, adjusted randomly by $\pm$ 4% to account for annual variations in insolation. I used the Van Blarcom's land value ($2,700/acre + $250,000 building structures) to calculate the minimum amount of money Van Blarcom would need to offset the transition of dairy farming to solar farming. Land value + Buidlings = $1.6 million. So $1.6 million / (141.3 GWh x 15% capacity factor) = $0.01132/kWh. For present value (2010 $), I assumed a 1% annual interest rate, and used: PV = $\frac{FV}{(1+r)^n}$, where r is the interest rate and n is the number of years after 2010, and assume no inflation, or taxes.

3.8 NYS Renewables are Frozen!

Volumes I and II of the draft NYS Energy Plan contains no historical data on New York State's electrical power generation, keeping NYS residents in the dark about the lack of improvement.

Figures 5 and 6 show such data. New York State has not improved the proportion of electrical power generated from clean resources. Clean energy production ranged between 31 TW·h and 34 TW·h (figure 5), representing between 22% and 24% of total electrical power generation for the past 8 years (figure 6). In spite of the terrific increase in wind energy, overall, there's no improvement in the total power generated from renewable sources of energy for the past 8 years.

Hence, our energy production from renewables is frozen! – and the Draft Energy Plan has no plan to increase the proportion of electricity produced from renewables.

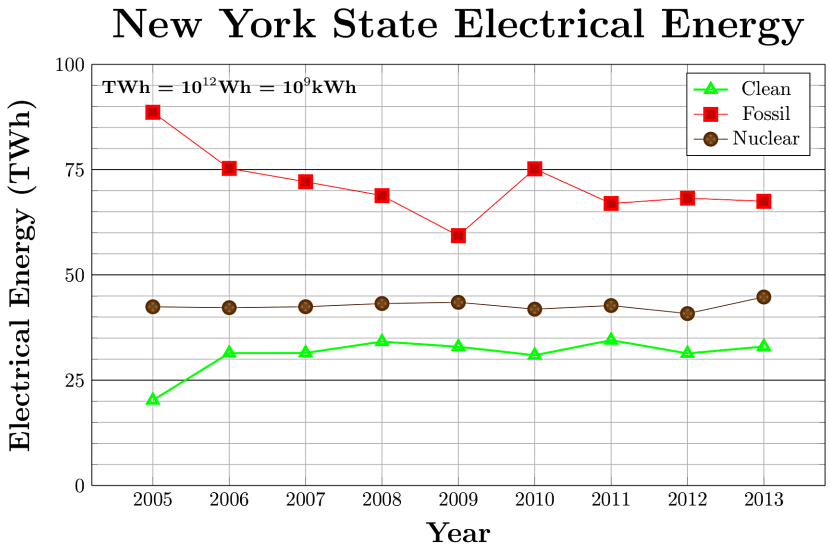

Figure 5: Electrical power generated from clean resources averaged between 31 gWh and 34 gWh for the past 7 years (green line). Clean energy includes: hydropower, solar PV, wind, biogas, refuse solid waste and wood waste. Fossil fuels include oil, coal, methane, jet fuel, kerosene and butane. Nuclear fuels are not considered clean since the highly radioactive spent fuel must be kept isolated from the biosphere for 100,000's of years, isolated from unfriendly countries and and isolated from terrorists – all three represent an impossible task. Data Source: NYISO Gold Book reports for the years indicated.

3.9 Wind and Solar Jobs Successes Ignored

On page 51 of volume I, the NY State Energy Plan Board lists the jobs successes.

> *100 cleantech startup companies and the creation of 323 jobs. Current and former tenant companies have launched more than 90 new cleantech products and have attracted nearly $100 million in private investment.*

Surely NYS Energy Board could find more job/industry success stories.

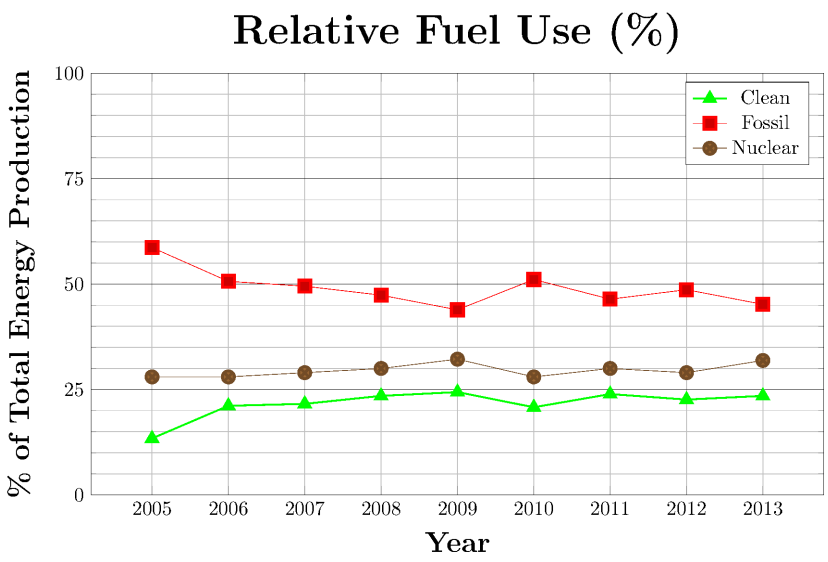

Figure 6: The proportion of electrical power generated from clean resources has remained essentially constant over the past 8 years (green line). Data Source: NYISO Gold Book reports for the years indicated.

In fact New York State has many jobs related to solar PV. NYS has 5,000 jobs related to solar installation, manufacturing and related jobs. And those solar job numbers increased by 51% from 2012 figures. Isn't this a success story?

New York State has many jobs related to the wind industry. NYS has between 1000 and 2000 wind turbine-related jobs, with a capital investment in New York State of $3.4 billion. NYS has 8 facilities manufacturing parts related to wind energy...products that range from blade, tower and turbine nacelle assembly facilities to raw component suppliers including fiberglass and steel[16]. Isn't this a success story?

3.10 Climate Change is Ignored – Future $ Expenditures for Current Fossil/Nuclear Infrastructure Emphasized

The New York Energy Plan should be honest with New York State residents: whether New Yorkers decide to continue with a fossilized/nuclear 'Business as Usual', or decide to switch to 100% renewables.....New Yorkers are locked into future cost increases. The question is about the magnitude of that cost increase: if we continue with fossil fuels we will permanently change the weather patterns on Earth. If we continue with nuclear energy, we will be living under the threat of future Fukushima disasters, the problems of isolating spent nuclear fuel from the biosphere, and nuclear proliferations. Either one is a gargantuan future cost burden to New York State residents that can only be ameliorated by switching to renewables. Switching to 100% renewable energy will minimize future cost increases to New York State residents. These facts are ignored, as indicated by the following statement on page 12 of volume I, where it's explained why we should go to renewables:

> *Unless we change our approach to provide greater emphasis on energy efficiency and clean, localized power sources, it is estimated that over the next 10 years more than $30 billion will need to be invested in New Yorks electric system to replace aging infrastructure and central generation resources just to meet currently projected energy demand.*

We should be spending more than $3 billion annually to replace our aging energy fossil/nuclear infrastructure with renewable energy generation. In fact New York State should be spending about $10 - $20 billion annually (see below) during the switch to 100% renewables, as the total cost of the Jacobson plan is about $250 billion.

The word 'climate' appears once on page 21, and refers to it as a global challenge (which it is) and says New York State should do its part to address it. Fine. But climate change deserves more than one sentence and the New York Energy Plan should formally recognize climate change amelioration as principal driving force for the switch to renewables.

3.11 Energy Plan Does not Address the Issue of Closing Nuclear & Coal Plants

All of New York State's coal-fired electrical generating plants are distressed economically because of 1) cheap natural gas and 2) enhanced EPA regulations on particulate emissions. The efforts to close nuclear power plants have received impetus from the Fukushima disaster. New York State's Draft Energy Plan should address these issues in the context of closing them, and bring forth a plan to replace them with renewable energy.

The vision of renewable energy replacing nuclear power is within viewing distance. The percentage of power generated from renewables is only 7% less than than that of nuclear (figure 6).

The New York State Energy Board should set an immediate goal of equalizing the power generated from renewables and nuclear sources within 4 years.

3.12 Marc Jacobson Plan for 100% Renewables in New York State is Ignored

In the spring of 2013, Marc Jacobson and colleagues published their seminal paper showing how New York State could generate all its power from renewables[32]. Jacobson has devoted his career outlining such transitions for many of the world's countries. Why did the Energy Planning Board ignore the world's leading expert?

3.13 Current State of Ontario Renewable Energy

By contrast to New York State, Ontario is rapidly growing its already abundant solar PV resources. Ontario currently has 765 MW[6] of solar PV and another 979 MW (to be placed on 10,122 acres) approved for construction[7]. Ontario shut down its last coal plant in April 2014[18], while NYS increased its coal usage by 5% (see above).

New York State solar PV totals are unknown because the NYISO Gold Book does not list mention the 211+ MW of solar PV on our 30,000+ roof tops: surely that number should be recognized by NYISO as that solar power is fed into the grid. And the Public Service Commission should mention it in the New York State Energy Plan.

For wind, New York State has 1,730 MW, representing 993 turbines, with no more in the planning stages. Ontario has 1,803 MW[8], with another 571 MW (534 turbines) approved for construction[9].

3.14 Ontario's Long-Term Energy Plan (LTEP)

In December 2013, Ontario's Ministry of Energy published a 92 page energy plan for that province[13]. By contrast to NYS Energy Plan, specific targets are plentiful, and some innovative suggestions included, and these should be included in NYS Energy Plan.

We quote some selections verbatim from Ontario's LTEP:

- By 2025, 20,000 MW of renewable energy will be online, representing about half of Ontarios installed capacity.
- Ontario will phase in wind, solar and bioenergy over a longer period than contemplated in the 2010 LTEP, with 10,700 MW online by 2021.
- Ontario will add to the hydroelectricity target, increasing the provinces portfolio to 9,300 MW by 2025.
- By the end of 2014, Ontario will be coal free. At the same time, increased energy efficiency and the changing shape of Ontarios economy have reduced the demand for electricity.
- The province expects to offset almost all of the growth in electricity demand to 2032 by using programs and improved codes and standards. This will lessen the need for new supply. Our long-term conservation target of 30 TW·h in 2032 represents a 16% reduction in the forecast gross demand for electricity....
- Ontario is aiming to use Demand Response (DR) to meet 10% of peak demand by 2025, equivalent to approximately 2,400 megawatts (MW) under forecast conditions.
- The Green Button Initiative will give consumers access to their energy data and the ability to connect to mobile and web-based applications so they can analyze and manage their energy use.

[6] http://en.wikipedia.org/wiki/Solar_power_in_Canada#Statistics
[7] http://www.ontario.ca/environment-and-energy/renewable-energy-projects-listing
[8] http://en.wikipedia.org/wiki/List_of_wind_farms_in_Canada
[9] http://www.ontario.ca/environment-and-energy/renewable-energy-projects-listing

Table 2: Comparison between Ontario's Long Term Energy Plan and NYS Draft Energy Plan.

Search Term	New York State Draft Energy Plan (Vol. I)	Ontario Energy Plan
'kW'	4	11
'kW·h'	0	6
'gW·h'	1	0
'MW·h'	7	2
'TW·h'	0	22
'$'	10	51
'Conservation'	1	111
'Fossil'	4	7
'Nuclear'	0	81
'Oil'	7	27
'Coal'	0	32
'Efficiency'	38	29
Totals:	**72**	**379**

- Social bench-marking can increase awareness of energy use and promote conservation. A social bench-marking pilot program is under way, led by the Ontario Power Authority (OPA) to test different approaches that enable consumers to compare their energy consumption with other similar consumers. Pending the success of the pilot program, the government will explore expanding social bench-marking and including other sectors.
- The Pickering [nuclear] Generating Station is expected to be in service until 2020. An earlier shutdown of the Pickering units may be possible depending on projected demand going forward, the progress of the fleet refurbishment program
- The Ministry of Energy and the OPA are developing a new competitive procurement process for future renewable energy projects larger than 500 kilowatts (kW), which will take into account local needs and considerations. The ministry will seek to launch this procurement process in early 2014.
- Ontario will examine the potential for the microFIT program to evolve from a generation purchasing program to a net metering program.
- Significant ratepayer savings will be realized as a result of reduced Feed-in Tariff (FIT) prices, the ability to dispatch wind generation, the amended Green Energy Investment Agreement, and the decision to defer new nuclear.
- By the end of 2014, the government will include storage technologies in our procurement process, starting with 50 MW and assessing additional engagement on an ongoing basis.
- The new competitive procurement process for renewable energy projects larger than 500 kW will also provide an opportunity to consider proposals that integrate energy storage with renewable energy generation

3.15 Comparing NYS Draft Energy Plan & Ontario's Long-Term Energy Plan (LTEP)

We compared the number of strategy indicators found in the NY State Energy Plan with Ontario's Long-Term Energy Plan, dated December 20132. LTEP has 6-fold more strategy indicators than NYS Draft Energy Plan. Often those additional indicators were associated with numbers. Hence, LTEP contains many specific targets for renewable energy. Can there be clearer evidence that NYS Draft Energy Plan is a *Business as Usual Plan?* and Ontario's energy plan is directed toward reducing fossil/nuclear fuel use while increasing renewable energy – all in a very competent and serious manner.

4 What the NYS Energy Board Should Do....

4.1 Develop a plan for switching to renewable energy while gradually reducing our dependence on nuclear and fossil fuels

4.2 Recognize the Problems Posed by Climate Change

Officially recognize and discuss the problem of anthropogenic climate change

4.3 Solving the Demand-Response Problem using Non-Dispatchable Sources of Energy

Climate change amelioration involves eliminating fossil/nuclear fuels and replacing them with renewable sources of energy: wind, solar and geothermal. This is a process that can take place over 2 decades.

Fossil and nuclear power generators are dispatchable: we can – to varying degrees – turn them on and off when needed. Non-dispatchable cannot and their power generation relies on the weather. How do we solve this problem?

While renewable sources of energy rely on the weather, using long term weather dara, we can predict how much power they generate – on average – each year.

The amount of renewable power that's needed to totally replace all our fossil and nuclear fuels is $\sim$ 5 to 6 times the current nameplate capacity (46 GW), or $\sim$ 250 GW of renewable energy.

We need about 5 to 6 times the current nameplate capacity because (apart from geothermal sources) wind and solar sources of energy works only 8% to 35% of the time (i.e. 0.05 to 0.35 x 8760 hours/year), for a rough average of 20% of the time. Hence the factor 5 to 6 – (5 times 20% = 100%).

As renewable sources energy are weather dependent (clouds, windless times), we build out – in widely geographically dispersed manner – our new energy infrastructure to be as resistent to clouds and windless areas as possible.

Our new renewable sources of energy – about 700 TW·h – will be plentiful, geographically disbursed, and highly resistant to terrorism. Failure of a few power generating sites – due to super storms/terrorism – will not have a significant effect on NYS residents.

Energy users and producers will be connected by a smart-grid that monitors the needs of energy users on a sub-second time scale. That is how the demand-response problem will be solved – all this is technologically feasible now.

Plentiful solar/wind/geothermal generators, geographically dispersed, and smart-grid interconnects are the keys to 100% dependence on renewable energy.

4.4 Hold State-Wide Hearings on Marc Jacobson's Plan for NYS

Seriously consider Marc Jacobson's plan[32] and hold hearings across the state for citizen input on that plan. Implementation of that plan will cost $\sim$ $260 billion. There maybe cheaper ways of implementing that plan by changing the mix of renewable energy.

Regardless of the particular mix of renewables, lands - real estate - space is required to build the solar and wind farm infrastructure. Apart from existing rooftops, where do we look for new lands upon which to build our new renewable energy infrastructure?

4.4.1 Evaluate New York's Abandoned Croplands for Renewable Energy Generation

While New York State has 7 million acres of actively farmed land[9], the Empire State has 9.156 million acres of abandoned cropland[36]. This land resource should be evaluated for wind turbines and/or solar PV.

For example, the abandoned cropland could produce 2,000 TW·h via solar PV[10], or 760 TW·h for wind generation[11]. In 2012, New York State generated a total of 140 TW·h of electricity from all sources.

To build our x5 nameplate capacity, we would need only 33%, or 90% of the abandoned cropland area for solar or wind, respectively.

Clearly there is an immensely usable resource in the abandoned croplands of New York State.

[10] Assuming 4 acres/MW and 10% capacity factor

[11] Assuming 25% capacity factor, and for a given area, wind nameplate is 7 fold less than solar PV nameplate

4.4.2 Evaluate EPA Sites

Consider placing solar PV and/or wind turbines on all EPA sites within New York State – 229,807 acres[36]. Such land could generate 50.3 TW·h from PV (10% capacity factor), or 18 TW·h from wind (26% capacity factor)

A 43 acres superfund site in Indianapolis is now home to the 8 MW Maywood Solar Farm[2], the largest solar farm on a superfund site. There are now 84 EPA superfund site solar farms in operation across the US.

Vertellus, a private company, owns the site. *'CEO Rich Preziotti said the project has put into productive use idle land on Indianapolis' southwest side that had served as storage space for shipping trailers since the mid-1990's. We're using this land in a really neat way we're providing renewable energy to the community and getting some value from that land'.* The lease arrangement between Vertellus and the solar panel maker – Hanwha Q CELLS – runs for 30 years.
[2].

The solar array supports were designed to minimize soil disturbance and subsequent spreading of the benzene-creosote-laden subsoil, and use the existing topography. The EPA helped extensively with that design.

We in New York have the mother of all superfund sites: Love Canal (figure 7). Love Canal was the first time in American history that federal disaster relief funds were allocated for a human-made disaster. *'Love Canal has "become the symbol for what happens when hazardous industrial products are not confined to the workplace but 'hit people where they live' in inestimable amounts'*[12].

Love Canal was the principle driving force helping to create a federal pool of money – a superfund – to help areas and residents impacted by unregulated disposal of toxic wastes.

Therefore New York State should start covering its EPA sites with solar and/or wind generation and should symbolically start first with Love Canal in Niagara Falls (figure 7). The EPA is standing by, willing to help with funding and details.

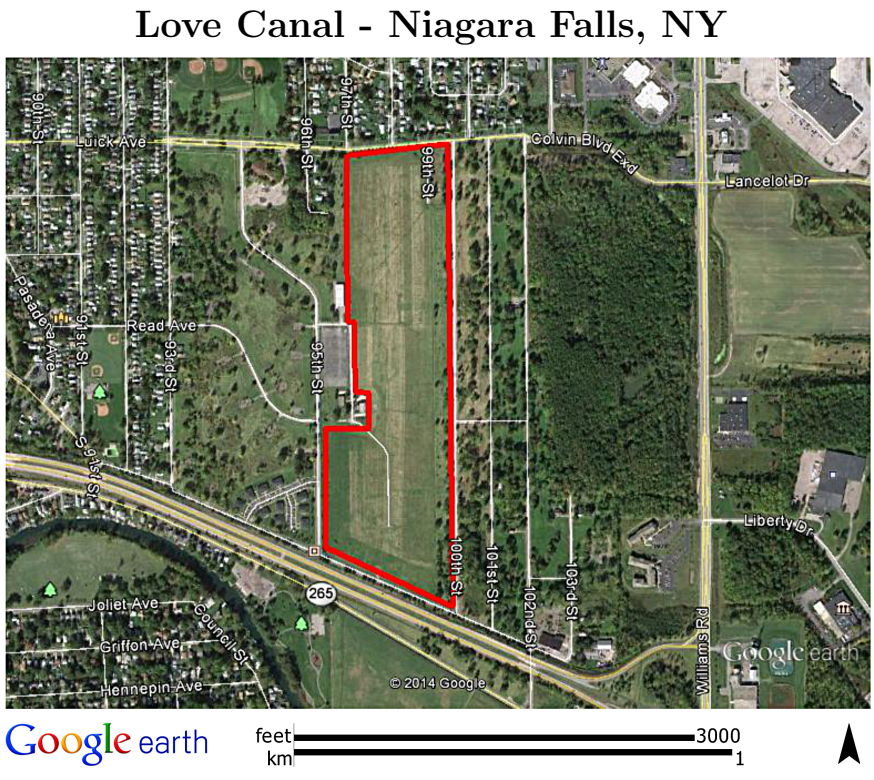

Figure 7: The 58.8 acre site at Love Canal, Niagara Falls could support a 14.7 MW solar farm, generating 12.9 GWh annually. This could be the largest superfund solar farm in the US.

The NYS Draft Energy Plan should encourage establishment of renewable energy on our 229,807 acres of superfund sites. The EPA is awaiting with some money to help out.

[12] http://en.wikipedia.org/wiki/Love_Canal

4.4.3 Evaluate Rights of Way Land: Rail, Transmission & Roadways

Consider placing solar PV and/or wind turbines on the rights-of-way of all rail, roads and transmission lines within New York State. Such lands total 367,938 acres. If 20% of that land were suitable for either wind or solar PV, 16 TW·h or 5.7 TW·h could be generated from solar PV and wind turbines, respectively.

4.4.4 Evaluate all Urban/Suburban NYS Rooftops

Evaluate rooftops within New York State for suitability for solar PV, and create a web site so building/home owners can evaluate the solar potential of their rooftops. Such evaluation can be done by properly equipped aircraft carrying aerial laser-scanning LIDAR (Light Detection And Ranging)[35]. That paper describes a method whereby solar insolation can be combined with PV module characteristics to give the solar potential for a scanned rooftop. Such an analysis was completed for Boston MA.

4.4.5 Evaluate all Former Military Base Lands

Evaluate all former military bases for solar PV and/or wind turbines. The largest closed military base in New York State is the former Seneca Army Depot which has 8,365.74 acres, excluding the 500 acre 'Area-Q – home to a unique population of white deer – and the Five Points Correctional Facility. Those $\sim$ 8,400 acres be home to 2,091 MW of solar PV farm generating 2,681 gW·h annually[13]. **The largest solar farm in the United States.**

4.4.6 Evaluate all NYS Thruway Travel Plazas

There are a growing number of electric cars, and we should encourage their use on the NYS Thruway. Evaluate all New York State Thruway Travel Plazas for solar PV canopies. Solar canopies could not only generate electricity but also capture rainwater for brown-water uses at the travel plaza. And we could use a portion of that energy to charge electric vehicles. We estimate there are 115 acres in total which could generate 37 gW·h annually[14].

And the solar canopy would be a visual reminder to gasoline-powered car owners that renewable energy is doable.

4.4.7 Evaluate Micro-Hydro at all Dams/Locks along the Erie, Cayuga, Oswego & Champlain Canals

As a kid, I remember my parents bringing me to the locks along the Champlain and Erie Canals, entering the power buildings along side the locks, and gazing at the hydropower generators constantly in operation. These were cared for by the lock tenders. Much effort was expended in shining the brass and the lock tenders were obviously proud of their work. Those hydropower generators – that worked for 50 years – were removed in the early 1970s as oil/gas pipeline infrastructure was built out, making the locks dependent on power lines and fossil fuels.

The structures that housed those generators are still in place, and we could again make power at all dams along our canal system. And we should use a smart-grid to export excess power to the grid from the locks.

Using all 54 dams at locks along the Erie, Champlain, Oswego and Seneca Canals to generate electricity. The dam heights range from 8 feet to 40 feet and the structural facilities to house such micro-hydropower generators are largely in place. So why not use them?

I calculated an approximate amount of canal hydropower available using methods developed years ago[29], and estimate a total of 289 gW·h could be generated annually from all 54 dams[15]. That would be roughly equal to the amount of power we generate from wood waste or fuel oil (figure 1). Let's get to it!

4.4.8 Evaluate all Reservoirs

Placement of solar PV on reservoirs is gaining popularity in water-scarce areas of the US. Such solar coverings reduce evaporation and do not interfere with the primary purposes of reservoirs: supplying drinking water or hydropower

[13] http://wnypeace.org/new/projects.html

[14] personal observation, unpublished

[15] assuming 60% capacity factor; 1,000 ft^3 per second flow rate(Q); 65% efficiency(E); Δ H: dam height in feet; ρ density of water is 62.4 lbs/ft^3; Power(kW) = $\frac{0.746*Q*E*\Delta H*\rho}{550}$

generation. While water scarcity is not (yet) an issue in New York State, the areas taken up by our reservoirs could be put to dual use. For example, the pump storage reservoir at Lewiston NY is the largest such reservoir in NYS. Its 1,860 acres (which includes small parcels of land adjacent to the reservoir) could generate 710 gW·h annually and be home to 620 MW solar PV array. The array would not affect fishing at the eastern edge of the reservoir as the boundary of the solar array would be 100 feet from shoreline. As the reservoir fluctuates weekly in height by 40 feet, steel support structures would probably be needed to support the array.

Another pump-storage facility exists at Blenheim-Gilboa Reservoir, which has 4 generators. Unlike those at the Lewiston Pump Storage Reservoir, the Blenheim-Gilboa Pump Storage generators remain idle for about 95% of the year: the Blenheim-Gilboa capacity factors range between 1.2% and 5.5% perhaps because its source of water is a reservoir that also functions as one the many reservoirs that supply drinking water to New York City.

Instead of remaining idle for an equivalent 11 months of the year, the 382 acre Blenheim-Gilboa Reservoir site could support 95.6 MW solar PV array and generate 83.7 gW·h annually – and supply clean power when it's most needed during the summer months.

4.4.9 Evaluate all Airport Lands

The FAA has a grant program to support the construction of solar PV arrays at airports. About 30 solar arrays are operating at 15 airports in the US[25].

New York State has 15 primary airports, 3 other airports with scheduled passenger service, 20 reliever airports, 50 general aviation airports, 50 "other public-use" airports, 12 private use airports, and 34 former airports, totaling 184 airports within New York State[12].

4.5 Publish Power Generation from Each Solar Array

Figure 8 shows 1,601 locations in NY State that have solar arrays/panels. Those locations generate a total of 129.5 MW. This is a minimum number since the database upon which figure 7 only has voluntary reporting (see legend, figure 7). The yellow pins in figure 7 represent less than half of NYS total solar PV generation.

Currently NYS has $\sim$ 247 MW of functioning solar PV[19], covering many roofs of homes and commercial establishments. In their annual "Gold Books", NYISO does not list the PV energy generation – $\sim$ 324 gW·h – from these arrays. The power generation is roughly equal to that generated from wood waste combustion, which is listed annually by NYSIO. NYS Energy Law, which empowered the NYS Energy Planing Board, requires the board shall

> (iv) an inventory of: (A) **all existing supply sources**, storage facilities, and transmission facilities which are used in providing service within the state...[3]

Where is the list of these solar PV sites? Why wasn't a summary of their power generation included in the 'Success Stories' section of the Draft Energy Plan?

The Energy Planing Board should encourage NYISO to list the power generation from all solar arrays in NYS, not just the Long Island Solar Farm.

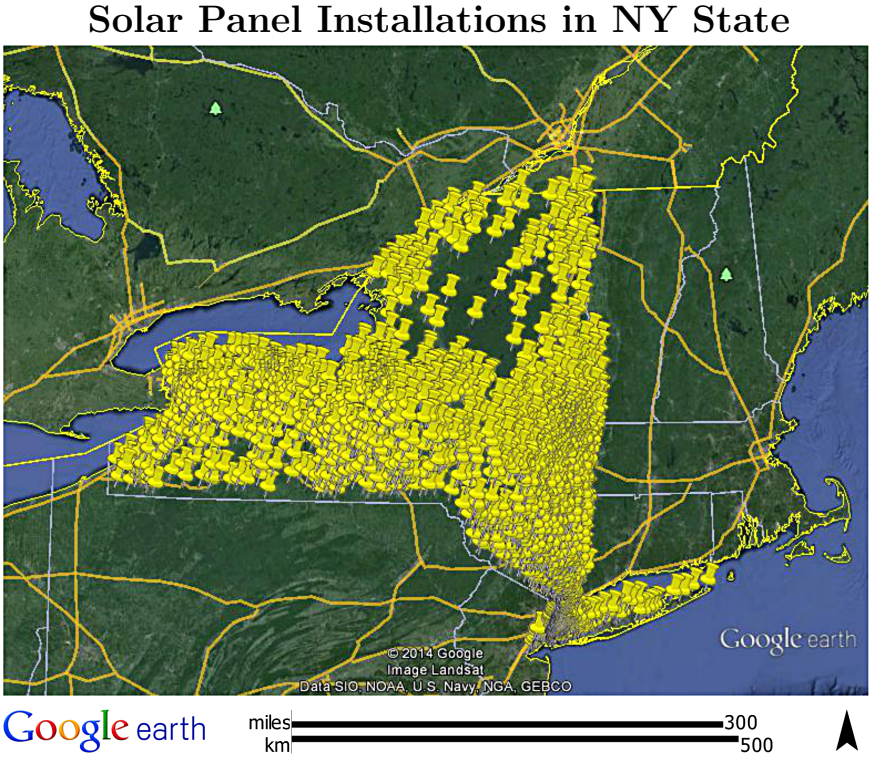

Figure 8: Solar PV installations in New York State. Data source: Open PV Project of the National Renewable Energy Laboratory [22]. The Open PV Project lists latitude and longitude of each solar installation - a total of 6,950 projects listed for NYS as of April 2014. There are many duplicate latitude and longitudes (as each project was built at different times on the same site). I wrote a Python program to eliminate the duplicate lats/longs ending up with 1,601 unique latitude/longitude, shown in the Google Earth map. Data in the Open PV project is voluntarily reported, so this compilation represents a minimum number of functioning solar arrays in NYS. The total PV power in NYS listed by the OpenPV project is 129.5 MW, and the median is 6.25 kW. It's likely the majority of the information covers roof-top installations. The oldest solar array listed was installed on September 1, 1995.

4.6 Increase Air Monitoring of Methane

Methane's atmospheric concentration is $\sim$ 1840 parts per billion (ppb) while CO_2 is $\sim$ 400 parts per million (ppm) – a 200 fold difference. Current radiative forcing of all greenhouse gases total 2.29 W/m^2. Carbon dioxide generated from fossil fuels accounts for about 55% and methane contributed 45% (about 1 W/m^2) [30], in spite if 200 fold less concentration. **Hence the immense power of methane to warm the atmosphere, and we need to do something about it.**

The proverbial *canary in the coal mine* methane detection method needs non-avian re-implementation on a world-wide level. In March 2014, President Obama sensibly called for increased air monitoring of fugitive methane from upstream sources (gas wells, mines) and downstream sources (pipe fittings) [23]. And Cornell University Professor Robert Howarth recently said *No new measurements for downstream [methane] emissions alone have been published since 2005* [30].

Atmospheric methane measurements are in a sad state of affairs, and NYS should do its part to change this. New York State should measure methane leakage from abandoned conventional gas wells. Says the NYS Department of Environmental Conservation (DEC):

At least 70,000 oil and gas wells have been drilled in New York since the 1800's, but information is available for only about 30,000 of them. Locations for the others are unknown, and wells have been found in such unexpected places as basements, stream banks and under parking lots. Abandoned wells may pose hazards not only to walking on the ground surface if outdoors, but also to ground water resources if not properly plugged. [16]

According to the DEC[17], we have 11,970 active gas wells; 2,171 wells active with expired permits (whose is checking up on these?); 18,425 plugged and abandoned wells; 1,938 wells of unknown status (no permits!); and 486 wells with voided permits. Seven wells are curiously classified as dry hole - active. How can a dry hole be active?

[16] http://www.dec.ny.gov/energy/1532.html
[17] http://www.dec.ny.gov/energy/30438.html

Of the total number of wells (41,102), 7,150 are active gas wells. Thirteen gas wells are listed as having an unknown location, each with a spud date of 1/1/1900. We have 3,531 active oil wells. 1,771 gas wells are plugged and 8,822 oil wells are so listed. The oldest active gas well was spudded on October 22, 1902 and last check by the DEC in 1991.

In my home town of Amherst NY there are:

- 29 wells do not have a specified owner.
- 23 of the gas wells with "unknown" status are not known to be plugged
- 2 gas wells are listed as inactive, but not plugged.
- Well depths are known only for 12 wells (ranging from 492 - 1000 feet)
- all are presumably inactive

Clearly many of these wells could be leaking methane – whether they are oil, gas, water or storage wells – and should be checked for emissions given the danger methane poses to global warming.

4.7 Allow Renters to Participate in Renewable Energy

The Draft Energy Plan proposes to establish a Green Bank with $1 billion to encourage private funding of renewable energy infrastructure. Establishing such a bank will likely rule out participation in renewable energy by renters in NYS. They are in a bind since they cannot unilaterally place a solar array/micro wind turbine on their roofs.

New York State has about 4.5 million residents living in multifamily dwellings[18]; hence there are 2.5 million adults who would be left in the lurch if the only thing the Draft Energy Plan does is establish a Green Bank.

The Energy Planning Board should create an additional financial vehicle whereby renters – indeed any NYS resident – can participate in funding our renewable energy future. For example, the board could allow groups of NYS residents to pool their money (i.e. buy shares in a company) to build solar/wind farms in rural New York State, as we have ample abandoned farm land to generate much, if not all, our power (see above). Power generated from such farms would be used to reduce their monthly power bills of the shareholders. Such an effort would help fulfill the Planning Board's authority: to wit,

> *Energy Law § 6-102.5. The board shall in the consideration and development of policies, programs, and other actions, be guided by the goals of: improving the reliability of the state's energy systems; insulating consumers from volatility in market prices;* ***reducing the overall cost of energy in the state****; and minimizing public health and environmental impacts, in particular, environmental impacts related to climate change. Each energy plan shall also identify policies and programs designed to maximize cost-effective energy efficiency and conservation activities to meet projected demand growth.*[8]

4.8 NYS Should Increase Annual Expenditures for Renewable Energy Infrastructure

As Jacobson et al has pointed out[32], we need to be generating almost all of our renewable energy in 20 years. That's the earliest projection that now-rapidly-disappearing Arctic sea ice will disappear for the entire year...i.e., no ice in the winter! Arctic ice reflects back to space much of the infrared radiation that would otherwise contribute to global warming, and sea-ice disappearance would greatly accentuate global warming.

NYS currently generates about 32 TW·h from renewables (Figure 2). Since we generate a total of 140 TW·h annually, we need to replace 108 TW·h generated by fossil and nuclear sources. We have 20 years (actually 19 now, but let's go with 20). That means we should be replacing 5.4 TW·h (i.e. about 1.2 GW; 50% capacity factor) of dispatchable[19] with non-dispatchable[20] renewables. That is, NYS needs to be building about 6 GW (5 times 1.2 GW) of renewables annually.

It's taken New York State 7 years to build 1.3 GW of wind generation (185 MW built annually), and 7 years to build 247 MW of solar capacity (35 MW annually). We won't meet the deadline if we keep up this turtle-slow pace.

[18] http://www.nmhc.org/Content.aspx?id=4708#Rent_v_Own
[19] electrical generation that's available when called upon
[20] electrical generation that depends on Mother Nature, but whose average annual production is very well known

We need to determine how much NYS should be spending on renewables each year. Since wind costs roughly $2/Watt and solar, $4.7/Watt ... for an average of ∼ $3.35 per Watt, **New York State should be investing approximately $20 billion annually on renewables to meet the 20 year deadline.**

4.9 Where, Oh Where Could New York State get $20 Billion of New Money Annually?

An April 4, 2013 Bloomberg news article estimated the Jacobson et al plan would cost $380 billion by 2030. For the next 16 years, we need ∼ $20 billion annually to fund the switch to renewables. Where can we find it?

The Stock Transfer Tax

From 1908 to April 2014 – 108 years – NYS imposed a tax on the transfer of stock. In 2012 and 2013 NYS collected $14,459,838,462, and $12,052,025,875, respectively[15].

While NYS collects about $12 billion annually from folks buying shares of stock, they also send – since 1981 – 100% back to Wall Street firms each year.

The stock transfer tax could easily fund the transition to renewables in NYS...$12 billion could support a $300 billion bond issue (at 4%) to fund the transition to renewables.

Let the high frequency traders & hedge fund traders pay for it.

One problem.

Even though Wall St. got 100% of that tax back every year, Wall St wanted more. In 2014, they asked Gov. Cuomo to repeal the tax, and shamefully, Gov. Cuomo said OK[21]...and the legislature passed the budget containing that request in April 2014.

The NYS Energy Board should request Gov. Cuomo and the legislators to reinstate the stock transfer tax for the purposes of funding the switch to renewable sources of energy.

4.10 Closing Coal Plants, Just Transition & Sources of $

While the probability of reinstating the stock transfer tax maybe equivalent to a global cooling in the next few years, we do need to find more politically expedient sources of money to aid workers, towns and schools that are at risk for coal plant closings.

NYS has 9 coal plants, located in Syracuse, Jamestown, Cayuga (north of Ithaca), Somerset and Buffalo, and all generated only 3.1% of our 140 TWh's in 2013.

The Clean Air Coalition's wonderfully detailed report[34] on the NRG's two coal plants at Huntley show they are experiencing financial hardship for the past few years, although in 2013 Huntley generated 68% more electricity in 2013 than 2012 (706 gW·h vs 1,074 gW·h). They are at risk of closing before plans for renewable energy and Just Transition mature in NYS.

In 2012, NRG paid the Town of Tonawanda ∼ $5 million in taxes, or $0.0071/kWh generation, and perhaps, $7.6 million in 2013.

What happens to the towns and plant workers if fossil fuel plants close in NYS?

New York State needs a source of revenue to support the unemployed coal plant workers (and future unemployed fossil fuel plant workers) and replace the tax base for towns and schools as we gradually transition to renewable fuels.
From a recent study on the wonderful hydropower generated at Niagara Falls[39]... comes an idea.

NYS and Ontario could divert more Niagara River flow for power generation, without seriously affecting tourism at the falls. If divided equally between Ontario and NYS, what could NYS do with an extra $50 million received by selling

[21] http://blog.timesunion.com/capitol/archives/208677/progressives-riled-by-stock-tax-plan/

1,600 GWh at $0.03/kWh?

Some possibilities:

1. Use the extra power to reduce total coal generated power in Zone A from 3,430 GWh to 1,830 GWh (i.e. goodbye all coal generating plants in Zone A, except Somerset, as Somerset generated about 2,000 GWh in 2012

2. Use the extra power to reduce to reduce methane/Fuel oil burning in Zone A from 528 GWh to zero, and reduce coal burning in Zone A to 2,358 GWh.

3. In addition to 1 and/or 2, we could the extra $50 million to pay the interest on a $1.25 billion bond at %4 APR.

The $1.25 billion fund for Just Transition in NYS would go along way in supporting unemployed workers destitute towns/schools as we transition to renewable energy.

Appropriately funding and defining Just Transition will smooth the political pathway to 100% renewables in NYS.

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