



September 7, 2018

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**Subject: Conversion of the TCAT Bus Fleet to Electric Vehicle Mobility
An Exercise in True Sustainability and True Environmental Protection**

Dear Governor Cuomo:

Attached is a subject titled draft. The acronym TCAT refers to the Tompkins County Area Transport serving Ithaca, NY, the city of my alma mater, Cornell University.

Please note that, on Page 9, I discuss the following headlines:

**NYSERDA Announces Completion of 11
Electric Vehicle Charging Stations in
Tompkins County**

**Installations are First Step Toward Tompkins Becoming
an Electric Vehicle Model County**

July 09, 2018

Thanks to you and those involved in this work. The attached seeks to build on those good efforts.

The inside sleeve contains an item of my previous automotive professional duties; there are very few that have equal experience with diesel powertrains; similar to those that propel TCAT and New York State buses. From its original concept to production launch, my team and I were privileged to bring this famous truck to market. It is partially in that context that I am now privileged to 'move forward' in these areas.

Please do not hesitate to contact me at any time.

Respectfully yours

Paul V. Sheridan

Attachments

Conversion of the TCAT Bus Fleet to Electric Vehicle Mobility An Exercise in True Sustainability and True Environmental Protection

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This essay with active hyperlinks is available here: <http://pvsheridan.com/Sheridan2TCAT-1.pdf>

Conversion of the TCAT Bus Fleet to Electric Vehicle Mobility An Exercise in True Sustainability and True Environmental Protection

Preamble

The Tompkins County Area Transport (TCAT) is an independent organization that provides public transport, concentrated in a region of New York State called the Finger Lakes. The service areas are routed around the second largest of the Finger Lakes, Cayuga Lake. ^A

This unique geography dictates much of the TCAT burden: (1) circuitous routes *per se*, (2) mountainous/hilly terrain, (3) both open rural and tight city routing, and (4) four distinct weather seasons, with winter being especially demanding (ATTACHMENT 1).

These factors are especially attractive as both pilot and prove-out of the concepts of electric vehicle (EV) mobility. If the EV is viable in this challenging Tompkins County setting, than it should be viable in the less demanding scenarios (ATTACHMENT 2).

The context of the Proposal to covert the TCAT bus fleet to battery EV (page 12) is three-fold.

Context – Part 1 of 3 : The Famous Natural Beauty of the Finger Lakes Region

The beauty of the Finger Lakes Region is not a matter of personal opinion, it is world-renown. The landscapes are as rugged as they are appealing to human and wildlife alike. When I share photographs of the area, including from the campuses of Ithaca College and Cornell University, many, especially those who have never visited are skeptical that the photos are “New York.”

Proposals that involve protection of the environment must ensure that said protections are pursued comprehensively. Proverbially, two steps forward and one back is not acceptable. Nor does trendy rhetoric constitute or justify alleged “compromises.” From ATTACHMENT 1:

Ithaca is home to two major academic institutions, making the population especially sensitive to the human condition, and how preservation of the environment is central to their well-being. That preservation however is intimately tied to ensuring that so-called solutions to environmental issues do not impinge in any way on the famous beauty of the Finger Lakes region.

Specifically, the notion that the enormous benefits of converting the TCAT bus fleet to full EVs can only be accommodated by blighting the Finger Lakes with *more* large-footprint eye sores, endemic to solar farms and wind farms, **is rejected.**

An alternative source for the incremental electrical energy power demanded by a TCAT EV bus fleet is discussed that is (1) far less destructive to the Finger Lakes’ environment especially its myriad wildlife, (2) far more robust technically (i.e. efficient, especially in terms of landscape footprint), (3) orders of magnitude more reliable (i.e. with predictable support for grid base load), and (4) far more forward-looking in terms of a future wherein, not only will the EV dominate most transportation needs, but elimination of hydrocarbon/carbon sources can also occur for non-transportation needs; home heating, etc. (ATTACHMENT 3).

Conversion of the TCAT Bus Fleet to Electric Vehicle Mobility An Exercise in True Sustainability and True Environmental Protection

Context – Part 2 of 3 : A Lack of Local Focus on the EV Solution

Examples of municipalities that have converted some or all of their buses to EV, or have active plans to do so, abound worldwide. But plans for EV buses in Tompkins County New York are rife, if existent at all. The numerous official energy studies produced over the last ten years on this region never even mention the term ‘electric bus.’ A few typical examples:

- In the 2012 report, *Energy Supply and Demand - Tompkins County, New York*, the terms bus, TCAT, etc. are nowhere to be found. **B**
- In the 2016 report, *Tompkins County Energy Roadmap*, the only time the TCAT bus is even discussed is in reference to “bus terminals.”

This latter report is typical. It never mentions ‘electric bus.’ Instead it claims that bus terminals are “*deemed appropriate*” for medium-scale wind turbines. A screenshot from Page 65: **C**

Lands Deemed Appropriate for Medium-scale Wind:

Many land uses may be acceptable for developing medium-scale wind power. This analysis identified the following tax parcel property classifications as being appropriate for hosting medium-scale wind:

- Agriculture
- Commercial
- Industrial
- Public Services – includes water treatment facilities, bus terminals, pipelines, landfills, electric and gas facilities
- Recreation and Entertainment – includes fairgrounds, racetracks, golf courses, riding stables, camping facilities and picnic grounds
- Vacant Land – includes abandoned agricultural land
- Community Services – includes schools, libraries, colleges, churches, hospitals, government buildings and parking lots, correctional facilities and cemeteries

Dozens of these studies involving Ithaca and Tompkins County New York are instead focused on “fossil fuels” and “carbon footprint.” **D**

- Assuming these two focus items are credible, how do we explain zero discussion of a two-fold resolution; conversion of the TCAT bus fleet to EV eliminates both. There is no reference in these studies to *Conversion of the TCAT Bus Fleet to EV Mobility*.
- This is compounded by the dishonest diatribe directed at nuclear power. Study comments are diversionary, dismissive, **and self-contradictory** . . . it is well-known that nuclear power does not have a “carbon footprint.”
- While the studies forcefully rail against the so-called “carbon footprint,” all avoid the large “footprint” **eye sores** of solar and wind farms that already blight the region; indeed these reports even seem to praise the latter!

Conversion of the TCAT Bus Fleet to Electric Vehicle Mobility An Exercise in True Sustainability and True Environmental Protection

Context – Part 3 of 3 : TCAT Bus Conversion to EV as ‘Low hanging fruit’

A few USA municipalities are actively pursuing the many advantages of converting their public transport to EV. **E**

A noteworthy example is the municipalities in the State of California, where favorable promotions, incentives, emissions laws, and positive public opinion/acceptance abound. Antelope Valley Transit Authority (AVTA), covers Los Angeles. From the AVTA website:

*January 2018 - The AVTA is bringing a fresh new energy to public transportation in the Antelope Valley! In 2016, the Board of Directors for AVTA set a goal of becoming the nation’s first fully electric fleet by the end of 2018, and plans to convert all of the agency’s aging diesel buses to a 100% battery electric bus fleet with up to 85 new all-electric buses. The board’s decision provided the agency with clear direction and sent a strong message that AVTA is serious about its intent to be “100% Green by 2018.” **F***

Indeed, the ACTA is an exemplar for all to emulate. That AVTA webpage continues:

The electrification of commuter routes will serve as a major pilot program for the State of California as electric commuter coaches are new to the transit industry.



But AVTA is not the only municipality to recognize, and act upon, the many advantages of the ‘low hanging fruit.’ The most awe inspiring is the City of Shenzhen, China.

Reacting in-part to a national edict . . .

AUTOS **BUSINESS**

China is banning traditional auto engines. Its aim: electric car domination

LA Times | By **RUSS MITCHELL AND JESSICA MEYERS** | SEP 12, 2017 | 10:00 AM | BEIJING

Conversion of the TCAT Bus Fleet to Electric Vehicle Mobility An Exercise in True Sustainability and True Environmental Protection

Context – Part 3 of 3 : TCAT Bus Conversion to EV as ‘Low hanging fruit’ - Conclusion

. . . Shenzhen has converted all of its buses to EV; a staggering feat involving **16,359 units**: ■



Amsterdam Airport in the Netherlands converted all Schiphol terminal buses to full EV: ■
These are a just few examples. The world at-large agrees (municipal and other); **conversion of the bus fleets to full EV constitutes the proverbial ‘low hanging fruit’** ■

Section Summary: Three-Fold Context – Basis of Proposal

- A. Proposals that involve (or allege to involve) protection of the environment must ensure that goal comprehensively. Heretofore avoided, the beauty and ecology of the Finger Lakes are not to be diminished in any way, or subjugated to the compromises of **alleged** “sustainability.”
- B. The attitudes and lack of a **long-term** foresight, of local and state level New York officials, regarding energy plans, specifically as such relates to the incremental power demanded by a **long-term** vision of electric mobility, must be addressed/corrected.
- C. Connected to Context B, the world at-large has already determined that transport bus conversion to full EV constitutes the greatest and quickest of comprehensive benefits; the proverbial **‘low hanging fruit.’**

Conversion of the TCAT Bus Fleet to Electric Vehicle Mobility An Exercise in True Sustainability and True Environmental Protection

Discussion – Very Brief Review of World Leader in Electric Mobility : China

The conversion of City of Shenzhen’s 16,359 buses to EV poses three simple questions:

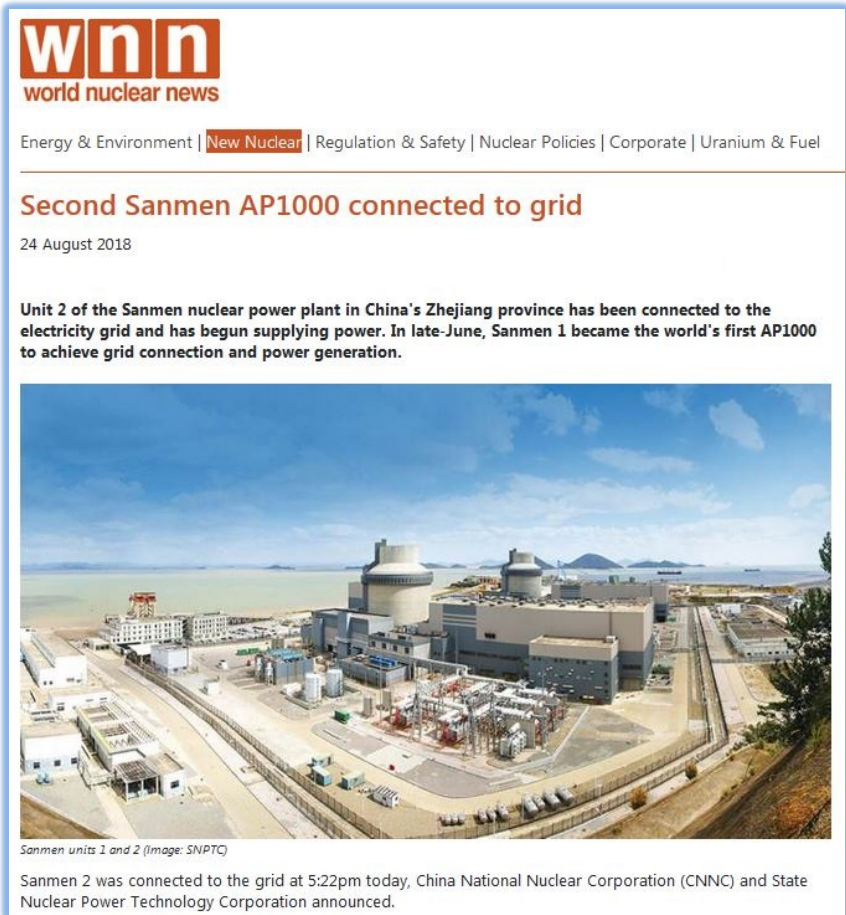
1. Does anyone actually believe that China intends to charge the batteries of that fleet (among many more to come) by use of wind farms and/or solar farms?

If we assume that most of the 16,359 units are the 40 foot coach model, the K9 Transit Bus, this involves charging its 500 kWh battery. The local charging infrastructure must accommodate an additional 8179500 kW, or **8.2 Gigawatts. An enormous amount of power.**

The Shenzhen infrastructure has been updated with 500-plus charging stations and 8,000 charging poles. The article, ‘China’s Shenzhen City Electrifies all 16,359 of its Public Buses,’ coyly concludes with the following unqualified, unspecified claim : **J**

“ . . . it took around \$490 million in subsidy to get the program started, but that’s a small price to pay for cleaner air, quieter cities and a huge boost to the renewables world.”

What renewables?! Clearly this journalist avoided the above question, and avoided the simple calculation for the power required to routinely charge 16,359 batteries of 500 kWh each! He also avoids Shenzhen’s 12,518 taxis; 62% already EV, the remaining 38% converted in 2018.




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Second Sanmen AP1000 connected to grid

24 August 2018

Unit 2 of the Sanmen nuclear power plant in China’s Zhejiang province has been connected to the electricity grid and has begun supplying power. In late-June, Sanmen 1 became the world’s first AP1000 to achieve grid connection and power generation.



Sanmen units 1 and 2 (Image: SNPTC)

Sanmen 2 was connected to the grid at 5:22pm today, China National Nuclear Corporation (CNNC) and State Nuclear Power Technology Corporation announced.

2. If China does ban the internal combustion engine (ICE) by 2030, what is their long-term solution to the enormous incremental electrical energy required to accommodate their new fleet of electric vehicles? **K**

Conversion of the TCAT Bus Fleet to Electric Vehicle Mobility An Exercise in True Sustainability and True Environmental Protection

Discussion – Very Brief Review of World Leader in Electric Mobility : China – Con't

An EyeShenzhen article of December 28, 2017 discusses how the low-hanging-fruit in Shenzhen has performed :

“ The electric buses use 72.9 percent less energy than diesel buses. In a year, the buses could save the energy equivalent of 366,000 tons of standard coal, replacing 345,000 tons of fuel, and reducing carbon dioxide emissions by 1.35 million tons. ” █

Nuclear Power in China

(Updated August 2018)

- Mainland China has over 40 nuclear power reactors in operation, about 20 under construction, and more about to start construction.
- The government's long-term target, as outlined in its *Energy Development Strategy Action Plan 2014-2020*, is for 58 GWe capacity by 2020, with 30 GWe more under construction.
- The impetus for nuclear power in China is increasingly due to air pollution from coal-fired plants.
- China's policy is to have a closed nuclear fuel cycle.
- China has become largely self-sufficient in reactor design and construction, as well as other aspects of the fuel cycle, but is making full use of western technology while adapting and improving it.
- Relative to the rest of the world, a major strength is the nuclear supply chain.
- China's policy is to 'go global' with exporting nuclear technology including heavy components in the supply chain.

Most of mainland China's electricity is produced from fossil fuels, predominantly from coal – 73% in 2015. Two large hydro projects are recent additions: Three Gorges of 18.2 GWe and Yellow River of 15.8 GWe. Wind capacity in 2016 was 9.1% of the total installed generating capacity, but delivering only 4% of the electricity.

China's commitment to modern sustainable nuclear power plants, and its commitment to banning the internal combustion engine, are inextricably connected: The former allows the latter to become not merely feasible, but robust. **These commitments resolve the pollution issues at both ends of the well-to-wheel life cycle:**

- A. At the well . . . the West continues to fumble with the notion of “carbon sequestration.” Globally these schemes involve trillions, not billions, **but TRILLIONS** in investment capital. The focus is the coal fired power plant. Nuclear power plants require no such schemes, and the associated counter-productive squandering of capital. █
- B. At the wheel . . . conversion of the bus fleet to EV eliminates the two primary issues: Chemical and noise pollution. (see 'The TCAT Bus Fleet – Background Brief' below.)

3. Would it not be prudent to emulate the China approach, wherein capital that was previously squandered in “carbon sequestration” retrofits of their coal-fired power plants, is now deployed to the construction of modern highly reliable and truly sustainable nuclear power? ^N

Conversion of the TCAT Bus Fleet to Electric Vehicle Mobility An Exercise in True Sustainability and True Environmental Protection

Discussion – Very Brief Review of World Leader in Electric Mobility : China – Conclusion



China operates the largest EV bus manufacturer in the world, BYD. China also already dominates the world in **the crucial portion of the EV paradigm**: vehicle battery design/production. NPP article of July 2018:

“Chinese vehicle maker BYD has opened a 24 GWh power battery factory in Western China’s Qinghai province and said it plans to increase total production capacity to 60 GWh by 2020. The factory, which is equivalent to the size of 140 football (soccer) fields, will be the largest in the world after its construction is completed in 2019. . . . **‘Electrification is a done deal** as several countries have announced a deadline for the sale of internal combustion engine cars to end. Electric vehicles are on the cusp of another boom,’ said BYD President and Chairman Wang Chuanfu.”

I attended the Society of Automotive Engineers (SAE) EV Symposium of February 2018, in San Diego, California. Mr. Xingyi Xu of Shanghai Dajun Technologies presented the following:

China Is Leading EV Development in the World

Huge total market with a large variety of segments

- Car-sharing in large cities vs. personal cars in the countryside;
- Light duty commercial vehicles with various specialties;
- Heavy duty E-trucks; etc.

Worldwide NEV Sales in 2017			
Ranking	Country	Total sales	Proportion
1	China	463369	53.70%
2	Japan	107740	12.49%
3	USA	104487	12.11%
4	Norway	33439	3.88%
5	France	32305	3.74%
6	Germany	27583	3.20%
7	England	22141	2.57%
8	Korea	13541	1.57%
9	Holland	8771	1.02%
10	Canada	8057	0.93%

Source: Marklines

Year	Charging Pile	NEV	Proportion
2010	~100,000	~10,000	51%
2011	~150,000	~15,000	103%
2012	~250,000	~25,000	135%
2013	~300,000	~30,000	101%
2014	~400,000	~40,000	30%
2015	~500,000	~50,000	13%
2016	~600,000	~60,000	28%
2017	~700,000	~70,000	26%

Source: Perspective research institute

The right panel establishes that China is not merely the leader in EVs . . . **China’s EV domination represents more than the next nine countries COMBINED.**

Conversion of the TCAT Bus Fleet to Electric Vehicle Mobility An Exercise in True Sustainability and True Environmental Protection

Tompkins County Area Transport (TCAT) Bus Fleet – Background



From the TCAT website: Q

“ At present, TCAT has a fleet of 54 buses, including eight electric-diesel hybrid buses, traveling a combined distance of 1.6 million miles a year. Recent replacement buses include two new electric-hybrid and 13 new diesel buses that adhere to federal standards in producing fewer carbon emissions.”

In both powertrain versions, during the steep uphill routes, the diesel engine is the primary propulsion, resulting in both chemical and noise pollution.

The chemical pollutants emitted by the TCAT buses are four-fold: (1) Carbon Monoxide, (2) Nitrous Oxides, (3) Hydrocarbons, and (4) Particulate Emissions.

- TCAT terrain results in approximately the following levels of **noise pollution**:

Flat terrain 75 - 80 decibels (can be higher)

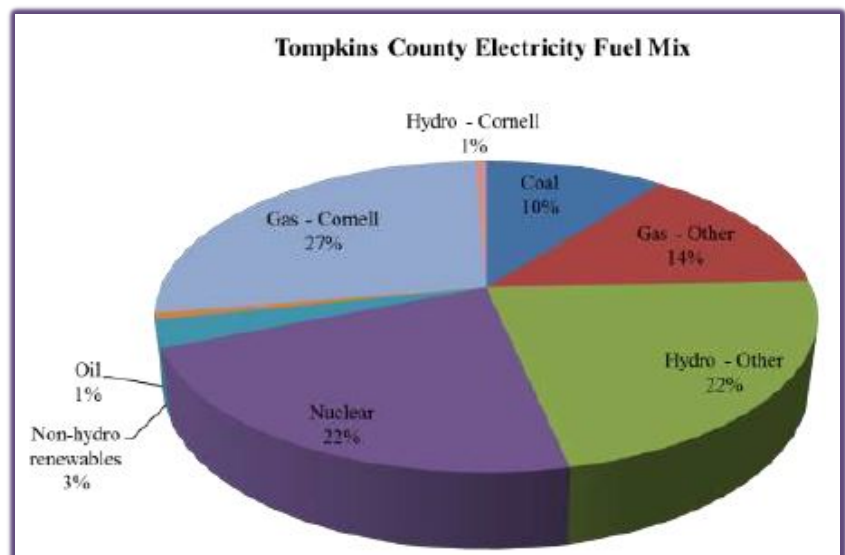
Long steep uphill 95+ decibels R

- For emphasis, especially in the elderly, 90 decibels is the threshold for hearing loss. S

The 2012 report on Tompkins County electricity mix at-right.

The 2016 report declares that by 2050 all nuclear power plants will be retired, 50% of the mix will be methane, and the remaining 50% “renewables” (Please see ATTACHMENTS 4, 5 AND 6). T

Again, none of these reports mention ‘*Conversion of the TCAT Bus Fleet to Electric Vehicle Mobility*’ (ATTACHMENT 7).



**Conversion of the TCAT Bus Fleet to Electric Vehicle Mobility
An Exercise in True Sustainability and True Environmental Protection**

Tompkins County Area Transport (TCAT) Bus Fleet – Background – Con't

In relation to ‘*Conversion of the TCAT Bus Fleet to Electric Vehicle Mobility,*’ Context #B above must be re-emphasized

B. The attitudes and lack of **long-term** foresight of local and state level New York officials, regarding energy plans, specifically as such relates to the incremental power demanded by a **long-term** vision of electric mobility must be addressed/corrected.

Recent announcements regarding electric mobility in New York State provide insight and confirmation regarding the lack of a ‘long-term vision of electric mobility.’ These also provide a stark comparison to the global leader in EV mobility: China.

Announced by New York Governor Andrew Cuomo on July 9, 2018: **U**



Eleven? Nowhere, in this otherwise laudable headline, do we find a reference to ‘*Conversion of the TCAT Bus Fleet to Electric Vehicle Mobility.*’ As if purposely avoiding the ‘low hanging fruit,’ this article claims:

Alicia Barton, President and CEO, NYSERDA said, “With every new electric vehicle charging station installed, New Yorkers are finding it easier than ever to drive clean and drive electric. I congratulate Tompkins County for being a leader in making electric vehicles a cornerstone of their efforts to fight climate change and commend the County for joining Governor Cuomo’s nation-leading efforts to lower greenhouse gas emissions across New York.”

That is, this announcement insinuates that the primary culprit of “climate change” is not the state government or local municipalities, **which emit orders of magnitude more chemical and noise pollution;** but instead their main culprit is the individual New Yorker. That is false.

Despite being about Tompkins County, we find no mention of the TCAT bus fleet. The TCAT fleet is also not mentioned in the nypa.gov websites.

MEMO: For perspective, the eleven chargers are not capable of charging an EV bus with utility.

Conversion of the TCAT Bus Fleet to Electric Vehicle Mobility An Exercise in True Sustainability and True Environmental Protection

Tompkins County Area Transport (TCAT) Bus Fleet – Background – Conclusion

In 2105 it was estimated that total electricity demand in Tompkins County was 780 gWh. **V**
This is approximately 2 gWh per day (Residential 38%, Commercial 44%, Industrial 18%).

If, like Dallas, or Toronto, or Chicago, or Antioch, or Duluth, or Washington DC, or Missoula, or San Francisco, or Asheville, or Baltimore, or Los Angeles, or Anchorage, or like Brooklyn . . . the TCAT buses were converted to the new 40-foot Proterra Catalyst bus with the E2+ battery . . .



. . . with the 550kWh battery, this offers a “nominal” range of 367 miles. TCAT buses average 40,000 miles per year, or 111 miles per service day. This allows one charge per day. Assuming full recharge, the incremental energy requirement for all 54 TCAT buses would be 27 mWh, or less than 1% of the total daily electricity demand for Tompkins County (2 gWh). **W**

Focus and Pragmatism - Updating the TCAT Mission/Vision Statement

The TCAT website lists the current Mission/Vision statement as follows:

Our Mission	Vision
To provide safe, high quality, reliable, efficient public transportation while being a responsive, responsible employer.	To become a model community transportation system committed to quality service, employee-management collaboration and innovation.

This needs to be updated to address **Context Items A, B and C** (Page 4). **X** A commitment to protecting the environment and ecology of the Finger Lakes in a comprehensive manner would implicitly eliminate the chemical, and drastically reduce the noise pollution of the TCAT fleet. An updated Mission/Vision statement will further accredit TCAT, and will provide pragmatic focus for key stakeholders in their effort to assist with the Proposal.

Conversion of the TCAT Bus Fleet to Electric Vehicle Mobility An Exercise in True Sustainability and True Environmental Protection

Preamble to Proposal - The Stakeholders

With the updated Mission/Vision statement as a guide, both TCAT and those affected by its services must solicit a focused and pragmatic participation in '*Conversion of the TCAT Bus Fleet to EV Mobility.*' Stakeholders include at-least the following groups/individuals:

- ◆ Governor Andrew Cuomo, including the ongoing good works of NYSERDA
- ◆ Administrator Jason Molino of Tompkins County New York
- ◆ Mayor Svante L. Myrick, City of Ithaca, New York
- ◆ President Martha Pollack of Cornell University, including the Atkinson Center for a Sustainable Future, et al.
- ◆ President Shirley M. Collado of Ithaca College
- ◆ The New York State Department of Transportation, including the State Operating Assistance (STOA) Fund Management
- ◆ Mr. Carl A. Taylor, President and Chief Executive Officer of the New York State Electric and Gas Company (NYSEG)
- ◆ Dr. Luvelle Brown, Superintendent of the Ithaca City School District (ICSD)
- ◆ The officials of local area affected towns and villages (Lansing, Caroline, Dryden, Freeville, etc.) that may need to be aware of and possible contribute to the charging infrastructure, etc.

Memo to Proposal: Solicited from world experts participating in the Professional Certification programs for electric mobility at Technology University at Delft (Netherlands) : **Y**



Conversion of the TCAT Bus Fleet to Electric Vehicle Mobility An Exercise in True Sustainability and True Environmental Protection

Proposal

The stakeholders, in the context of public service, should embark on a ‘crash program’ to implement the conversion of the TCAT bus fleet in to full electric vehicles:

- Financing options should not be limited to outright purchase of the fleet; there are numerous commercial assistance programs already in-play, and these are specifically focused on municipal bus fleet conversion to EV. The relationship between China’s BYD Bus Manufacturing and America’s Generate Capital is an example. *

It is recommended that the stakeholders **act on** the long-term benefits of a TCAT conversion to electric mobility. The effort in Tompkins County will provide the opportunity to pilot the new EV technologies against the unique geography and climate of the Finger Lakes region:

The other two major bus fleets of Ithaca, NY are discussed in ATTACHMENT 10.

It recommended that no further funding/consideration be expended on hybrid (HEV), plug-in hybrid (PHEV), or hydrogen-fueled bus designs.

It is recommended that stakeholders update their knowledge of nuclear power as, not only a viable alternative/replacement to existing energy generation in Tompkins County and the Finger Lakes, but as far superior in all relevant measures to the thinking that presumes otherwise:

- This is especially requested with respect to the SMR discussed in ATTACHMENT 8, and TerraPower (and the nuclear “waste” issue) discussed in ATTACHMENT 9.

Elimination of the chemical and noise pollution from the TCAT fleet, by conversion to full EV, must not threaten the pristine beauty and appeal of the Finger Lakes region:

- The ‘Three-Fold Summary of Context’ discussed on Page 4 above, which forms the ‘Basis of Proposal,’ must be prioritized (ATTACHMENT 4).

It is recommended that all endnotes, attachments and hyperlinks of this essay be reviewed in-detail; such will add depth, dimension and preliminary perspective to this proposal. This will aid in review of comparative stature with the C40 municipalities. **Z**

* [BYD and Generate Capital Take the ‘Messiness’ Out of Deploying Electric Buses](https://techcrunch.com/2018/07/11/byd-and-generate-capital-launch-200m-electric-bus-leasing-jv-in-the-us/)
<https://techcrunch.com/2018/07/11/byd-and-generate-capital-launch-200m-electric-bus-leasing-jv-in-the-us/>
[BYD Introduces New \\$200 Million Electric Bus Leasing Program In Partnership With Generate Capital](https://techcrunch.com/2018/07/11/byd-and-generate-capital-launch-200m-electric-bus-leasing-jv-in-the-us/)

Conversion of the TCAT Bus Fleet to Electric Vehicle Mobility An Exercise in True Sustainability and True Environmental Protection

ENDNOTES

^A Officially the Finger Lakes number 12, east to west: Cazenovia, Otisco, Skaneateles, Owasco, Cayuga, Seneca, Keuka, Canandaigua, Honeoye, Canadice, Hemlock and Conesus.

^B [Energy Supply and Demand - Tompkins County, New York](#)

^C [Tompkins County Energy, March 2016](#) In other words, while waiting for their bus, the TCAT users can enjoy the spinning and whirling of the turbine blades above their heads?!

^D Although far beyond the scope/purpose of this instant essay, the term “fossil fuels” is at-best a misnomer; there is no such thing, The fact that those alleging scientific competence/integrity continue to promote that misnomer is possibly deliberative is disturbing, see <https://www.youtube.com/watch?v=lynQAoWcd3o>

^E One category, that is repeatedly emphasized by this author, is the many **safety** advantages of EV mobility; not the least of which involves the drastic reduction in severe-injury or death caused by hydrocarbon fires. Directly relevant and on-point to the instant subject, avoidance of human catastrophe surrounding the TCAT bus fire incident of March 23, 2018 was the result of [a deeply competent TCAT Bus Operator, Antoinette Briggs](#):



<http://cornellsun.com/2018/03/23/tcat-bus-catches-fire-on-state-highway-no-injuries-reported/>

The author has already written several letters regarding this implicit fire-safety benefit of EV mobility, in the context of his safety expertise/experience. One such letter of over three years ago was directed at the efforts of Apple, Inc. to enter the EV manufacturing sector. [The 2015 letter to Apple Chairman Tim Cook here.](#)

Further discussion of fire-related safety by author can be sampled here:

<https://www.youtube.com/watch?v=9bbfPpIWyqI>

https://www.youtube.com/watch?v=TH_0izSyPk0

^F <http://www.avta.com/index.aspx?page=482>

^G <https://www.youtube.com/watch?v=sLo3Pn4KC3w>

- H <https://news.schiphol.com/biggest-electric-bus-fleet-in-europe-at-and-around-schiphol/>
<https://www.youtube.com/watch?v=0hQP5Wjcgto>
- I <https://www.youtube.com/watch?v=cmXsxl-KbAc>
<https://dictionary.cambridge.org/us/dictionary/english/low-hanging-fruit>
- J [China's Shenzhen city electrifies all 16,359 of its public buses](#)
- K <http://www.world-nuclear-news.org/Articles/Commissioning-milestones-at-Chinese-AP1000s>
<http://www.world-nuclear-news.org/Articles/Second-Sanmen-AP1000-connected-to-grid>
- L [EyeShenzhen article of December 28, 2017](#)
- M ['Clean Coal' Technologies, Carbon Capture & Sequestration](#)
- N <http://www.world-nuclear.org/information-library/country-profiles/countries-a-f/china-nuclear-power.aspx>
<http://hub.globalccsinstitute.com/sites/default/files/publications/201688/global-ccs-cost-updatev4.pdf>
- O <https://newpowerprogress.com/byd-builds-battery-plant/#>
- P http://pvsheridan.com/SAE-Xingyi_Xu_ShanghaiDajunTechnologies.pdf
- Q <https://www.tcatbus.com/about/>
- R Typical date here: <http://www.trolleycoalition.org/noise.html>
- S The author's expertise in the areas of diesel engine chemical and noise pollution results in-part from years of professional experience, see: [Critics Rave About Cummins Powered Dodge Ram Pick-ups.](#)
- T The author is adamantly against the practice of "fracking" as one source of methane
<http://pvsheridan.com/Fracking-the-Biosphere.pdf>
- U <https://www.nyserda.ny.gov/About/Newsroom/2018-Announcements/2018-07-09-Tompkins-County-EV-Charging-Stations>
- V [Tompkins County Energy Roadmap Fall 2015.](#) The text discussion above is based in Slide 13 from 2008 date, which has probably changed/increased in the last ten years.
- W <https://untappedcities.com/2018/01/09/cuomo-announces-all-electric-bus-pilot-program-to-modernize-nycs-public-transit-fleet/> From the 2014 TCAT Annual report, the latest that is available.
- X <https://www.tcatbus.com/about/mission-vision/>
- Y <https://www.edx.org/professional-certificate/delftx-electric-cars>
- Z <https://www.c40.org/other/fossil-fuel-free-streets-declaration> The current municipal signatories of the C40 Group are Paris, London, Los Angeles, Copenhagen, Barcelona, Quito, Vancouver, Cape Town, Seattle, Mexico City, Auckland, Milan, Rome and Heidelberg. These municipalities and **their commitment to full EV bus fleets** is formally presented here: [Green and Healthy Streets Los Angeles, as one example states on Page 16:](#)

Procure, with our partners, only zero emission buses from 2025.

LA Metro has endorsed a goal of a fully zero-emission bus fleet by 2030, which means all bus procurements moving forward will be electric. Metro has already started

towards this goal with the recent procurement of 100 electric buses. LADOT will procure only electric buses starting in 2025.

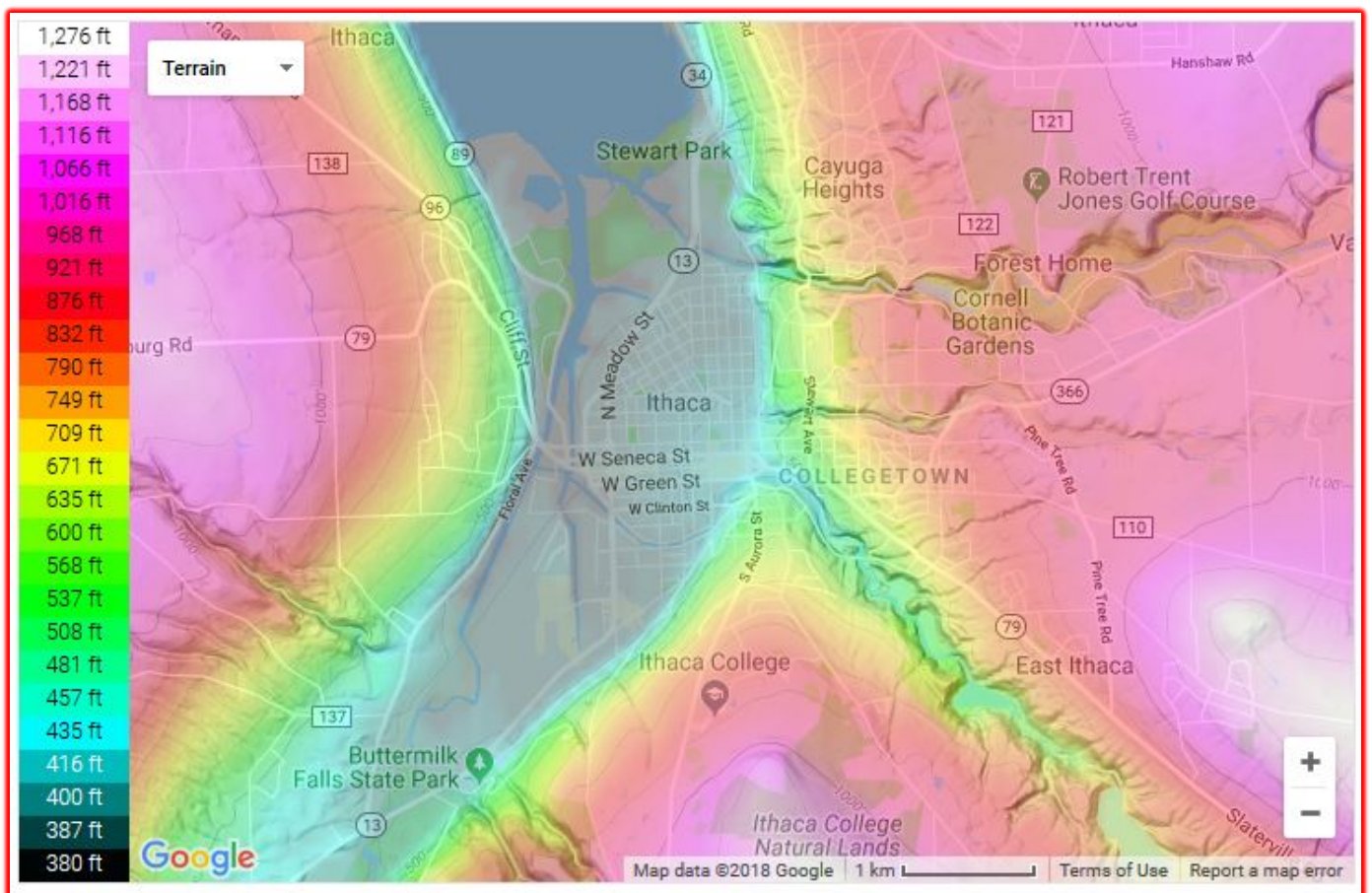
Conversion of the TCAT Bus Fleet to Electric Mobility An Exercise in True Sustainability and True Environmental Protection

Geographic Review

The beauty of the Finger Lakes Region is world-renown. The landscapes are as rugged as they are appealing. As the song of my alma mater, [Cornell University](https://www.cornell.edu/), declares:

“High above Cayuga’s waters . . .”

As an example, travel from the basin of Lake Cayuga to the Cornell or Ithaca College campuses requires long uphill drives, **with a change in elevation of up to 1000 feet:**



This terrain is routinely traversed by the Tompkins County Area Transportation (TCAT) system of buses. **TCAT diesel and diesel-hybrid buses** negotiate Ithaca and Tompkins County New York throughout the year, serving residents and university students with award-winning reliability (See Attachment 2 demographic review).

The steep uphill, passenger-loaded bus routes produce chemical pollution, **and the strain on the diesel powertrains are notoriously noisy**. These issues detract from the beauty and serenity of Ithaca, New York.



Conversion of the TCAT Bus Fleet to Electric Mobility An Exercise in True Sustainability and True Environmental Protection

One of the most beautiful regions of New York is called the Finger Lakes. Now officially comprised of 12 lakes in-total, the largest most populated county is Tompkins County, which has its spiritual, cultural and commercial center in the city of Ithaca, New York

Ithaca is home to two major academic institutions, making the population especially sensitive to the human condition, and how preservation of the environment is central to their well-being. That preservation however is intimately tied to ensuring that so-called solutions to environmental issues do not impinge in any way on the famous beauty of the Finger Lakes region.

There are two major academic institutions in Ithaca, Ithaca College, and my alma mater, Cornell University. Tompkins County houses Tompkins County Community College, and many technical and cultural learning centers; education is a major economic activity of the county. This academic focus contributes to a demographic that is much younger than the USA national median for cities/regions of similar population.

Relevant statisticsⁱ of the Tompkins County and Ithaca, New York:

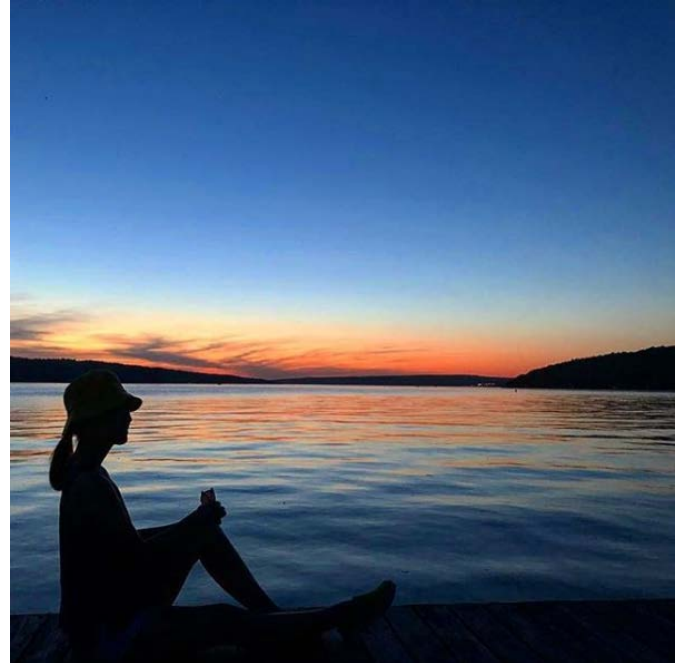
	Ithaca New York	Tompkins County
Population	30,625	104,268
Median Age	21.8	30.3
Median Household Income	\$30,291	\$54,133
Median Property Value	\$219,100	\$182,600
Number of Employees	11,976	49,581
Poverty Rate	44.8%	20.1%
Households w/ One Vehicle	40%	28%
Households w/ Two Vehicles	31%	41%
Households w/ More than Two Vehicles	13%	24%
<u>Commuter Transport Modes:</u>		
Drove Alone	33.7%	63.2%
Car-Pooled	6.3%	8.6%
Commercial/Public Transport	12.6%	6.5%
Walked	37.8%	14.1%
Climate / Weather	Four Distinct Seasons	Four Distinct Seasons
Average Annual High Temperature	56.5° / 13.6°	~same
Average Annual Low Temperature	36.8° / 2.6°	~same
Average Annual Rainfall	37.3" / 95 cm	~same
Average Annual Snowfall	65" / 165 cm	~same
Sunny Days	154	~same
Precipitation Days	85	~same

ⁱ *Sources: [DATAUSA](#), [usclimatedata.com](#), [nerdwallet.com](#)

**Conversion of the TCAT Bus Fleet to Electric Mobility
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Photographic Review of the Finger Lakes Region

Space does not allow a complete photographic review, but the beauty of the Finger Lakes is a crucial part of the context of the discussion, and especially the Proposal discussed above:



<http://150.cornell.edu/glorioustoview/>

Conversion of the TCAT Bus Fleet to Electric Mobility An Exercise in True Sustainability and True Environmental Protection



**Conversion of the TCAT Bus Fleet to Electric Mobility
An Exercise in True Sustainability and True Environmental Protection**



Conversion of the TCAT Bus Fleet to Electric Mobility An Exercise in True Sustainability and True Environmental Protection

Brief Review/Critique of Renewables/Sustainability in Context of EV Mobility

On the home page of my alma mater, Cornell University which is located in Ithaca, New York, the heart of Tompkins County, where TCAT buses operate, we find the following headlines:

Cornell links to an article about misuse of geothermal energy in Yellowstone National Park, an icon of our landscape, an exemplar of natural processes; environmental and pristine ecological beauty.

That this was on the home page is a testament to Cornell's commitment to protecting the environment in a comprehensive manner. ¹

The National Geographic Society article of August 8, 2018 asks, **'Yellowstone Supervolcano Could Be an Energy Source. But Should It?'**



The article also explains that the answer to that question is a resounding **“NO!”** ²

The article emphasizes the PRIMARY reason as follows:

*“The idea, however, has reached a standstill. Yellowstone and other national parks have long been protected from commercial energy development **to ensure that these regions remain pristine.** The 1970 Geothermal Steam Act, which prohibited the placement of geothermal plants in national parks, even lists Yellowstone by name.*

While many geothermal experts agree that Yellowstone should remain untouched, reactions to NASA’s thought experiment highlight the promise and perils of other sizzling sites across the globe. Geothermal energy holds enormous clean energy potential, but it does carry drawbacks, and new power plants can face pushback from communities concerned about preserving the environment and even respecting local deities.”

So, in a region pock-mocked with volcanos “comprehensive protection of the environment” is strenuously enforced, **including enactment/enforcement of Federal Laws.**

Is it not our duty to ensure that the spirit of these laws is applied with equal vigor to the pristine Finger Lakes of upstate New York . . . a region that is not threatened by volcanic eruptions . . . but is threatened by the portent of Attachments 5 and 6 below?

¹ Please see Context Item A on Page 4 of 14, and Proposal on Page 12 of 14, in main text.

² [Yellowstone Supervolcano Could Be an Energy Source. But Should It?](#)

**Conversion of the TCAT Bus Fleet to Electric Mobility
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Brief Review/Critique of Renewables/Sustainability in Context of EV Mobility

ITHACA

*They say that Ulysses, sated with marvels
Wept tears of Love at the sight of his Ithaca*

*Green and humble
Art is that Ithaca*

*Of green eternity
Not of marvels*

*It is also like the river with no end
That flows and remains*

And is the mirror of one same

*Inconstant Heraclitus
Who is the same, and is another*

Like the river with no end . . .

From the poem *Arte Poética*, by Jorge Luís Borges ♡



♡ For a reading of *Arte Poética*, please click on image or Ithaca Falls, or [here](#).

Sheridan cherishes ties to Tompkins

By ANNE JU
Journal Staff

ITHACA — Paul Sheridan's introduction to Ithaca was in 1973, the first time he ate at Manos Diner. Five years later, he would enter Cornell University's business school to earn a master's degree in business administration and logistics — and he's remained loyal to Ithaca, Cornell and the area ever since.

From running around Beebe Lake on the Cornell campus, to sitting on the Stewart Park benches, to dining at Ithaca Bakery, Sheridan built up an affinity with the area that has never left him.

"If I had to characterize Ithaca, I would say people are very freedom-oriented," he said. "There is an exaggerated prioritization of independence ... and people who are like that are attracted to the place."

Sheridan would later become a minivan project manager at Chrysler Corp. in Dearborn, Mich., where

he currently resides, and would cause a stir by blowing the whistle on unsafe minivans.

Sued by Chrysler for \$82 million in 1997, he became a champion of disclosing automotive safety defects and demanding accountability from corporations.

But before all that, there was Cornell and Ithaca.

"I've been coming to Ithaca for 30 years," he said.

Sheridan entered the Johnson Graduate School of Management in 1978, then called the Business and Public Administration School. Cornell was the only application he sent out.

"I liked the area, and I liked the school," he said. "I knew this was where I wanted to be."

Going for a degree in business administration and logistics after studying math and physics at State University of New York at Albany was a natural segue, as he enjoyed

the transition from "physics labs to focus groups."

During the first year of his degree, he was also working full-time as regional sales manager for Cerrache Cable, deploying cable service to Ithaca and surrounding areas.

That's how he got to know the ins and outs of Ithaca's geography as well as its social and cultural quirks.

It was also during his one-year tenure as sales manager — he quit after a successful venture in Trumansburg, and decided he needed to study more — that he honed his skills with people, his sharp business tactics and his common sense approach to sales.

He discovered, for instance, that women sales representatives had a better rate of success with selling cable accounts than men did.

"Mommy, there's a lady at the door," worked better than "Mommy, there's a man at the door," he explained. "First impressions are

everything. If it was a softer hit, the likelihood of the sale was astronomically higher."

For the past 23 years, Sheridan has remained in contact with the Cornell business school, sending letters, promoting business ethics and serving as team steward of the Society of Automotive Engineers.

He's still pushing the school for more emphasis on business ethics education as part of the core curriculum. They're doing well, but could be doing more, he said.

"Ethics and morality are taught at home," he said. "But a good pit stop for learning ethics should be the graduate business schools. Whole lives have been destroyed because of lack of ethics."

While Sheridan's work in Dearborn isn't over, he's planning his next geographical move, and likely choices are Ithaca, Lansing or Aurora.

"Maybe within a year," he said.

**Conversion of the TCAT Bus Fleet to Electric Mobility
An Exercise in True Sustainability and True Environmental Protection**

The True Consequences “Renewables/Sustainability” in Context of Electric Mobility

An example of a nation that has zero nuclear power, and is converting its coal-fired power plants to so-called “renewables” is Australia.

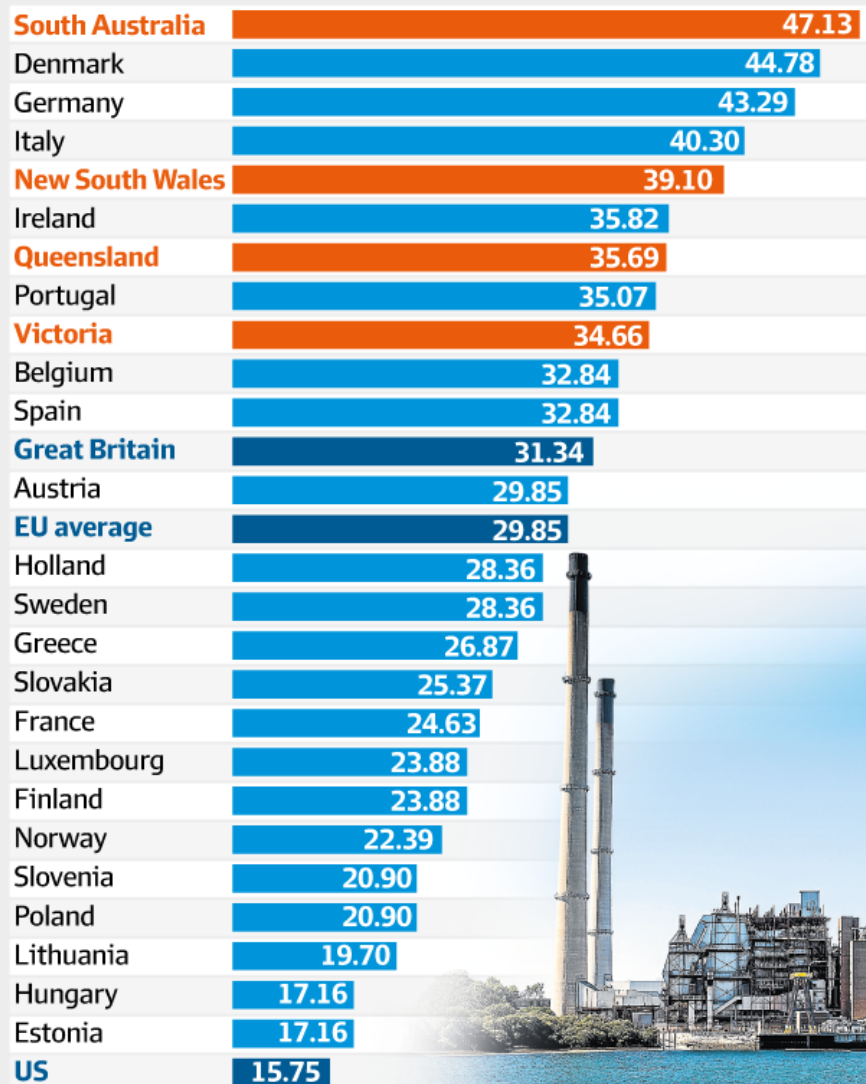
There are no plans to install modern nuclear power plants ala China. This is deeply ironic since Australia is the #1 miner/exporter of uranium, selling much of that resource to Asia and China.

Like China, Australia has historically relied on coal for electricity. Instead of an energy plan which includes modern nuclear, Australia is moving to methane and so-called “renewables.” ^A

Recent data from the real-world shown at-right. The Australian taxpayers now pay more for their electricity than any other; over 3 times what Americans pay.

Similar to the energy plans for Tompkins County New York, “renewables” in Australia involves the blighting of their landscapes with wind farms and solar farms. ^B

Retail electricity prices of NEM states, including taxes, compared to selected countries (¢ per kWh)



SOURCE: MARKINTELL, US ENERGY INFORMATION ADMINISTRATION

Such costly real-world results, of so-called “renewables” do not comport with elimination of the chemical and noise pollution of ICE vehicles, especially the bus fleets. ^C

These results do not bode well for electricity rates in Tompkins County New York. ^D

Although critique of the promoted opinions about “sustainability,” via wind farms and solar panels, goes far beyond the scope of this essay, **criticism is made more relevant by any plans which will further stress the already outdated/inadequate electrical grids with the incremental demands borne by conversion of the transportation fleets to full electric.**

In that specific, but very important **long-term** context please see the following videos: ^E



<https://www.youtube.com/watch?v=tORmmTnr6A4&feature=youtu.be>



<https://www.youtube.com/watch?v=ZH4m-Cs-u3Y>



<https://www.youtube.com/watch?v=y-S0Pn3kOqo&feature=youtu.be>

<https://www.extremetech.com/extreme/188328-californias-new-solar-power-plant-is-actually-a-death-ray-thats-incinerating-birds-mid-flight>



Pictured above is the environmental poisonous disaster facing Puerto Rico after the winds from Hurricane Maria in 2017 spent less than 30 minutes in the vicinity of the Humacao solar farm.

Reacting to this obvious fate of solar farms in “severe weather zones,” Michael Shellenberger, a former advocate of “sustainable energy” as the sole source for our future, asks:

If Solar Panels are so clean why do they produce so much toxic waste?

<https://www.forbes.com/sites/michaelshellenberger/2018/05/23/if-solar-panels-are-so-clean-why-do-they-produce-so-much-toxic-waste/#66c7816c121c>

<https://www.nationalreview.com/2017/06/solar-panel-waste-environmental-threat-clean-energy/>

In stark contrast, a September 1, 2017 Forbes headline reads:

Hurricane Harvey Makes the Case for Nuclear Power

“Hurricane Harvey made land fall in Texas this week and the flooding was historic. What is shaping up to be the most costly natural disaster in American history, the storm has left refineries shut down, interrupted wind and solar generation, caused a constant worry about gas explosions, and caused a chain of events that led to explosions and fires at the Arkema chemical plant that is only the beginning.

Over a fifth of the country’s oil production has been shuttered. Natural gas futures hit a 2-year high as did gasoline prices at the pump.

But the Texas nuclear power plants have been running smoothly. (bolding added)

The two nuclear reactors at the South Texas Project plant near Houston were operating at full capacity despite wind gusts that peaked at 130 mph as the Hurricane made landfall. The plant implemented its severe weather protocols as planned and completed hurricane preparations ahead of Category 4 Hurricane Harvey striking the Texas Gulf Coast on August 25th.

Anyone who knows anything about nuclear was not surprised. Nuclear is the only energy source immune to all extreme weather events – by design.

This nuclear plant has steel-reinforced concrete containment with 4-foot (1.2 meter) thick walls. The buildings housing the two reactors, vital equipment and used fuel have steel-reinforced concrete walls up to 7 feet (2.1 meters) thick, which are built to withstand any category hurricane or tornado. It can even withstand a plane flying directly into it.”^F

Do solar farms fulfill ‘True Sustainability and True Environmental Protection’ ?

No. Especially in the evolving context of electric mobility and its requirement for reliable, non-intermittent, pollution free, and substantial incremental electrical energy.

Footnotes to ATTACHMENT 5

A <http://www.world-nuclear.org/information-library/country-profiles/countries-a-f/australia.aspx>

B <http://www.cleanenergyregulator.gov.au/DocumentAssets/Pages/The-Renewable-Energy-Target-2016-Administrative-Report.aspx>

C <https://www.thegwpf.com/green-madness-australia-has-gone-from-cheapest-to-most-expensive-power/>

D <https://www.electricitylocal.com/states/new-york/ithaca/>

E To activate link or image, please hover over and click the Ctrl key, see hand, and then left click mouse.

F [Hurricane Harvey Makes the Case for Nuclear Power](#)

Conversion of the TCAT Bus Fleet to Electric Mobility
An Exercise in True Sustainability and True Environmental Protection

Do Wind Farms Fulfill ‘True Sustainability and True Environmental Protection’ ?

Perspective on an answer . . . In February 2018 the author attended the Society of Automotive Engineers (SAE) symposium in San Diego, California: **A B**



Among the many presentations was that of the California Energy Commission (CEC) entitled, *‘Plug-In Electric Vehicle Infrastructure for California : Deployment and Integration.’* At conclusion, during the Question & Answer portion, the author seated in the front row, asked:

“ It has just been announced that the last of California’s nuclear power plants, Diablo Canyon, will be shut down. That means that the only nuclear power available to California will be imported from sites such as Palo Verde. What is the CEC plan to replace that power given its concerns about the incremental power needed for electric mobility? ”

To an audience of 400+ attendees, the CEC had no specific answer, no general answer, no recommendation who to contact for an answer; he raised his voice and impolitely blurted:

“Well . . . I’m not the nuclear guy!” **C**

The SAE audience was stunned, and repulsed. Many conferred with the author during a break, asking the proverbial *“What the heck?!”* as an indication of their shock, and as consolation. **P**

The notion that **thee** heart-n-soul of the California energy officialdom would not be prepared to address a direct, relevant, on-point question, that was prompted by recent local headlines that had global coverage, was not merely staggering for the learned audience, but as it turns out, **it was prophetic !**

California power grid urges consumers to conserve energy in heat wave



Reuters • July 23, 2018



(Reuters) - California's power grid operator on Monday issued an alert to homes and businesses to conserve electricity on Tuesday and Wednesday when a heat wave is expected to blanket the state.

Just to be clear, in case the likes of the CEC missed it, **it is not unusual for “heat waves” to hit southern regions of desert states in summer.** As sentient beings, living in the 21st century, living in the “world’s last remaining superpower,” are we not prepared as alleged public servants, for that obvious ever-repeating weather scenario? ^{E F}

The comments from news readers world-wide poured in:

510 reactions 😊 4% 😬 81% 😡 15%

[Sign in to post a message.](#)

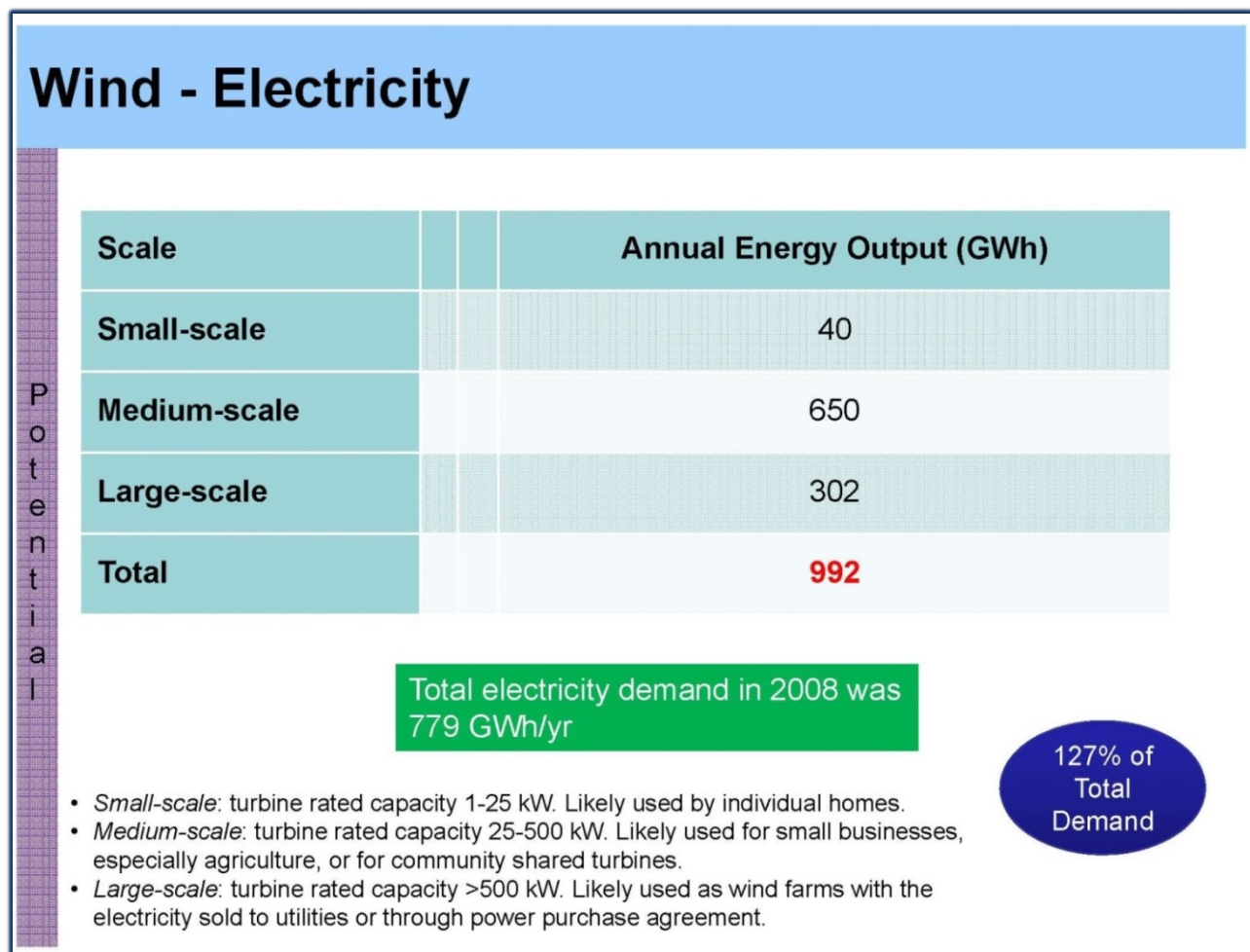
Top Reactions ▾ 👤 175 viewing

- P Patrick** 15 hours ago ⋮
What happened to these wind turbines and solar panels?
↩ Reply Replies (27) 👍 256 🗨 4
- R Randall** 15 hours ago ⋮
Now, about that renewable / green energy?
↩ Reply Replies (19) 👍 263 🗨 4
- SA Sean Alexander** 15 hours ago ⋮
So how's all that renewable energy working out?
↩ Reply Replies (7) 👍 196 🗨 1

[Show More](#)

Are the plans for “renewables” for the Finger Lakes any more robust than that of the CEC and California? Are the New York plans any more “sustainable” in the context of electric mobility?

In the 2015 study ‘*Tompkins County Energy Roadmap*’ we find various proposals for the future, none of which involve modern nuclear power. Slide 19 discusses the commitment of New York planners to the installation of wind farms throughout the beautiful Finger Lakes region:



Slide 19 is put in perspective for Tomkins County residents with simple calculations. **So . . . How many Small, Medium and Large turbines are hidden behind Slide 19, assuming its Annual Energy Output of 992 gWh?**

We assume median outputs for each scale (see ranges in Slide 19 footnotes above):

Small-scale	=	15 kW	40 GWh	=	913 turbines
Medium-scale	=	250 kW	650 GWh	=	890 turbines
Large-scale	=	500 kW	302 GWh	=	<u>207 turbines</u>

Total turbines required

2010 turbines

Obviously the prospect of a **wind farm footprint** blighting thousands of acres of pristine land in the Finger Lakes should be forcefully shunned by Tompkins County residents.

Similar to their counterparts at the CEC, it is unlikely that the full implications of the *'Tompkins County Energy Roadmap'* were spelled out for area residents, **in an open forum.** Typically these types of "sustainable" discussions are held behind-closed-doors, and only later are the specifics of the plans revealed to those most directly affected. Only later are the true long-term consequences revealed. This vested-interest "planning" has no place in a modern society. **G**

Obviously the *'Tompkins County Energy Roadmap'* does not specify that all of the future Finger Lakes energy be comprised solely of wind turbines. The calculation above is meant for perspective. How does such a torrid scheme comport with a theme of **comprehensive protection** of the Finger Lakes environment and ecology? Indeed, my calculations are generous to the point of being ludicrous. For example, I assumed twofold:

That the **capacity rating** of each turbine was (1) produced during a full **eight** hours of (2) **every** day. That, of course, is silly. **H I J**





A bald eagle is nesting upon a burned out, rusting eyesore in California. Luckily his fate did not mirror those described in Attachment 5 above. **K**

It is estimated that the US taxpayer has subsidized the wind turbine industry with \$2.3 billion, with more already budgeted. But let us answer the question posed by this attachment:

Do Wind Farms Fulfill *'True Sustainability and True Environmental Protection'* ?

No. Especially in the evolving context of electric mobility and its requirement for reliable, non-intermittent, pollution free, and substantial incremental electrical energy.

ENDNOTES TO ATTACHMENT 6

- A [Author attended the Society of Automotive Engineers \(SAE\) symposium in San Diego, California](#)
- B <https://saeevents.org/>
- C [SAE CEC February 2018](#)
- D [California approves closure of last nuclear power plant](#)

Commenting on her actions leading to the closure of the last nuclear power plant in California, Commissioner Liane M. Randolph (pictured) stated: ***“It moves California away from the era of nuclear power and toward the era of zero-carbon renewable energy.”***



Her statement is at-best absurd; it is well-known to her that nuclear power is by-definition “renewable,” and is already a “zero-carbon” energy source.

- E [California power grid urges consumers to conserve energy in heat wave](#)
- F [California energy review](#)
- G [Tompkins County Energy Roadmap – Fall 2015](#)
- H 365 days * 24 hours = 8960 hours per year / 3 = 2920 hours, or 8 hours per day. Silly, especially for the Finger Lakes region. Whenever I fly from Michigan to Ithaca, New York, I peer out of the Delta airliner window to observe the usual . . . beginning in western New York state are hundreds of already installed wind turbines . . . just sitting there, doing absolutely nothing . . . except blighting the New York landscape.
- I [Critics and Supporters Agree – Giant Wind Turbines Are Ugly!](#)
- J [Shocking Before-And-After Photos: How Wind Parks Are Devastating Idyllic German Countryside!](#)
- K [Retiring Worn-out Wind Turbines Could Cost Billions that Nobody Has](#)

**Conversion of the TCAT Bus Fleet to Electric Mobility
An Exercise in True Sustainability and True Environmental Protection**

Total Cost of Ownership (TCO) Benefit : BEB versus TCAT Diesel/Diesel-Hybrid

The TCO calculations/projections for the TCAT Battery-Electric-Bus (BEB) scenario are complex, and requires the most up-to-date TCAT data (not publically published for 2017).

TCO calculations for municipalities world-wide have already occurred and provide guidance. TCO and other benefits of BEBs are already being justified and implemented.

Computer-based TCO modeling software is available. The study by Goehlich and Kunitz, *Stochastic Total Cost of Ownership Forecasting for innovative Urban Transport Systems*, uses BEB systems constituents and related algorithm structured as follows: ^A

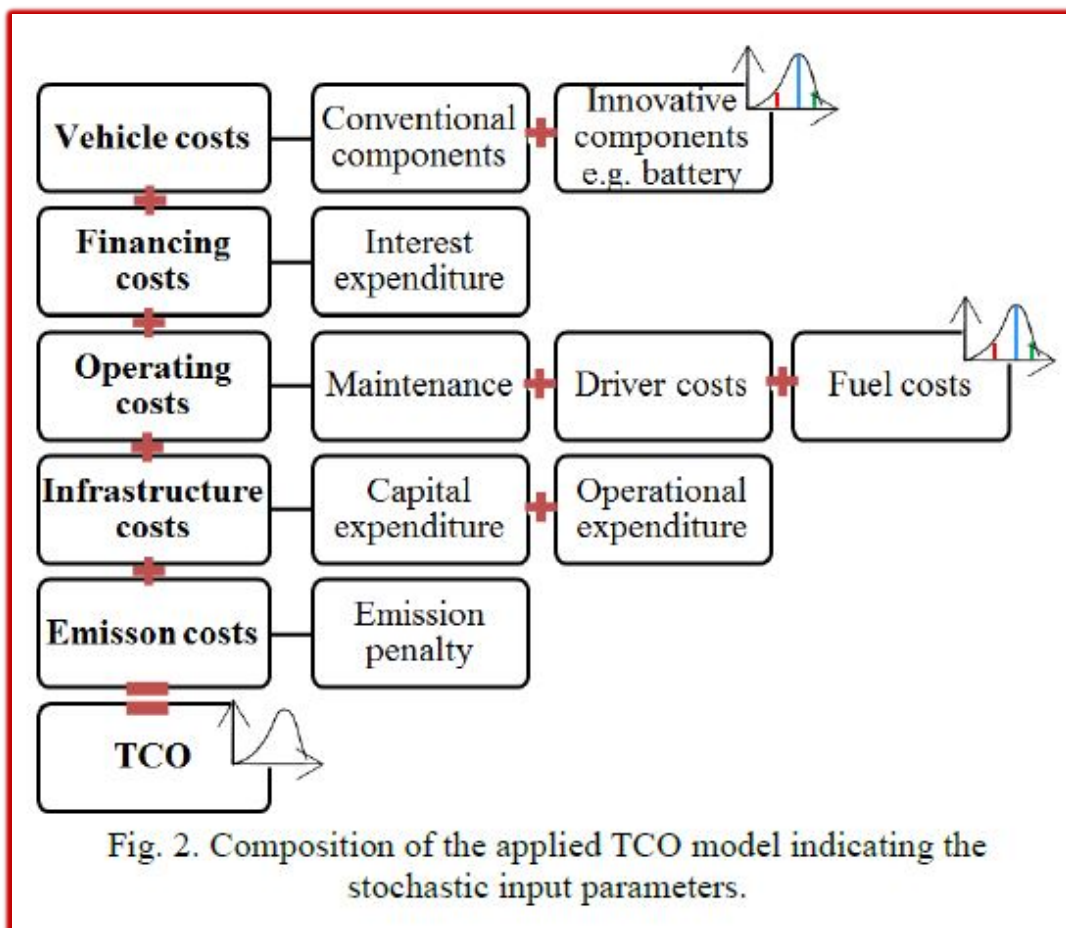


Fig. 2. Composition of the applied TCO model indicating the stochastic input parameters.

Alternatively, the 2018 Bloomberg New Energy Finance (BNEF) study, *Electric Buses in Cities*, is outdated. It uses outdated BEB technology and charging infrastructure assumptions; which were already available from the City of Shenzhen scenario of a year earlier. ^B

This BNEF deficiency is pointed out not as diatribe, but to further alleviate any of the current misconceptions (especially by municipal officials), that large vehicle conversion to full electric is not viable; especially relating to transport buses.



For example, in his blog ‘*Electric Trucks: Economically and Environmentally Desirable but Misunderstood*,’ Auke Hoekstra, Senior Research Fellow at Eindhoven University of Technology, addresses these misconceptions:

“In this blog series we will calculate the cost per kilometer of a heavy-duty long-haul battery electric truck. The real thing! We add this option to the comprehensive report ‘*The Future of Trucks*’ that the International Energy Agency published this month. **This report strangely omits this option from its comparison**, even though we will see it is both the best way to combat global warming and to decrease costs.” (bolding added) ^C

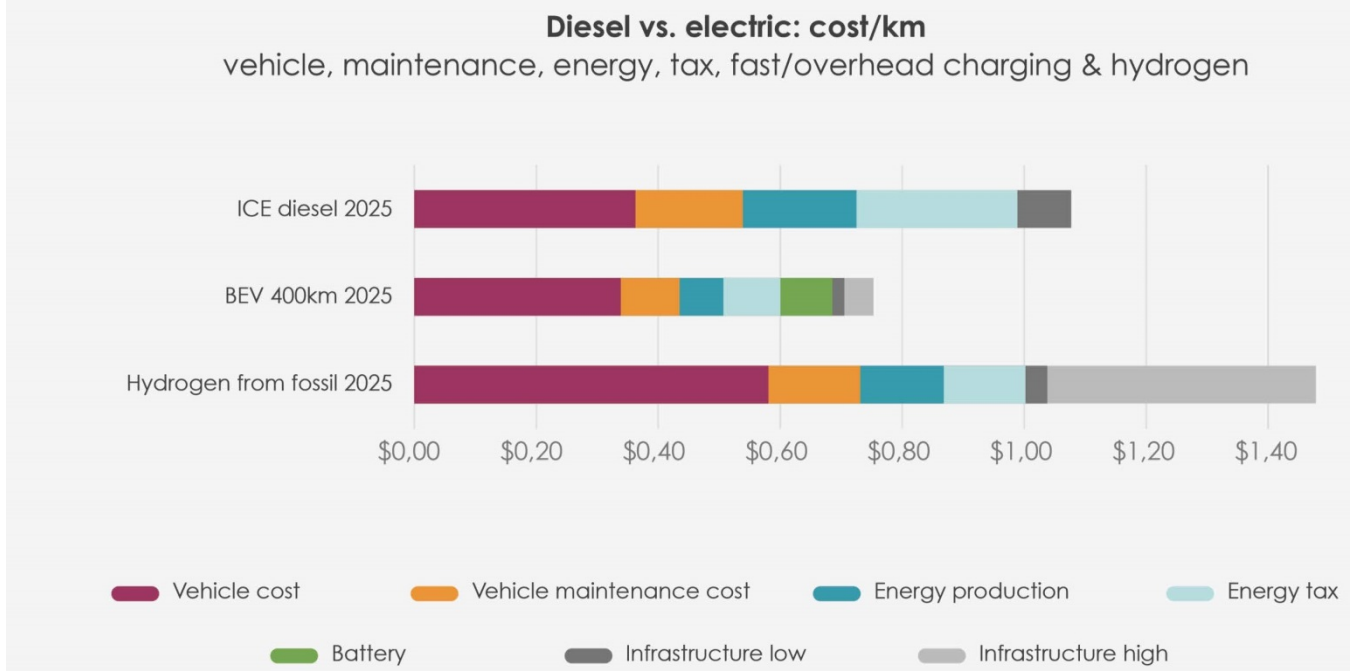
Mr. Hoekstra is correct in his concern that as late as 2017 the IEA would choose to omit large vehicle electrification; feeding the broad misconception held by municipalities.

However, he is NOT correct when ostensibly claiming that the ‘heavy-duty long-haul battery electric truck’ represents the low-hanging fruit. That BEBs are already being justified is proof that the BEB owns that distinction. The following headline furthers that opinion: ^D

A screenshot of a tweet from the account @FredericLambert. The tweet is from October 23, 2017, at 12:59 pm ET. The headline of the tweet reads: "12 major cities pledge to only buy all-electric buses starting in 2025". The tweet is from the account @FredericLambert. The background of the tweet is white with a teal border. The Electrek logo is visible in the top left corner of the tweet content area. The navigation bar of the website is visible at the top of the tweet content area, showing "Automakers", "Alt. Transport", "Autonomous Driving", and "Energy" with dropdown arrows. The date "OCTOBER 23, 2017" is displayed in a black bar above the headline. The headline itself is in a large, bold, black font. The text of the tweet is in a smaller, black font.

In his blog Mr. Hoekstra offers a glimpse of the many TCO benefits for large vehicle electrification with a graph focused on fuel costs: ^E

Full Electric Trucks: economics



Low-Hanging Fruit



When we include all constituents of the TCO (Emissions, Infrastructure, Operating expenses, Financing and Vehicle maintenance), and project for future developments/improvements, the BEB is the clear winner of the 'low hanging fruit' contest. ^F

Endnotes to Attachment 7

- A [Stochastic Total Cost of Ownership Forecasting for innovative Urban Transport Systems](#)
- B [Bloomberg Electric Buses in Cities](#)
- C [The Future of Trucks - Implications for Energy and the Environment](#)
- D [12 Major Cities Pledge All-Electric](#)
- E [Electric Trucks: Economically and Environmentally Desirable but Misunderstood](#)
- F [Advanced Electric Bus Systems – TCO Studies and Modeling](#)

Conversion of the TCAT Bus Fleet to Electric Mobility
An Exercise in True Sustainability and True Environmental Protection

Incremental Energy Demanded by the Electric Mobility Paradigm – The SMR
Need to Protect the Grid Base Load from the Intermittency of “Renewables”

If you listen to the pundits of so-called “renewables” . . . solar farms and wind farms in-particular . . . long enough, they will convince you that zero progress has been made in the area of nuclear power plant engineering, and that the status and format of nuclear power technology remains at the level of the 1960s Chevrolet Corvair. (The purpose here is not to besmirch General Motors, but to criticize unsubstantiated cynical attitudes about progress in-general, progress in nuclear power in-particular.)



For perspective, during that Corvair time period, the first nuclear powered vessel, the USS Nautilus submarine (SSN-571), broke through the ice cap of the exact geographic North Pole under the top secret, Operation Sunshine. On January 17, 1955 its Commanding Officer Eugene Wilkinson signaled the historic message, **"Underway On Nuclear Power!"** In just a few years SSN-571 shattered all submerged speed and distance records. From 1954 until decommissioning in 1989, **the Nautilus cruised for over 500,000 miles without incident.**

The world no longer makes Chevrolet Corvairs. The world no longer designs nuclear power plants such as Chernobyl, or Three Mile Island, or Fukushima. But you would never know that, judging from the deeds of Western politicians and the vested interests connected to “renewable energy.”

The world also no longer makes the USS Nautilus, despite its original marvel of engineering, with its unblemished operational record. The world has moved on to technological marvels such as the USS Gerald R. Ford. **A** The world has also moved on to Generation III nuclear power plants such as the Westinghouse AP-1000, and the VVER-1200. **B**

But the move to the modern nuclear power is not happening in the USA. According to the US Energy Information Administration, **the average age of US nuclear power plants is 37 years:**

“Almost all the US nuclear generating capacity comes from reactors built between 1967 and 1990. Until 2013 there had been no new construction starts since 1977.”

With a construction start in 1973, the most recent US power plant to come online was Watts-2:

“During the 20 years that Watts Bar 2 fizzled, China has built 7 new nuclear power plants.”

In China, the average age of their nuclear plants is less than 10. To be clear, the seven AP-1000 power plants built by China are not 1960s Chevrolet Corvairs . . . neither are the upcoming builds.

Not a Peep from “The Swamp”

It is ironic that President Donald Trump has been chastising the nation of China regarding its alleged thief of intellectual property . . . but not a peep about China’s aggressive move into building the Westinghouse AP-1000 . . . the most modern of Generation III designs . . . **a stunning example of American “intellectual property.”**

WORLD NUCLEAR
ASSOCIATION

Embarking upon Generation III plants

In September 2004, the State Council approved plans for two units at Sanmen, followed by six units at Yangjiang (two to start with), these to be 1000 or 1500 MWe reactors pioneering Generation III nuclear technology from overseas. The Sanmen (in Zhejiang province) and Yangjiang (in Guangdong province) reactors were subject to an open bidding process for third-generation designs, with contracts to be awarded in mid-2006 – in the event, mid-2007 – putting them clearly into the 11th Five Year Plan.

Construction in Sanmen, China of the American-designed Westinghouse AP-1000: P



Timing is everything - The Convergence

China is serious about eliminating coal; they are committed to electric mobility. Their nuclear power focus to accomplish both is the large scale; plants that produce in the gigawatt range: **E**

Units	Province	Net capacity (each)	Type	Operator	Grid connection	Commercial operation
Daya Bay 1&2	Guangdong	944 MWe	French M310	CGN		
Qinshan Phase I	Zhejiang	298 MWe	CNP-300	CNNC	Dec 1991	April 1994
Qinshan Phase II, 1&2	Zhejiang	610 MWe	CNP-600	CNNC	Feb 2002, Mar 2004	April 2002, May 2004
Qinshan Phase II, 3&4	Zhejiang	619, 610 MWe	CNP-600	CNNC	Aug 2010, Nov 2011	Oct 2010, Dec 2011
Qinshan Phase III, 1&2	Zhejiang	677 MWe	Candu 6 PHWR	CNNC	Nov 2002, June 2003	Dec 2002, July 2003
Fangjiashan 1&2	Zhejiang	1012 MWe	CPR-1000 (M310+)	CNNC	Nov 2014, Jan 2015	Dec 2014, Feb 2015
Ling Ao Phase I, 1&2	Guangdong	950 MWe	French M310	CGN	Feb 2002, Sept 2002	May 2002, Jan 2003
Ling Dong/Ling Ao Phase II, 1&2	Guangdong	1007 MWe	CPR-1000 (M310)	CGN	July 2010, May 2011	Sept 2010, Aug 2011
Tianwan 1&2	Jiangsu	990 MWe	VVER-1000/V-428	CNNC	May 2006, May 2007	May 2007, Aug 2007
Tianwan 3	Jiangsu	1060 MWe	VVER-1000/V-428	CNNC	Dec 2017	Feb 2018
Ningde 1&2	Fujian	1018 MWe	CPR-1000	CGN & Datang	Dec 2012, Jan 2014	April 2013, May 2014
Ningde 3&4	Fujian	1018 MWe	CPR-1000	CGN & Datang	Mar 2015, Mar 2016	June 2015, July 2016
Hongyanhe 1&2	Liaoning	1061 MWe	CPR-1000	CGN & SPI	Feb 2013, Nov 2013	June 2013, May 2014
Hongyanhe 3&4	Liaoning	1061 MWe	CPR-1000	CGN & SPI	Mar 2015, April 2016	Aug 2015, Sept 2016
Yangjiang 1&2	Guangdong	1000 MWe	CPR-1000	CGN	Dec 2013, Mar 2015	March 2014, June 2015
Yangjiang 3&4	Guangdong	1000 MWe	CPR-1000+	CGN	Oct 2015, Jan 2017	Jan 2016, Mar 2017
Yangjiang 5	Guangdong	1000 MWe	ACPR1000	CGN	May 2018	July 2018
Fuqing 1&2	Fujian	1020 MWe	CPR-1000 (M310+)	CNNC & Huadian	Aug 2014, Aug 2015	Nov 2014, Oct 2015
Fuqing 3&4	Fujian	1000 MWe	CPR-1000 (M310+)	CNNC & Huadian	Sept 2016, July 2017	Oct 2016, Sept 2017
Fangchenggang 1&2	Guanxi	1000 MWe	CPR-1000	CGN	Oct 2015, July 2016	Jan 2016, Oct 2016
Changjiang 1&2	Hainan	601 MWe	CNP-600	CNNC & Huaneng	Nov 2015, June 2016	Dec 2015, Aug 2016
Taishan 1	Guangdong	1660 MWe	EPR	CGN	June 2018	
Sanmen 1	Zhejiang	1157 MWe	AP1000	CNNC	June 2018	
Total: 41		38,419 MWe				

Timing is everything - The Convergence – Conclusion

The convergence of modern nuclear concepts (and plant designs), with the EV paradigm has greatly favored policy makers in China; they are poised at the right ‘time & place’ in history.

But an emerging technology is equally poised, and represents another stunning example of American intellectual property . . . The SMR.

The Small Modular Reactor (SMR) – The Right Time & Place in American Energy History

Regarding the convergence of EVs and modern nuclear power, there is a new technology that greatly favors the USA. It is safe, scalable, it is as reliable as it is powerful, it is affordable, **and it will protect the Finger Lakes environment and ecology in a comprehensive manner** (versus the blight of “renewables”) . . . the Small Modular Reactor (SMR).

Because of the powerful grip upon the American economy and psyche, by everyone from Big Oil to the vested interests of “renewable energy,” it is doubtful that the American citizen is knowledgeable about SMRs . . . that is about to change.

A game-changer for the SMR occurred this past April 2018 . . . The headlines read:

NuScale Power’s Small Modular Nuclear Reactor Becomes First Ever to Complete Nuclear Regulatory Commission’s Phase 1 Review. **F**



Assistant Secretary for the US Department of Energy (DOE), Office of Nuclear Energy, qualified this news further : **G**

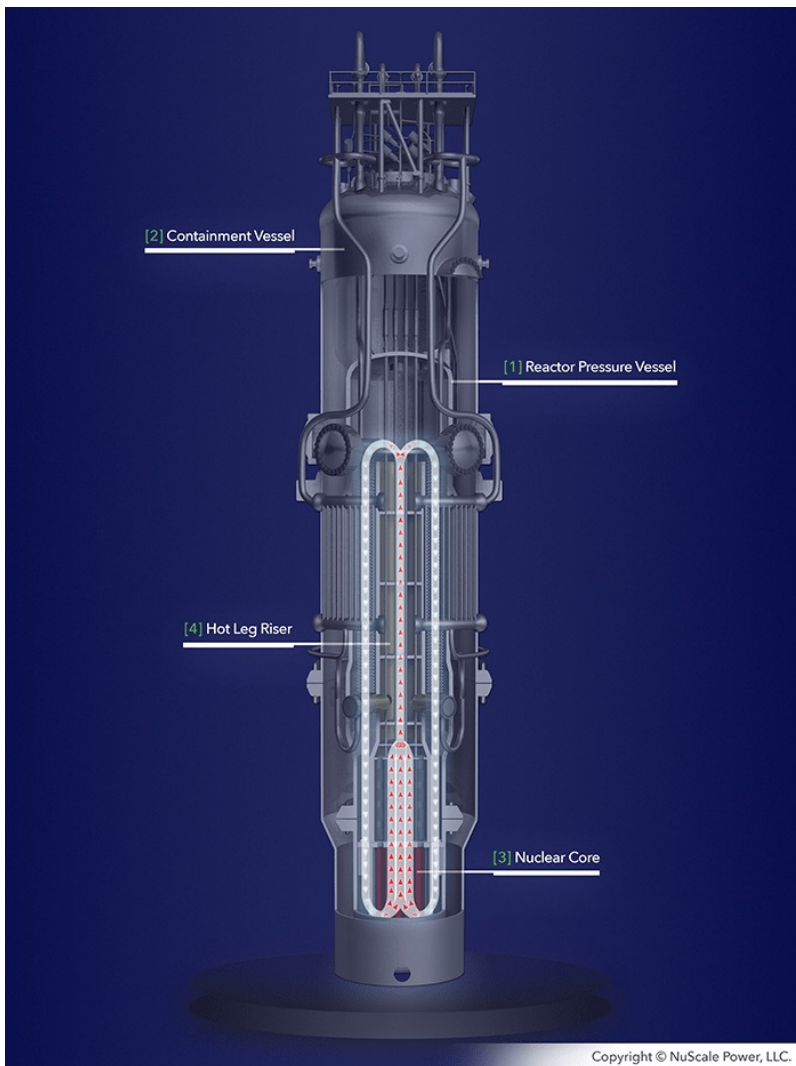
"As opposed to an \$8 billion unit for a gigawatt or larger before financing, you're looking at a unit that may cost \$1 billion to \$1.5 billion put that base plant in, with \$350 million to \$450 million per unit to add to it, allowing a utility to take bites at a time. That could break down significant barriers to nuclear generation at smaller utilities, and in countries with limited finances or smaller grids that do not need large-scale reactors. I think the implication is potentially dramatically opening up a market, a market that would never have materialized with large reactors. As valuable as large reactors still are, we simply have utilities that don't have the financial wherewithal and also are very excited about the design attributes."

Small Modular Reactor (SMR) – The Right Time & Place in American Energy History – Con't

The DOE statement above is relevant to the instant essay:

“Conversion of the TCAT Bus Fleet to Electric Mobility –
An Exercise in True Sustainability and True Environmental Protection.”

The fact that the SMRs “could break down significant barriers to nuclear generation at smaller utilities” points to an option that Tompkins County and New York have not considered in their prior energy plans for the Finger Lakes region. It is time they did so.



The NuScale SMR is very feasible for the Finger Lakes.

The SMR footprint is far smaller, and nowhere as unsightly as solar farms and wind farms.

A single SMR unit is called the NuScale Power Module (NPM).

The NPM is rated at 50 mW, and recent technology improvements have raised that to 60 mW. But the SMR is also scalable, so the total capacity of multiple NPMs can be raised to 300 mW or higher.

Phase 1 Review by the DOE specifically acknowledges the SMR design, which allows factory assembly, for later shipment to the site for deployment and connection to the grid

Referencing Page 3 of Attachment 7 above, the annual electrical energy requirements for Tompkins County are about 780 gWh.

Memo: The 780 gWh requirement for Tompkins County is *prior to* the electric mobility (EV) paradigm; the implicit increment energy requirements for conversion of the transportation fleet to EV, was not mentioned/considered in the prior New York studies.

Small Modular Reactor (SMR) – Right Time & Place in American Energy History – Conclusion

Total electricity demand in 2008 was
779 GWh/yr

Conclusion:

A single location dual-NPM SMR, or two distinct SMRs, are all that would be needed to power all of Tompkins County, including the future conversion of the TCAT bus fleet to full electric.

Assuming continuous year-long operation, two NPMs would generate 525 mWh each, a combined total of over 1 tWh. (The author prefers that three NPMs be considered.)

Not degraded by the implicit intermittency of wind farms and solar farms, the global nuclear output and utilization are nearing 100%: ^H

“The capacity factor for the global fleet stood at 81% in 2017, maintaining the high availability of around 80% that has been maintained since 2000, up from the 60% average capacity factor at the start of the 1980s. In general, a high capacity factor is a reflection of good operation performance.”

For a detailed review of the overall status of the US nuclear power industry, including discussion of the NuScale SMR, I recommend the PBS Nova program, The Nuclear Option: ^I

ENDNOTES TO ATTACHMENT 8

^A <https://youtu.be/W6su6Nb99Yo?t=2m46s>

^B [Nuclear Power in Russia](#)

^C [Nuclear Power in the USA](#)

^D [Westinghouse AP1000 nuclear power plant](#)

^E [Nuclear Power in China](#)

^F [NuScale’s SMR Becomes First Ever to Complete NRC Phase 1 Review.](#)

[NuScale Power Design Certification Project](#)

^G [SMRs a 'game-changer' for US nuke industry, DOE tells Congress](#)

^H While politicians and vested interests are constantly proclaiming the alleged virtues of solar farms and wind farms, these are constantly bailed out by nuclear power: [Steady growth in nuclear generation continues August 16, 2018](#)

^I [PBS Nova program, The Nuclear Option](#)

Conversion of the TCAT Bus Fleet to Electric Mobility
An Exercise in True Sustainability and True Environmental Protection

Incremental Energy Demanded by the Electric Mobility Paradigm –
Advanced Nuclear Energy Concepts, the Nuclear Waste Issue and TerraPower

For perspective . . . we start with my alma mater, Cornell University. Promoted numerous times by the Cornell film *Glorious to View*, the computer science research facility; Gates Hall: **A**



Compliments of a donation from the *Bill & Melinda Gates Foundation*, the building, its staff and benefactors are the focus of much praise from Cornell officialdom. It is a testament-to, but only a partial fulfillment-of the founding statement:



“I would found an institution where any person can find instruction in any study.”

For example . . . nowhere on the campus of Cornell can ‘any person’ find instruction in the study of nuclear engineering or nuclear power plant engineering. Perhaps *an even larger donation* from Mrs. and Mr. Gates would be required?

Not merely ‘*not mentioned,*’ but actively avoided by most university officialdom, is the fact that Mr. Gates is actively involved in some of the most advanced thinking in nuclear power plant engineering . . . and for all the correct reasons. Pictured at a TED Talk, Mr. Gates reviews his reasons for supporting nuclear power, and how his company TerraPower intends to make enormous contributions to resolving the issue of nuclear “waste” from prior, existing, and future nuclear power plants: **B**



A recent criticism was that this presentation was made ten years ago, why haven't we heard anything? First of all who is “we”? Second of all, they should re-read the above discussion regarding a university that touts itself as offering Any-Person-Any-Study, but actively fails to teach nuclear power engineering. Cornell is not alone in this trendiness.

So, where can one become informed about the TerraPower concepts? Professor Charles Forsberg at the Massachusetts Institute of Technology (MIT) explains:

“China by a very large margin is the largest market in the world for new power plants of any type. If we do not get our act together, the low-carbon energy business will be owned by the Chinese.” **C**

“By a very large margin”? Is that accurate? Again, Page 2 of Attachment 8 states:

“ . . . the average age of US nuclear power plants has shot up to more than 30 years. Almost all the US nuclear generating capacity comes from reactors built between 1967 and 1990. Until 2013 there had been no new construction starts since 1977. With a construction start in 1973, the most recent US power plant to come online was Watts-2. During the 20 years that Watts Bar 2 fizzled, China built 7 new nuclear power plants.”

Referencing Prof. Forsberg above . . . the Watts Bar II power plant, which began construction in December 1972, is a Generation 2 design. When did the “*world’s last remaining superpower*” finally place Watts II online? 2016. **That’s 44 years later!**

How is such a travesty possible? A broad answer to that question begins with the avoidance directed at Mr. Gates and TerraPower, typified by Cornell officialdom. **D**

This charlatanism by Big Academia morphs and convolutes into stagnant stifling government policy. Michael F. Keller, president of Hybrid Power Technologies LLC:

“ (The Nuclear Regulatory Commission is a) bureaucratic straight jacket that creates a massive financial burden on the deployment of advanced reactors. As advanced reactors are generally passively fail-safe, there is no rational reason to apply the grossly overly-complex regulations currently in use.” **E**

Advanced reactors? Let us be clear, the Gen 2 design deployed at Watts is not, by current standards, “advanced.”

In stark contrast, China is not only placing Generation 3 power plants online, **F** they are already into the intermediate phases of Generation 4. (For review of the Westinghouse picture caption below, please review Page 2 of Attachment 8.)



Unit 1 of the Haiyang plant (Image: Westinghouse)

And the “*world’s last remaining superpower*” ? It has one Gen3 plant in-construction (i.e. not yet online), and no activity EVEN PLANNED for construction of a Gen4. Instead the USA is focused on natural gas that is obtained from the environmental horror called fracking. **G**



Energy & Environment | **New Nuclear** | Regulation & Safety | Nuclear Policies | Corporate | Uranium & Fuel

Commissioning milestones at Chinese AP1000s

17 August 2018

Milestones in the start-up of two AP1000s under construction in China were met on 17 August, with Sanmen unit 2 achieving first criticality and Haiyang unit 1 being grid connected.



Sanmen units 1 and 2 (Image: SNPTC)

Unit 2 of the Sanmen nuclear power plant in China's Zhejiang province attained first criticality - a sustained chain reaction - at 12.07am today, China National Nuclear Corporation (CNNC) and State Nuclear Power Technology Corporation (SNPTC) announced.

After completing a series of low-power physics tests, the unit's turbines will be driven for the first time using nuclear-generated steam. The next stage in the commissioning of Sanmen 2 will be synchronisation to the electricity grid. This will be followed by gradual power ascension testing until all testing is safely and successfully completed at 100% power.

Meanwhile, unit 1 at the Haiyang plant in Shandong province was connected to the electricity grid at 9.50am today and began power generation.

The Nuclear “Waste” Issue

American policy on nuclear “waste” was enshrined by President Jimmy Carter on April 7, 1977 under Executive Order 12192. ^H The crux, Carter’s philosophical approach, was grounded in the fears of nuclear weapons proliferation. The triggering event of Carter’s crux occurred three years earlier when India detonated their first atomic weapon on May 17, 1974. The additional urgency of EO-12192 resulted from India, an ally, refusing to sign the original Nuclear Non-Proliferation Treaty (NPT), signed on July 1, 1968, led by the six “nuclear club” nations. **!**

190 nations are ‘Party to the NPT.’ While many are signatory, others have only acceded. Five laggards, well-known to possess nuclear weapons, but refusing to sign or accede to the NPT:

Democratic People's Republic of Korea
India
Israel
Pakistan
South Sudan

So, it is in the context of weapons proliferation, and the obstinacy of the laggards, that nuclear “waste” is **defined** (i.e. ill-defined). In the harried geopolitical environment of the 1960/70s, the edict of merely disposing partially used nuclear fuel, rather than reprocessing that fuel, was **also** specified by the NPT. That is, politics, not scientific or engineering facts, has dictated that the issue of nuclear “waste” remains unresolved. The blame, regarding this **absurd** ongoing state of affairs, is partially directed at the laggards listed above.

But the world is re-evaluating the nuclear “waste” issue on at least two fronts:

- (1) Genuine spent fuel reprocessing,
- (2) Advanced nuclear power plant fuel cycles such as that proposed by Mr. Gates at TerraPower.

The current world leaders in (1) nuclear fuel reprocessing are France, United Kingdom, Japan, and Russia. The USA is not even on the same page, instead merely storing or dumping the spent fuel as “waste.” However it is Russia that is expected to take the global lead in nuclear fuel reprocessing by virtue of four conditions:

- A. Recent long-term oriented statutory enactments (Nuclear and Radiation Safety in 2016- 2030, called Federal Target Program FTP-NRS-2,
- B. FTP-NRS-2 is focused on the enormous clean-up and retrieval of Soviet Union era mismanagement and incompetence,
- C. Extensive and ongoing research into advanced Generation 4 nuclear fuel cycles,
- D. Russia has made the formal choice to generate a majority of its electrical power with nuclear fuel.

In fact, Item D is tied to statements by Russian President Vladimir Putin who prefers electric mobility but cautioned, last October 2017 at the Russian Energy Week conference in Moscow, that until the grid is “clean” the EV would remain “dirtier.” **!**

The Nuclear “Waste” Issue - Con’t

Reprocessing of nuclear “waste” is merely a stop-gap. **K** The technology being developed at TerraPower seeks to put the issue of nuclear “waste” behind us, with an advanced nuclear fuel cycle called the Traveling Wave Reactor (TWR). Similar to mitigation of the footprint issue by the SMR (Attachment 8 above), TerraPower is pursuing the Molten Chloride Fast Reactor (MCFR). The MCFR uses the TWR technology.

The original TWR concepts were proposed in 1958 by Soviet physicist Saveli Feinberg, who used the phrase, a “breed-and-burn.” But the nuclear “waste” is summarized as follows:

1. Global depleted uranium (i.e. nuclear “waste”) is a feedstock for the TerraPower TWR. The USA alone has stored (under EO-12192) over 772,000 tons.
2. TerraPower estimates that the Paducah enrichment facility stockpile alone represents an energy resource equivalent to \$100 trillion worth of electricity.
3. TerraPower estimates that TWR use would enable stockpiles of nuclear “waste” to sustain over 80% of the global population at US levels of per capita energy usage . . . for a thousand years . . . **without emitting any airborne pollutants.**

What the world has been calling “waste,” is no-such-thing. In-truth it is a fuel for advanced nuclear fuel cycles that have been discussed for over 60 years, predating the absurdities of EO-12192 by twenty years.

It is no-surprise, given their commitment to EVs and their simultaneous commitment to truly sustainable nuclear power, it is not the USA or Cornell University, **but it is China that has offered to assist Mr. Gates and TerraPower with the first TWR prototype:** **K**

ENVIRONMENT SEPTEMBER 26, 2017 / 11:35 PM / A YEAR AGO

China National Nuclear, Shenhua team up to develop gen-4 reactor

Reuters Staff 3 MIN READ  

SHANGHAI (Reuters) - The China National Nuclear Corp (CNNC) has signed an agreement with the Shenhua Group, China’s biggest coal producer, to promote the development of advanced “traveling wave” reactor technology, the state nuclear giant said.

The Nuclear “Waste” Issue - Con't



Taking the Next Steps for TWR Prototype Development

September 23, 2015

By: *Lee McIntire - Chief Executive Officer*



Yesterday in Seattle, we were honored to have an impressive crowd gathered at the Grand Hyatt Hotel to witness the signing of a memorandum of understanding (MOU) between TerraPower and China National Nuclear Corporation (CNNC). The audience brought together clean energy leaders such as China's Ministry of Commerce Vice Minister Zhang Xiangchen, as well as Washington's Lieutenant Governor Brad Owen, CNNC's President Qian Zhimin and Bill Gates. Their presence was a recognition of the incredible support and encouragement for TerraPower's efforts to innovate.

Conclusion – Part One:

For an excellent video report of the current state of nuclear power in the United States, a report that highlights the work of NuScale on the SMR (Attachment 8 above) and that of TerraPower and the TWR, please see the PBS report, [The Nuclear Option](#). **M**

For an up-to-date review of the global performance of nuclear power, please see the ['World Nuclear Performance Report 2018.'](#) **N**

Conclusion – Part Two

The author has endured those that are 'locked in' to the so-called “sustainable energy” of wind farms and solar farms. Invariably these individuals are ignorant of modern developments and deployments of nuclear power. As such they are intellectually locked-out of nuclear power . . . At-best their lock-in and locked-out positions are tentative.

Endnotes to Attachment 9

-
- A <http://150.cornell.edu/glorioustoview/>
- B https://www.ted.com/talks/bill_gates
- C <http://web.mit.edu/nse/people/research/forsberg.html>
- D <http://terrapower.com/>
- E <https://www.bloomberg.com/news/articles/2017-09-21/nuclear-scientists-head-to-china-to-test-experimental-reactors>
- F <http://www.world-nuclear-news.org/Articles/Second-Sanmen-AP1000-connected-to-grid>
- G <http://www.world-nuclear-news.org/Articles/Commissioning-milestones-at-Chinese-AP1000s>
<http://pvsheridan.com/Fracking-the-Biosphere.pdf>
- H <http://www.presidency.ucsb.edu/ws/index.php?pid=32917>
- I <https://www.pbs.org/wgbh/pages/frontline/shows/reaction/readings/rossin.html>
- J <https://financialtribune.com/articles/energy/77246/russia-takes-action-to-clean-up-soviet-era-nuclear-waste>
<https://jalopnik.com/vladimir-putin-likes-electric-cars-but-claims-they-are-1819152966>
- K <http://www.world-nuclear.org/information-library/nuclear-fuel-cycle/fuel-recycling/processing-of-used-nuclear-fuel.aspx>
- L <http://terrapower.com/updates/taking-the-next-steps-for-twr-prototype-development/>
<https://www.reuters.com/article/us-china-nuclear/china-national-nuclear-shenhua-team-up-to-develop-gen-4-reactor-idUSKCN1C2088>
<https://spectrum.ieee.org/energy/nuclear/terrapowers-nuclear-reactor-could-power-the-21st-century>
<http://www.world-nuclear.org/information-library/country-profiles/countries-a-f/appendices/nuclear-power-in-china-appendix-1-government-struct.aspx>
<http://www.world-nuclear.org/information-library/country-profiles/countries-a-f/china-nuclear-fuel-cycle.aspx>
- M [PBS Nova Program: The Nuclear Option](#)
- N <http://www.world-nuclear.org/our-association/publications/online-reports/world-nuclear-performance-report.aspx>

Conversion of the TCAT Bus Fleet to Electric Mobility
An Exercise in True Sustainability and True Environmental Protection

Vendor Candidate Recommendations for Supply of Electric Bus - Introduction

In June/July 2018 I was invited to the rollouts of the 2019 Jaguar-Land Rover (JLR) hybrid and electric vehicle models at the Irvine Marriott in Irvine, California.

All outstanding products. The highlight of the show, the vehicle that took the center-stage was the all-new full electric Jaguar I-Pace. **A** The author enjoying the JLR gala: **B**



When we say “all new,” that is emphasis of the fact that the I-Pace is not a formerly Internal Combustion Engine (ICE) platform, later converted to an electric powertrain. This remarkable vehicle was conceived as an electric vehicle at its Concept stage of development.

This developmental distinction is central to my recommendations regarding which electric bus vendors should be prioritized, as a matter of maximizing the effects of limited research and evaluation resources as deployed, by the Stakeholders (Please see Page 11/12 of cover).

This 'clean-sheet-of-paper' concept-level approach to electric mobility is the development approach that Tata Motors Group adopted for its all-new EVision product; focused on the 'Electrify India' program. **C** Below, being introduced at the March 2018 Geneva Auto Show by Cornell University alumnus Mr. Ratan Naval Tata, shown at far-left (photo is hyperlink) : **D**



Mr. Tata is the benefactor of the Cornell Tata Innovations Center in New York; shown at-center with university President Martha Pollack at the December 2017 opening gala: **E**



The Tata Motors Group owns Jaguar-Land Rover. Unfortunately, relating to this attachment, Tata does not yet manufacture a battery-electric transport bus (BEB). **F G H**

Vendor Candidate Recommendations for Supply of Electric Bus - Context

Although the cover essay focuses on the TCAT fleet, it would be prudent to mention the other two major bus fleets in the Ithaca, New York area.

There are three major bus transport fleet operators in the Tompkins County, Finger Lakes region, and the immediate Ithaca, New York area:

1. The **Tompkins County Area Transport (TCAT)** public transportation company; an independent organization with both city and rural routes discussed in-detail in cover.
2. The **Ithaca City School District (ICSD)** school bus fleet: This district is comprised of twelve individual schools teaching “K through 12,” kindergarten through 12th grade. The ICSD bus fleet covers 77 individual routes for student transport.
3. The **Cornell University Transport (CUT)**: This ‘Campus-to-Campus Bus Service’ is primarily involved in the daily roundtrip transport between the Ithaca, New York and New York City campuses.

All three fleets overcome region-specific terrain and weather burdens. CUT involves the longest non-stop distance; its route/distance presents the greatest challenge to electric bus range and charging. The CUT route lacks infrastructure with adequate energy levels and/or chargers that accommodate the utility of short recharge times (EXHIBIT A below).

According to the telephone interviews, none of the above have approved/funded plans to update their bus fleets to full EV.

As discussed on cover page 4, review of the Context of these proposals:

- A. Proposals that involve (or allege to involve) protection of the environment must ensure that goal comprehensively. Heretofore avoided, the beauty and ecology of the Finger Lakes are not to be diminished in any way, or subjugated to the compromises of **alleged** “sustainability.”
- B. The attitudes and lack of a **long-term** foresight, of local and state level New York officials, regarding energy plans, specifically as such relates to the incremental power demanded by a **long-term** vision of electric mobility, must be addressed/corrected.
- C. Connected to Context B, the world at-large has already determined that transport bus conversion to full EV constitutes the greatest and quickest of comprehensive benefits; the proverbial **‘low hanging fruit.’**

Two vendor candidates have emerged from this exercise that appear, from publically available and telephone interview sources, to fulfill the needs of all three fleet conversions listed above. These recommendations are preliminary.

Vendor Candidate Recommendations for Supply of Electric Bus - PRELIMINARY

If the bus transport circumstances of the Tompkins County region are addressed proactively by a vendor, that candidate will potentially provide ongoing support for this effort; the proactive character of an existing presentation (by a vendor) played a significant part in my thinking.

For example, one vendor has already made available for public viewing numerous videos that address the following key route burden and bus product attributes:

1. Existing and ongoing conversion experience with University clients.
2. Direct experience and interaction with students, that were solicited for original input on the conversion process and subsequent experience/ridership, which provide ongoing feedback and product/infrastructure development.
3. Existing video demonstrations of battery electric bus (BEB) gradeability performance.
4. Video demonstrations of BEB cold weather performance; both on-the-road and HVAC.
5. Existing video demonstrations of BEB performance on snow-covered roads (northeast).
6. Video demonstrations of BEB record breaking range performance on one battery charge.
7. Discussion/video review of their real-world BEB mechanical durability and reliability.
8. Video review of real-world BEB ease-of-serviceability (versus ICE designs)
9. Video discussion of crashworthiness and lack of body corrosion (due to the use of advanced composite materials, not the traditional steel body/frame sheet steel design).
10. Discussion/video review of their real-world contributions to the charging infrastructure.

The most important criteria, mentioned on the first two pages of this attachment, involve the fact that both vendor recommendations have designed their BEB as a full electric at the concept level . . . these BEBs are not converted from the traditional body/frame sheet steel designs, that were originally powered, at *their* concept level with an ICE (i.e. diesel or diesel hybrid). |

The two vendors that meet most or all of the above criteria, and are poised to assist with the TCAT, ICSD and CUT bus conversion proposals :



BYD is the world's largest BEB manufacturer based in Shenzhen, China with its USA office headquarters in Los Angeles, California. BYD fulfilled most of the 10 criteria listed above.

Proterra is a USA-based manufacturer, which was founded as a concept level BEB maker. Based in Burlingame, California, **Proterra fulfilled all of the 10 criteria listed above.**

Vendor Candidate Recommendations for Supply of Electric Bus - PRELIMINARY **

The only manufacturer that has already delivered a BEB to an American university is Proterra. That gala took place in early 2016 at the University of Montana at Missoula: **J**

Fulfilling Criteria #1 and #2 from page 4 above, the order for the 2 electric buses was placed by the Associated Students of the University of Montana (ASUM), not university administrators.



These screenshots link to the BEB evaluation Criteria #3 (gradeability) and #4 (cold weather) discussed on page 4 above: **K**



** All screenshots are hyperlinks (Ctrl and left click)

Vendor Candidate Recommendations for Supply of Electric Bus - PRELIMINARY **

The Proterra screenshots link to the BEB evaluation Criteria: #5 (snow covered roads), #6 (range performance) , #7 (mechanical durability and reliability), #8 (ease-of-serviceability), #9 (concept level development and use of advanced corrosion-resistant composite materials) and #10 (contributions to charging infrastructure) as discussed on page 4 above: **L M**



** All screenshots are hyperlinks (Ctrl and left click)

Vendor Candidate Recommendations for Supply of Electric Bus - PRELIMINARY

Founded in early 1995, based in Shenzhen, China, BYD Company is wholly owned and partially funded by the government of China. With a market capitalization of approximately \$15 billion, BYD has made staggering and rapid progress in the area of EV transportation through its subsidiary BYD Auto Company Ltd.

Soon to be the world's largest EV battery manufacturer, BYD is also in the business of solar panels, a vested interest; hence their heightened advertising of that mode as "sustainable."

Their presence in the United States is growing exponentially, and its October 2017 opening of a BEB manufacturing facility in Lancaster, California is the beginning in what is seen as a strategy to dominate the US EV bus segment. **N**



In addition to its raw financial might, BYD enjoys an indirect tie to Cornell University through the 'Cornel in China' program; these ties are decades-old and the envy of other universities. **O**



Similar to the Proterra offerings, the BYD buses are EV concept level developments, and hence are included in this Preliminary candidate recommendations.

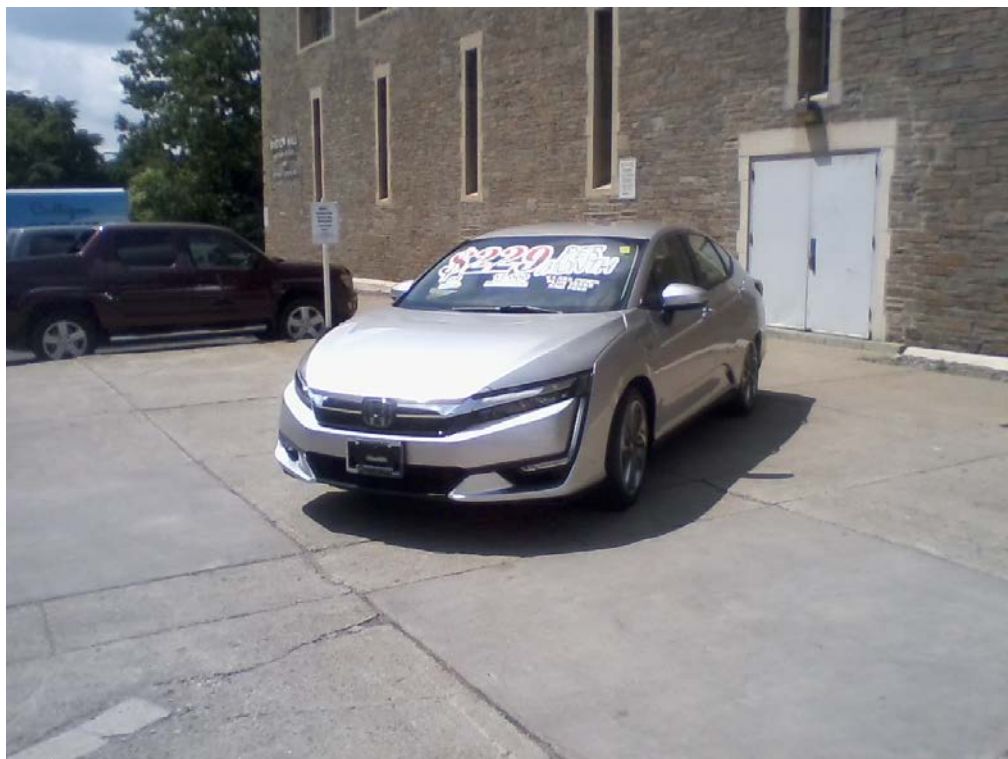
Although the publically available technical information implies that BYD can meet the 10 Criteria listed on Page 4 with their BEB products, their video presentations are not on-par with Proterra. The BYD flagship is the K-9 series. **P**

Vendor Candidate Recommendations for Supply of Electric Bus - CONCLUSION

1. The Proterra and BYD BEB products should be prioritized by the Stakeholders as part of their efforts to convert the TCAT Bus Fleet to Electric Vehicle Mobility. **Q**
2. Extension of these product evaluations, by the Stakeholders, to the ICSD and Cornell CUT bus fleets is encouraged.

Endnotes to Attachment 10

- A <https://www.youtube.com/watch?v=E3Ngz785hS0>
<https://www.youtube.com/watch?v=OePK3nANUHY>
<https://www.youtube.com/watch?v=dsK15k8yVWo>
<https://chargedevs.com/features/2019-jaguar-i-pace-an-apex-brand-pounces-on-the-electric-crossover-scene/>
- B http://pvsheridan.com/I-Pace_Irvine-Marriott.pdf
- C <http://www.tata.com/>
- D <https://www.youtube.com/watch?v=VKncuDvPSJU>
- E <http://news.cornell.edu/stories/2017/12/cornell-tech-celebrates-tata-innovation-centers-launch>
<http://news.cornell.edu/stories/2017/12/cornell-tech-inaugurates-tata-innovation-center>
- F [How Big Is Tata](#)
- G During 2017/2018 I visited numerous Cornell students, staff, administrators and professors regarding my proposal to showcase the Jaguar I-Pace on our campus. I had and continue to propose that two I-Pace vehicles be made available for display, drive and evaluation. The students “love the idea.” The purpose was at least three-fold: (1) continue to inform campus persons whom were/are totally unaware that one of our most generous benefactors is deeply involved in the production of sustainable transportation and, as-such, that Tata Motors Group is the owner of Jaguar, (2) increase exposure of the all-electric Jaguar I-Pace as an exemplar to the Ithaca, New York / Cornell University community, (3) draw attention to the lack of focus, the lack of coursework specific to the electric vehicle paradigm (Review ‘*Preamble to Proposal - The Stakeholders*’ on Page 11 of the cover text).
- H Relating to the proposal discussed in Endnote G, the showcasing of product from local Ithaca, New York car dealerships is routinely accommodated on the Cornell campus, especially if that vehicle is deemed “sustainable.” Please see ‘[Honda at Cornell.](#)’ a typical showcasing outside Barton Hall from April 2018 below:



^I For example, the concept level design of the Proterra “Duo powertrain” includes an “electrified axle,” rather than the retrofit of an electric motor to an existing ICE-based ring-n-pinion differential. The Jaguar I-Pace and the Tata EVision utilize TWO electrified axles in its outstanding design (which allows for extremely competent AWD).

^J <https://www.proterra.com/news-resources/blog/the-sustainability-honor-roll-electric-buses-for-universities-and-colleges/>

^K Video presentations of the ten BEB evaluation Criteria listed on Page 4: in order:

Criteria 1 and 2, University and student involvement: <https://www.youtube.com/watch?v=1UI-KWhA-54>

Criteria 3, Gradeability: https://www.youtube.com/watch?v=pnrWemnFe_I

<https://www.youtube.com/watch?v=V5JV5KRwr54>

Criteria 4, Cold Weather: <https://www.youtube.com/watch?v=nxxfOdsC4yA>

^L Criteria 5, Snow in the Northeast: https://www.youtube.com/watch?v=8BOK_CwVies

Criteria 6, Extended Range per Charge: <https://www.youtube.com/watch?v=sIDCwWnpQV0>

<https://www.youtube.com/watch?v=AEWcVHSoliE>

<https://www.youtube.com/watch?v=zERKJleA3F4>

Criteria 7, Durability and Reliably: <https://www.youtube.com/watch?v=qrwdGFKC-rE>

Criteria 8, Ease-of-serviceability: <https://www.youtube.com/watch?v=9hrOGjNIAoA>

Criteria 9, BEB **Concept Level Development** / Use of Advanced Corrosion Resistant Composite Materials:

<https://www.youtube.com/watch?v=4V-D8p3eLuA>

<https://youtu.be/NIDRYAWn7ds?t=32s>

<https://youtu.be/9JpMTWdPZ6c?t=3m58s>

Criteria 10, Contributions to the Charging Infrastructure:

<https://www.youtube.com/watch?v=jw4e02Oje6w>

<https://www.youtube.com/watch?v=pwdl4HFkyUg>

https://www.youtube.com/watch?v=dp3_zUgD6KE

<https://www.youtube.com/watch?v=zKM8v0Vdasc>

https://www.youtube.com/watch?v=RDwGD_TsMuo

^M I attended the BMW I-series rollout of 2016 in Irvine, California. I was exposed to the BMW I-3 and I-8 all-electric vehicles, which are also EV concept level developed products. Shortly thereafter, BMW announced its chosen USA-based partner for BEB manufacturing: Proterra. <https://www.youtube.com/watch?v=TETNb249DZE>

^N <https://www.youtube.com/watch?v=5MN-7VRX-1g>

^O <https://global.cornell.edu/cornell-china>

<https://global.cornell.edu/cornell-china-advisory-board>

^P <http://en.byd.com/usa/bus/k9-electric-transit-bus/>

^Q Three Proterra Catalyst zero-emission E2 buses have been delivered to the New York MTA, with five additional BEBs coming as part of the MTA electric bus pilot: <https://www.proterra.com/press-release/proterra-secures-three-year-lease-program-with-new-york-mta/> <https://www.youtube.com/watch?v=n0GSaKdon0Q>
<https://www.youtube.com/watch?v=60TDFmH79DU>

**Future Electric Mobility Design Exercise/Proposal
Design Review of the Transport Bus Requirements of Tompkins County, New York**

Cornell University Transport - Campus-to-Campus Bus Service

As shown on Page 2 of 2, the following services involve 230 miles/371km, one-way:

Ithaca to NYC Departure Times			
	North Campus	Sage Hall	Vet College B Lot
Monday – Friday	5:30 a.m.	5:40 a.m.	6:00 a.m.
3 trips daily	11:30 a.m.	11:40 a.m.	noon
	5:30 p.m.	5:40 p.m.	6:00 p.m.
Saturday	10:00 a.m.	10:10 a.m.	10:30 a.m.
2 trips daily	5:30 p.m.	5:40 p.m.	6:00 p.m.
Sunday	10:00 a.m.	10:10 a.m.	10:30 a.m.
3 trips daily	12:30 p.m.	12:40 p.m.	1:00 p.m.
	5:30 p.m.	5:40 p.m.	6:00 p.m.

NYC Arrival (in order)

- Cornell Club (44th and Madison)
- F Train to Tech Campus (64th and 3rd)
- Weill Cornell Medical College (69th and York)

NYC to Ithaca Departure Times			
	Weill Cornell Medical	64th and 3rd	Cornell Club
Monday – Friday	6:00 a.m.	6:15 a.m.	6:30 a.m.
3 trips daily	11:40 a.m.	12:00 p.m.	12:30 p.m.
	5:40 p.m.	6:00 p.m.	6:30 p.m.
Saturday	11:40 a.m.	12:00 p.m.	12:30 p.m.
2 trips daily	4:10 p.m.	4:30 p.m.	5:00 p.m.
Sunday	11:40 a.m.	12:00 p.m.	12:30 p.m.
3 trips daily	4:10 p.m.	4:30 p.m.	5:00 p.m.
	6:10 p.m.	6:30 p.m.	7:00 p.m.

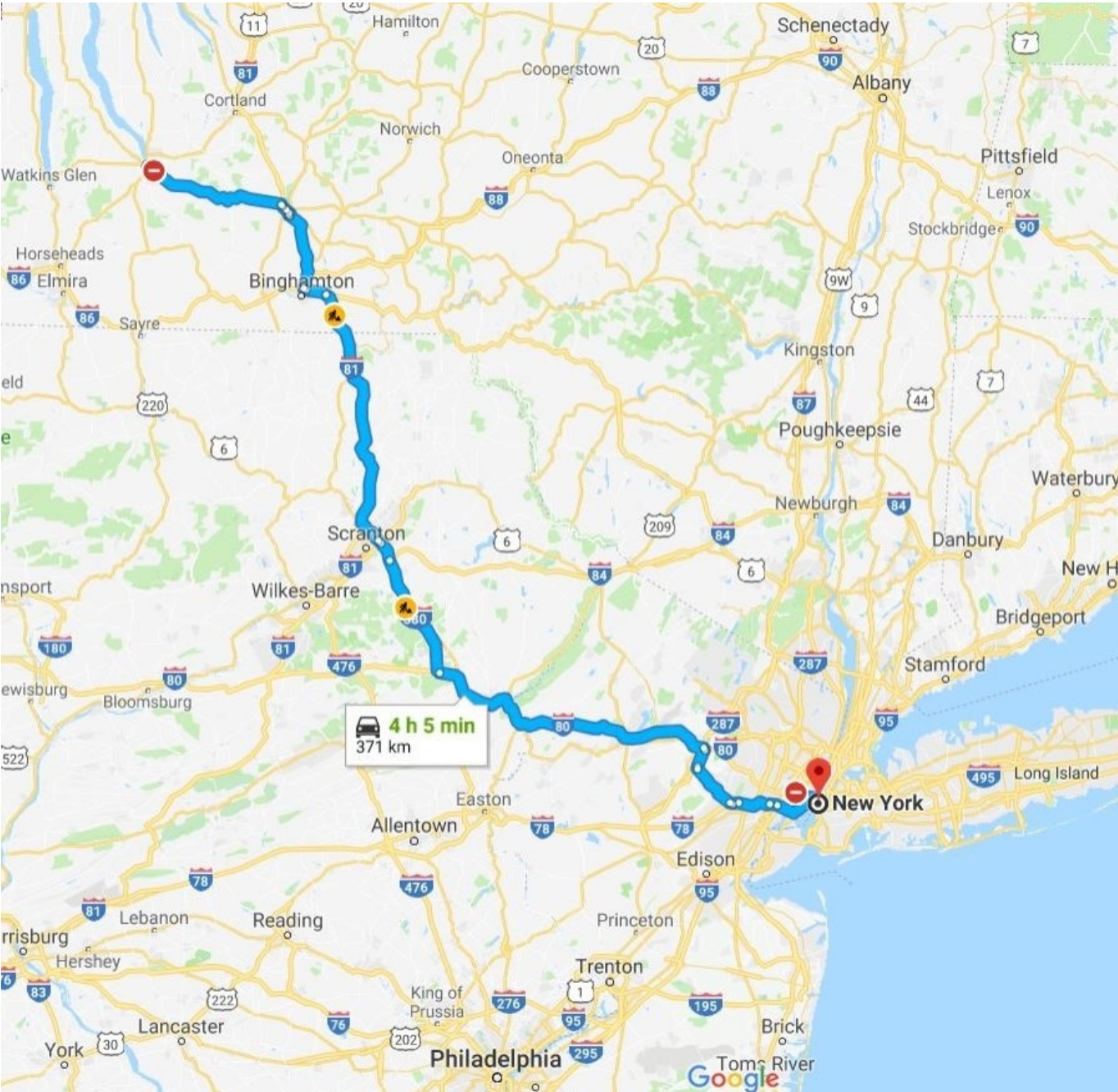
Ithaca Arrivals, in order:

- Vet College B Lot
- Statler/Sage second
- North Campus
- Best Western hotel on demand only, please inform driver prior to Ithaca arrival.

**Future Electric Mobility Design Exercise/Proposal
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Cornell University Transport – Campus-to-Campus Bus Service

The following is meant to depict the approximate distance of the Cornell Transport only, the exact routing(s) are unknown.



Future Electric Mobility Design Exercise/Proposal
Design Review of the Transport Bus Requirements of Tompkins County, New York

Cornell University Transport – Campus-to-Campus Bus Service



**Future Electric Mobility Design Exercise/Proposal
Design Review of the Transport Bus Requirements of Tompkins County, New York**

Electric School Bus Roll-outs – New York State

A wonderful subject resource is schoolbusfleet.com . Reported there is the following headline:

“Lion Delivers 5 Electric School Buses to New York for Pilot.”



The Lion Electric Company, based in Canada, has already delivered 5 eLion school buses to the White Plains, New York city school district, for opening day of class September 2018.

Announcing this gala, District Superintendent Dr. Joseph Ricca:

“The White Plains City School District is very excited at the prospect of using electric school buses. With Lion Electric providing five buses to our contractor, National Express, our children will

experience the most technologically advanced means of transportation and our community will benefit from the positive environmental impact. We’re anxious to roll out the buses in September and continue working to identify innovative and sustainable measures throughout our district.”

White Plains seems to have taken the early lead in EV school buses, but they are not alone. Suffolk County and the Islip School District are also actively discussing conversion of their fleet to full EV, with the US-based Blue Bird Bus Company:



**Future Electric Mobility Design Exercise/Proposal
Design Review of the Transport Bus Requirements of Tompkins County, New York**

Electric School Bus Roll-outs – Additional and Often Overlooked Safety Benefit

The Suffolk Transportation Service background wall banner above proclaims that safety is central to their good works. **An issue, that is a subject of long-experience and expertise for the author, is gasoline/diesel-fueled vehicle fires.** Any transportation device that stores large quantities of combustible fluids presents a danger of a consuming and catastrophic fire. **The following occurred two days ago, August 23, 2018, but is not unique:**



The EV school bus greatly diminishes this risk to our children.

**Future Electric Mobility Design Exercise/Proposal
Design Review of the Transport Bus Requirements of Tompkins County, New York**

Electric School Bus Roll-outs – New York State

Endnotes for Attachment 2

<https://www.schoolbusfleet.com/>

<https://www.schoolbusfleet.com/news/730190/lion-delivers-5-electric-school-buses-to-new-york-for-pilot>

<https://thelionelectric.com/en>

<https://www.whiteplainspublicschools.org/page/1>

<https://www.nationalexpresstransit.com/>

<https://www.youtube.com/watch?v=-IVPYEzEPpE>

<https://www.blue-bird.com/electric>

http://www.islipufsd.org/our_district/central_administration

<http://cornellsun.com/2018/03/23/tcat-bus-catches-fire-on-state-highway-no-injuries-reported/>

<https://www.youtube.com/watch?v=9bbfPpIWYqI>

<https://www.youtube.com/watch?v=LxdK-ekrabY>

https://www.youtube.com/watch?v=TH_0izSyPk0

<http://www.kulr8.com/clip/14586156/school-bus-carrying-35-students-suddenly-caught-on-fire>

<https://www.youtube.com/watch?v=X4QhPYU5uD4>

**Conversion of the TCAT Bus Fleet to Electric Vehicle Mobility
An Exercise in True Sustainability and True Environmental Protection**


End of Document

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First and Foremost Safety is a
Management Issue

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