Critique of Amory Lovins' 2021 Yale Article

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CV of Herschel Specter

Herschel Specter, President of Micro-Utilities, Inc., holds a BS in Applied Mathematics from the Polytechnic Institute of Brooklyn and a MS from MIT in Nuclear Engineering. He is a Licensed Professional Engineer in the State of New York. At the Atomic Energy Commission in the 1970s he was responsible for the licensing of the Indian Point 3 nuclear power plant. In the 1980s the New York Power Authority hired Mr. Specter to defend its Indian Point 3 nuclear plant in a federal adjudicatory trial. He and his team of experts prevailed in court. Mr. Specter served at diplomat rank for 5 years at the International Atomic Energy Agency in Vienna, Austria where he led an international effort writing design safety standards for nuclear power plants.

Mr. Specter has been Chairman of two national committees on nuclear power plant emergency planning and was a guest lecturer for several years on emergency planning at Harvard's School of Public Health. He analyzed emergency responses for a hypothetical terrorist attack on the Indian Point power plants which were located in the nation's highest population density area. Mr. Specter has presented testimony at the National Academy of Sciences on the Fukushima accident and on other nuclear safety matters and has been a guest speaker at many universities on matters of energy policy.Today he is one of 14 Topic Directors in Our Energy Policy Foundation, a group of about 1500 energy professionals who seek to bring unbiased and comprehensive energy information to our political leaders and members of the public.

Mr. Specter has been active in social and environmental matters. He has been a Big Brother and in 1971 had the honor of being selected as "Big Brother of the Year" for all of the USA and Canada. While voluntarily serving as President of Big Brothers of Washington, D.C., the number of boys the agency helped was doubled. He also received a personal letter of commendation from the President of the United States for his work with the Youth Conservation Corps.

Mr. Specter was born in White Plains, NY and lives there now.

Critique of “Three Myths about Renewable Energy and the Grid, Debunked” by Amory B. Lovins and M.V. Ramana, published by Yale University

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From his earliest days Amory Lovins structured energy discussions as “Either/Or” conflicts. Remember debates like “soft path vs. hard path”, “centralized energy vs. decentralized energy”, and “renewable energy vs. nuclear energy”? Over time this theme of excluding one energy source in favor of another has not fared well.

Lessons can be learned from the history of climate change denial that apply to the Lovins and Ramana paper. Climate change is driven by the release of greenhouse gases into our atmosphere from the burning of fossil fuels. Initially the idea that climate change was occurring and largely driven by human actions was met with resistance by some people, in spite of the significant amount of data and science to support this realization. However, nature intervened with floods, droughts, massive fires, extreme heat, more frequent large hurricanes, melting glaciers, and polar vortices. As a result of nature’s intervention, increased capability of the scientific community to connect specific events to climate change, and social unrest, the level of awareness and acceptance of climate change has shifted considerably. There will always be those who cling to their climate change denial, but reality has set in and the world is moving on to face the enormous task of trying to save life on this planet. Similarly, there will always be those who believe that a single technology should exclusively be our energy future, but the rest of the world is moving on.

Lovins initially appealed to our national spirit of independence, harmony with nature, and suspicion of large centralized corporations. He portrayed a benign world with everyone living in harmony with nature in some pastoral setting where all needs were met with decentralized renewable energy. However, people were quick to point out that the Aztecs lived in an all renewable world and they were hardly benign. Instead of Lovins’ romantic dream of decentralized energy, nations are building giant off-shore wind turbines taller than the Washington Monument and manufacturing these machines in huge centralized factories. Large wind farms and large solar farms are not decentralized energy sources and their extensive land use and aesthetics have created public backlashes in many locations. The industrialization of renewable energy brings with it many of the same problems we hear from other industries, such as what do you do with the wastes from solar panels, some of which are toxic? Much of Lovin’s early romantic notion of renewable energy being in harmony with nature has worn thin.

Just as in the history of climate change denial, nature is shaping our evolving energy policies. In general, solar, wind, and biomass have low energy densities. This is a fact of nature, not some argument against increasing the renewable energy contribution. These low energy densities require very large energy collection areas which then precipitate a number of other problems. Per kilowatt-hour of clean electricity, renewable energy is materials intensive, land intensive, and needs many more miles of transmission lines, all of which have been opposed by the public. Large collection areas also make renewable energy much more vulnerable to climate change than nuclear power. Each US nuclear plant has its reactor surrounded by a strong containment building.These robust structures have withstood direct hits by category 5 huricanes, tornadoes, huge earthquakes, and local floods. Their basic designs make them "hardened" structures. However, the large exposed areas of solar and wind farms can not be hardened and not just because of the high costs to do so. To cover them over for protection from the detriments of nature would end their ability to enjoy the benefits of nature, such as collecting low energy density wind and sunshine. As an example of this vulnerability to nature, just a small snowfall or frost covering eliminates the electricity output of solar panels. Large off-shore wind turbines are only built to withstand category 3 hurricanes. Stronger storms, like hurricane Maria, have torn the blades off of wind turbines. Category 5 protection would cost more and may result in heavier lifts beyond present crane capacities. Ice storms have collapsed electricity transmission towers and renewable energy needs many more miles of transmission lines.

Besides renewable energy being less resilient to climate change, nature interferes with renewable energy in other ways. For example, in winter in New York, the sun sets before the evening peak demand for electricity occurs. Unless very large energy storage systems are available, solar energy cannot reduce peak winter demands. As space heating and hot water making become more electrified, the winter peak demand will be much higher, making the inability of solar energy to reduce peak winter loads a much more important drawback. Even with assuming optimistic cost projections, battery storage would be too expensive to offset solar energy's limited winter contribution.

Not only are there seasonal variations in solar output, there are geographical ones as well. A solar panel in New York would produce 41% less electricity per year than the identical panel in Los Angeles. In New York solar energy has a capacity factor of only 14%. This is like having a car that only operates one day a week and you don't get to pick which day.There is no guarantee that wind power could come to the rescue when solar energy is insufficient. There are variations in wind power from year-to-year and lulls occur during the year. The New York Independent Systems Operator reported on lulls in NY State: *"In 2019 there were 64 instances when wind resources supplied less than 100 MW to the grid for periods of more than 8 consecutive hours. 100 MW represented about 5% of the installed wind capacity in 2019."* (1). In 2020 there were 74 such instances. Meteorologically, wind patterns are very large, often far larger than the biggest wind farms. As data from Europe show, local lulls in wind speeds coincide with lulls over much larger areas. Building larger wind farms does not solve the lull problem. When Lovins and Ramana state that "all electricity supply varies", that is a half truth. It could have the reader believing that in New York, the variability of solar energy with its 14% capacity factor and land based wind power with its 26% capacity factor somehow have a variability comparable to New York's nuclear power plants with their over 90% capacity factors. Renewable energy is known for its variability and Lovins would know this if he ever looked at actual wind power production data and their large and frequent output swings. The electricity produced by a wind turbine varies as the cube of the wind speed.(2) A momentary decrease in wind speed of just five meters per second from 20 m/s to 15 m/s would decrease the electricity output by about 58%. Again, this is a fact of nature, not some anti-renewable energy propaganda. Small swings in wind speed are capable of producing large swings in output which is the opposite of nuclear power which is so reliable and steady it is used for base load electricity.

The authors claim to quote Bloomberg news stating that solar and wind are the cheapest source for 91 percent of the world's electricity. But how many billions of people in this 91 percent group live in abject poverty and need far more clean energy? How much of this 91% comes from hydropower which many environmentalists object to? How much comes from burning wood pellets?

Lovins and Ramana's discussion of Germany is most peculiar. Germany, with one of the highest prices for electricity in Europe, plans to close its last nuclear plants soon. Yet Germany also plans to continue burning dirty lignite coal until 2038, burdening the whole world with 16 more years of its greenhouse gas releases. How many more years beyond 2038 will other nations need to clean up Germany's mess? If renewable energy in Germany is so successful, why does Germany need to wait until 2038 to eliminate coal use? Further, by phasing out its nuclear plants Germany has created a national security issue with its overdependence on gas imported from Russia. Gas payments to Russia help pay for Russian troops massing at the Ukrainian border. Lovins refers to Germany's decline in greenhouse gas releases in 2020. The reference (3) he apparently used attributed two thirds of the 2020 decline to the effects of COVID-19 and predicted that emissions would grow in 2021 as the economy improved. How about a Germany with a one billion ton CO_2 reduction by 2045? Keep your six nuclear plants and phase out coal, then gas.(4)

California is another example of a failed energy policy. It plans to close its last carbon-free nuclear plant, Diablo Canyon, while blistering heat has caused wildfires, droughts, electricity demand to soar, and hydropower water levels to sink to levels not seen in decades. In desperation, California's Governor has approved running fossil fueled electricity stations beyond their permitted environmental limits, authorized the use of "temporary gas plants", is willing to run highly polluting emergency diesels, and approves importing coal-generated electricity from Wyoming. He has asked Californians to cut back on charging their electric vehicles. Is California a model for an all-renewable energy future for the rest of the country?

Lovins' and Ramana's comments about Japan are outdated. Following Fukushima, Japan shut its nuclear reactors down and became the world's third largest importer of coal, after China and India (5). Lovins and Ramana claim that the closure of more than 40 nuclear plants was done "without materially raising fossil-fueled generation or greenhouse gas emissions". Are we to assume that Lovins and Ramana believe that massive use of coal does not generate greenhouse gases? However, Japan under new leadership has reversed its course and now plans to reopen its nuclear plants on an accelerated schedule.

Lovins and Ramana claim that solar and wind power tend to work independently at different times and seasons making shortfalls less likely**. "Less likely" is just not good enough!** The likelihood of a shortfall under severe weather conditions must be made to be vanishingly small. These authors wrote *"Texas generates more wind power - about a fifth of its electricity-than any other state in the U.S."* Yet it was Texas that suffered a great tragedy in 2021when hit by a polar vortex. Estimates as high as 702 fatalities and $195 billion dollars in damages have been reported (6). Texas's large amount of wind power was incapable of preventing this tragedy because wind power, like solar energy, cannot be ramped up to meet emergencies. They are not dispatchable sources of electricity.

The authors want to paint a picture of nuclear plants being unreliable in spite of nuclear plants having the highest capacity factors of all energy sources and far higher than renewable energy sources. They try to connect the Fukushima accident with the 2003 regional blackout stating that abrupt shutdowns caused nine reactors to produce no power for several days. There is nothing about the operation of these nine nuclear power plants that ties them to the cause of this blackout, let alone to Fukushima. The “abrupt” shutdowns of these nuclear plants that Lovins writes about are not a result of any design defect in these plants. Quite the opposite. For safety purposes, these plants were designed to shut down in an orderly way if the electric grid goes down. They performed exactly as they were designed to do.The 2003 regional blackout was a software problem in the system that manages the electric grid and not in the nuclear plants which responded quickly and appropriately. What message comes through from the Lovins and Ramana paper? Would readers learn that the nine reactors had nothing to do with causing the 2003 blackout and most locations had power restored within 7 hours? (7)

Perhaps the most disappointing aspect of the Lovins and Ramana paper is how outdated it is. People have long ago moved beyond the Lovins romantic vision of pastoral peace and total individual freedom, all supported by renewable energy. Recently renewable energy leaders like the National Renewable Energy Laboratory have shown that as the deployment of renewable energy increases, so do problems and uncertainties. NREL has shown (8) that at high renewable energy deployments there are issues which lack solutions today. But there already are renewable energy land use issues at much lower deployment levels.

Others have recognized that shortfalls under extreme weather conditions must be prevented and have called for clean, firm (reliable), dispatchable energy of sufficient scale to prevent dangerous shortfalls. The leading candidates to overcome such renewable energy shortfalls are nuclear power, fossil fuels with carbon capture and sequestration or a combination of the two. Overcoming weaknesses in renewable energy with nuclear power and/or with fossil fuels means that 100% renewable energy futures would have to be replaced by a mix of energy sources. It has now been shown that mixes of energy sources would reduce the cost of electricity, reduce the amounts of land and materials needed, and minimize the MW-miles of new transmission lines. The need to protect people from the extremes of nature heralds the end of the “Either/Or” arguments and the beginning of the “And” agreements.

The Clean Air Task Force (9), and the United Nations (10) have shown that a mix of energy sources including renewable energy, nuclear power and/ or fossil fuels with carbon capture and sequestration, have profound advantages over any extreme scenario, like 100% renewable energy. Not only is this diverse group of energy sources more resilient to deal with climate change, the cost of electricity would be far less, there would be a reduction in the land needed, in energy storage requirements, and the number of MW-miles of transmission needed. Note that Maine just rejected a clean electricity transmission line from Canada to Massachusetts.

Recent more inclusive renewable energy analyses include firm, clean, energy sources that are dispatchable and this is just the beginning. What is evolving is the recognition that there are opportunities for renewable energy and nuclear energy combinations that are superior to either technology alone. What is evolving is that the ideological battles, the Either/Or battles, are truly irrelevant. Instead of spending time debating ideological differences we must solve an enormous "nuts and bolts" challenge. It is not yet clear if America has the industrial base to respond quickly enough to prevent irreparable damage. The goal is to reduce greenhouse gas emissions as rapidly as possible. Renewable energy, in concert with nuclear energy, conservation, and net zero carbon synthetic fuels, offers our best chance.

References:

1. NYISO Power Trends 2020, page 16.
2. "The Power of the Wind: Cube of the Wind Speed", Danish Wind Industry Association, 1997.
3. "Corona year 2020: record declines in carbon emissions and coal power". Agora Energiewende, January 5, 2021.
4. "One Billion Tons -CO_2 reductions and a Faster Coal Exit in Germany", https://www.onebilliontons.org/
5. "Japan is the world's third-largest coal-importing country", US Energy Information Administration, June 14, 2019.
6. "2021 Texas power crisis", Wikipedia.
7. "Northeast blackout of 2003", Wikipedia.
8. "The challenges of achieving a 100% renewable electricity system in the United States.", Joule 5, 1331-1352, June 16, 2021.
9. "California needs clean firm power, and so does the rest of the world.", Clean Air Task Force, September 7, 2021.
10. "Global climate objectives fall short without nuclear power in the mix: UNECE", UN News, August 11, 2021.