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The Transition to Renewables Is Underway

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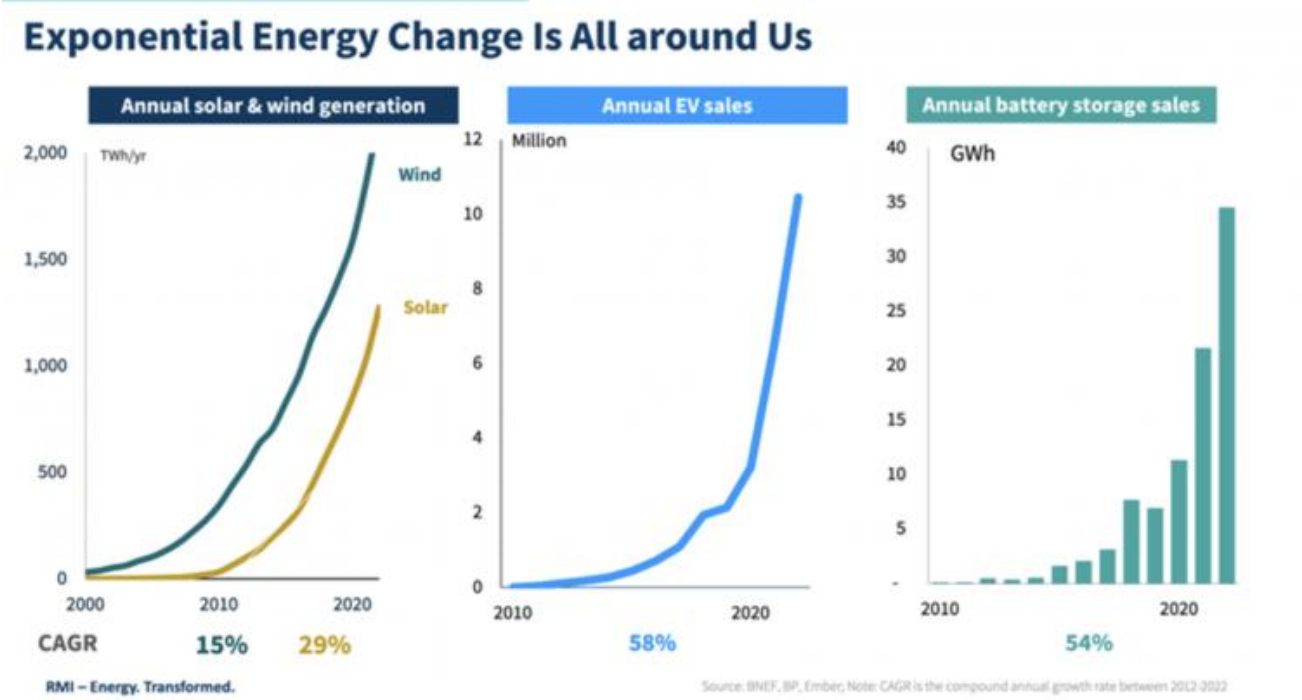
The transition to a world powered by abundant, affordable, fuel-free and emissions-free solar and wind farms is underway. Increasingly, this transition will be driven by economics that favor renewables — and less by government policies and programs. While this trend is our friend, at its current pace, the switch to renewables will not happen fast enough or on a broad enough scale to eliminate our use of fossil fuels. This is necessary to reduce greenhouse gas emissions to stay under internationally agreed-upon limits for global warming. It is unlikely to be a smooth transition, as we are seeing today. There will be bumps and setbacks along the way.

The growth of renewables is accelerating.

We still depend on fossil fuels for over 80% of our energy needs. Today, renewable energy from solar and wind accounts for about 7% of global energy production. In 2023, about 18% of global automobile sales were electric vehicles (EVs). A growing share of electricity is produced using renewables, reaching 21% in the U.S. and 30% globally last year.

These low percentages mask the fact that green energy, especially from solar and wind farms, as well as electric vehicles and battery storage, is starting to exhibit exponential growth. Technology and economies of scale are rapidly improving, leading to further cost reductions and performance improvements.

The cost of electricity from solar has dropped steadily and dramatically mainly due to competition between manufacturers in China where over 90% of the world's solar cells are made. Additional cost reductions are likely due to increasing economies of scale and technology improvements.



source: The Energy Transition in Five Charts and Not Too Many Numbers May 3, 2023, Rocky Mountain Institute (RMI)

According to the BloombergNEF New Energy Outlook 2024, "The energy transition has accelerated in recent years with the pace of clean technology deployment and capital investment surging to record levels." The use of electric vehicles (EVs) will grow as the cost of EVs reaches parity with gasoline and diesel-powered vehicles, the range and rapid charging of EVs improves, as well as when charging stations become more common.

A possible risk.

The U.S. is the only large developed country that is self-sufficient in oil and gas, thanks to the fracking revolution and our abundant fossil fuel reserves. Others — such as China, Japan, Europe and rapidly developing India — have more incentive to embrace renewables to reduce their dependence on imported fossil fuels. China and India also have huge air pollution problems that can be reduced by the transition to renewables.

There is a danger that the U.S. will resist the growth of renewables to preserve its fossil fuel industry as long as possible and to protect domestic vehicle manufacturers. If so, the U.S. would fall further behind China in the development and production of solar panels, wind turbines, batteries and electric vehicles.

The grid we need.

The modernization and expansion of the electric grid is an essential first step to electrify the economy by distributing more than twice the amount of today's electricity output, and to connect the best locations for renewable energy production to the grid. Today, thousands of solar and wind projects are waiting for grid connections. A number of states, such as those in New England, do not have the potential for large wind and solar projects due to climate, land

area and other factors. These states will have to import much of their renewable electricity from other windier and sunnier areas, much as many states import most of their fossil fuels today.

What's needed is a national system that is the equivalent of today's national pipeline network. For example, the longest natural gas pipeline in the U.S., the **1700-mile-long** Transcontinental Pipeline**, connects West Texas to New York City.**

In addition to the transmission system, the capacity of local electricity distribution systems needs to be increased. We will have to provide for charging electric vehicles, the transition from gas furnaces to heat pumps and other changes that substantially increase the local demand for electricity.

Land use.

Land use is a contentious issue with growing public opposition to large solar and wind farms as well as transmission lines. Solar and wind farms should be placed in optimum locations with adequate sunlight and wind. There are enough good locations that can be developed without using scarce farmland or areas deemed unacceptable to the public. These locations have to be connected to the grid by new transmission lines. According to a report from the National Renewable Energy Laboratory, roughly 22,000 square miles of solar panels would power the United States. This is less than 1% of the land area of the continental U.S.
The Permian Basin in west Texas covers 75,000 square miles and has enough sunny and windy land to power the U.S. in addition to being one of the world's largest sources of oil and natural gas. There are other large areas that are excellent sites for solar and wind farms.
According to the National Renewable Energy Laboratory (NREL), the land needed for solar is a little more than the land area occupied by railroads (18,500 square miles), only about 55% occupied by active oil and gas leases (40,500 square miles) and only 37% of the land area used to grow feedstock for ethanol production (40,500 square miles).

Changes in energy investment.

Over time, most global energy investment would be directed to replace fossil fuel infrastructure that is aging, obsolete or no longer cost-competitive. In 2023, global energy investment was $2.8 trillion. Already, over 60% of this was spent on renewable energy projects, not on fossil fuels. Most of the funds for the energy transition would come from the private sector, such as purchasing an EV when it is time to replace a gasoline-powered vehicle. All solar and wind projects can be funded by the private sector if grid connections are available.

Cost savings from reducing fossil fuel use could be substantial. The International Monetary Fund (IMF) recently updated its study of fossil fuel subsidies. According to this report, fossil fuel energy subsidies are estimated to be $7 trillion annually, about 7.1% of global GDP in 2022. This includes explicit subsidies for fossil fuels totaling about $1.26 trillion. Underpricing the cost of air pollution and global warming is estimated to cost $4.2 trillion annually.

Will we stop global warming?

Increasing the use of emissions-free renewables will reduce future increases in the Earth's temperature but will not stop global warming until all greenhouse gas emissions are eliminated. We have to replace fossil fuels with energy from renewable sources wherever possible, increase the Earth's ability to absorb carbon dioxide from the atmosphere naturally, as well as make changes to agriculture to sequester more carbon dioxide and reduce methane and nitrous oxide

emissions. If we stop greenhouse gas emissions at some future date, the Earth's temperature will not go down but will stabilize at some higher value consistent with greenhouse gases in the atmosphere at that time.

The international and U.S. government objective is to reach net zero, meaning no net greenhouse gas emissions, by 2050 to keep the Earth's temperature increase to less than 1.5 degrees C (2.7 degrees F). Based upon present trends, the Earth's temperature increase is likely to exceed 2.0 degrees C (3.6 degrees F) in the next 30 years or so.

There is no guarantee that the world will ever achieve net zero and we will have to live with increasing global warming and climate change.

What should the federal government do?

So far, the U.S. is proceeding without a national plan or project management organization to achieve emission-reduction goals. Present government efforts are based on legislation; mandates, tariffs, subsidies, tax breaks and loan guarantees, all spending borrowed money, to provide incentives to transition from fossil fuels to renewables. This will make some progress but will not be enough to stop global warming. The Inflation Reduction Act of 2022 included about $400 billion over the next 10 years to fund tax incentives, grants and loan guarantees. The primary focus is on the production of renewable energy, followed by incentives to transition to electric vehicles.

In response to China's growing lead, the Biden administration recently imposed a 100% tariff on electric vehicles and a 50% tariff on solar panels from China. This will temporarily protect U.S. vehicle manufacturers, including Tesla. However, shielding U.S. vehicle and solar panel manufacturers could lead to their falling further behind and also raise the cost of transitioning to renewable energy and electric vehicles in the U.S.

Perhaps a better strategy is to do what China has done over the past 50 years: To have access to the U.S. market, require companies to form joint ventures with U.S. companies, build factories in the U.S. and employ U.S. labor.

Throwing money at this problem is not effective as demonstrated by recent progress with charging stations for electric vehicles. In 2021, the Inflation Reduction Act included $5 billion to build fast charging stations. As of March 2024, only seven stations and 38 individual chargers were up and running. Hopefully, this is not representative of the overall effort.

To take serious action to slow down or stop global warming, we should learn from successful large-scale projects, including the Manhattan Project, the Space Program and the National Highway system. These successful efforts had plans and organizations in place with the authority to manage the implementation, report progress, solve problems and remove roadblocks along the way.

Any plan should start with the government commissioning a realistic forecast of how quickly the U.S. can transition from fossil fuels to renewables with a smooth transition to avoid disruptions in our energy supply. How much longer will we need fossil fuels to meet our energy requirements? We need an accurate — not a politically acceptable — answer to this important question.

A national effort wouldn't necessarily require a new apparatus to plan, organize and implement it: The Department of Energy, with its large organization and seventeen national laboratories, could be tasked with coordinating the preparation of a national plan for the

transition from fossil fuels to renewables. This should include all the changes needed to eliminate greenhouse gas emissions, eventually reaching net zero.

This planning effort should include contributions from other government organizations, our universities, think tanks and private industry. Many of these organizations are already working on some aspects of global warming and climate change. Bringing together their research and expertise could accelerate the transition and spur innovation.

We know what needs to be done, and the technology needed is available and improving. Progress is being made, but not fast enough and on a broad enough scale. Will we do what is required or will we choose to live with ever-increasing global temperatures and climate change?

William Fletcher and Craig Smith, Ph.D., are coauthors of "The Global Climate Crisis: What To Do About It," published by Elsevier in March.

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