Inquiring Minds for May 10, 2019

Topic.. Energy for/of the Future

Moderator.. Al Kaplan

This article tells the story of Energy in the world of tomorrow, and as such poses many questions for us to address.

... How will the users of these energies, the industrial world and the personal world accept these potential and real changes in energy sources??

... Can Renewable energy sources be an adequate replacement for fossil fuels, or, as the authors claim, not be an adequate Replacement??

... Do you see any evidence of the Industrial world already making changes to accept nuclear sources of energy??

....Can, will, and are these users able and willing to accept the financial burdens of these changes???

... Is the public, you and I, willing to accept any increasing financial costs of converting to new and different energy sources?

... Are the naysayers to climate change able accept the changes brought on by changes in energy sources?

.. Will the possible rapidity of changes of sources of energy be accepted by industry? And the public??

... Will John Q Public accept the potential negatives and fear of "nuclear" in Nuclear energy??

Nuclear Power Can Save the World

By Joshua S. Goldstein, Staffan A. Qvist and Steven Pinker April 6, 2019Expanding the technology is the fastest way to slash greenhouse gas emissions and decarbonize the economy.

As young people rightly demand real solutions to climate change, the question is not *what* to do — eliminate fossil fuels by 2050 — but *how*. Beyond decarbonizing today's electric grid, we must use clean electricity to replace fossil fuels in transportation, industry and heating. We must provide for the fast-growing energy needs of poorer countries and extend the grid to a billion people who now lack electricity. And still more electricity will be needed to remove excess carbon dioxide from the atmosphere by midcentury.

Where will this gargantuan amount of carbon-free energy come from? The popular answer is renewables alone, but this is a fantasy. Wind and solar power are becoming cheaper, but they are not available around the clock, rain or shine, and batteries that could power entire cities for days or weeks show no sign of materializing any time soon. Today, renewables work only with fossil-fuel backup.

Germany, which went all-in for renewables, has seen little reduction in carbon emissions, and, according to our calculations, at Germany's rate of adding clean energy relative to gross domestic product, it would take the world more than a century to decarbonize, even if the country wasn't also retiring nuclear plants early. A few lucky countries with abundant hydroelectricity, like Norway and New Zealand, have decarbonized their electric grids, but their success cannot be scaled up elsewhere: The world's best hydro sites are already dammed.

Small wonder that a growing response to these intimidating facts is, "We're cooked."

But we actually have proven models for rapid decarbonization with economic and energy growth: France and Sweden. They decarbonized their grids decades ago and now emit less than a tenth of the world average of carbon dioxide per kilowatt-hour. They remain among the world's most pleasant places to live and enjoy much cheaper electricity than Germany to boot.

They did this with nuclear power. And they did it fast, taking advantage of nuclear power's intense concentration of energy per pound of fuel. France replaced almost all of its fossil-fueled electricity with nuclear power nationwide in just 15 years; Sweden, in about 20 years. In fact, most of the fastest additions of clean electricity historically are countries rolling out nuclear power.

This is a realistic solution to humanity's greatest problem. Plants built 30 years ago in America, as in France, produce cheap, clean electricity, and nuclear power is the cheapest source in South Korea. The 98 U.S. reactors today provide nearly 20 percent of the nation's electricity generation. So why don't the United States and other countries expand their nuclear capacity? The reasons are economics and fear.

New nuclear power plants are hugely expensive to build in the United States today. This is why so few are being built. But they don't need to be so costly. The key to recovering our lost ability to build affordable nuclear plants is standardization and repetition. The first product off any assembly line is expensive — it cost more than $150 million to develop the first iPhone — but costs plunge as they are built in quantity and production kinks are worked out.

Yet as a former chairman of the Nuclear Regulatory Commission put it, while France has two types of reactors and hundreds of types of cheese, in the United States it's the other way around. In recent decades, the United States and some European countries have created ever more complicated reactors, with ever more safety features in response to public fears. New, one-of-a-kind designs, shifting regulations, supply-chain and construction snafus and a lost generation of experts

(during the decades when new construction stopped) have driven costs to absurd heights.

These economic problems are solvable. China and South Korea can build reactors at one-sixth the current cost in the United States. With the political will, China could replace coal without sacrificing economic growth, reducing world carbon emissions by more than 10 percent. In the longer term, dozens of American start-ups are developing “fourth generation” reactors that can be mass-produced, potentially generating electricity at lower cost than fossil fuels. If American activists, politicians and regulators allow it, these reactors could be exported to the world in the 2030s and ’40s, slaking poorer countries’ growing thirst for energy while creating wellpaying American jobs. Currently, fourth-generation nuclear power receives rare bipartisan agreement in Congress, making it a particularly appealing American policy to address climate change. Congress recently passed the Nuclear Energy Innovation and Modernization Act by big margins. Both parties love innovation, entrepreneurship, exports and jobs.

This approach will need a sensible regulatory framework. Currently, as M.I.T.’s Richard Lester, a nuclear engineer, has written, a company proposing a new reactor design faces “the prospect of having to spend a billion dollars or more on an openended, all□or□nothing licensing process without any certainty of outcomes.” We need government on the side of this clean-energy transformation, with supportive regulation, streamlined approval, investment in research and incentives that tilt producers and consumers away from carbon.

All this, however, depends on overcoming an irrational dread among the public and many activists. The reality is that nuclear power is the safest form of energy humanity has ever used. Mining accidents, hydroelectric dam failures, natural gas explosions and oil train crashes all kill people, sometimes in large numbers, and smoke from coal-burning kills them in enormous numbers, more than half a million per year.

By contrast, in 60 years of nuclear power, only three accidents have raised public alarm: Three Mile Island in 1979, which killed no one; Fukushima in 2011, which killed no one (many deaths resulted from the tsunami and some from a panicked evacuation near the plant); and Chernobyl in 1986, the result of extraordinary Soviet bungling, which killed 31 in the accident and perhaps several thousand from cancer, around the same number killed by coal emissions *every day*. (Even if we accepted recent claims that Soviet and international authorities covered up tens of thousands of Chernobyl deaths, the death toll from 60 years of nuclear power would still equal about one month of coal-related deaths.)

Nuclear power plants cannot explode like nuclear bombs, and they have not contributed to weapons proliferation, thanks to robust international controls: 24 countries have nuclear power but not weapons, while Israel and North Korea have nuclear weapons but not power.

Nuclear waste is compact — America's total from 60 years would fit in a Walmart — and is safely stored in concrete casks and pools, becoming less radioactive over time. After we have solved the more pressing challenge of climate change, we can either burn the waste as fuel in new types of reactors or bury it deep underground. It's a far easier environmental challenge than the world's enormous coal waste, routinely dumped near poor communities and often laden with toxic arsenic, mercury and lead that can last *forever*.

Despite its demonstrable safety, nuclear power presses several psychological buttons. First, people estimate risk according to how readily anecdotes like well-publicized nuclear accidents pop into mind. Second, the thought of radiation activates the mindset of disgust, in which any trace of contaminant fouls whatever it contacts, despite the reality that we all live in a soup of natural radiation. Third, people feel better about eliminating a single tiny risk entirely than minimizing risk from all hazards combined. For all these reasons, nuclear power is dreaded while

fossil fuels are tolerated, just as flying is scary even though driving is more dangerous.

Opinions are also driven by our cultural and political tribes. Since the late 1970s, when No Nukes became a signature cause of the Green movement, sympathy to nuclear power became, among many environmentalists, a sign of disloyalty if not treason.

Despite these challenges, psychology and politics can change quickly. As the enormity of the climate crisis sinks in and the hoped-for carbon savings from renewables don't add up, nuclear can become the new green. Protecting the environment and lifting the developing world out of poverty are progressive causes. And the millennials and Gen Z's might rethink the sacred values their boomer parents have left unexamined since the Doobie Brothers sang at the 1979 No Nukes concert.

If the American public and politicians can face real threats and overcome unfounded fears, we can solve humanity's most pressing challenge and leave our grandchildren a bright future of climate stability and abundant energy. We can dispatch, once and for all, the self-fulfilling prophesy that we're cooked.

Joshua S. Goldstein, professor emeritus of international relations at American University, and Staffan A. Qvist, a Swedish energy engineer, are the authors of "A Bright Future: How Some Countries Have Solved Climate Change and the Rest Can Follow." Steven Pinker is a professor of psychology at Harvard University and is the author of "Enlightenment Now."