You Can't Fight the Pandemic, Or Rebuild the Economy Without Power—Nuclear Power

by Paul Gallagher

July 2—The LaRouche Political Action Committee on May 28 issued its report, *The LaRouche Plan to Reopen the Economy: The World Needs 1.5 Billion New, Productive Jobs*, which begins with the building of a new international healthcare system of modern hospitals and clinics to treat millions of COVID-19 patients. The report estimated that 50-100,000 megawatts of new electric power capacity must be built throughout the developing sector, simply to provide reliable electricity for the 30,000 new hospitals needed to reach coverage levels legislated in many advanced economies. Their required supplies of fresh water must be provided as well.

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Medical personnel attending a patient in an Intensive Care Unit.

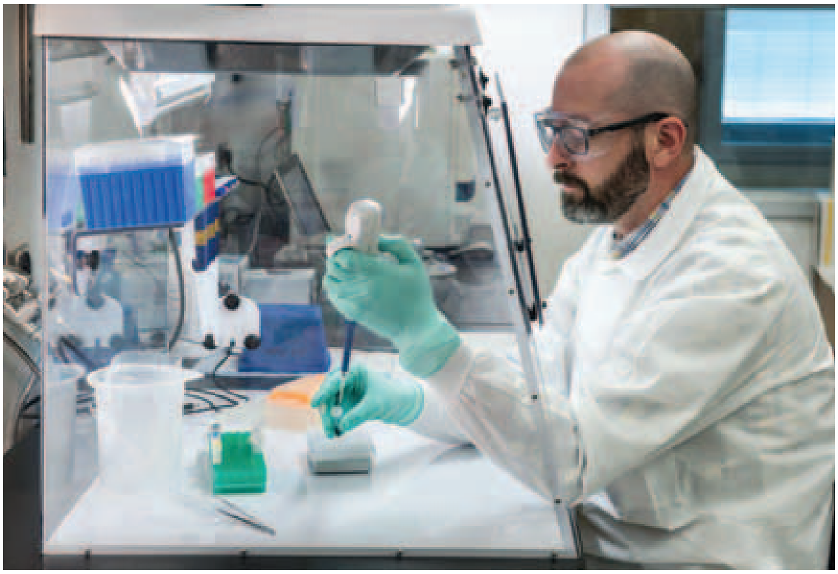
This was seen by LaRouche PAC as the pandemic-emergency front edge of "Tennessee Valley Authority"-type major development projects across South Asia, the Middle East and Africa, and South America, and new basic infrastructure platforms in the (de-)industrialized countries as well.

The partnering of these two great tasks, needing a cooperative initiative from the leaders of a number of major powers, can create 50 million new, productive jobs in the United States over a generation—starting immediately with 6-7 million in building and staffing new healthcare systems and expanding the frontiers of space exploration and science. In the world as a whole, 1.5 *billion* new, productive jobs can be created over a generation, replacing what is now the non-productive and bare subsistence "informal employment" of two-thirds of the world's labor force.

USMC/Daniel R. Betancourt, Jr.

A U.S. Navy medic checks on a COVID-19 patient receiving ventilator care at Baton Rouge General Hospital.

Creating such "TVA"-type development projects across the entire developing sector and building new, modern infrastructure platforms in the industrial economies requires much more new electrical capacity than that required for the new "world healthcare system" alone—perhaps as much as a 30% increase in just two



CDC

A scientist conducting molecular testing.

years in the world's 7 million megawatts capacity, as we will show.

Just over a week after LaRouche PAC's report was published, the World Bank and the Brookings Institution publicized a report by four Brookings researchers which confirmed our report's emphasis on the critical importance of a great increase in reliable electric power to fight the coronavirus pandemic. The study, headlined "You Can't Fight Pandemics without Power—Electric Power," provides greater detail on the life-or-death role of electricity in medical care than LaRouche PAC had in making the argument that up to 100,000 megawatts of added power is essential.

The study's authors noted that the number of people worldwide with *no* access to electricity has fallen from 1.2 billion in 2010 to just about 800 million in 2018; but that if the measure is changed to the more critical one of access to *reliable electric power*, the picture is quite different. For example, just 28% of all hospitals across the developing nations have reliable electricity. Moreover, 25% percent of health clinics in six countries they surveyed—Cambodia, Myanmar, Nepal, Kenya, Ethiopia, and Niger) lack electricity completely, and this had not changed since 2010. A study of 33 hospitals in 10 countries found that unreliable power was the single most common cause of medical equipment failure.

All those developing nations, that like Ghana, and other African nations, now want to mobilize to build new district and regional hospitals and clinics to fight COVID-19, face four challenges: Building new facilities with modern capacities; recruiting and training staff; providing large amounts of fresh water; and powering those facilities. The Brookings study makes clear the extensive need for electricity.

Virtually all current diagnostic tests for COVID-19 require electricity; communicating patients' records requires electricity. Electricity determines the effectiveness of—

> the many resources that enable health systems to detect, prevent, and treat infectious diseases; clean water, decent equipment, qualified staff, and medical supplies….
>
> Patients who need further diagnosis (e.g., pulse oximetry) or treatment with ventilators or oxygen masks have to be placed in clinics with reliable power; outages for even a few minutes can be life-threatening. Besides, electricity powers sanitization and cleaning equipment like autoclaves and air filtration and, in some places, pumped clean water. These are necessary for preventing the spread of infection among patients and medical workers.

Hospital and clinic staff, whether veteran professionals or those newly trained for newly built facilities, will want to live in homes with reliable electricity.

And looking ahead to delivery of a vaccine, once approved, and produced in billions of rounds, the Brookings study states that:

> The WHO [World Health Organization] estimates that nearly 50% of freeze-dried and 25% of liquid vaccines are wasted each year, in large part due to cold chain electricity disruptions.

LaRouche PAC's report showed that worldwide, roughly 110 million productive jobs can be created in 2020-21 alone, simply by the building and powering and staffing of a new worldwide healthcare system.

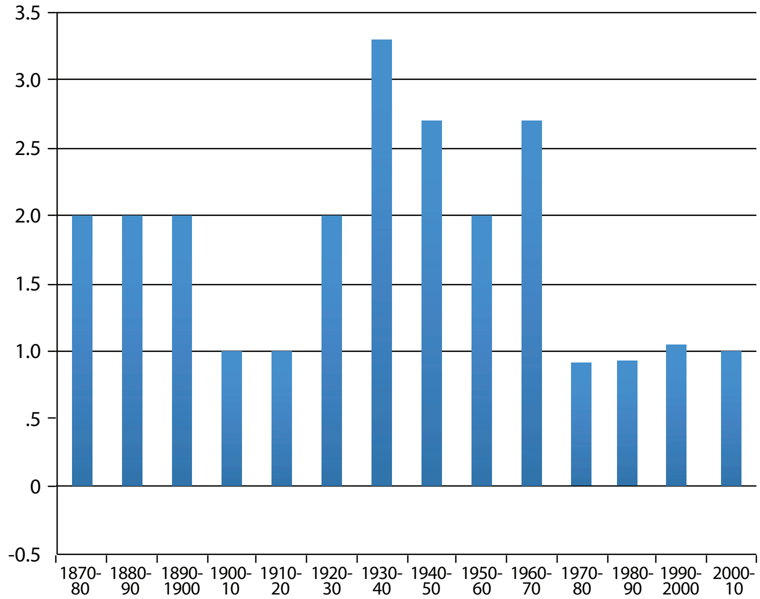
Electrical Power and Productive Workers

We are talking about creating employment on a level of productivity which is absent from the "informal" employment so characteristic of the developing nations,

FIGURE 1

Total Factor Productivity in the U.S. Economy

(Annual Growth by Decade)



Source: NBER, Congressional Research Paper "Total Factor Productivity Growth in Historical Perspective", 2013

and since the 1970s, increasingly of burgeoning service economy jobs of the "industrial" nations as well.

To determine the amount of new electric capacity such a pandemic-fighting first surge of productive employment would require, we have to look at the period of greatest productivity growth in the American economy, roughly the 1930s to the 1970s, sometimes called the "golden age of American productivity." (See **Figure 1**.)

During those years, America's electric power capacity multiplied 14 times, from 36,000 MW to 505,000 MW. During the next 40 years to 2015, capacity merely doubled to 1,020,000 MW, barely keeping up with the growth of the population, because of deindustrialization.

By 1975, for every American productive worker (in manufacturing, construction, mining/forestry, utilities, transportation), or one in essential services such as medical care, the economy was producing about 20 kilowatts of installed electrical capacity. For every such productive worker, Americans were using 70 megawatt-hours a year in generated electricity at work, in households, traveling, and otherwise. For every *person*, Americans in 1975 were using less than half that; productive workers need much more electricity than those not productively employed.

So we are taking a standard of electric power associated with productive work, which was already reached in the United States 45 years ago. But the huge decline in the share of productive employment since then, from more than 30% of the total American labor force to less than 15%, and the deindustrialization of the U.S. economy, makes it pointless to take a more recent standard. If we did so, we would be talking largely about masses of electricity used to air-condition office buildings and run computing centers, not to build, launch, invent, or supply the kind of infrastructure and capital goods needed around the world now.

If we take only the 1975 U.S. standard of electric power required for productive employment and apply it to the 110 million new productive jobs, building a new "world healthcare system" would require *2 million megawatts of new power,* or about 10,000 new power plants of about 200 megawatts capacity. Each could provide reliable electric power and fresh water to a complex of two community hospitals and one larger district hospital, with a total of about 1,000 beds including isolation and ICU wards, as well as housing and transportation for medical staff.

That 2 million megawatts are an almost 30% addition—in just two years—to the 7 million megawatts of installed capacity in the world now. Thus, many of those newly productive workers will be employed building and then operating that new electric power capacity itself. The LaRouche PAC report presents all this in detail.

In the United States alone, this rapid creation of 6 million new productive jobs focused on new worldwide hospital construction and staffing, will have to include building 100,000 megawatts of new electrical capacity to be added to the 700,000 megawatts capacity installed in the United States now. This is for the requirements of operating the hospitals themselves. As the productive portion of the American labor force rises to 30 million and higher (it has sunk to 24 million out of a labor force of 170 million), the demand for new electrical capacity may go even higher in just the next two-three years.

Over a generation, to about 2045, the LaRouche PAC report describes how to create *50 million* new, productive jobs in the U.S. economy as well as many hundreds of millions in the world. This involves much more than building a new world healthcare system. It involves building a new economy, led by the "science drivers" of fusion, plasma and laser technologies, Moon settlements and Solar System explorations; transporting people and goods along the Earth's surface faster than by air for most distances; ending desertification by transferring and also producing fresh water for irrigation; carrying out "Tennessee Valley Authority" projects in many regions of the developing sector; see The LaRouche Plan *to Reopen the Economy: The World Needs 1.5 Billion New, Productive Jobs*.

ORNL

Construction of the ITER facility (International Thermonuclear Experimental Reactor), a tokamak magnetic-confinement fusion device, in Cadarache, France, 2018.

This job creation over a generation *would mean, in the United States, that the nation's 700,000-megawatt electrical capacity will have to be doubled*.

But worldwide, the increase will have to be proportionally greater than that. American electricity use for decades has averaged about 10,000 kilowatt-hours of electricity use per person per year, while in many developing countries it is less than 1,000 kWh/capita/year, and in some, 100 kWh/capita/year or less. That gap brings millions of unnecessary deaths with it—years-lower life expectancy and much higher infant and child mortality, according to a 2018 study done for *EIR* by Benjamin Deniston comparing electricity/capita in the 142 countries of more than 8,000 square miles in area.

Granted, American electricity usage is unusually high, because its population density is low—about 40% lower than the world average—and it has been established that countries with higher population density can reach the same standards of life and work with less electricity per capita. But even if we take a common European level of about 7,000 kWh/capita/year, and figure conservatively that the world population will grow to 9 billion in a generation (it is about 7.5 billion now), *the 7 million megawatts of power installed worldwide now, will have to be more than tripled to reach that standard—adding 16 million megawatts of new electric power*.

China, at about 4,000 kWh/capita/year, shows that in a country with high population density (more than three times the world average), a rapid increase in living standard and the elimination of extreme poverty, as well as large-scale infrastructure and industrial production, can be achieved at a lower level of electricity use per person. *But just to reach this standard worldwide will require doubling the world's electric power capacity, adding 7-8 million megawatts*.

What Kind of Power?

The relentless pressure for "green energy" conformity by the major central banks' Green Finance Initiative, and the City of London's and Wall Street's drive to create a huge new "green finance" bubble, have made it almost a requirement of public discourse to associate any economic initiative with "renewable" energy sources. The authors of the Brookings study cited above, for example, do this. These sources are arbitrarily and somewhat absurdly delimited to wind energy, solar energy, and biomass energy. The financial powers involved strongly resist even environmentalist groups' efforts to include nuclear. They thereby make clear that their aim is not even that of carbon dioxide-global warming propaganda, but simply forcing high-density energy sources to shut down and be replaced by wind and solar projects supported by carbon taxes and other taxpayers' funds, and backed by cheap gas turbine electric plants.

"Renewables" advocates generally agree that wind turbines are "more efficient" producers of electric power than solar farms—though just as intermittent in delivering power, just as dependent on gas turbine plants as backup power and requiring significantly more land or offshore area for a power plant.

We can start from one simple example to consider whether anything like the world healthcare system and infrastructure mobilization we are describing, could be powered by wind.

In 2017 New York's Governor Andrew Cuomo called for a "green new deal for Long Island"; the island has roughly 7.7 million people on 3,000 square miles of territory. This would require, Cuomo said, 9,000 megawatts of wind turbine electric capacity to replace all the existing electric power—but not the residential or commercial heating—now generated by coal and oil. According to very recent figures from the National Renewable Energy Laboratory, this would require covering 900 square miles—about 30% of Long Island's land area including the Boroughs of Brooklyn and Queens in New York City—with wind turbines, not to mention the gas turbines for backup at windless times and for heating.

Look back at the 100,000 megawatts of new power the United States needs for a mobilization of productive employment just to build and power new hospitals. New nuclear power plants with that capacity would take up about 100 square miles of space; wind farms, about 10,000 square miles—the total area of Maryland—or solar farms, 7,500 square miles, plus area for gas turbine backup.

But then look at the *8 million megawatts of new power* the world's nations need in the most conservative estimate of our report on how to create hundreds of millions of productive jobs over a generation. Nuclear plants to produce that power might require 10,000 square miles of land worldwide, but wind or solar farms would consume roughly a million square miles—the total land area of India. And that is the most conservative estimate of new power required for that generation-long productive jobs boom.

Moreover those wind or solar farms *must have gas turbine backup* on a large scale as well—without it, they do not generate anywhere near half the electricity per year that their power rating would claim, and this is true right up to 2019 figures. The gas turbine plants for the wind and solar farms covering India would have to go elsewhere, perhaps in Pakistan; and the new "smart grids" they need would likely cover part of Bangladesh as well. Then the Sub-Continent could power the world, provided all the Indians, Pakistanis and Bangladeshis were relocated elsewhere.

The idea of providing the electric power really needed worldwide, or even the current level of power, with "renewables" is a completely fantastic one, and the advocates of the "green finance" bubble most certainly know this.

It is no wonder that a certain recent proposal for a new global solar project involved a wide belt of solar farms and electric grids stretching all the way from Indonesia across all of Eurasia and North Africa to Morocco, following desert regions along the way—and no doubt enlarging them by the heat radiating from billions of solar panels. Harvard's John A. Paulson School of Business, which helped circulate the proposal, estimated it would cost $13 trillion! This is what we mean when we say Wall Street and London, led by the monster BlackRock, want a new "green finance" bubble to replace the financial bubbles now bursting.

But vast land consumption and huge cost are just the *symptoms* of electric power sources which, relative to coal and oil, not to mention fission and fusion power, would throw the world economy centuries back in terms of technology, living standard, human life-span. The real measure of these technologies is what the late economist and statesman Lyndon LaRouche called *energy-flux density*.

Power and Population

Electric power is the universal machine-tool for productive work in a modern economy. Every electric power source exhibits a basic range of efficiency in converting the input energy—whether it be sunlight, wind, burning coal, nuclear fission, or a super-high-temperature plasma—into electric power or work. This *energy conversion efficiency* can be combined with the metric of how much of that power is generated in a given time—say, a year—to give an idea of *power efficiency*. This second metric is sometimes referred to as the availability, or reliability of the electric power—how much of the time the power is available at the required voltage. This is how the comparison looks.

Hydropower: Energy efficiency (80-90%) × availability (2006-2016 average of 70%) = power efficiency of 60%.

Nuclear reactors: Energy efficiency (35%) × availability (85-90%) = power efficiency of 30%.

Coal- and oil-fired power: Energy efficiency (37%) × availability (75%) = power efficiency of 28%.

Wind turbines: Energy efficiency (up to 45%) × availability (20%) = power efficiency up to 9%.

Solar farms: Energy efficiency (2%) × availability (2006-2016 average of 20%) = power efficiency of 4-5%.

When we also take into account, as we did above, the size and associated labor costs of the infrastructure for fuel and power which must be built to generate and transmit a given amount of electricity for use in a given amount of time, nuclear fission power—with large energies emitted from extremely small amounts of fuel—surpasses not only coal and oil but also hydropower. Wind and solar become almost *de minimus* because of the large land areas required to use attenuated and intermittent fuel sources and to transmit the resulting electricity for use in population or industrial centers.

Electric power transmitted per square kilometer of the power's infrastructure, per unit of time, roughly expresses Lyndon LaRouche's specification of the energy-flux density of a power source. This is obviously closely related to the energy-flux density of the machines and machine-tools powered by the electricity produced—solar powered electricity infrastructure will not power the operation of high-power, high-speed or magnetic levitation railroad lines, or provide the capability to give a higher, more "electrified" standard of living to a more dense population per square kilometer. LaRouche emphasized that this quality of technology, rising energy-flux density, of investing sufficient capital or credit in it, represents an increase in the *potential relative population-density* afforded by new infrastructure, incorporating new technologies.

TVA

Only nuclear-generated electricity has the power efficiency and reliability to fulfill the near-term requirements of a world healthcare system. Pictured here is the Bellefonte Nuclear Power Plant, near Hollywood, Alabama.

Again, electric power per capita—more exactly, electricity generation and use per capita—is fundamental for living standards of human beings. Again, Benjamin Deniston's study for *EIR* showed that the 34 nations with the lowest levels of electricity per capita, taken as a group, gave their people an eight-years shorter lifespan, and had them suffer 170% more child mortality, than the middle-range group of the 142 nations. These 34 nations averaged just 900 kilowatt hours/person/year in generation and use of electric power. Over the next two generations to 2070, Deniston estimated between 130 million and 175 million excess infant deaths in those countries if they were not brought up to a modern standard of electricity per capita.

So-called "renewable sources" of electric power will not do this. As we have shown, their wide spread will actually lower energy-flux density, human power over nature, living standards, and the number of human beings on the Earth, and will not allow any human beings to escape Earth's gravity and explore and settle other bodies in the Solar System.

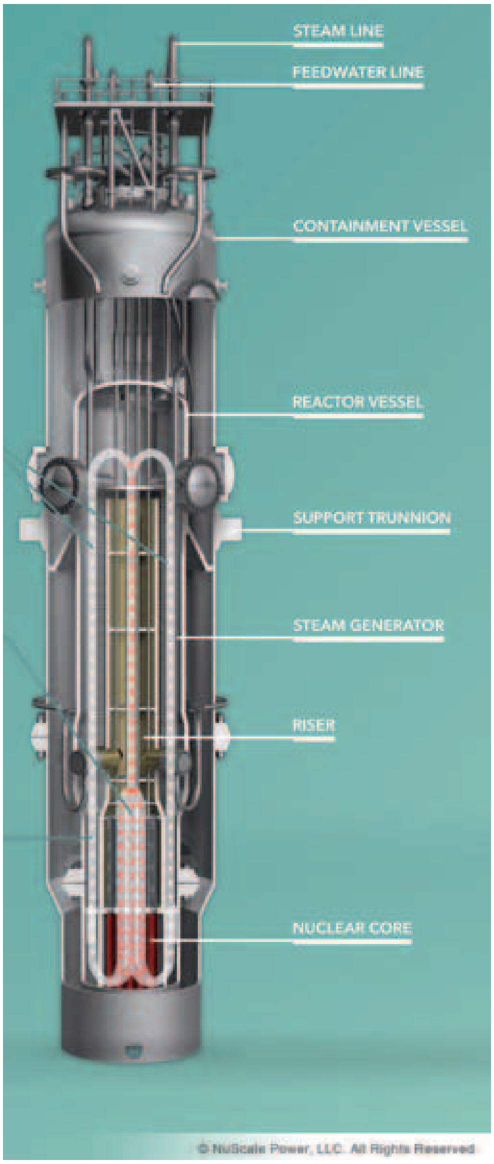
For this reason—and not because it emits no carbon dioxide—nuclear power must be used as rapidly as possible to build out a new electric power system and grids across the developing nations.

Power Plant Requirements

The real "economic reopening" described by LaRouche PAC in its "1.5 Billion New, Productive Jobs" report builds a new infrastructure and economy for the two billion non-productive or "informal" workers in the pre-COVID economy, hundreds of millions of whom lost the jobs they had. This will require the equivalent of 5,000 new full-sized nuclear power plants even if coal- and gas-fired plant construction continues apace; 7,000 new nuclear plants if it does not.

In 2018 there was a net addition of just 10 large nuclear power plants to the world's electric grids. Only a few developing countries are aggressively pursuing nuclear power: China, India, Egypt, South Africa, and a few Southern Asia nations. Nuclear power plants are also being seriously pursued in some Eastern European countries. As LaRouche PAC's report concluded, the thousands of power plants of roughly 200 megawatts capacity that must be added as hospitals and clinics and clean water facilities are rapidly built all over the developing sector, will at first be dominated by gas turbine and coal-fired plants.

As soon as possible—and that could and should mean the middle of this decade—nuclear power plants consisting of even smaller modules built in factories, of 50-75 megawatts per module, must proliferate. These so-called small modular reactors (SMRs), which can be factory-built and connected to even a limited grid much more rapidly than a large reactor built on its site, will be either of the light-water type or the inherently safe gas-cooled reactor design. The latter usefully operates at higher temperatures and is suited to desalinate brackish or salt water as well. Either design will use safe "pebbles" of fuel made of ceramic oxides or carbides, called TRISO fuels.



NuScale

Small modular reactors (SMRs) can be factory-built and connected to even a limited electrical power grid more rapidly than large reactors built on site. Shown here is a cutaway diagram of a NuScale power module.

Demand for these nuclear SMRs is spreading worldwide, even though right now, only one American company, NuScale Power, is near the regulatory approval to build them, and only Rosatom in Russia can build them to be towed on barges to where they will be plugged into a grid. The British Ministry of Energy announced on June 26 that it had a plan for "40 SMRs by 2050" in the UK. Weeks earlier the Australian government made clear it wants SMRs installed in the near future. On June 14, the South African Energy Minister initiated the procurement process for 2,500 megawatts of nuclear electric power after Cabinet approval last October. (See article in this issue.)

Canada and several South American countries are developing their own SMRs.

These small modular reactors are often referred to as the only commercially viable "future of the nuclear industry." But in fact, their designs are being advanced toward commercial operation by governments, for example by aggressive support of private commercial designs by the U.S. Department of Energy and its national laboratories. Moreover, the Trump Administration is right now removing the anti-nuclear regulation which currently limits the U.S. International Development Finance Corporation (DFC), so that the DFC and/or the U.S. Export-Import Bank can provide financing for the export of nuclear power plants for development projects in the developing sector.

The 60- or 75-megawatt modules can start very quickly to generate power at a site—as for example, at a site near newly-built hospitals and their staff living areas—and then increase that power as more modules are transported in, installed, and commissioned. Each module may weigh no more than 50-60 tons.

As for the construction of new electric power grids, whether the new power capacity is hydroelectric, fossil fuel or nuclear, the clear world leader in this regard is China's State Grid Corp., which has developed technologies to install grids under the most challenging conditions and convey ultra-high-voltage electricity over long or short distances with far less transmission losses than other companies' power line technologies. Again, the diverse capacities of the technologically leading nations, particularly the United States, China and Russia, require those nations to *cooperate* to get a new world healthcare system built to fight the pandemic.

The productive employment and new global infrastructure for survival and progress of the human species, requires that these reactors be spread fast across the world during this decade. African nations alone will have need for a thousand or more installed reactor modules, even if the first years' "takeoff power" for new healthcare and public health facilities comes from fossil fuels.