"The development of the new economic paradigm is threatened not only by war but by the incalculable danger of a new international financial crash, equal or worse in economic effects than that of 2007-08."

DANGER OF A NEW FINANCIAL CRASH

without Glass-Steagall Bank Regulation

The development of the new economic paradigm is threatened not only by war but by the incalculable danger of a new international financial crash, equal or worse in economic effects than that of 2007-08. The ability of the City of London and Wall Street to stop Glass-Steagall bank separation laws from being enacted in the United States and Europe since the 2008 crash, is the reason for that danger and the Achilles' heel of the trans-Atlantic financial system.

The runaway effects of a decade of major central banks' post-2008 furious issuance of cheap debt into banking systems, combined with the lack of Glass-Steagall bank separation which has seen the "universal banks" become immensely larger and more complex over 20 years, have brought the trans-Atlantic countries' banking systems, centered on Wall Street and London, to the point of another meltdown.

And what Japan's former IMF Director Daisuke Kotegawa has recently explained as the "financialization" of those economies since the mid-1990s has fostered 20 years of low growth, low productivity growth, and loss of industrial strengths, making the huge reinflated debt bubbles even more ready for collapse.

In December 2017 as the Federal Reserve very gingerly implements its fourth small increase in short-term interest rates over two years, it and the European Central Bank, Bank of England, and Bank of Japan appear to face Scylla and Charybdis. Junk-rated firms and sub-prime consumer debt are so overextended due to the 9-years' ocean of cheap central bank money, that higher interest costs will doom them to default. But the longer the central bankers keep pumping the cheap debt out, the greater the overvaluation of such bank assets, producing intense "reverse leverage" when they start to fall.

Accurate 2007 Forecast Ignored

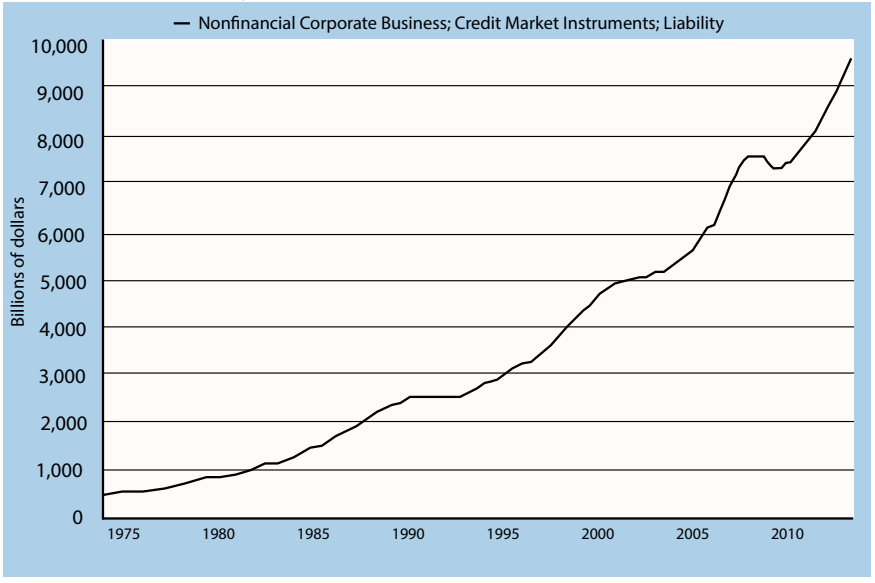
In its March 19, 2007 issue, 18 months before Lehman Brothers failed, Founding Editor Lyndon LaRouche's *EIR* magazine published a 10-page analysis as its cover story, "How U.S. Mortgage Crisis Can Trigger Global Crash." Analyzing the exposure of the post-Glass-Steagall megabanks of the United States and Europe, to the securities and derivatives related to the then-$11 trillion mortgage bubble, *EIR* warned of the blowout which would accelerate over the following 18 months, leading to full-blown global bank

panic. Members of Congress and others in leading positions in the United States denied the forecast as impossible.

A decade earlier, the Glass-Steagall Act had been eliminated after it had preserved banking system stability against panics and crashes for 60 years. In early 2007, the idea that this deregulation was bringing on a general financial crash within less than 10 years, was dismissed out of hand. *EIR* Editor-in-Chief Lyndon LaRouche's July 2007 proposal to stop the coming crash with emergency legislation, combining Glass-Steagall bank reorganization with a national moratorium on home foreclosures, was kept out of Congress by Wall Street, despite broad constituency support.

Figure 1

Non-Financial Corporate Debt



Again the choice was posed in 2009-10: Restore Glass-Steagall to prevent this from happening again, or accept universal banks, using huge deposit bases as the basis for securities speculation, as inevitable, and simply draft some rules to "limit" it. Thus far, the wrong choice has again been made.

Corporate Debt Bubbles Buckling

Now another, perhaps worse collapse is looming, this time not from mortgage securities and derivatives, but primarily from the Wall Street and City of London megabanks' exposure to an even larger bubble in speculative corporate debt, which is showing alarming patterns of defaults.

The debt of U.S. non-financial corporations has more than doubled in seven years, reaching more than $14 trillion—$11 trillion owed to banks and the rest to "shadow banks" such as money market mutual funds, pension funds, and similar funds. **Figure 1** shows the extraordinary rate at which the banks' portion—only—of that debt bubble grew, leading into the 2008 crash and after it, up through mid-2015.

European non-financial corporations' bond market debt is now at about 1.8 trillion euros, but has grown by roughly 750 billion euros in 2016-17 alone. The European Central Bank (ECB) has bought a thousand bond issues totaling 120 billion euros of corporate bonds, and in fact now is exposed to the potential large bankruptcy of the Steinoff AG multinational. The ECB has driven corporate junk bond rates in Europe down to the range of 2%, lower than the yield on 10-year U.S. Treasury bonds, an absurd and dangerous situation.

Feeding the explosion of corporate debt has been the vast money-printing of the central banks of the United States, UK, Japan, and the Eurozone: their $15 trillion in lending facilities to big banks, with effective zero interest rates, has been combined with roughly $14 trillion in capital and liquidity infusions by buying bonds from the big private banks.

Just as dangerously, the large corporate borrowers, especially in the United States, have been using the vast accumulation of debt primarily to raise stock market values of their own companies and others they target for takeovers—and not for business capital investment, which has been persistently low. In some years since 2013, some 80% or more of this borrowing has been used by larger corporations for "financial engineering"; that is, buying their own stock to drive it up, or buying other companies' stock in mergers and acquisitions which have the same effect. Approximately $4 trillion has gone into driving up stock market indices, while betting on them; an-

other $4 trillion into dividends to stockholders. But total non-financial corporations' profits have not increased since 2011; and in the three years 2013-15, they fell.

Therefore debt leverage has jumped up. Morgan Stanley bank itself published a detailed research note on April 20, 2017 which reported that the ratio of non-financial corporate debt to cash-from-operations is at an all-time high of 3.2:1 (2.7:1 is the highest it has ever been before, the bank reported). Companies have low and falling "interest coverage," or ability to even pay interest from earnings—coverage levels like those in the 2001 recession and the 2008 crash (**Figure 2**).

The IMF 2017 Global Financial Stability Report found that in the United States, the debt service to income ratio of non-financial corporations had risen quickly from 37% in 2014, to 41% in 2016. With debt flying up relative to operating cash, and profits declining, companies can keep servicing debt only by borrowing more. Those corporations have $7 trillion more debt than at the 2008 crash, but $3 trillion less equity invested in them.

In that report, the IMF made the startling forecast that any sudden interest rate rise in the United States economy would result in 20% of more of American non-financial corporations being brought to default—a default rate higher than any reached in the mortgage sector prior to the 2008 bank panic. Shortly after that, on June 5, a report by the British Association of Business Recovery Professionals, or bankruptcy experts, found that just a one-quarter-percent rise would trigger defaults by as many as 80,000 businesses, one in every 25.

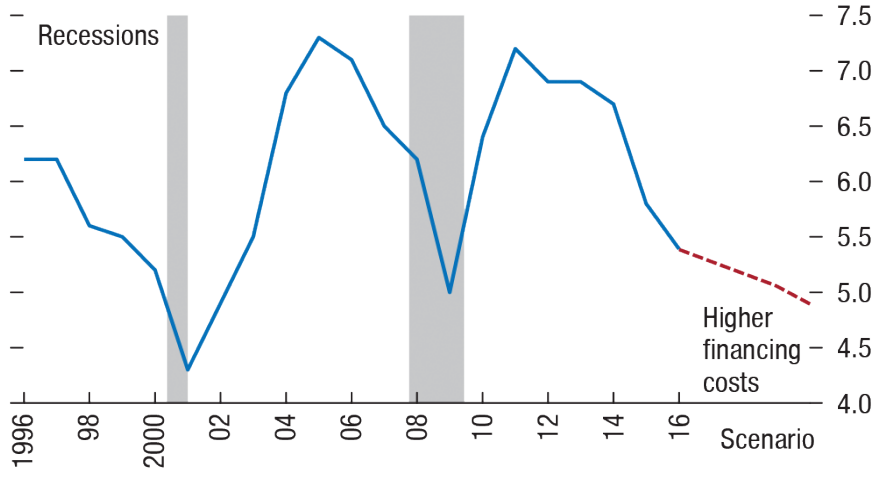
And this was rising rapidly; in September 2016, the Association had found that just one in 100 companies would be knocked out by a quarter-point rate rise. And it said 96,000 companies—about one in 20 across the UK—cannot repay their debt; "they are only able to pay interest on their borrowings." This is what the Federal Reserve and other central banks face in trying to inch up short-term rates.

In the same period as the IMF and British Association warnings, *Handelsblatt* on May 8, 2017 and the London *Financial Times* on May 30 published articles by bank researchers noting that a 2008-like debt crash could be near, triggered by an unrepayable U.S. corporate bubble. *Handelsblatt* wrote, "A surge in corporate loans, especially in the United States, could unleash a new global financial crisis.... Companies worldwide took up $3.7 trillion (3.37 trillion [euros]) in new debt in the capital markets last year. The last time a similarly high [relative] level was reached was in 2006—just before the beginning of the last major financial crisis.

It is a loud warning signal.... The United States could once again become the trigger and possibly the epicenter of the next crisis." And it blamed the Federal Reserve's and European Central Bank's zero-interest and qualitative easing.

Figure 2

Average Interest Coverage Ratio
(ratio of EBIT to interest payments)

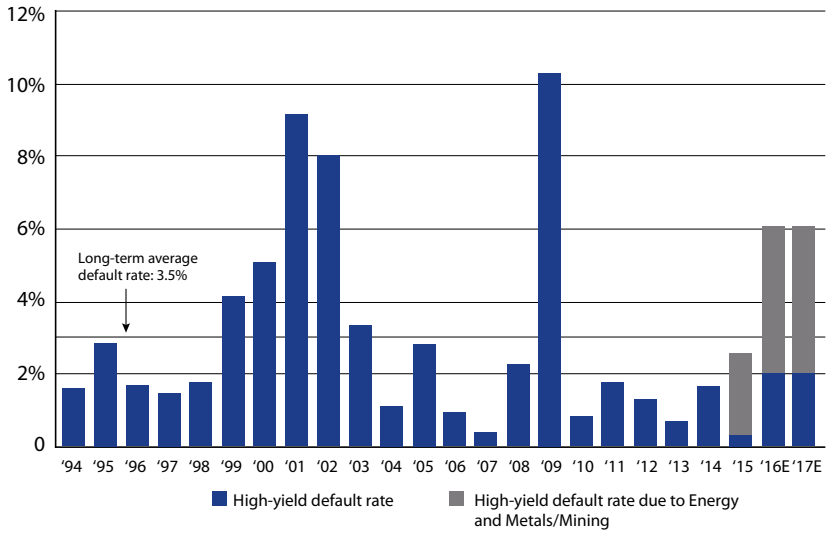


The *Financial Times* piece, by author Dombisa Moyo and financial editor Gillian Tett, was headlined "Global debt woes are building to a tidal wave." But it placed most of the weight of danger on debt bubbles in the United States. "U.S. companies have added $7.8tn [trillion] of debt since 2010 and their ability to cover interest payments is at its weakest since 2008.... Growth in the United States and Europe is very slow, and any recession will cause a nasty shock to the system."

The End of the Bubble

Total debt securities in the U.S. economy are, as of the IMF's Global Financial Stability Report, 2017, at 220% of GDP, whereas in 2007 at the height of the last (mortgage-centered) bubble, they reached 180% of GDP. Total debt in the economy, as of the IMF's Global Stability Report, 2018, approximated $70 trillion, some 350% of GDP.

Figure 3
Corporate Debt Default Rate



But the banks decided during 2017 to put the brakes on new credit, indicating that they are aware this bubble has rolled over its top and is headed for big trouble. Corporate debt growth levelled off in the United States in 2017. Growth in total U.S.-based banks' credit has suddenly dropped from 4.5% to 2-3% annually; commercial and industrial lending growth stopped entirely in early Summer 2016 and as of November 2017 was just 0.7% above the November 2016 level.

Bloomberg reported already on April 26, 2017: "Total loans at the 15 largest U.S. regional banks declined by about $10 billion to $1.73 trillion in the first quarter, compared with the previous three-month period, the first such drop in five years.... A slump in commercial and industrial lending sapped growth." One example from American Banker April 25, involving Fifth Third Bank, a large Cincinnati-based regional, was reported as follows: "The withdrawal from auto lending was said to be a conscious choice to reduce lower-return auto originations to improve returns on shareholders equity, while the decline in C&I [commercial and industrial—ed.] lending was described as a deliberate exit."

The default rate for all non-financial corporations has jumped from 3.0% at the start of 2016 to 5.0% at its end, averaging 4.2%, the highest since 2009. The default rate for "high-yield" (i.e., subprime) corporate debt had more than doubled in a year to 6% at the end of 2016 (**Figure 3**). And the corporate "subprime" debt bubble—junk bonds and leveraged loans—approximates $2.5 trillion in the United States alone. Subprime mortgages never exceeded $1.5 trillion in debt. Standard and Poor's said 162 U.S. companies defaulted on $239.8 billion in debt in 2016, more than double the $110.3 billion total for 2015. Again, this was the highest since the economic collapse year 2009. Defaults have gone still higher in credit card and auto loan debt, and are above 25% in student loan debt.

As the corporate debt bubble in the United States reached its peak and threatened to begin the collapse, its composition shifted strongly in 2017 toward "junk debt"—that is, junk bonds and leveraged loans, or loans to already over-indebted companies essentially allowing them to pay interest—with this junk or subprime component of corporate debt growing by $800 billion in 2017 alone. A further shift was away from commercial and industrial lending to real estate debt. At the same time, consumer debt suddenly started growing rapidly after generally shrinking since the 2008 crash. The Bank of England reported November 9 that consumer debt in the UK was growing at a nearly 10% annual rate; credit card, auto loan, and student debt all grew sharply in the United States in 2009, while default rates on these categories also rose. Subprime auto debt, for example, has higher default rates in 2017 than subprime mortgage debt did in 2007.

But the rates at which these categories of the debt bubble were growing, were not as fast as the rates at which they were being securitized by the ma-

jor banks, and the new debt securities sold to mutual funds, pension funds, individual investors, and so on. Here too, the biggest banks were trying to get out and dump the debt on other investors. They did the same thing with mortgage securities and derivatives during 2007 and 2008. These practices were fully exposed in 2011 hearings of then-Sen. Carl Levin's U.S. Senate Permanent Investigations Subcommittee. Their return is a sure sign that the huge debt bubble is nearing a crash, and a securitization practice which lending banks were prohibited under Glass-Steagall regulation. Re-enacting Glass-Steagall now would stop this dumping of toxic waste all over the world, which was the hallmark of the 2007-08 crash and the reason lawsuits continue to this day pitting investors all over the world against their financial advisors and major bank issuers of securities and debt derivatives.

On June 6, 1933, President Franklin Roosevelt signed the Banking Act of 1933, more commonly known as the Glass-Steagall Act, into law, thus separating commercial banking from investment banking, and creating the Federal Deposit Insurance Corporation (FDIC) which provided protection for commercial banks only.

In the Fall of 2017, then-German Finance Minister Wolfgang Schäuble warned in the *Financial Times* on October 8 that "spiraling levels of global debt and liquidity present a major risk to the world economy," because of "bubbles forming due to the trillions of dollars that central banks have pumped into markets." Schäuble also warned that the risks in the Eurozone were becoming greater, because the balance sheets of its major banks are weighted down by masses of non-performing loans from the 2008 financial collapse.

William White, former Bank of International Settlements (BIS) chief economist and now head of the OECD Review Committee, had warned already at the end of 2016 that the condition of global debt bubbles was "worse than 2007," and had particularly blamed the refusal across the European banking systems to write down or write off bad debts. Now the BIS itself, in its quarterly financial report December 2, warned that unstable financial bubbles were far too large and that the Federal Reserve and Bank of England had failed in their efforts to cut off higher-and-higher-risk debt, by raising rates.

In November 2017 the U.S. corporate and "emerging market" junk debt markets started to buckle, with European corporate junk next to go. The superinflated prices in the $2.5 trillion "junk debt" part of the $14 trillion U.S. corporate debt bubble was unable to withstand even the small and slow interest rate increases being dripped into the financial system by the Federal Reserve. In the third week of the month average yields jumped up to 3.8% from 3.3% in U.S. junk; a near-record $6.7 billion flowed rapidly out of junk bond investment funds, according to the Novmber 18 *Wall Street Journal*. The paper quoted an analyst, "We're seeing huge outflows from mutual funds and ETFs, so it's triggering this domino effect." In the telecom sector, which has about $400 billion of this debt, average interest rates rose faster, from 5.2% to 6.4%. The *Financial Times* posted an article November 15 headlined "Contagion worries rise after junk-bond sell-off." And at that point a *Wall Street Journal* report of November 16 on Europe's unpayable corporate debts informed that "10% of the companies in six Eurozone countries including France, Germany, Italy and Spain are zombies, according to the [European] Central Bank's latest data—they are incapable of paying even the interest on their debts."

The crash of South Africa–based international retail conglomerate Steinhoff S.A. thus occurred at a bad time, in the second week of December 2017. Steinhoff lost 80% of its share value and was immediately downgraded into deep junk debt by Moody's. The firm represented $21-23 billion in loss exposures of banks led by Citigroup, Bank of America, HSBC, and BNP Paribas, and ironically, the European Central Bank itself, which had bought Steinhoff bonds from banks as part of the 1000 issues purchase described above, supposedly to backstop against exactly this kind of event.

Figure 4

The gigantic bubble of corporate debt used for their own stock-buying, mergers and acquisitions, financial engineering, and general Wall Street-pumping, is made more unpayable, and more dangerous, by the continuing lack of economic growth, productivity growth, or growth in business capital investment in the trans-Atlantic economies.

Despite the extreme descriptions by Wall Street and London financial analysts of the amount of debt in the Chinese economy, this financial crash is threatening from the universal banks of Europe and the United States. The structure and practices of these banks are a critical part of the incalculable danger of a bank panic worse than 2007-08.

Some 35% of the assets of the 12 largest U.S.-based banks are securities, although they are supposed to be commercial banks receiving deposits and making loans. The nominal derivatives exposure of these banks has grown to $265 trillion, 30% more than their exposure 10 years ago and 12 times U.S. GDP. The five largest Chinese public commercial banks, by contrast, have very little exposure to the derivatives markets, accounting for less than 3% of global derivatives contract issuance despite their size and extremely large issuance of credit. They do not own securities broker-dealers or other kinds of "non-banks" and investment firms.

For this reason—regulation according to the Glass-Steagall principle (**Figure 4**)—these banks are far better able to handle non-performance of loans, defaults, and bankruptcies, and Chinese regulators have been able to crack down on credit creation of "non-banks" by about 40% in 2017 without harming the state-owned commercial banks.

The purpose of the latter, has been to lend, on a very large scale, for the creation of new, productive infrastructure and other physical-economic assets—as is the purpose of commercial banks in the "American System" tradition, and also very large government credit institutions in U.S. history such as the Reconstruction Finance Corporation of President Franklin Roosevelt's administrations.

Until Glass-Steagall was abandoned in the 1990s, there were no U.S.-based "megabanks" or "universal banks"; none held more than 6% of the total assets in the banking system as a whole. From the late 1990s

the Wall Street banks exploded in size, and this has continued since the 2008 crash, so that now just six banks hold two-thirds of the deposits and assets in the entire banking system. They also exploded in complexity: A New York Federal Reserve study of 2012 showed that whereas in 1995 the largest bank holding companies typically had 100-300 subsidiaries, by 2011 they each had 2,500-4,000 subsidiaries, vehicles for every manner of securities and derivatives speculation. The derivatives markets themselves exploded in size under the impact of this deregulation, from nominal values totaling about $70 trillion in 1997 to more than $700 trillion in 2008. These derivatives markets would have brought all the biggest U.S.- and Europe-based banks to bankruptcy at once in late 2008, had not governments bailed most of them out. After the crash they accumulated, on average, 30% more derivatives exposure.

Today, as a result, these megabanks are still greatly overleveraged, as has been repeatedly emphasized—in the face of further deregulation campaigns—by the most credible American bank regulator, Federal Deposit Insurance Corp. (FDIC) Vice-Chairman Thomas Hoenig. Hoenig has reminded that the major banks lost, on average, more than 6% of their total assets during the 2007-08 meltdown, and had very large derivatives losses; therefore the "European level" (Basel III) of a 5% capital ratio is completely inadequate, and so is the 6% target ratio under Dodd-Frank in the United States. The 5,500 or so non-systemic "community banks" in the United States, for example, have an average capital ratio of 16%, and almost none have any derivatives exposure at all.

The Adam Smith Institute in the UK, which did an analysis of the mid-2017 Bank of England "stress tests" of the biggest British bank, made the same point: The stress tests are not modelling even the degree of asset losses the big European banks took in 2008-11, although a corporate debt bubble on the verge of crashing now is considerably larger than the mortgage bubble which blew up a decade ago. And many of the universal banks in the United States and Europe went on failing these mild central banks stress tests right up to the 2017 round.

The FDIC's Hoenig holds that because these are still universal banks, mixing lending and Federal deposit insurance with the whole spectrum of securities speculations, they should be compelled to maintain a capital ratio of 10% of all their assets, including the full value at risk in their derivatives exposure.

Banking experts truly familiar with the practices of these universal banks—especially their multitude of investment banking and broker-dealer units—point out that the collateral backing which regulations like the Dodd-Frank Act are requiring for the banks' speculation and trading, are similar to backing which the same banks thought they had provided for these speculations before the crash. They were wrong. When the liquidity in credit markets froze, not just those particular speculations, but all assets plunged, because it was so difficult to sell them, or to make interbank borrowings against them.

Precisely because they were universal banks, all involved in similar speculations and trades, and completely interconnected in doing so, they suffered losses across nearly all their units and what seemed like "capital fortresses" were swept away, leaving them insolvent. As Federal Reserve Chairman Ben Bernanke acknowledged to the Financial Crisis Investigative Commission in 2011, all but one of the 12 largest, most interconnected universal banks based in the United States became insolvent at once in September 2008. They would all have failed without hundreds of billions in Federal bailouts and more hundreds of billions in liquidity loans from the Federal Reserve.

This is the nature of the kind of general bank panic and financial crash which was avoided for 60 years due to the success of U.S. Glass-Steagall bank regulation, which was copied in the post-War decades by many European countries.

Moreover, even one of the authors of the Volcker Rule, U.S. Sen. Jeff Merkeley of Oregon—who has adopted sponsorship of the 21st Century Glass-Steagall Act—has acknowledged that the complexity and opacity of these megabanks' trading activities made it impossible to determine whether the Volcker Rule has worked or not. The Volcker Rule had been put forward by its sponsors as "the modern version of, or substitute for, Glass-Steagall." It has failed as such.

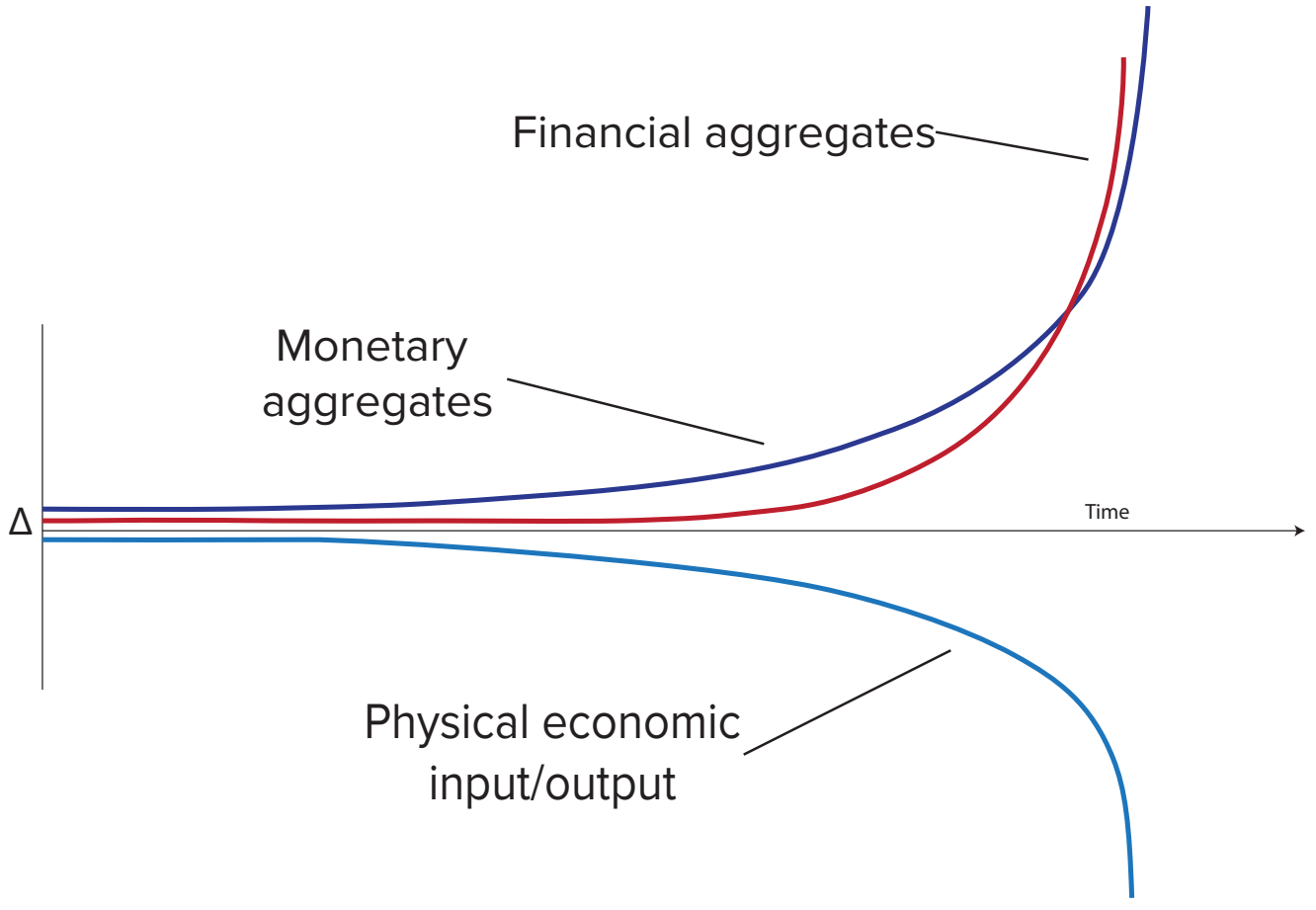
The fact that in 2017, with a debt crash looming, only China of the major nations protects its commercial banks with Glass-Steagall-type regulation, is a

major factor in the gravity of the threat of financial breakdown and the economic collapse which followed the last crash.

Even at this moment to stop the megabanks' practice of transferring the risk from this huge mass of endangered debt and derivatives, to depositors by "bail-in," to investment funds by securitization, and to taxpayers, Glass-Steagall must be restored in the United States and Europe. This critical situation underlies the sudden appearance of high-profile attacks on Glass-Steagall in leading media of New York, London, and Washington, DC during 2017. All of the attacks date from the April 5 introduction of the U.S. Senate 21st Century Glass-Steagall Act, and the reporting that its sponsors had received some form of encouragement from President Trump's head of the National Economic Council, Gary Cohn. The attacks on Glass-Steagall, in number, volume, and tone have become indicative that the City of London and Wall Street, knowing the signs of an approaching financial crisis, are arrogantly—perhaps suicidally—determined to stop the bank breakup which could prevent it.

See following two-page spread on LaRouche's 1995 Triple Curve and collapse forecast.

LaRouche's 1995 Triple Curve:

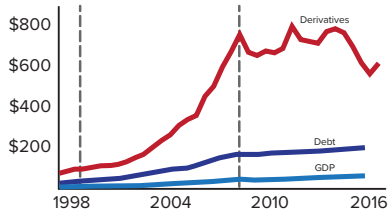


"The **top curve** is a hyperbolic, self-feeding growth of financial aggregates — what might be called 'shareholder values,' nominal shareholder values as accountants would account for them, or the equivalent. The **second curve**, which is the monetary expansion, both by Treasuries and Central Banks, which was feeding the money-flow in, to help pump up the growth of this financial bubble. Then the other tendency, the **third curve**, which I dated from 1971, is the accelerating decline in real physical output and consumption, in terms of productive potential per capita and per square kilometer."

–Lyndon LaRouche, January 2002

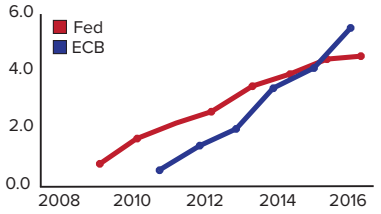
A Forecast of the Trans-Atlantic Collapse

Global Derivatives vs Debt and GDP
($ Trillions)



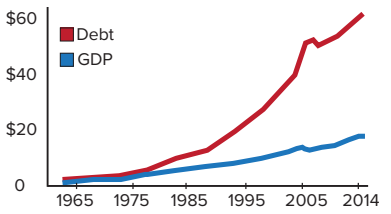
The explosion of derivatives in the 1990s signaled the beginning of a self-doomed feeding frenzy based not on investments and growth of the real economy, but purely speculative bets on its "performance." Derivatives are essentially legalized gambling. They have hijacked the flow of investments away from the real economy, and into short-term profit.

Quantitative Easing: Fed and ECB
($ Trillions)



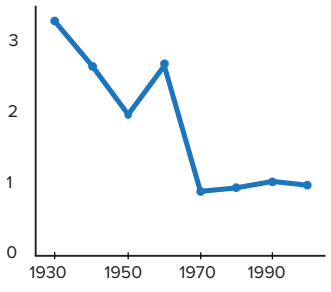
When the derivatives bubble burst in 2007, the Fed and ECB stepped in to bail the speculators out. After seven years of Quantitative Easing (QE), when the Fed could no longer continue its frenetic 2013 pace of $1 trillion in a single year, the ECB stepped in and has continued to pump trillions of dollars of QE into the bankrupt trans-Atlantic banking system.

Total Debt & Loans vs. U.S. GDP
($ Trillions)



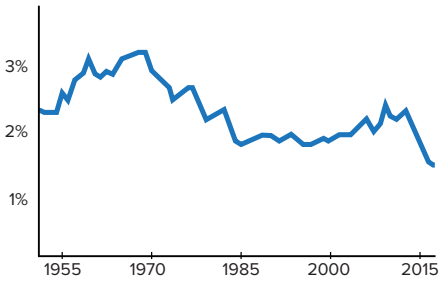
Another indicator of the vulnerability of the U.S. economy is the widening gap between debt and Gross Domestic Product (GDP) growth. For more than forty years, U.S. debt growth followed economic growth. But beginning in the 1990s, the growth of debt began to far outstrip growth in the economy. Today, every $1 increase in GDP is associated with a $4 increase in debt.

Total Factor Productivity (TFP)



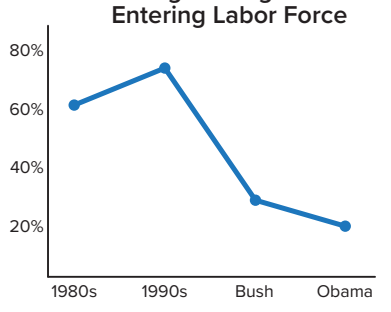
Total Factor Productivity (TFP) measures the rate of growth of an economy due to technological advance, rather than the simple application of more labor and/or capital. The highest rate of growth of TFP in U.S. history, was its 3.3% annual rate of growth in the 1930s, under Franklin Roosevelt's New Deal & Four Corners infrastructure programs.

Annual U.S. Infrastructure Investment as % of GDP



In 1965, as the so-called "golden age of productivity" was nearing an end, U.S. annual investment in infrastructure was above 3% of GDP. By the mid-1980s it had fallen below 2%, and since 2005 has fallen further to 1.4%, an extremely low proportion compared to China's nearly 9% over the past 20 years, and investment rates of 5-6% in other major Asian economies.

Percentage of Eligible Youth Entering Labor Force



In the 1980s-90s, between 60-70% of newly eligible youth were entering the workforce. After sixteen years of Bush and Obama, however, 70-75% of eligible youth are *staying out* of the labor force, a shocking statistic which reflects the plight of the young generation, which is experiencing rising hopelessness and despair.

The Triple Curve depicts a typical collapse function. When monetary and financial policies are systematically decoupled from physical investments, the economy enters a breakdown process, as the physical economy collapses due to lack of investment and due to looting (such as asset-stripping, for example), and the monetary and financial systems become hyper-inflationary (generating increasingly fake assets to support the system). Shadows of this process can be seen in the above economic statistics.

"Lyndon LaRouche's 'Four New Laws To Save the USA Now' ... remains today the immediate and indispensable policy necessary to launch sustained economic recovery from a decade's worsening effects of an international financial crash and following economic collapse."

'FOUR LAWS'

For the New Paradigm

Lyndon LaRouche's "Four New Laws To Save the USA Now," was authored and published in 2014. It was intended to propose economic and scientific steps which must be taken by the United States. However, it remains today the immediate and indispensable policy necessary to launch sustained economic recovery from a decade's worsening effects of an international financial crash and following economic collapse.

In "The Principles of Long-Range Forecasting" in 1998, LaRouche had written:

> The potential increase of the potential relative population density of a society is bounded by the number of valid ... discovered principles known, and thus available to be expressed, in the form of applicable new technologies of individual and social practice.
>
> However, the realization of the benefits of discovery and proliferation of scientific and technological progress, is conditional upon the way in which social relations define the communication of [these] validated products of cognition...

LaRouche's "Four Laws" specify principles of credit—in this case, *re*discovered; of technological productivity; and of nuclear science and human space exploration which nations must master and implement to avoid another general financial breakdown and establish a new paradigm of economic progress and cooperation. He described them as follows:

> The economy of the United States of America, and also that of the trans-Atlantic political-economic regions of the planet, are now under the immediate, mortal danger of a general, physical-economic chain-reaction breakdown crisis of that region of this planet as a whole....
>
> The only location for the immediately necessary action which could prevent such a genocide throughout the trans-Atlantic sector of the planet, requires the U.S. Government's decision ***to institute four specific, cardinal measures which must be fully consistent with the specific intent of the original U.S. Federal Constitution,*** *as had been specified by U.S. Treasury Secretary Alexander Hamilton while he remained in office:*

Table 1

China Real (Inflation-Adjusted) GDP Growth*

Year:	1985	1987	1989	1991	1993	1995	1997
Growth*:	105	170	200	220	250	420	500
1999	2001	2003	2005	2007	2009	2011	2013
600	700	850	1020	1320	1630	2000	2280

** based on 1980 = 100; source: IMF*

1. *The immediate re-enactment of the Glass-Steagall law instituted by U.S. President Franklin D. Roosevelt, without modification as to principle of action.*
2. *A return to a system of top-down, and thoroughly defined, national banking.*
3. *The purpose of the use of a Federal Credit system, is to generate high-productivity trends in improvements of employment, with the accompanying intention to increase the physical-economic productivity, and the standard of living of the persons and households…*
4. *Adopt a fusion-driver "crash program" … [for scientific breakthroughs in fusion science and space exploration].*

In this section we elaborate these actions as necessary for making the New Silk Road into the World Land-Bridge.

1. 'GLASS-STEAGALL' BANK SEPARATION

The well-known University of Chicago economist Luigi Zingales has said that one characteristic distinguishes Glass-Steagall bank separation from all other actual and conceptual regimes for organizing and regulating banks and the financial sector. *Glass-Steagall has public support and full credibility, because it has been tested over a long period and it works*, Zingales points out. It not only works in preventing individual bank problems from spreading "contagion" into general bank panics. It also works in creating deep and reliable capital markets for business, industry, and households, based on the special and separate roles of commercial banks and investment firms.

We present one example of this point which nations all over the world should pay attention to.

During the period 1994-97, the United States Federal Reserve and Securities and Exchange Commission essentially eliminated the effect of the Glass-Steagall Act in the American financial system. They set aside some of its most important regulations and allowed commercial banks to invest more and more of their deposit bases and profits into securities and derivatives markets, and into credit support of securities firms of all kinds. Finally in 1999 the U.S. Congress repealed Glass-Steagall entirely and allowed commercial banks to acquire, merge with, and/or create, all manner of securities broker-dealers and insurance underwriting firms.

At just that same point, 1993-95, China's government acted through the People's Bank of China to create a number of large commercial banks for the first time, and put those large public commercial banks under a regime of bank separation, not permitting them to engage in securities broker-dealing or to acquire securities firms or "shadow banks."

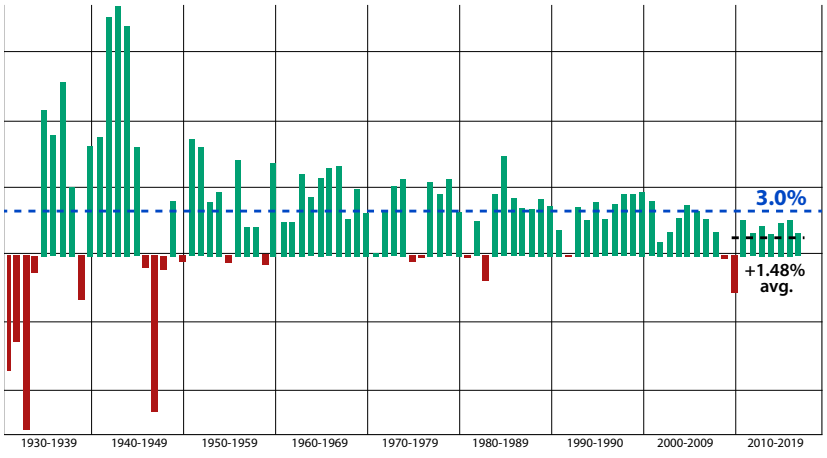
It subsequently severely limited these commercial banks' ability to create or deal in financial derivatives, so that although these banks are now among the world's largest financial companies by assets, they are extremely small actors in the notional $550 trillion world derivatives markets.

Thus, China put its large commercial banks under a Glass-Steagall regime.

Which regime has *worked* to create a large and dynamic capital (credit) market for business investment, infrastructure building, overall economic growth? The Chinese economic path since those mid-1990s actions is shown in GDP growth in **Table 1**. Even leaving aside the lack of the cavernous plunge in 2008-10 seen in so many economies around the

Figure 1

US GDP Growth Year on Year



world, China's growth, if anything, inflected upward in the mid-1990s from an already fast pace, and sustained it.

The U.S. economic path since casting aside Glass-Steagall regulation is shown by GDP growth in **Figure 1**. Again, even considering only the years in which there was positive economic growth, its impulse since the 1990s has been lower than any decade in 80 years, and steadily falling from the 1990s to the 2000s to the 2010s. The only thing growing rapidly during the past 25 years has been the Wall Street banks, which have become true megabanks for the first time and control two-thirds of the banking system's assets among just six banks.

And in terms of the annual rates of GDP growth themselves, China's have been approximately three times as high, even as its economic product has become comparable to that of the United States.

(European governments which during 1945-55 had imitated the United States's original Glass-Steagall Act, had all repealed their Glass-Steagall laws by the late 1980s' "Big Bang" complete deregulation of City of London banking. **Figure 2** adds the UK and Eurozone to the United States, and shows the effect is the same.)

As already shown in the previous section of this Special Report, since 2008 even an estimated $14 trillion in newly printed capital pumped into the trans-Atlantic banks by the "quantitative easing" programs of the Federal Reserve, European Central Bank, and Bank of Japan have not been able to revive lending and business capital markets under "post-Glass-Steagall" banking.

In the U.S.-based banks, deposits increased by $3.5 trillion to $11 trillion, $4 trillion in newly printed "quantitative easing" capital was provided, along with nearly $10 trillion more in temporary liquidity assistance. Yet loans and leases from the banks rose only from $7.3 trillion in 2008 to $8.3 trillion at the end of 2015, according to Federal Reserve data. Some 35% of assets of the largest U.S. commercial banks are now reported to be securities—leaving aside derivatives exposure.

The same effect, during the period from the 1990s to today, shows (**Table 2**) when comparing U.S. and Chinese total factor productivity, or labor productivity which results directly from technological progress (these figures are those of the OECD; other estimates differ slightly in amount but not direction).

An International Necessity

The issuance of large masses of credits among countries for large-scale and modern new infrastructure platforms requires, first, "Glass-Steagall" bank separation and regulation by the nations involved. Without such legislation being urgently reinstated throughout the trans-Atlantic nations, the major banks of the United States and Europe are facing another crash. Warnings of a debt crash with any significant rise in interest rates have been issued during

Figure 2

Economic Growth UK - EU - US

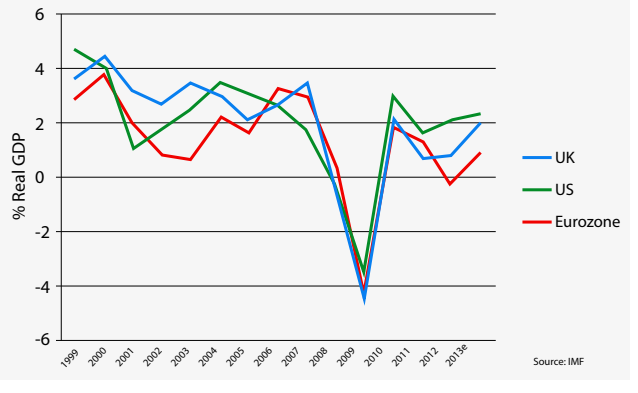


Table 2

Annual Total Factor Productivity Growth, 1985-2015

Years	United States	China
1985-1995	1.85%	2.3%
1996-2004	1.75%	3.9%
2005-2015	0.7%	3.3%

2017 by the Bank for International Settlements, the IMF, and by national agencies such as the Bundesbank, as well as private forecasters led by *EIR* Founding Editor Lyndon LaRouche.

Most dangerously, the huge new bubbles of corporate and household debt are aggressively being securitized and re-securitized with derivatives by large banks, which shift increasingly illiquid debt onto other investors by this means—a means prohibited to commercial banks under Glass-Steagall regulation.

Furthermore, productivity "driver" projects on a national or global scale have always been done by national credit. If such credit is issued directly to banks (private or national) which are plugged into securities markets and offshore profit centers, or have large parts of their asset books in high-risk securities and derivatives activities, the credit will likely be wasted.

If nationally chartered *commercial banks* have been protected, regulated, and kept out of securities market speculation, those banks will participate in the infrastructure driver projects by vigorous private lending.

What Does Glass-Steagall Bank Regulation Mean?

As the introduction to the original 1933 American legislation stated, the intention was "to provide for the safer and more effective use of the assets of banks, to regulate interbank control, and to prevent undue diversions of funds into speculative operations, and for other purposes." Investment banks were forced to completely separate their activities from commercial banks, and because only commercial banks were federally insured, the speculative holdings made by (non-banks) were not, and their fictitious "assets" could now be written off.

A Glass-Steagall Act's regulations basically have four components. First, the requirement that commercial banks, investment banks or broker-dealers/funds or similar entities, and insurance companies (able to underwrite insurance as well as sell it) be entirely separate from one another, and not share directors, ownership, or management. Nor can a commercial bank's deposit base be used in loans to create, expand, or support investment banks or securities broker-dealers.

Second, the definition of a significant range of securities and derivatives activities as "not sufficiently closely incident to banking as to be proper to it," and therefore not permitted to commercial banks.

Third, the provision of Federal deposit insurance exclusively to support commercial banks and their depositors.

Fourth, the prohibition of transferring any but the highest-rated securities, within a holding company, onto the books of a Federally insured commercial banking unit, or otherwise causing low-quality securities to be backstopped by government funds intended to safeguard customer deposits.

More important, was the greater conception encompassing Glass-Steagall known to then-U.S. President Franklin Roosevelt, that the physical productivity of the nation, in food production, transportation, and technology levels, per person and per square land area, was the absolute primary concern, and had to

*The U.S. Supreme Court in 1971 (*Camp vs. Investment Company Institute*) ruled that the Congress's intent to protect commercial banks from the temptation to throw deposits into high-risk, high-yield securities was a legitimate national interest, and that the Glass-Steagall Act was the United States's primary banking regulation.*

remain free from financial manipulations by speculative financial entities.

Roosevelt took an emergency approach to halt the compound economic crisis then, and paired Glass-Steagall with numerous other measures to stop farm foreclosure, restore employment, and return security to the banking system. In later years, Roosevelt was an original voice in the movement for global economic progress now sweeping the planet, as seen in his role in the creation of the Bretton Woods financial system for secure long-term economic development for every nation; his push for the independence of former British, French, Dutch, Belgian, and Portuguese colonies; and efforts to enforce these countries' rights to self-development, in productive growth and by scientific and cultural contributions. He wanted an alliance of the strongest countries on the planet, which would secure the ability for weaker countries to develop.

For more than 60 years after its passage, under Glass-Steagall organization of the commercial banking system, no U.S. bank failure triggered failures or bailouts of other banks. But within a decade of the removal of Glass-Steagall regulation, Federal Reserve Chairman Ben Bernanke had to testify (to the Financial Crisis Investigation Commission) that as of September 2008 all but one of the 12 largest banks operating in the United States were insolvent at the same time—a condition never seen before, even in 1931-33. And the same condition obtained across banking systems in Europe; the largest, most complex, most interconnected "universal banks" were nearly all bankrupt.

Without Glass-Steagall, Recurring Bank Panics

The disingenuous claims that Glass-Steagall enforcement would not have avoided the global financial crash of 2007-08, can be dismissed. The financial institutions whose failure set off the collapse were not—as so often claimed—those overleveraged institutions which lacked a connection to a large commercial bank. Rather, they were those overleveraged institutions which were not bailed out by governments.

In the United States, for example, the financial institution widely known to be most bankrupt in 2007-08 was Citibank—the very "destroyer of Glass-Steagall" through its 1998 merger with Travelers Insurance. Citigroup survived only through a massive series of government bailouts of its capital assets totaling more than $400 billion, not including short-term liquidity loans from the U.S. Federal Reserve. At the other extreme were the investment firm failures Bear Stearns and Lehman Brothers, frequently described as "independent" of any commercial banks and therefore not subject to Glass-Steagall regulation. Both, in fact, leveraged their capital up to 40:1 with various forms of debt borrowed from JP Morgan Chase and other commercial banks, which would not have been permitted were Glass-Steagall in effect. Bear Stearns was bailed out when it collapsed by the Federal Reserve, making an absorption by JP Morgan Chase possible; Lehman was not bailed out, and so became one major trigger for the global crash.

The two real alternatives were: Glass-Steagall bank separation; or, huge and indiscriminate taxpayer bailouts of the largest financial institutions.

All of the various "alternatives to Glass-Steagall," in which regulators attempt various schemes of "ring-fencing" divisions of banks, have the same fatal disability, and will not produce sound commercial banking. The much-invoked "bank bail-in" schemes are the most disastrously unworkable; they have triggered increasingly dangerous plunges in the value of whole ranges of bank securities each time they have been tried, from the "Cyprus template" to the most

President Bill Clinton repeals Glass-Steagall by signing the Gramm-Leach-Bliley Act in 1999. A number of those still in Congress who voted for Gramm-Leach-Bliley call it the single worst legislative mistake they have ever made.

recent Monte dei Paschi and other Italian bank hybrid bailouts/bail-ins. Worse, they have impoverished investors in bank securities, who are very numerous in some nations' banking systems, and led to wealthier investors and funds gambling on the high returns of bank securities which *are made to be bailed in and become worthless when the bank has a crisis.*

In all the "alternatives," the large bank holding companies (or whatever agencies try to resolve them into when insolvent) remain responsible for capitalization of all their operating subsidiaries. This capitalization either is taken from the commercial bank division, in violation of the ring-fencing scheme; from a large public taxpayer bail-out in a crisis; or, in the "bail-in" scheme, from both. "Bail-in" simply attempts to expropriate creditors' assets and depositors' money, and besides being chaotic and actually potentially triggering runs on banks, it represents deadly economic austerity.

Reinstating Glass-Steagall

Lyndon LaRouche and his political movement have been organizing for the restoration of Glass-Steagall bank separation since 2008, and there have been moves to put bank separation back in force in numerous countries since then. Against intense opposition from Wall Street and the biggest London-centered banks, legislation to restore the Glass-Steagall Act is being sought across the trans-Atlantic countries.

In the United States, bills to reinstate the Glass-Steagall Act now have bipartisan support in both Houses of the U.S. Congress: Senate bill S-881 with nine sponsors and House of Representatives bill HR-790 with 59 sponsors, one of two such bills in the House. Both major political parties put reinstatement of Glass-Steagall in their platforms during the 2016 Presidential election.

In Italy, nine bills to enact Glass-Steagall bank regulation have been introduced in both the Senate and the House of Delegates, and have broad support across all but the current governing party. Glass-Steagall bills have come close to passage in the British Houses of Lords and Commons, and actually passed in the lower Houses of both the Swiss and Danish Parliaments.

At the first sign that an oncoming new financial crash is upon these nations, these moves to restore Glass-Steagall bank separation will rapidly gain strength. But will that be too late? As the prominent American bank regulator Thomas Hoenig (vice-chair of the Federal Deposit Insurance Corporation) has frequently warned the U.S. Congress and others, the time to break up the now-immense "universal banks" is *before* they crash again; when these banks are in crisis, it will be much more difficult to do so.

The cycle of recurring bank panics must be broken now. It is clear that reinstating the Glass-Steagall Act in the United States, its originator, will lead quickly to the passage of similar legislation in many European countries.

2. FINANCING THE WORLD LAND-BRIDGE: 'HAMILTONIAN' NATIONAL CREDIT AND NATIONAL BANKS

A well-regulated—Glass-Steagall regulated—system of nationally-chartered commercial banks does not in itself create economic growth, although a deregulated speculative casino of a banking system can destroy it in cycles of debt-bubble expansion followed by collapse.

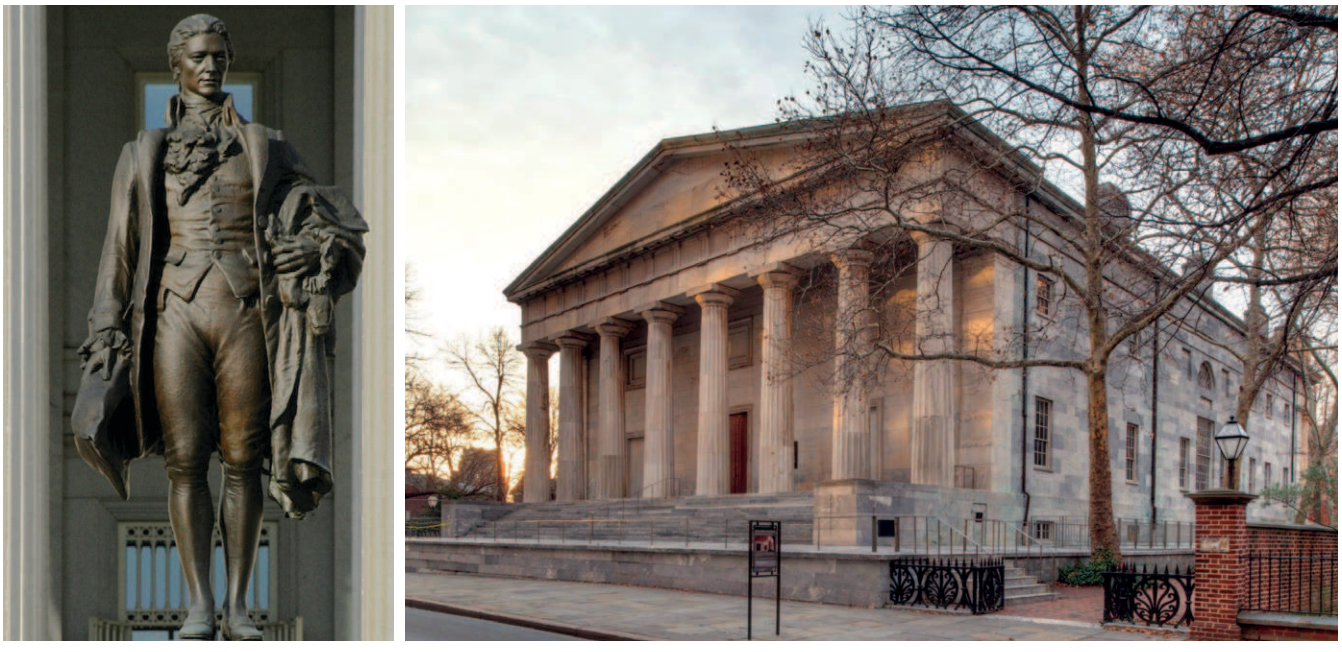
What is necessary to create sustained growth is *credit* issued and directed to support and raise the productivity of the nation and its workforce. Above all, this means credit to make possible building new economic infrastructure at high levels of technology—such as high-speed and highly connected transportation systems, high-energy power sources, multi-modal ports, etc.—and credit to enable entrepreneurs to exploit creative changes in production. What is at stake is the answer to the constant complaint of elected officials all over the world when necessary "great projects" are discussed: "How will this be paid for?"

The most powerful answer for this question, thus far today, is being given by China's Belt and Road Initiative, where such "great projects" in scores of nations are being funded by partnerships with China's large state-owned commercial banks issuing large volumes of new credit.

But the greatest leap in modern history, in understanding and directing national credit to foster productivity and individual creativity, was made 225 years ago by the first United States Treasury Secretary Alexander Hamilton, and a few of his closest collaborators such as the revolutionary financier Robert Morris.

Hamilton's method of generating productive national credit was realized in national Banks of the United States in the early 19th Century, in President Abraham Lincoln's creation of a new currency and national banking system for the last third of that Century, and in President Franklin Roosevelt's extraordinary use of $50 billion in credit ($600 billion today) issued by the Reconstruction Finance Corporation (RFC) to recover from the Great Depression and win World War II.

The results were extremely successful in every case, in terms of sustained national economic growth and breakthroughs to new "platforms" of infrastructure, technology, and productivity.



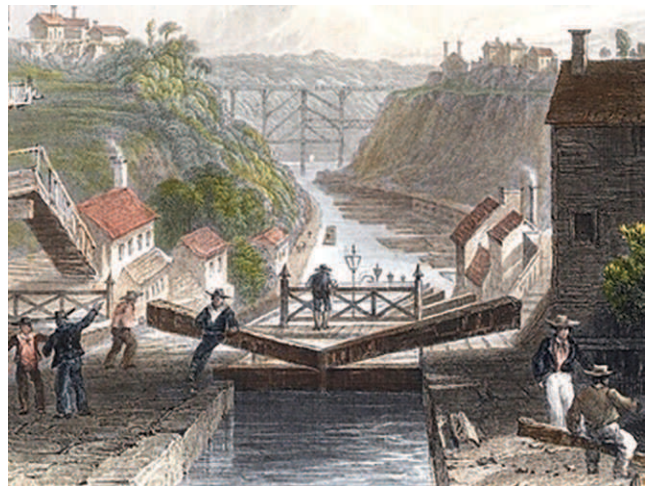
The Philadelphia headquarters of the Second Bank of the United States, 1816-36, one of the extremely successful American national credit banks based on Alexander Hamilton's methods, from Hamilton's First Bank of the United States in 1791 to Franklin Roosevelt's Reconstruction Finance Corporation. Today the building is a museum, and the United States has no such national credit source. Hamilton's credit concepts are successfully reflected in China's rise.

Today both China and Japan use strategies of national credit creation which are similar to those of Hamilton and of Franklin D. Roosevelt, although with their own characteristics. The United States, however, has abandoned Hamiltonian methods of credit since Roosevelt's death. It has not had a national credit and lending institution since the RFC ended operations in 1957; it has not had a national "infrastructure mission" since the Apollo Project to travel to the Moon. It clearly lacks any means or policy, to fund President Donald Trump's often-repeated promise of $1 trillion in new rail, road, port, and airport infrastructure—even though both China and Japan clearly want to support this by investments in new infrastructure in the United States. America actually needs not $1 trillion, but $5 trillion or more in new infrastructure investments. Its Congress is postponing even the obviously urgent reconstruction funds for the states and territories devastated by hurricanes in 2017.

So the United States must create a Hamiltonian national credit bank in order to participate in the Belt and Road Initiative and the new infrastructure development banks set up by the BRICS nations, simply in order to meet America's own needs for long-overdue new infrastructure. It is also urgent that the nations of the Middle East and North Africa use Hamilton's method to create a regional infrastructure development bank so that the "New Silk Road" of infrastructure development can fully expand throughout that region.

Hamilton's and LaRouche's Credit System

Alexander Hamilton not only founded America's first national bank in 1791; he had earlier co-founded two of its first four private commercial banks. These were banks of a new kind, commercial banks whose *only* business was to, as Hamilton said, "concentrate the savings of the country and place them at the disposal of those best able to use them productively," through lending. Hamilton's partner in the Bank of New York was an ancestor of President Franklin Roosevelt, who during his own university days studied his ancestor's work; so FDR as governor and President did not merely "accidentally" take up Hamilton's methods of credit.



A drawing of work building the Erie Canal, perhaps the most important single infrastructure project in American history, during the period of functioning of the Second Bank of the United States.

Hamilton's view was not only that such well-run private commercial banks were a blessing to the nation, but that the national government needed a national bank to coordinate its important national purposes with an expanding number of private banks.

The most important of those national purposes, Hamilton said, was fostering individual invention and creativity of the population, which he understood was the basis of national wealth. In his reports to Congress on public credit, a national bank, and manufacturing, he wrote:

> Public Credit … is among the principal engines of useful enterprise and internal improvement.… As a substitute for capital, it is little less useful than gold or silver [then considered the only "capital"–ed.], in agriculture, in commerce, in the manufacturing and mechanic arts.
>
> Public utility is more truly the object of public banks, than private profit. And it is the business of Government, to constitute them on such principles, that while the latter will result, in a sufficient degree, … the former be not made subservient to it.
>
> To cherish and stimulate the activity of the human mind, by multiplying the objects of enterprise, is not among the least considerable of the expedients, by which the wealth of a nation may be promoted.

Hamilton amazed his President and military commander George Washington, by: first, successfully exchanging distressed, non-performing debt of the Continental Congress and the individual states for new, long-term debt of the new United States funded by specific revenues; second, quickly raising the value of that newly funded debt up to par by 1790; third, successfully exchanging that debt in turn, for stock in a Bank of the United States capitalized at $10 million; and fourth, issuing a new national currency from that Bank, which effectively allowed the nation's debt to be used as sound money.

With each new adoption of Hamiltonian national banking in American history, the investments in new infrastructure and new industries became more expansive. Hamilton's first national bank invested in development of water power for industry, ironmaking, canals, etc. The Second Bank helped launch the first American railroad building, more important canals and ports, steam power, coal mining. President Abraham Lincoln's "Greenback" system created new continent-wide railroads—for war and for transcontinental travel and freight—as well as an expanded and revolutionized coal industry, a steel industry, a merchant marine, a national education system for scientific agriculture, the beginnings of electrification, and so on.

EIR historian Anton Chaitkin has shown[1] that each surge in industrial growth and technological revolution in American history has been linked directly to the application of Hamilton's principles—often called "the American System of economy"—by American governments. Senator and Secretary of State James G. Blaine's great economic history of the 19th-Century United States demonstrated exactly the same conclusion.

Lincoln, after a 20-year period in which banking and currency had fallen into chaos and the nation was splitting apart, successfully organized a new national system of commercial banks which—along with individual citizens—purchased newly issued national debt fully funded by new tax revenue. Those chartered banks held the government debt as their reserve capital, placed it at the Treasury, and circulated a new Treasury currency ("Greenbacks") based on it, again effectively making government debt circulate as sound money. The new Greenback currency funded the expansive investments Lincoln launched into creation of infrastructure and industry, which propelled the United States to the world's leading industrial power by World War I. The fact that those banks were prohibited by Lincoln Administration regulations from securities broker-dealer activities—the "Glass-Steagall principle"—was essential.

In the process, Lincoln's Administration demonstrated how large a volume of new, funded debt can be issued to and raised from a nation's own citizens, commercial banks, and other institutions, for purposes of creating national credit for important projects, even when a nation is cut off from international borrowing as the United States was in 1861. Many nations today can take heed of this principle. It was shown in 2016 by Egypt's successful and very rapid borrowing of approximately $8 billion from its own citizens exclusively, for the major project of building a second channel for the Suez Canal.

President Franklin Roosevelt, through the Reconstruction Finance Corporation, expanded the nation's electric power generation by 50% in a decade, dramatically increased its agricultural productivity, lifted millions out of poverty in the Southeast of the country, and in mobilizing for World War II created entirely new industries such as aluminum production, multiplied the national production of machine tools by hundreds of times, and more.

EIR Founding Editor Lyndon LaRouche revived the "American System of economy" which was based on Alexander Hamilton's life's work, and has carried it forward to a greater understanding of the impact of technological advance upon successful and sustainable economic growth.

In 1976 LaRouche's proposal for an International Development Bank (IDB) was adopted by the nations of the Non-Aligned Movement in conference at Colombo, Sri Lanka. In 1982, after meeting and collaboration with then-President of Mexico José Lopez Portillo, LaRouche in his book Operation Juárez spelled out how individual nations could cooperate with the IDB.

1 "Leibniz, Gauss Shaped America's Science Successes," *EIR*, February 9, 1996.

- Loan of government-created credit (currency notes) must be directed to those forms of investment which promote technological progress in realizing the fullest potentials for applying otherwise idled capital goods, otherwise idled goods-producing capacities, and otherwise idled productive labor, to produce goods or to develop the basic economic infrastructure needed for maintenance and development of production and physical distribution of goods....
- In each republic, there must be a state-owned national bank, which rejects in its lawfully permitted functions, those private banking features of central banking associated with the Bank of England and the misguided practices of the U.S.A.'s Federal Reserve System....
- No lending institution shall exist within the nation except as they are subject to standards of practice and auditing by the Treasury of the government and auditors of the national bank. No foreign financial institution shall be permitted to do business within the republic unless its international operations meet lawful requirements for standards of reserves and proper banking practices under the laws of the republic.
- The Treasury and national bank, as a partnership, have continual authority to administer capital controls and exchange controls, and to assist this function by means of licensing of individual import licenses and export licenses, and to regulate negotiations of loans taken from foreign sources....

In the 1980s LaRouche inspired Ronald Reagan's adoption of the Strategic Defense Initiative to develop "new physical principles" to shoot down nuclear missiles; LaRouche then organized strongly, though ultimately unsuccessfully, for Reagan to adopt a Hamiltonian national credit strategy so as to spread these new laser and beam technologies into both the industrialized and the developing world economies.

Had Reagan adopted Hamiltonian credit policies as LaRouche urged, not only could we have achieved actually effective anti-nuclear missile defenses, but also global economic progress would have contributed to putting the threat of world war permanently on the shelf.

FDR's recovery plan depended heavily on infrastructure construction, financed by such agencies as the TVA and the Reconstruction Finance Corporation. Here, construction work at the TVA's Douglas Dam in Tennessee, June 1942.

But LaRouche forecast that the Soviet system would collapse within five years of its refusal to cooperate on new strategic missile defense technologies with Reagan's United States—this did in fact occur. LaRouche then, in numerous meetings and events in Russia during the 1990s, recommended that Russia adopt "the Chinese system" of national credit and new infrastructure building, though this did not occur.

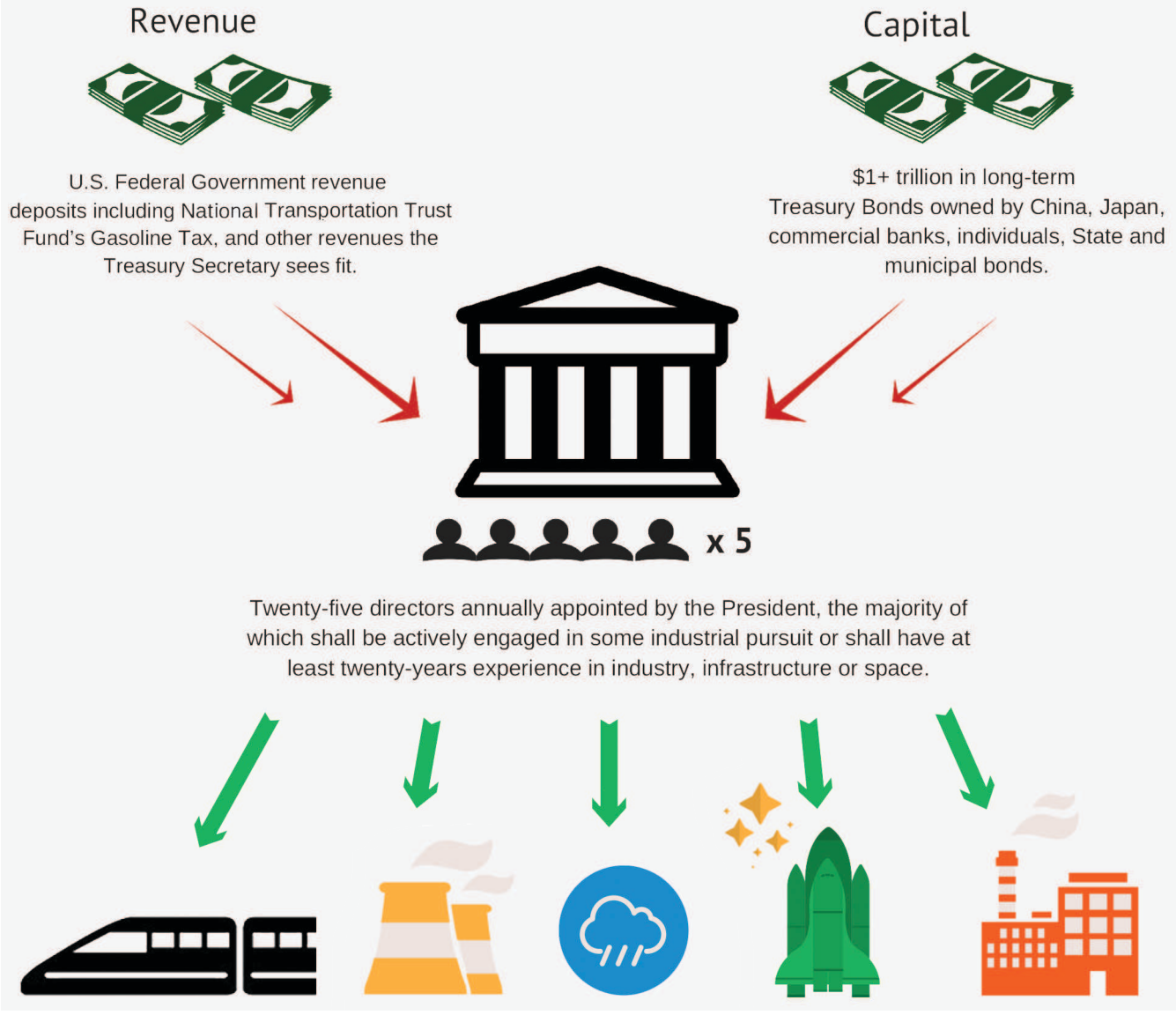
For more than fourty years LaRouche and his wife, Schiller Institute Founder Helga Zepp-LaRouche, have held conferences and met with heads of state and other leaders all over the world to promote those national programs and "great projects" of infrastructure most important for raising the productivity of nations' economies.

Today the LaRouches' concept of nations cooperating to issue joint national credits for high-technology "great projects" of new infrastructure across the world, has finally been launched by China's Belt and Road Initiative, stretching to more than 60 nations.

Lyndon LaRouche's movement proposes the United States Congress now urgently create a Hamiltonian Third Bank of the United States, as sketched in **Figure 3**. This will bring the United States into cooperation with the Belt and Road, or "New Silk Road," and bring that New Silk Road into the United States

Figure 3

A Third National Bank—How to Turn U.S. Debt into Credit for the Real Economy



to build the new economic infrastructure, from high-speed rail corridors to flood-prevention sea-gates, which it so badly needs.

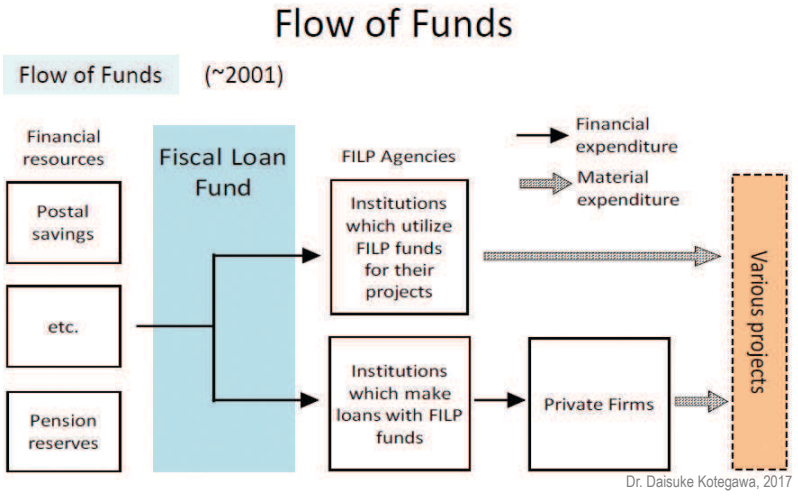
Here once again, as in Alexander Hamilton's successful Bank plan and its successors, holders of U.S. Treasury debt voluntarily subscribe that debt to become shareholders in a Bank of the United States. Private commercial banks, which hold considerable excess reserves in the form of Treasury securities, would become a major part of the shareholders. In this respect the Bank's structure would resemble that of the Federal Reserve Bank but with *entirely opposed intention*—that of a commercial lending institution to major national, regional, and local infrastructure projects and new branches of industry, as opposed to a rarified investment bank whose only "clients," by policy, are the biggest money-center banks of Wall Street and the City of London.

But the new Bank would also expand international cooperation—and the Belt and Road Initiative—because China and Japan have U.S. Treasury securities holdings in excess of $1 trillion each, and both wish to invest in new infrastructure development in North America.

Proposed legislation circulated to Members of the U.S. Congress by LaRouche's associates reads:

"Section II. Responsibilities and Authorizations

"(a) By this legislation, the Congress authorizes the creation of a public corporation to be called the Bank of the United States, which is authorized to: provide credit for major national projects of infrastructure, including surface transportation and ports, national intercity high-speed rail transport, water management and supply, drought prevention, flood prevention and storm protection, electrical energy production and distribution, and space exploration; make loans to agencies of the United States authorized for such projects; enter joint ventures with agencies of other nations mutually to provide credit for major international projects of new infrastructure; provide credit to state and municipal capital projects by purchase of municipal bonds as issued; discount bank loans to businesses participating in such projects; and cooperate with the United States Export-Import Bank to provide trade credits to businesses engaged in international infrastructure projects."



Japan's capital budget for infrastructure projects comes in significant part from a Fiscal Investment and Loan Program very similar to the American Reconstruction Finance Corporation of the period 1933-57.

Japan's 'Second Budget'

Clearly such U.S. legislation to create a Bank of the United States would effectively create a "second national budget" or "capital budget" consisting of credit for building of new infrastructure and introducing new technologies to industry. The Reconstruction Finance Corporation (RFC) of President Franklin Roosevelt was the last such credit system the United States had.

Japan, which invests in new infrastructure projects through a program similar to Roosevelt's RFC, has now publicly indicated it will join in cooperation with China on the Belt and Road Initiative. At a reception of the December 4-5, 2017 Sino-Japanese Entrepreneurs and Former High-level Officials Dialogue in Tokyo, Japanese Prime Minister Shinzo Abe said: "I believe Japan will be able to cooperate well with China, which has been putting forward its 'One Belt, One Road initiative' in a free and open Indo-Pacific region.... Meeting robust infrastructure demand in Asia through cooperation between Japan and China will contribute greatly to the prosperity of Asian people, in addition to the economic development of the two countries."

In Japan, the predominant credit institution funding new economic infrastructure is the Fiscal Investment and Loan Program (FILP)—an institution very similar in operation to the Reconstruction Finance Corporation of President Franklin Roosevelt's administrations.

The FILP loaned infrastructure credits, according to its own 2017 report, of more than 20 trillion yen (approximately $200 billion) in 2016, which was a typical year. The FILP is funded by investments from the Postal Savings system (i.e., by citizens), from commercial banks, from pension funds, and from some privatized former government monopolies such as NTT. Its bonds pay slightly more than Japanese government bonds.

Crucially, the FILP has been called "a second budget for Japan"; in other words, a national capital budget. Its credit is also designated as "fiscal loans." The FILP makes loans to those government agencies which carry out infrastructure projects, whether they receive additional tax revenue, or not. The government agencies in turn lend to contracting companies on the projects, to local infrastructure utilities, and so forth. The FILP may also make international infrastructure loans.

A Southwest Asia/Africa Development Bank

It is also urgent, in order that rapid reconstruction can proceed with the end of 25 years of war devastating the Mideast and that the new China-led infrastructure building in Africa can be maximized, that the economically stronger nations in this region should form a Southwest Asia Regional Development Bank. The purpose: To create credit to cooperate in new infrastructure projects with the new international development banks led by the Asian Infrastructure Investment Bank (AIIB), the New Development Bank, China's public commercial banks, and Japan's infrastructure credit facilities. Roughly $200 billion can be taken as a baseline level for the Bank's equity and borrowed capital combined.

The nations forming the regional development bank should provide a basic share of its equity capital, at least 20% of the total stock, in the form of new full-faith-and-credit bonds issued by their Treasuries, and back those bonds by dedicated future tax revenues which are to make the payments on the bonds to the Bank. The Bank will have other revenues directly and indirectly related to the infrastructure projects it invests in and the economic expansion around these projects; but the "sinking fund" for the Bank's stock dividend payments should be identified in advance and be independent of this future expansion, to ensure the soundness of the Bank's liabilities.

The founding nations will offer stock in the Bank directly to their citizens and to their private banks in order to subscribe the other 80% of the equity capital. This will include banks or citizens who already hold bonds issued by their governments, subscribing those bonds to the Bank in exchange for its stock—which will increase the future payments of the governments to the Bank.

The regional development bank should be authorized to issue bonds to the public as well, including internationally, in order to reach its targeted capitalization with the help of borrowed capital. But the goal should be to meet the original capitalization entirely by stock subscriptions of the governments, citizens, and private banks of the countries forming the Bank. The Bank's stock must be a long-term investment.

The regional development bank will issue loans exclusively to agencies assigned to carry out important infrastructure developments, whether those be local government agencies or agencies created for the purpose of the project. It will conduct discounting activities with private banks only as those banks make loans to contractors and service providers on the projects, and only as necessary for those loans to flow. It will also buy and/or syndicate infrastructure bonds issued by regional governments and local governments for approved projects.

Cooperation with International Development Banks

The recent important emergence of new international development banks for non-austerity-conditioned, infrastructure-specific lending—the BRICS New Development Bank and the Asian Infrastructure Investment Bank (AIIB) initiated by China—open up potentials for credit agreements not seen since the Bretton Woods Conference. The critical great projects or "infrastructure platforms" proposed here require cooperation among several nations, including credit cooperation among the major economic powers providing the bulk of capital goods and industrial products for these projects—but *not* supranational direction.

Extending the New Silk Road to West Asia and Africa will require more credit for major projects than can be created by a new development bank for the region. It requires international project lending as well. This is clearly true for the great reconstruction efforts needed in areas which have been subject to wars.

It is also shown by the long-term, low-interest international credits recently extended for the nuclear power complex at El-Dabaa in Egypt, for example, or the new Kenya Standard Gauge Railway. A Southwest Asia/Africa Regional Infrastructure Bank will provide proportional matching funds for such major projects or assist national development banks in doing so; and it will facilitate the conversion of international project loan funds into national currencies (also essential to prevent capital flight and/or speculation).

A Southwest Asia/Africa Regional Infrastructure Bank will be able to develop credit agreements for major projects in cooperation, for example, with the Export-Import Bank of China at low, government-to-government interest rates, if that country's companies are involved in providing capital goods and logistics; and could develop similar agreements with the AIIB, New Development Bank, or the Silk Road Fund. Such credit partnerships will minimize the need of the Regional Infrastructure Bank to borrow capital by issuing bonds on international capital markets at higher rates.

If the United States and Japan were now to join both the AIIB and the Belt and Road Initiative, an international combination of powerful development banks would be capable of acting like an International Development Bank with capital in the trillions.

A Southwest Asia Regional Infrastructure Bank will be able to act as an arm of this combination of international development banks, and the mediator between them and national banks of the nations of Southwest Asia and Africa.

Public-Private Partnerships Cannot Substitute

It is only when the funding of new infrastructure by public credit fails, as it has for decades in the United States and Europe, that "public-private partnerships for infrastructure" become a subject of constant proposals in the financial media and from governments. Such partnerships with private investors have worked only when they are used to feed and complement larger-scale public infrastructure developments with more local developments, as with connecting major high-speed rail lines into secondary cities and light rail systems. In those cases the public investors are typically municipalities and the private investors typically larger locally-active companies which want to develop and modernize the infrastructure around them; such public-private partnerships have become common in China's burgeoning urban areas.

"PPPs" have not often attempted to build substantial new economic infrastructure; when they have taken over infrastructure previously publicly built, particularly in the United States, their special corporations have usually failed, sometimes going into bankruptcy and forced public bailout more than once.

A June 17, 2017 *New York Times* article, entitled "World Offers Cautionary Tale for Trump's Infrastructure Plan," discussed a broad academic study of such partnerships, compared to public funding of infrastructure. The paper reported that countries which had placed emphasis on PPPs had bad results to show for it. "In India, politically connected firms have captured contracts on the strength of relationships with officialdom, yielding defective engineering at bloated prices. When Britain handed control to private companies to upgrade London's subway system more than a decade ago, the result was substandard, budget-busting work, prompting the government to step back in. Canada has suffered a string of excessive costs on public projects funneled through the private sector, like a landmark bridge in Vancouver and hospitals in Ontario."

Public funding, the *Times* reported, had been far more successful. "By contrast, China has engineered one of the most effective economic transformations in modern history in part through relentless investment in infrastructure, traditionally financed and overseen by an unabashedly powerful state." The authors report that China has invested an average of 8.6% of its GDP into new infrastructure projects for 25 years, 1992-2016. This has worked, with rapid and efficient development of projects and high productivity; and large amounts of private investment in industrial development—both from within and outside China—has followed.

Credit for serious new infrastructure development, from new rail and road corridors to nuclear power complexes or major water management and water supply projects, must be at interest rates in the 2-4% range, and must be for terms approximating the prime operating life of the project. Because new economic infrastructure platforms are not low-risk investments, private capital cannot create such credit even if it has no intention to loot the public or speculate on real estate and commodity values. Public infrastructure banks, able to look to long-term increases in general productivity and economic growth for the return, can do so.

3. CREDIT FOR INCREASED PRODUCTIVITY

The purpose of the use of a Federal credit system, is to generate high-productivity trends in improvements of employment, with the accompanying intention to increase the physical-economic productivity and standard of living of persons and households.

"Productivity" is given in everyday government statistics as the national product—or the product of an economic sector—divided by the total hours worked by employed persons in that national economy or sector. This definition of productivity does not show the advances or regressions in the power of an economy to provide for the general welfare of its people, because it does not account for whether the calculated "product" is useful in any way, nor whether it is being produced more or less efficiently than in a previous period of the same economy. Worse, this measure is shown to be nearly useless by the fact that in periods of sudden mass unemployment—such as the year 2009 in the United States and some European economies—this "productivity" rises sharply; amidst economic collapse, the few still employed are producing more "product" per capita than before.

Lyndon LaRouche's economic method takes productivity to be reflected in the degree of free energy which an economy can produce, over and above maintaining the living standard of the employed population, producing and maintaining modern capital goods including infrastructure against attrition, and providing for those employed in non-goods-producing occupations or not employed. The measures of such free energy, and of the "energy of the system" which it exceeds, are market baskets of consumer goods and services of all kinds, and "market baskets" of existing and/or new-technology capital goods and infrastructure.

Over the longer run, such productivity is fundamentally reflected in what LaRouche years ago named "potential relative population density." Greater productivity increases the highest *potential* level of population density per square kilometer of an economy, at the same or higher living standards and cultural levels, *relative* to the degree of improvements that economy has made to land, infrastructure, and production technologies.

To quote a further specification of this by LaRouche more than 30 years ago:

> Taking the society (economy) as a whole, this net increase [in productivity and free energy—ed.] is the outcome of some increase in average level of technology of the economy as a whole. This may be accomplished either by introducing new, more advanced technologies, or by replacing obsolete capital stocks with competitively modern capital stocks, or by increasing the average level of productivity of the entire labor force through productive employment of significant portions of the unemployed, or some combination of these measures. All things being equal, in the longer run, it must be based on introduction of more advanced technologies.

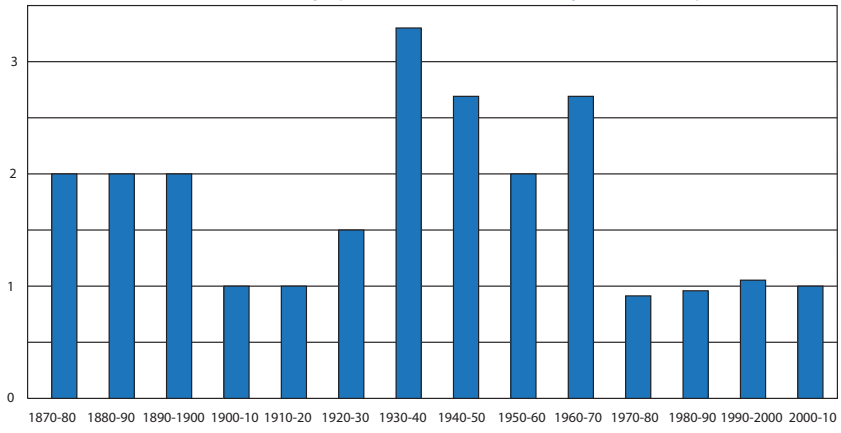
Most crucially, this is a function of the introductive of new economic infrastructure built with higher levels of technology, on the scale of regions, nations, or even the connectivity relations among continents and seas. LaRouche's notes on this in 2010:

> Man as a creator in the likeness of the great Creator, is expressed by humanity's creation of the "artificial environments" we sometimes call "infrastructure," on which both the progress, and even the merely continued existence of civilized society depends.
>
> The level of achievable productivity depends upon raising the "platform" through revolutions in infrastructure, on which successful general advances in potential relative population densities depend. Without those advances in basic economic infrastructure, merely particular technological progress, locally applied, will fail in its attempted performance of the truly vital mission of physical economic program....

The constant herald and measure of rising productivity, as LaRouche emphasizes, is rising *energy*

Figure 4

Total Factor Productivity (Annual Growth by Decade)



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

flux-density of technologies used to produce power and for industrial processes; that is, the capacity to concentrate a growing amount of energy in a relatively small apparatus through which it flows in order to perform work. The potential energy-density of fuels themselves contributes to this—see the chart in the following section of rising energy density of fuels over human history, to the peaks of nuclear fission and fusion fuels—as does the efficiency in converting energy to power or work, because this tends to make the apparatus or "power plant" smaller for the same power output. The radical advances of energy flux-density in industrial work, can be seen in the dramatic difference in tolerances and smoothness of a metal cut made by a laser, as opposed to one made by a diamond saw. The energy flux of the laser is both much greater, and applied on a far, far smaller cross-section.

An Example of Technological Productivity

A physical-economic example of this definition of productivity—one which sprawls across the 20th Century as China's example has dominated the 21st to date—is the "golden age of American productivity" centered in President Franklin Roosevelt's terms in office, clearly resulting from his administrations' extraordinary building of new economic infrastructure. **Figure 4** shows this upsurge as measured by sustained, extremely high rates (2-3%) of annual growth of "total factor productivity" in the U.S. economy, which is the estimated economic growth caused by technological advance, over and above all other growth factors.

The highest annual rate of growth of productivity in America's history, occurred in the periods in which the greatest investments were in new infrastructure which required new technologies—rail and road, and later space transportation technologies, electric power technologies, water management and flood control technologies, and communications. These periods are the decades after the American Civil War in the 19th Century, and the decades of the 1930s to 1960s in the 20th Century.

The U.S. Commerce Department's National Bureau of Economic Research wrote in a 2005 report, "Sources of Total Factor Productivity Growth in the Golden Age": "This was due to the very strong growth in electric power generation and distribution, transportation, communications, civil and structural engineering for bridges, tunnels, dams, highways, railroads, and transmission systems; and private research and development."

Roosevelt's New Deal built roads, rails, airports, and bridges across the country; it increased national power generation by 50% by building large-scale, high-efficiency, and high-power-rating (online performance) hydroelectric installations; and it established national laboratories for research in frontier areas such as atomic fission and aerodynamics. Private companies' engineering capabilities were challenged to perform this extraordinary building and responded with research and development and technological breakthroughs.

New, more advanced infrastructure was the driver of productivity. Technological productivity growth was also fairly good in the 1920s, the graph shows—new technologies like the internal combustion engine, radio, and telephone were spreading—but not comparable to the decades which followed.

In the 21st Century thus far, it has been China's technological productivity growing at rates near or

even above 3% annually, according to studies by the same U.S. agency and by the OECD; and for the same reason, very high investments in building new infrastructure, transportation connectivity above all, and in frontier energy technologies and space exploration.

Productive Credit and Money

The issuance of national credit, as explained in the prior section, is targeted, or intended for those improvements in infrastructure platforms, agro-industrial technology, and also household and individual productivity as through education—otherwise it cannot be called *credit*.

The "big three" central banks of the United States (Federal Reserve), Europe (European Central Bank), and Japan (Bank of Japan) have shown dramatically, over the past decade, the difference between credit, and simple creation of new money. These central banks have created, by rough estimates, $13-14 trillion equivalent in money since late 2008 (by "quantitative easing" programs), and have additionally issued temporary liquidity loans to banks in the many trillions of dollars equivalent.

But none of that money—new currency and electronic entries—has been created for an economic purpose, nor for a trade purpose. It has all been created for a strictly financial purpose: Providing the largest banks in the Trilateral countries enough capital and liquid reserves to survive massive losses and bad debts, and to resume and expand investments in whatever markets or securities those banks saw fit. Claims that the creation of this vast quantity of money in this way, would cause banks to restore and then dramatically increase their lending—thus claiming a general "economic purpose"—have proven to be untrue in Europe, the United States, and Japan. Most of the money which has not simply become excess bank reserves—the majority of it—has gone instead to investors in the form of dividends, and stockholders in the huge rises in market prices, and to large corporations which in turn used it to buy their own stock.

Credit is also issued in the form of currency and electronic entries. Credit issued by governments is a debt those governments assume, but when issued for purposes of a more productive nation, it is a debt which will be "paid back" with a large amount of interest by the greater overall productivity of a future generation. Essentially, growing future productivity is the security for the issuance of *credit*.

The large public commercial banks of China, in contrast to the "big three" Trilateral central banks, are world-leading examples of the issuance of credit. They have created nearly as much new currency—"money"—in the form of loans, as have the "big three" central banks in the form of securities prices and bank reserves, over the past decade.

Their lending has fostered extraordinary new platforms of transportation, navigation, water management, power production, agricultural production, and scientific research in the Chinese economy; and they have now extended and committed roughly $300 billion since 2014 in additional credit for infrastructure projects outside China through the Belt and Road Initiative. The result has been an extraordinary 8-10% of GDP invested in economic infrastructure for 20 years, and the near-complete eradication of rural poverty which once entrapped 6-700 million Chinese. Moreover, accounting studies like those of PricewaterhouseCoopers have estimated that these banks' credit has created in excess of $10 trillion in new physical capital assets dominated by intercity and urban infrastructure, in China and increasingly in the Belt and Road countries.

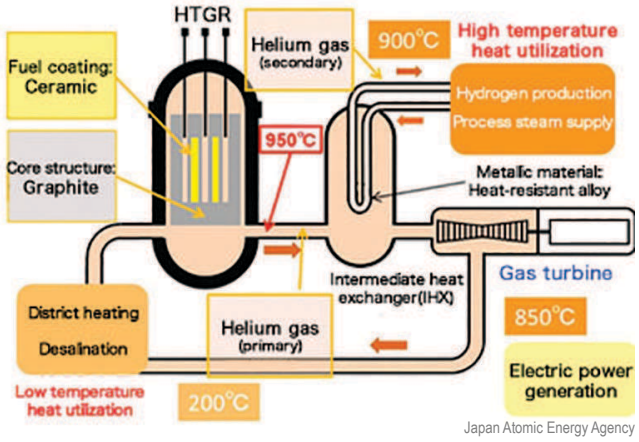
The lack of such new infrastructure and industrial assets associated with the extraordinary growth of corporate and household debt bubbles in the trans-Atlantic countries since 2010, is why we assess a general financial crash coming on in those economies. This is not the case for the large amounts of new credit created by China's public banks and international development banks and funds.

The Principles of New Infrastructure

Energy-flux density and power: When higher levels of power per capita and per square kilometer can be created at the same relative physical costs to society, the cost for existing applications is lowered, new processes with higher total power requirements become economical, and new physical reactions, as-

Figure 5

A High-Temperature Gas-Cooled Reactor



Japan Atomic Energy Agency

sociated with new domains of physical chemistry, become possible. In the past, this process was demonstrated when the new principles of electromagnetism replaced the simple motion of steam engines; or in production, when previously enormously expensive materials, such as aluminum, became easy to mass produce.

It is seen in the potential—given enough reliable electric power—of computer controlled machining, electron-beam welding, laser cutting, and electric-discharge machining. Conversely, when the technological level of an economy stagnates, the resources defined by that level of technology become "finite" and are gradually depleted by continued use. Then the development of higher levels of power per capita allows the creation of new resources.

This next level requires a long-delayed nuclear power revolution. This involves vastly expanding the installation of nuclear power plants, and, in particular, a crash effort for mass production of cheaper and safer fourth-generation nuclear fission reactors (including the medium-term development of the thorium cycle).

There are productive innovations on the immediate horizon. The introduction of high-temperature gas-cooled reactors (see **Figure 5**), developed in concept four decades ago, will not only be inherently safe but will make possible energy-efficient and inexpensive desalination of salt and brackish water, the production of hydrogen for fuel, generation of easily available process heat, and reliable electric power.

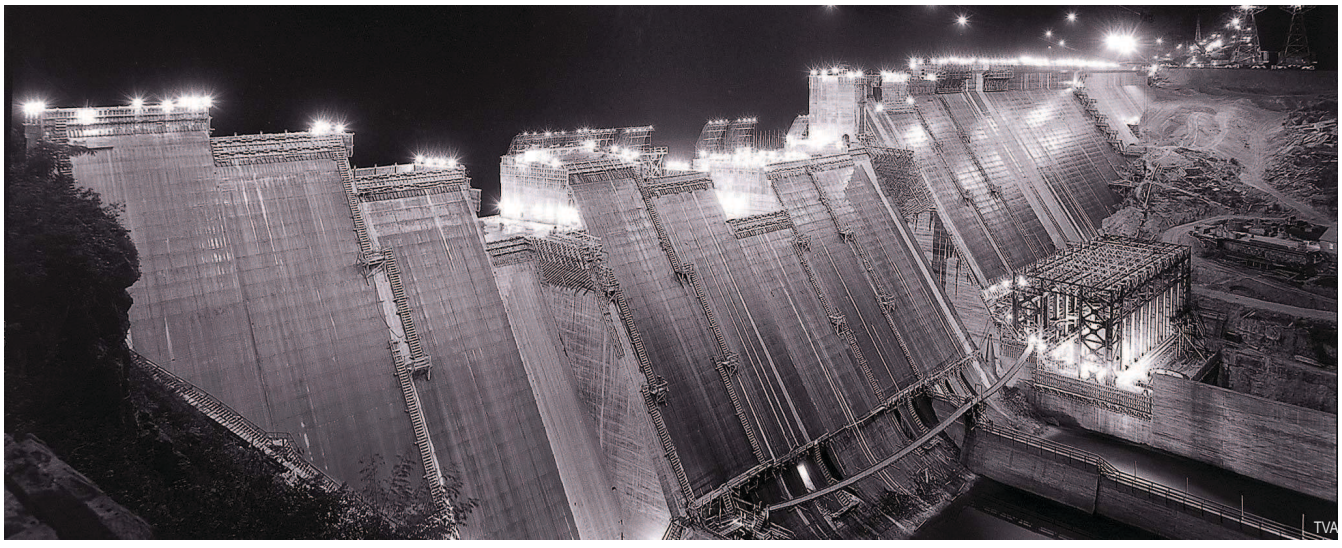
Another innovation is the deployment of floating nuclear power stations for special uses. Decades ago, Westinghouse Corp. was at work on this concept, at its facilities in Jacksonville, Florida, for quick deployment off the coasts of developing regions in need of abundant reliable power. However, this initiative was thwarted during the years of casino economics. Now Russia and China have active construction programs for floating nuclear plants.

Russia's first one will be installed at the Arctic Circle town of Pevek, in Chukotka in Summer 2019. In April 2018, the *Akademik Lomonosov* left the shipyards in St. Petersburg, Russia, under tow to Murmansk, where two on-board reactors will be fueled before it proceeds to its final mooring in the Far East.

China expects to launch its first floating nuclear plant in 2019-2020. These kinds of small barge-mounted units in the range of 50-75 MW will offer ready power not only for Arctic towns, but also for a range of needs including port operations and construction, restoring power after natural disasters, and quickly introducing flexible electric power supplies in regions which lack electrification.

The full picture of nuclear needs and capacities is

The Akademik Lomonosov *is shown departing the Baltic Shipyard in St. Petersburg in April 2018, under tow to Murmansk, where the two nuclear reactors on board will receive nuclear fuel, and then be towed to Pevek, Chukotka for installation in Summer 2019. The barge's two nuclear reactors can produce up to 70 MW of electricity, enough to serve 100,000 people.*



Construction of the Norris Dam, part of the Tennessee Valley Authority system. The dam was completed in 1936.

presented in Volume 1 of The New Silk Road Becomes The World Land-Bridge, in Section II, "Expand Nuclear Power for the World's Survival." As the sub-title to that 2014 report states, "Much of the world lives in virtual darkness, lacking the electricity essential for modern life; but world leaders are not prioritizing the solution to the problem."

In the four years since that was written, the governments of China and Russia, in collaboration with India, South Korea, and others, have made a priority of pushing ahead with commitments for nuclear power plant construction. China, for example, has 28 reactor projects in the works within its own borders, and additional projects abroad. Russia is collaborating on nuclear power plants in Egypt and elsewhere.

However, the United States and Western Europe continue to go backward on nuclear fission capacity. The consequences of this go beyond the harmful impacts confined within their own national boundaries.

What is required internationally, is many times over the current 450 nuclear power plants in operation worldwide, which account for only 11% of total electricity used. Humanity needs not only more electricity, but the productivity only possible from fully "going nuclear" with fission energy, in order to create the worldwide conditions of industrial might, and human ingenuity to lift off into a totally new domain of a fusion energy era. This is discussed in Law Four below, "A Crash Program for Fusion Power, Plasma Technology and Space."

Water: Increasingly since the breakthrough represented by the Tennessee Valley Authority, water management projects for flood control and irrigation have also been power projects, providing electricity with very high energy-conversion efficiency and reliability. As construction technologies have advanced, the potential geographical scope for surface water management has expanded. A prime example is the Three Gorges Dam project on the upper Yangtze River, completed in 2012.

Among the most important such infrastructure undertakings now pending in the world is in Africa: the long-planned Transaqua Project, to recharge the disappearing Lake Chad, by diverting a small percentage of the massive freshwater resources of the Congo Basin, to transform productivity and population potentials throughout the Sahel and central Africa (see Section III of this Special Report). *EIR* and the Schiller Institute have promoted the launching of this combined water management/irrigation/transportation/power infrastructure project for many years, and it is now coming closer to realization as a result of the Belt and Road Initiative.

Another potential project of the same scope and importance is the North American Water and Power Alliance (NAWAPA) plan, designed and engineered already by the 1960s, and discussed in the North America section of this report. Above all, the agricultural productivity of the entire western, dry, and partially desertifying portion of the North American

continent would boom with NAWAPA, by conveying southward, 5-10% of the abundant fresh water run-off of the Alaska/Yukon hydrological district of the northwest (much of which currently flows unused into the ocean with little productive economic or biospheric application).

However, the inherent constraint associated with such river diversion projects come from dry spells and natural variations in weather patterns, which can reduce water availability and, therefore, hydroelectricity output and supply for irrigation.

Two advanced technologies relieve any such constraints entirely. They constitute direct intervention into higher levels of the Earth's water cycle itself, not simply reconfiguring surface run-off—desalination (providing freshwater directly from the oceans), and weather modification with atmospheric ionization technologies (tapping the freshwater resources of the sky). The "Dimensions of the Water Cycle" graphic shown here illustrates this point (**Figure 6**).

Because the process of desalting sea water (or brackish inland water) is energy intensive, nuclear-powered systems are in order. Several nations have good designs, and there are many successful operating nuclear desalination plants, with long records. The challenge is to scale-up the programs to not only relieve the growing number of water-short regions, but to provide abundant water for increased economic activity to spur productivity and progress. As of 2018, only an estimated 350 million people worldwide were served by desalinated water, and most of that was produced by limited, expensive non-nuclear power sources.

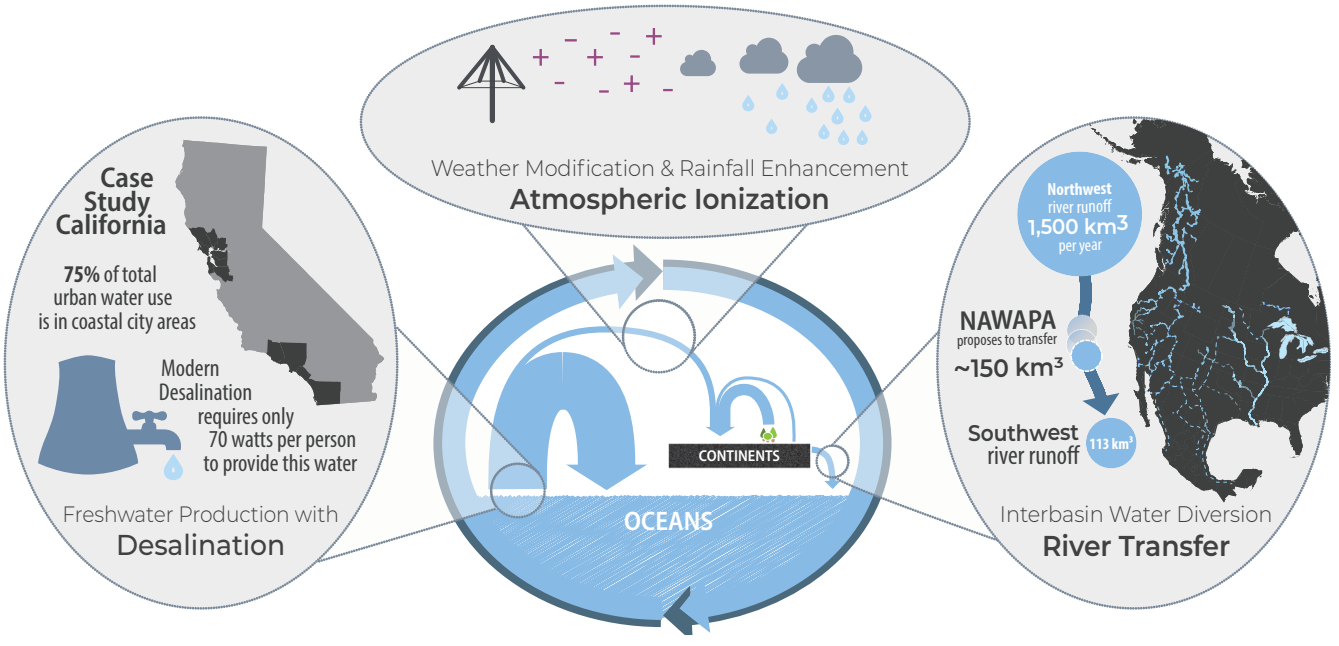
The power to increase rainfall with weather modification will be greatly enhanced with new kinds of technologies using electrically-induced ionization of the atmosphere to accelerate water vapor condensation and increase precipitation (or reverse the process where precipitation is not desired).

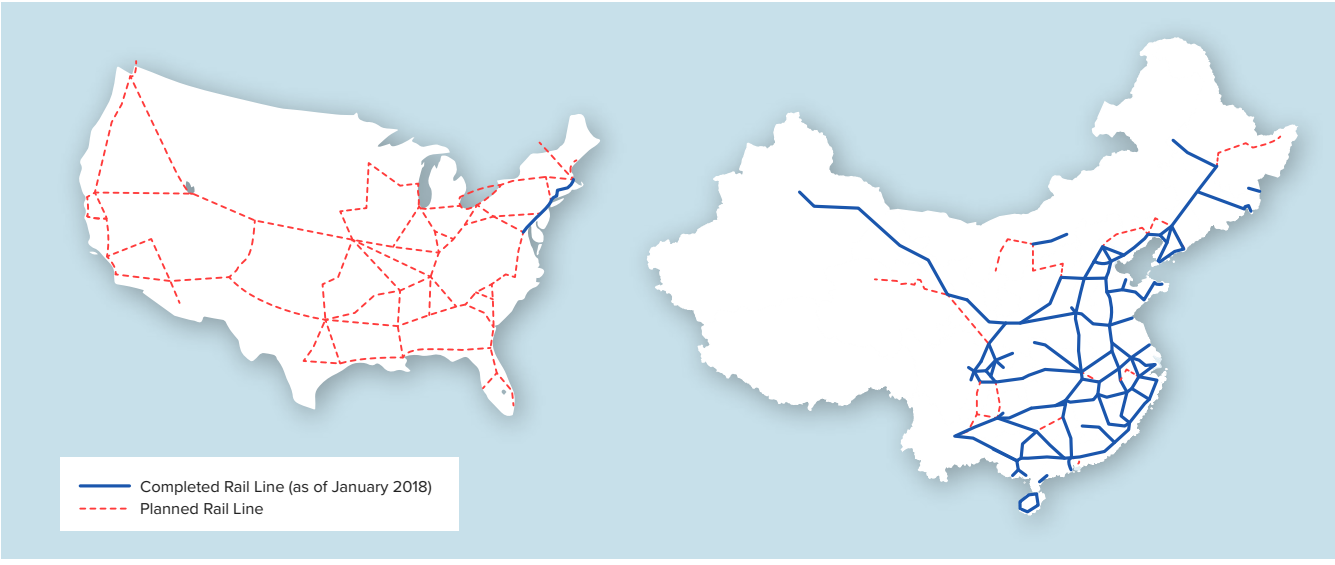
The principle involved mimics the way galactic cosmic radiation controls key aspects of climate change through influences on cloud formation. The techniques have been tested and successfully demonstrated in Mexico, Russia, Australia, Israel, the United Arab Emirates, Oman, and in other locations.

Thus, through infrastructure, mankind creates "natural" water resources. A full report on these technologies, and the status of world water supplies, is given in "The New Silk Road Becomes the World Land-Bridge, Volume I" in the chapter entitled "Solve the World Water Crisis," and its appendix, "Initiatives for Nuclear Desalination."

Figure 6

Dimensions of the Water Cycle





The U.S. and China have similar land areas, yet China has more than 100 times as much high-speed rail (16,000 miles), with a network of 30,000 miles planned by 2020. In the graphic, blue lines depict currently existing high-speed rail, and red lines depict potential future routes. While in China these future routes are already on the books and slated to be built, in the U.S. they remain only proposals.

In water management, it is equally important to develop advanced *storm and coastal flood protection* technologies, which have been thus far limited to relatively few countries and selected urban areas. The United States's recent history with powerful hurricanes provides a dramatic example. Not only economic productivity, but thousands of lives and hundreds of billions of dollars of wealth have been needlessly thrown away in the devastation of cities which could have been protected. The city and metropolitan area of New Orleans has been protected by large modern sea-gates, new levees, and a powerful pumping system—only after Hurricane Katrina killed nearly 3,000 people and destroyed whole areas of the city in 2005. Not only America's East Coast cities, but those all across the Gulf of Mexico, in Mexico and Central America as well, need the protection of modern sea-gates and dykes, as well as many more dam/reservoir systems to stop the flooding of those cities by tropical storm rains.

These projects are postponed in the United States, due to costs in the billions—only because of the lack of a national credit institution for infrastructure—and then reconsidered only after hundreds of billions in wealth, and priceless human lives, once again have been lost.

The lesson is true worldwide.

Transportation: A modern high-speed and magnetic levitation rail system does more than increase speed and convenience of transportation. It changes the entire physical-economic space-time characteristics of the economic system. More extensive areas become accessible in less time, ensuring more diverse population centers and encouraging healthy growth of population; manufacturing capabilities are increased (especially in the building and operation of the high-speed/maglev lines!); agricultural regions can be economically accessible to the individual or productive process; the social interchange of ideas and cultures is encouraged.

Transcontinental rail corridors are still to be built for South America, Africa, and Australia. The great Eurasian landmass is finally being spanned now by multiple rail corridors for freight which moves much more quickly than by sea, much more cheaply than by air.

As these corridors become standardized and electrified, making high speeds possible, Eurasian passenger lines will develop. In Africa, the new high-speed Kenya Standard-Gauge Railway is one of many rail projects developing and leading toward a Djibouti-Dakar Transcontinental. All this is the developing fruit of the great Belt and Road Initiative initiated by China, the "New Silk Road" toward which the

war-ravaged Mideast nations are looking for reconstruction as well.

On the cross-continental scale, the 55-mile crossing of the Bering Strait by high-speed rail and road—opening the shortest route from Beijing and Northern China to America's Midwest—must be in the near future. This will integrate the North American continent into the modern rail systems now being built across Eurasia. It will be associated with the crossing of the North American continent from North to South by rail for the first time, and ground transportation finally through Central America's Darien Gap to South America.

Just further in the future, advanced systems of vacuum tube transport could provide supersonic access between select regions.

4. A CRASH PROGRAM FOR FUSION POWER, PLASMA TECHNOLOGY, AND SPACE

Currently, the world population is 7.6 billion people. Had the great progress and momentum in nuclear fusion research during the decades following World War II been allowed to continue, the world population today would be in the range of 20-25 billion people, living longer, healthier, and more productive lives than those relatively few in the most technologically advanced nations today.

In 1954, then-head of the United States Atomic Energy Commission Lewis Strauss said of ongoing efforts to achieve fusion power:

> Our children will enjoy in their homes electrical energy too cheap to meter. It is not too much to expect that our children will know of great periodic regional famines in the world only as matters of history. Will travel effortlessly over the seas and under them, and through the air with a minimum of danger and at great speeds; and will experience a life span far longer than ours, as disease yields and man comes to understand what causes him to age.

Such is the natural optimism which accompanies—then and now—the potentialities of a fusion platform.

Humanity has now reached a point where shifting to a platform of fusion power and plasma technology is no longer an optional step. Thermonuclear fusion will completely transform the conversion of energy into power and useful work, and thereby transform human economies and the productive capacities of individual human beings.

A human race that wants to explore the solar system and the galaxy will need fusion power to do so—a trip to Mars powered by fusion propulsion will take just a few weeks. Nations that want such high-quality power and heat, that we will produce the materials and pure isotopes we need from scrap and waste, and cut and shape anything easily, can only achieve that with plasma technologies. A world that wants unlimited energy indefinitely, wants fusion energy. And a human race that wants to eliminate pollution from the production and use of power and heat energy, needs fusion power to do it.

The revolutionary discoveries of the early 20th Century revealed an immense potential, altogether beyond chemical reactions: the fundamental equivalence of matter and energy, as expressed in the domains of fission, fusion, and matter-antimatter reactions. Each in this series of reactions operates at successively higher energy densities, and the entire set is orders of magnitude beyond the entire successive set of chemical reactions in the creation of power for work.

Control of these reactions enables the increase in what Lyndon LaRouche has termed the energy-flux density of the economies, as measured in the rate of energy use and efficiency of energy conversion

Table 3

The Energy Density of Fuels

Fuel Source	Energy Density (J/g)
Wood*	1.8×10^4
Petroleum (Diesel)*	2.7×10^4
Coal (Bituminous)*	4.6×10^4
H_2 and O_2*	1.2×10^5 (only H_2 mass considered)
Uranium-235 (Fission)	3.7×10^9
Deuterium-Tritium (Fusion)	3.2×10^{11}
Matter-Antimatter	9.0×10^{13}

* *combustion*

to power of applied technologies, such as the energy concentrated in the beam of a laser used for metal cutting, compared to a power saw. Energy-flux density can be measured as the energy use per person and per unit area of the economy as a whole. This increasing power is associated with qualitative changes through the entire society—new technologies, new resources, higher levels of living standard, and essentially new economies (see **Table 3**).

For example, at the founding of the United States, the wood fire- and water wheel-based economy of the time provided an estimated 2,400-3,000 Watts (W) per capita. Thus, each member of that economy represented a potential application of energy up to 30 times greater than a fire-less society. By the 1920s, the increasingly coal-powered United States had a per-capita power use of 5,000 W, meaning every individual in the economy expressed nearly twice the power of members of a wood-waterpower-based economy. This supported the powered machinery, transportation, and early electricity generation that transformed life alongside the development of modern chemistry.

By 1970, the per-capita power rate in the United States, which now made extensive use of petroleum, natural gas, hydroelectric, and limited applications of nuclear power, had reached 10,000 W per capita, another doubling over the level 50 years prior. Thirty years later, per-capita power had reached 11,000 W; since 2005, however, this measure of individual human productive power has fallen slightly.

In each of these transitions, the previous fuel declined in use as a power source, allowing non-combustive uses—wood for construction and petroleum for plastics and other petrochemicals—while the array of resources expanded. In today's electromagnetic, and partially nuclear economies, rare earth minerals have become resources, the excellent fusion fuel of helium-3 on the Moon is being eyed by the Chinese space program, and the future, truly fusion-based economy will be able to process mineral deposits far below the quality of ores exploited successfully today.

Given these power transitions, it is no surprise that per-capita electricity consumption and per-capita wealth are so closely correlated, as seen in **Figure 7**.

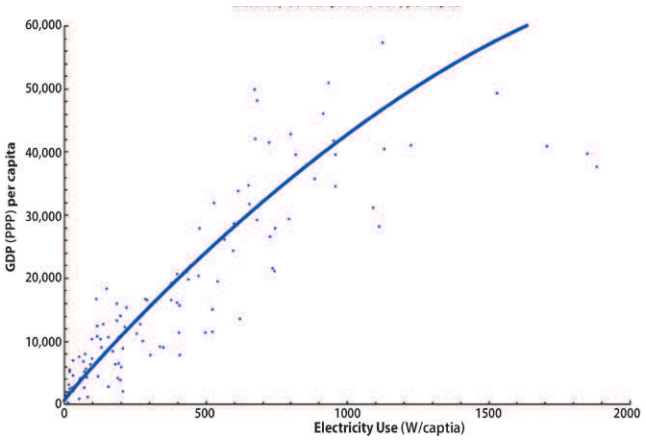
The potential of a fusion-powered economy would approach 40,000 W of power per capita within a generation. Such potential drives home how unacceptable the current world average of only 2,400 W per capita (similar to the United States at its founding) truly is.

A Multi-Nation Crash Program

The United States and China have the task of leading the world into an entirely new level of capabilities of the human race, on Earth and in space: fusion power and plasma technologies. Other nations, such as the Republic of Korea and the Federal Republic of Germany, have very advanced experimental fusion power devices; and many nations will contribute

Figure 7

Electricity Consumption vs. GDP, Per Capita



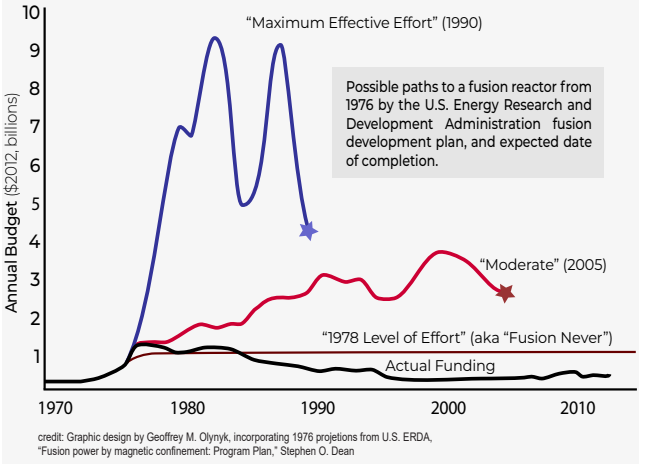
critical designs and breakthroughs for sustained generation of controlled fusion power.

But to make these breakthroughs and create a successful reproduction of the fusion process which drives the stars, requires a true crash program which joins the urgent work of large numbers of scientists, engineers, and machinists for a common objective. Some 135,000 such highly talented people made the breakthrough to nuclear fission in the United States's 1944-45 "Manhattan Project," for example. And Project Apollo, the American mission to the Moon, employed 400,000 skilled people and 20,000 industrial companies for several years.

But in no country thus far, has the number of scientists and engineers working on fusion power exceeded a few thousand at the very most. America invested the equivalent of more than $25 billion current dollars in the Manhattan Project in two years; its fusion research funding has never exceeded $450 million/year and recently is far below that. Scientists knew quite well back in 1979, when the U.S. Congress passed legislation promoting fusion research, that such merely investigative levels of funding and manpower could and would never conquer fusion power (**Figure 8**). China, on the other hand, is leading the world in resources invested in fusion experiments. It is the only major nation whose fusion power program funding level is growing rapidly; it is getting experimental results accordingly, and aiming at operating a first, relatively lower power demonstration fusion reactor in less than 15 years.

Figure 8

Fusion Funding Regimes



credit: Graphic design by Geoffrey M. Olynyk, incorporating 1976 projetions from U.S. ERDA, "Fusion power by magnetic confinement: Program Plan," Stephen O. Dean

But opening the fusion technology era of mankind will take more than funded research. It will take very large concentrations of electrical power, applied to create the demonstration "platform" from which fusion will vault us up to a much higher "platform" of unlimited, easily controlled and directed power for every kind of human work and adventure.

For example, the ultra-short laser pulse used in laser-fusion experimental work at Lawrence Livermore Laboratory, is given 500 million megawatts of power for a small fraction of a second, compressing a tiny capsule of deuterium fuel which could produce even greater amounts of power. In "tokamak" and other magnetic fusion experimental reactors, the heating of light gases into plasmas and the operation of strong magnetic fields which compress the plasma to cause fusion, require application of large amounts of electrical power. Aggressively conducting dozens of such experiments simultaneously—the characteristic of a scientific crash program—will need very large capacities for completely reliable, high-voltage electrical power.

As an example, the United States increased national electric energy generation and use by 150% in a single decade 1935-45—using particularly a great surge in hydroelectric power capacity—making possible a tremendous 1944-50 concentration of manpower, experimentation, and demonstration of new technologies including atomic power, but also aluminum production, pure chemical and medical isotope production, new levels of computing power, and electronics manufacturing (see **Table 4**).

Today, American power generation has not risen since 2005; but what was done then, can be done again at a higher level. China, for its part, now has the world's highest level of power generation at 5,500 billion kWh/year. Given its population, its power generation per capita is still well below the level of the United States, but its power generation per square kilometer is significantly above it.

All the countries involved should rapidly increase their nuclear electric power production, as the driver for other sources, and the driver for the breakthrough of a crash scientific program to demonstrate and then achieve fusion power. Once the breakthrough to continuous, controlled fusion reactions is

Table 4

Power Production Leading to Mastery of Nuclear Fission, United States, 1930-1950

Year	Electric Power Generation (kWh)		
	Per km²	Per Capita	Per Productive Worker
1930	30,000	650	6,000
1935	33,000	700	7,300
1940	47,000	1,100	8,000
1945	73,000	1,600	10,500
1950	94,000	2,050	13,100

made, this large "investment" in electrical power will be "paid back" many times over for the indefinite future. But it will also have great benefits in itself.

What will this mean?

- Power for high-speed freight and passenger rail systems; a great deal of electrical capacity, generation and distribution, which must be of a high energy density and complete online reliability, is demanded by a system like China's now nearly 20,000 km of high-speed rail.
- Power for higher quality industrial machines, tools, and processes, featuring the use of lasers and the production of very high purity chemical isotopes.
- Power to lift, pump, and move water over distances to where it is needed.
- Power to desalinate salt and brackish water efficiently at very high temperatures, relieving drought and desertification conditions.
- Power for industrial expansion, especially in high-value-added industries.
- The ability to develop nuclear propulsion for spacecraft, of much higher specific moment—and therefore, speed—than chemical propulsion.
- The potential to develop plasma technologies—such as plasma steelmaking, plasma metal-cutting, and "fusion torch" materials purification—even before fusion power itself is demonstrated.
- The potential of achieving fusion power breakthroughs within 15 years.

Fusion: Mastery of the Cosmos

There are many challenges to be overcome as we tame the fire of fusion. A fusion reaction is the uniting of two light nuclei (e.g., hydrogen) into one, which results in a tremendous release of energy in the form of electromagnetic radiation and high-energy particles. We can capture that energy to produce electricity, heat for industrial processes, and many other advanced applications, such as rocket propulsion.

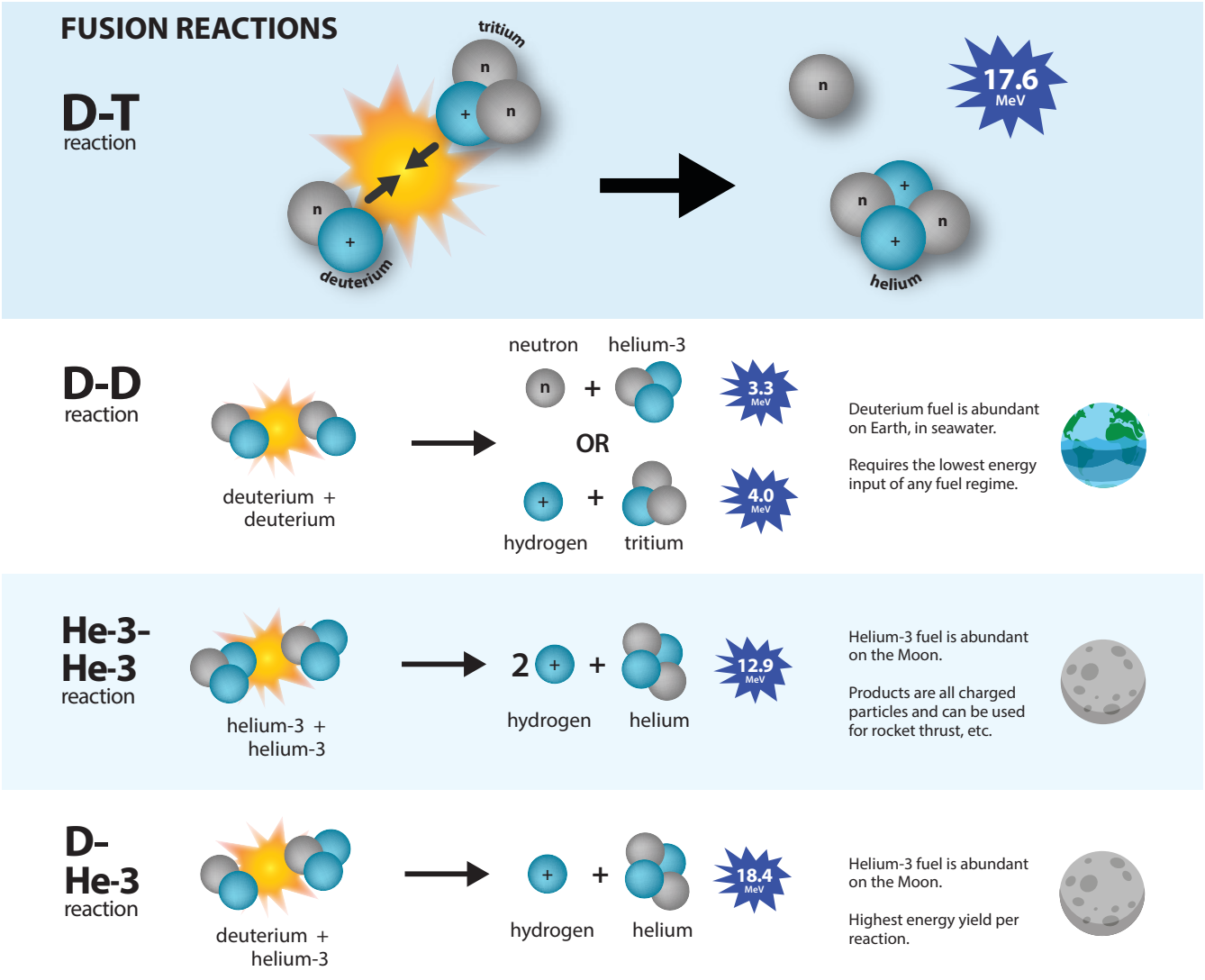
In the most basic terms, for two nuclei to get close enough to fuse, they must overcome the Coulomb barrier, created by the tendency of two similarly-charged particles (in this case, the positively charged nuclei) to repel one another. This requires a tremendous input of energy. A successful, energy-producing fusion reaction—one which yields more energy than was required to bring it about—requires that the fuel is confined at a high enough density and temperature, and for a sufficient time, such that the energy being given off heats the fuel without further external input. In the process of trying to make this happen, plasma instabilities and other surprising behaviors of the fusion fuel have disobeyed our mathematical formulas, and challenged our assumptions about the characteristics of matter and energy.

Today, stunning new breakthroughs are being made by the impressive fusion efforts which have been developed around the world (**Figure 9**). If a vigorous crash program of international cooperation were initiated within a new win-win paradigm, we could finally bring to fruition what the old paradigm had placed "always 50 years away."

Leadership in the EAST

China, which began its fusion program in the 1970s, has developed one of the world's only tokamaks (a type of fusion machine) using advanced superconducting magnets, the Experimental Advanced

Figure 9



Superconducting Tokamak (EAST) housed at the Institute of Plasma Physics in Hefei. China is the only nation today which is increasing its domestic fusion budget, and it has the intention of graduating 1,000 fusion scientists by 2020 (there are currently more than 350 Master's and Ph.D. students studying fusion in Chinese universities).

In February 2016, it was announced that with recent upgrades, scientists were able to maintain a plasma in the EAST tokamak at 50 million degrees (over twice the temperature of the Sun's core) for 102 seconds, setting a new record for plasma creation. The goal is to sustain a plasma for 1,000 seconds, at twice the temperature. Professor Luo Guangnan, deputy director of the EAST project, said, "It is a milestone event, a confidence boost for humanity to harness energy from fusion." In November 2016, another record was set, maintaining a plasma of 50 million degrees for 60 seconds in a "high confinement mode," nearly double the previous record.

These advances were not accomplished alone. Scientists in the United States, at General Atomics in San Diego, collaborated with their Chinese colleagues on the experiment, and have even begun operating the tokamak remotely for a "third shift," during the nighttime in China. The cooperation is viewed as very valuable on both sides. "We have made a very good start of international collaboration in fusion research between China and the U.S., and we are very proud to be a pioneer in this field," said Dr. Xianzu Gong, of China's Institute of Plasma Physics.

The recent achievements have bolstered confidence to move forward with the next step toward fusion energy, the Chinese Fusion Engineering Test

Reactor (CFETR), for which approval is expected in China's next Five Year Plan. This facility will be dedicated to solving the remaining engineering challenges, such as the need for new materials, before moving ahead with a demonstration power plant. The CFETR could come online as early as 2025.

Promising work is emerging in other parts of Asia. In December 2016, a record of 70 seconds of plasma high-density mode operation was achieved in Korea's KSTAR tokamak, breaking its prior record of 55 seconds, set in 2015. KSTAR is one of only three advanced superconducting tokamaks in the world (another is Japan's JT-60 SA), and began operation in 2008. Major upgrades over the next few years are intended to allow work that would lead to a demonstration power reactor, KDEMO.

Achievements in the West

Deindustrialization and geopolitics have held back scientific progress for decades in the West, but glimmers of real optimism appear in the fusion laboratories of Europe and the United States.

At the Max Planck Institute for Plasma Physics in Greifswald, Germany, the Wendelstein 7-X, the largest stellarator in the world, went online in 2014. The stellarator is a design for a fusion machine based on a different concept than the more common tokamak, and may avoid many of the plasma instabilities which challenge the basic tokamak designs.

In February 2016, the Wendelstein 7-X began its experimental operation, and in December released a report that the very complicated geometry of its stellarator is accurate to within 1 part in 100,000. In March 2018, new upgrades of five additional "trim" coils, designed to improve the machine's operation, were declared successful. The 2016 analysis of the Wendelstein 7-X stellarator's geometry and the 2018 uprades were completed with collaboration from the U.S. and other fusion programs, all of which show great excitement at what can be learned from this unique approach.

In the United States, fusion work has made experimental breakthroughs in national laboratories and universities despite virtually no funding. On September 30, 2016, the last day of its operation due to budget cuts, the Alcator C-Mod tokamak at the Massachusetts Institute of Technology set a new world record, achieving a plasma pressure (one of the key parameters in an energy-producing fusion reaction) of 2 atmospheres, surpassing its own previous record. The Alcator device, a high-magnetic-field compact tokamak, is of a unique design, and could be readily restarted with restoration of funding. Dale Meade, formerly of Princeton Plasma Physics Laboratory, said of the work, "This is a remarkable achievement that highlights the highly successful Alcator C-Mod program.... The record plasma pressure validates the high-magnetic-field approach as an attractive path to practical fusion energy."

However, breakthroughs continue. In March 2018, scientists at MIT announced new developments in advanced high-temperature supeconducting magnets—four times as strong as those currently in use—with which they (via Commonwealth Fusion Systems) intend to develop a prototype compact fusion reactor within 10 years.Similarly, a division of Lockheed Martin secured a patent in February 2018 for a non-tokamak compact reator, small enough to be mounted on a truck, which would produce 100 MW of electricity. They aim to have a prototype in 2019.

Fusion Is a Space Platform

Fission and fusion power will allow us to live and work in other places in the Solar System, and to transform them in a way that is impossible with chemical power alone (see "Applications of Fusion Plasmas and Technology" at the end of this section).

The process will begin on the Moon, which is a rich depot for fusion fuel. For billions of years, the Sun via the solar wind has been depositing helium-3, an isotope of helium, onto the surface of the Moon, where it is held within the upper layers of the lunar soil. Helium-3 is very rare on Earth, but estimates are that there are 1 million tons of helium-3 on the Moon, enough to power civilization on Earth at current levels of consumption for millions of years.

Helium-3 is an ideal fuel for controlled fusion. Fusion of deuterium and helium-3 releases more energy than any other regime (see Figure 9), and unlike other fuel combinations, the products of the re-

action are almost entirely charged particles—which can be controlled with a magnetic field. This means that they can be used to produce electricity directly and efficiently, and also can provide thrust in fusion rockets. With nuclear power we can maintain work and industry through the 2-week lunar nights. Nuclear rockets can power flight to distant bodies like Mars in weeks, as opposed to 8 months with chemical fuels.

With fusion power, we will upshift the human species to one which can extend its existence and activity throughout the inner solar system, and perhaps beyond. Immediately, we have the potential for international cooperation in exploration and development of the Moon and cislunar space. Such a program would involve new discoveries in high-energy physics, biology in the space environment, and fission and fusion power.

China has taken leadership on lunar missions in the past decade, inviting cooperation from other nations, and will soon place a lander and rover on the far side of the Moon. Mankind has never landed on the lunar far side in any way. Its unique geology promises to tell us more about the history of the development of our Solar System than anything we can access on Earth. Setting up a very low frequency radio astronomy observatory there will give us a glimpse into features of the Solar System, Milky Way galaxy, and far distant galaxies which are simply impossible to see from Earth or Earth orbit.

The spinoff technologies generated by expanding human dominion first to cislunar space, then to the orbit of Mars, and then to the entire Solar System, have the ability to lift every nation out of poverty, feed every child, cure diseases, and render the tools and causes of war obsolete. The commitment of space-faring nations to space exploration will be the embodiment of the new paradigm. Human beings are a space-faring species, with a mission to discover and understand who we are as mankind in the universe.

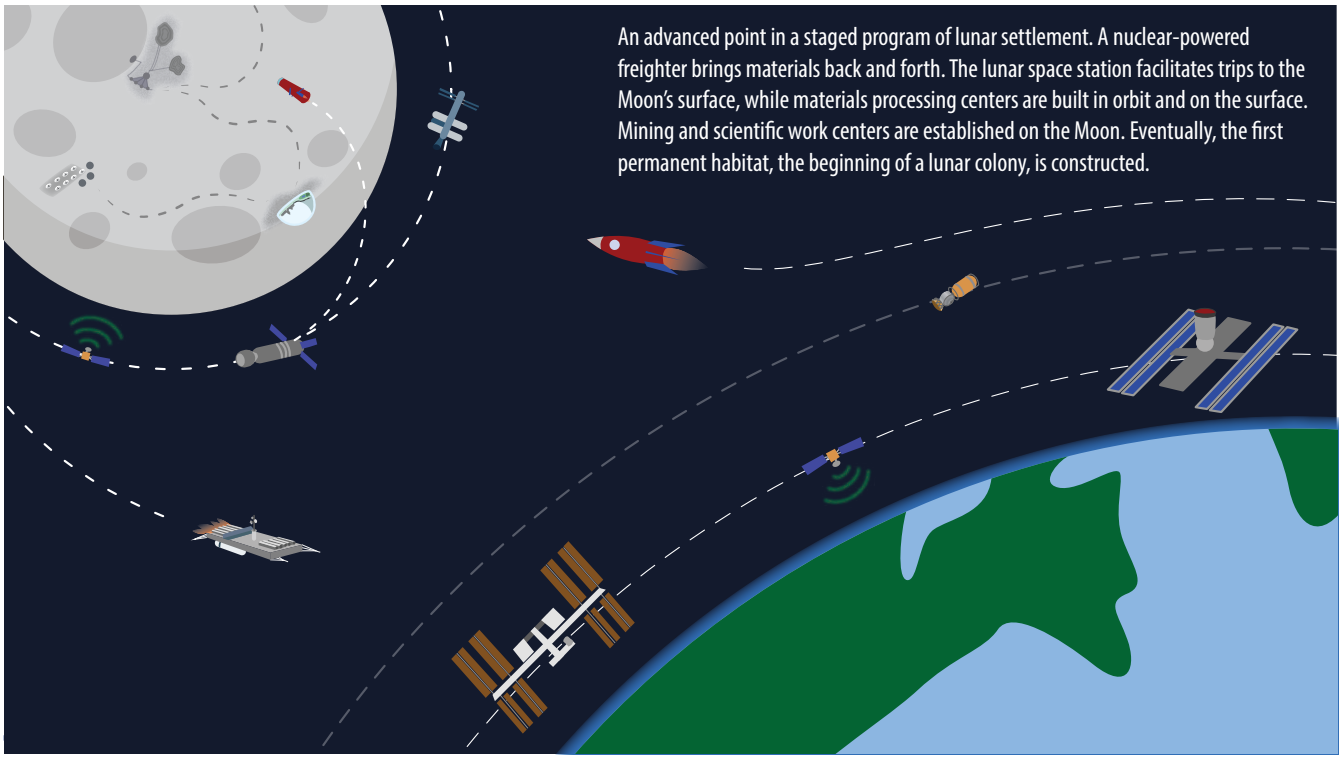
The great German-American space pioneer Krafft Ehricke, designer of upper-stage rockets for America's space program during its great growth, understood that the industrial development of the Moon and beyond is an extraterrestrial imperative (see **Figure 10**).

Ehricke wrote in 1970:

> Space opens new horizons beyond Earth and offers new beginnings in ways we can manage this precious planet. It offers noble aspirations, opportunities for creative action, for bringing the human family closer together and contributing to a better future for all.

Figure 10

The Development of Cislunar Space

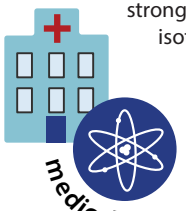


APPLICATIONS OF FUSION PLASMAS & TECHNOLOGY

TRANSMUTATION

With the high-energy products of fusion reactions, we can transmute elements, manufacturing specific isotopes to serve specific purposes. Short-lived medical isotopes can be manufactured on-site. Isotopically-pure materials such as steels for construction, or diamonds and silicon for industrial purposes, can be stronger or better conductors than isotopically-mixed materials.

industry

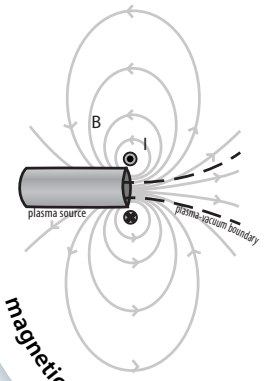


medical

construction

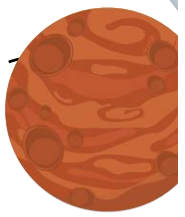
for more, visit:
lpac.co/forging fusion
lpac.co/fusion-torch
lpac.co/world-mine

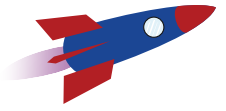
FUSION ROCKETS



magnetic nozzle

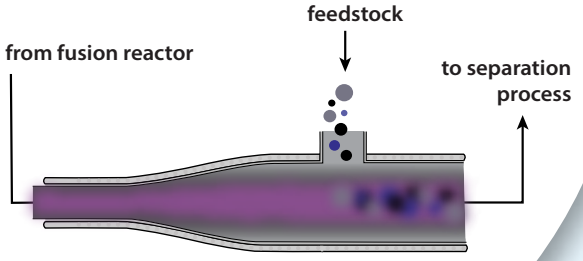
Plasma from a fusion reactor source is expelled by a magnetic nozzle to produce thrust. A fusion-powered rocket has a specific impulse nearly 300 times that of chemical rockets. Fusion rockets would make trips to Mars and beyond possible in weeks, rather than months.





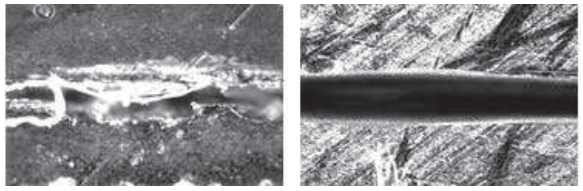
FUSION TORCH

Plasmas inside fusion reactors reach temperatures of millions of degrees, hot enough to vaporize any material, breaking it down into its constituent elements. In the 1960s, Eastman and Gough developed a design for the fusion torch, in which any feedstock, from material from landfills to scrap metal to dirt, could be turned into plasma, and the constituent elements separated and harvested. We could then mine landfills for our commonly used resources, or easily harvest resources from low-grade ore.



PETAWATT LASER

The petawatt (quadrillion watt) laser, originally developed for laser inertial fusion, is many orders of magnitude more powerful than conventional lasers. This leads to qualitative increases in our power over nature. When used for industrial purposes, it can vaporize the target material while transferring little to no heat to the surrounding material—a non-linear leap in precision for cutting and machining.



Steel cut with a conventional laser (left) and petawatt laser (right).

CHEMICAL PROCESSING

The industrial processing sector consumes over 30% of energy in the U.S. Controlled fusion reactors can provide 1) high temperature thermal energy, 2) electrical energy, 3) neutron and gamma high energy radiation, all of which can be used for chemical processing on a mass scale. Temperatures up to 3,000°C, plentiful electricity for electrolysis, and gamma and UV radiation can revolutionize or make economical mass production of heavy chemicals, aluminum, ozone, methanol, ultraviolet radiation for sanitation, water, etc.