

The World at a Crossroads: a BRICS-led Nuclear Renaissance or a War of Extinction



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The World at a Crossroads: BRICS Paradigm, or a War of Extinction

2 December 2014

In a presentation to over 100 diplomats, policymakers, and citizens in the nation's capital Dec. 2, Helga Zepp-LaRouche, founder of the Schiller Institute, made an impassioned appeal for the United States to join in the process of building the World Land-Bridge, which is now underway under the leadership of China and other BRICS nations. The offer made by Chinese President Xi Jinping to the U.S. and Europe, to join in this process of development, is "a lifeboat for a bankrupt trans-Atlantic world," she said. For if the trans-Atlantic world stays on its present course, it is headed for confrontation with Russia and China—the path toward thermonuclear war.

During the course of her presentation, Mrs. LaRouche detailed the "blueprint" for development which has just been issued in the Special Report from Executive Intelligence Review, "[The New Silk Road Becomes the World Land-Bridge](#)." Her extensive opening remarks were followed by an hour of discussion with the audience, which paid close attention to the details of the worldwide dynamic she presented.

The event was filmed by the Chinese news service Xinhua, which published an English-language report in Global Times, as well as in other newspapers.

The Dec. 2 event, sponsored by EIR, will be followed by a series of events around the United States, aimed at both educating and motivating the American public to take the necessary steps to get the U.S. government to take up the China/BRICS offer for economic cooperation, and abandon the current pathway toward confrontation with Russia and China. A listing of those events, to be held under the auspices of the Schiller Institute, can be found under "What's New" at www.schillerinstitute.org

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HELGA ZEPP-LAROUCHE: I think it is a fair statement to say that the future destiny of mankind will depend on the question of whether the United States and, to a secondary degree, Europe, will take up the offer made by President Xi Jinping to President Obama at the press conference during the APEC conference, where Xi invited the United States, and other major nations, to cooperate with a whole set of policies promoted by China and also the BRICS countries.

This set of policies is, naturally, on the one side, the New Silk Road. It is the idea of a new credit mechanism around the Asian Infrastructure Investment Bank, the AIIB, but also the new Silk Road development Fund, and similar mechanisms and new institutions which I will go into in the course of my presentation.

Now, why do I say that the fate of civilization, in all likelihood, will depend on that that particular offer by Xi Jinping to the Atlantic world, in particular, to join.

Because it's very clear that the policy, which is presently the policy of the trans Atlantic sector—the United States, NATO, the British, the EU—toward Russia and China, is one of confrontation. Toward Russia, it's more obvious, since the outbreak of the Ukraine crisis—which, if you are honest about it, is entirely the fault of the EU, because the condition on which the EU Association Agreement was offered, was already a kind of first step in the direction of regime change against Russia. And all the subsequent developments are really a chronology, in which Russia all the time reacted, and therefore is really not the guilty party, despite the fact that the mainstream media in the United States and Europe tell you the exact opposite.

So, this policy toward Russia and China, which consists of a color revolution—that goes back since the end of the Soviet Union. [U.S. Assistant Secretary of State] Victoria Nuland has praised herself for having spent \$5 billion from the NED [National Endowment for Democracy] alone to accomplish that. But it also includes the sanctions. Russian Foreign Minister Lavrov has been explicit to say that the aim of the sanctions is not to change the policy of Russia, but to get rid of [President] Putin. And naturally, the NATO expansion eastward, which breaks all promises made to Russia at the end of the Soviet Union, is part of the same game. And the same organizations which are in the destabilization in Eastern Europe, are also heavily involved in the Hong Kong demonstrations. And there the aim is exactly the same.

And if you look at the front page of the *Washington Post* this morning, you have another example of the black propaganda, using human rights issues, using issues of democracy; but if you really look at it, democracy in the United States is not in such good shape either. And in Europe, with the EU Commission, I think even the officialdom admits that we have a democracy deficit, to put it mildly.

A Lifeboat for the Trans-Atlantic World

When President Xi Jinping makes this offer, it also comes at a point where the Atlantic sector is hovering on the edge of a new financial collapse. You have, on the one side, the collapse of the oil price, which in part is also economic warfare, because Saudi Arabia, at the recent OPEC meeting, flatly refused to adjust the production; and who is the hurt country? This is Iran, naturally, but it's also Russia, in particular.

However, as President Putin recently pointed out, this is one of the evil deeds that backfires, because it has now dropped the oil price to about \$70, or even somewhat less yesterday, and that is creating a big problem for those oil companies, and shale oil companies, which have gone into massive debt. They're indebted by about \$1 trillion, but the repayment of that debt would require an oil price of \$80 to \$120; so one could make the comparison now, that the situation approaches a similar situation, like during the secondary mortgage crisis in 2007, when the collapsing mortgage prices triggered the big crash. And right now, the falling oil price could trigger a big crash.

So, either the oil price shoots up dramatically, or a crash could happen. And that, naturally, on top of the situation that the too-big-to-fail banks are today about 30-40% bigger than in 2007, and if one of these banks would collapse, it could trigger the virtual evaporation of the entire financial system of the trans-Atlantic sector.

So, therefore, when I'm saying that the acceptance of President Xi Jinping's offer is a lifeboat for a bankrupt trans-Atlantic world, this is not an exaggeration.

The Land-Bridge Becomes a Reality

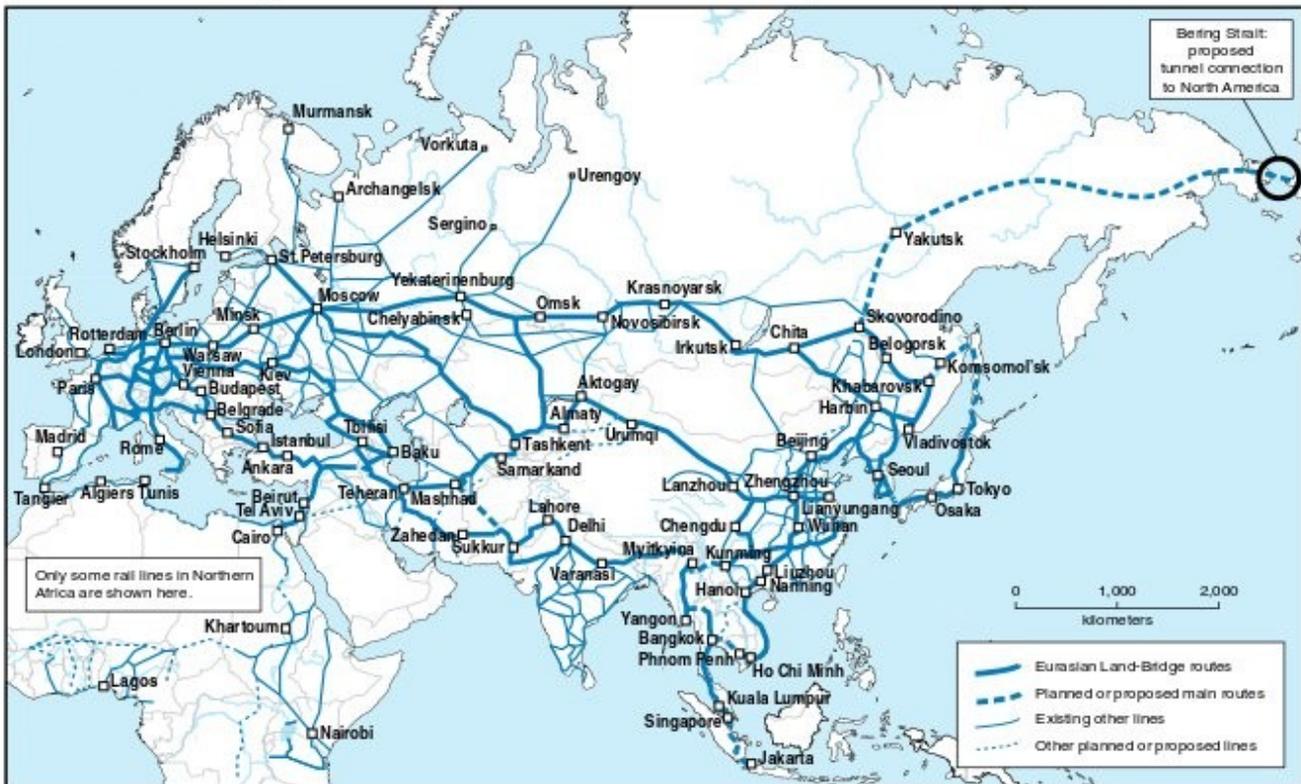
Now, first slide (**Figure 1**): This is a proposal we made, Mr. LaRouche, myself, and other members of our organization. When the Soviet Union collapsed—actually it started a little bit earlier—but when the Soviet Union collapsed in 1991, we proposed the Eurasian Land-Bridge, as a way to connect the population and production centers of Europe with those of Asia, through so-called development corridors. And we have campaigned for this program in the 24, or 25 years, since.

That is why, when President Xi Jinping announced a New Silk Road last year in September in Kazakhstan, we were extremely happy. We were extremely happy because we had thought of this Eurasian Land-Bridge as a peace order for the 21st Century. And then, when in the Fall last year, he added the idea of a Maritime Silk Road, this program developed. Then, in May, you had the extraordinarily important strategic summit between President Putin and President Xi in Shanghai, where they had many economic and other cooperation deals, including the 30-year cooperation in the gas delivery from Russia to China.

But then, the really big break came with the BRICS meeting in July in Fortaleza, Brazil, where virtually, the birth of a new economic system was announced. And at that point, you had not only the BRICS countries meeting, but in the following days, the heads of the BRICS states met with the leaders of the UNASUR [Union of South American Nations], of the CELAC [Community of Latin American and Caribbean States] of Latin America, and they agreed on many, many projects of cooperation.

And since July of this year, a completely new dynamic has developed in the world, which most people in the United States and Europe have no inkling of, because the mass media are absolutely not reporting on it. But as you will see, from what I'm going to say, an explosion of big projects has been agreed upon, or already started, and it has spread an unbelievable optimism, whereby even nations which are not part of the BRICS or the CELAC or UNASUR, have been encouraged to implement projects which have been on the shelves for decades, but because of the IMF conditionalities, were not implemented. Because the IMF would always say, no, you can't organize this project because you have to pay your debt first. You have to cut your health system. You can't invest in infrastructure. So, a lot of these projects were available, but they were not implemented.

FIGURE 1
Eurasian Land-Bridge: Main Routes and Selected Secondary Routes



But with the new dynamic, this has completely changed. And, for example, China is now in the process of helping to build a second Panama Canal through Nicaragua. China is also involved in building, for the first time in history, a transcontinental railway from Brazil to Peru, and other routes are also envisioned.

Other countries, like Egypt, are clearly in the dynamic of this optimism, and with the taking over of the government by General [Abdel Fattah] el-Sisi, they're building now not only a second Suez Canal; el-Sisi has promised a job for every young person in Egypt. They're building agro-industrial complexes. They're desalinating ocean water, and many other such things.

Besides China, which I will go into somewhat later, also India has completely been transformed, and there is an enthusiasm among the Indian population about the leadership role of Narendra Modi, the new prime minister, who has promised to build 100 new cities in India; to create 1 million new jobs every month. Now, that is an unbelievable change in the situation which really is—I have not seen in my whole lifetime, not during the time of the Non-Aligned Movement, at no time—that this really took place. And they agreed on many programs of nuclear cooperation among China, Brazil, Russia, Argentina, India. Also joint space programs. So it is a completely new situation.

A New International Financial Architecture

Now, before I go into these projects, I will address the issue which most people always ask: Who should finance all of this? It's the most pressing issue people have. It shouldn't be, but it is.

There are dramatic changes occurring: China has organized the Asia Infrastructure Investment Bank, and on Oct.

24 of this year, the cooperation in this bank was signed by 21 Asian nations. The initial capital in this bank will be \$100 billion. The BRICS countries had also agreed in Fortaleza to construct a New Development Bank, which has an [authorized] starting capital of \$100 billion. The Shanghai Cooperation Organization is also creating its own bank. The South Asian Association of Regional Cooperation, the SAARC, which just had a conference in Nepal, also will create such a bank. There will be a New Silk Road development fund, to kick off the Silk Road, of \$40 billion. The Maritime Silk Road will have an initial funding from China of \$20 billion.

And the BRICS countries also agreed on a so-called Contingency Reserve Arrangement, with capital of \$100 billion, that is designed to help participating countries in fending off attacks from vulture funds. Because these countries have drawn the conclusion from the big Asia crisis, from 1997—when such speculators a George Soros speculated the Asian currencies, in a couple of weeks, down, by up to 80%—that they will now protect themselves with such a fund.

If we can get the United States and Europe to join—which we are determined to really make the strategic issue number one—then even larger amounts of credit could be made available, and in that case, one would have to address the bankrupt trans-Atlantic financial system, and implement the Glass-Steagall reform, exactly in the way that Franklin D. Roosevelt did on the 16th of June 1933, and which led to a period of several decades of stability and growth in the financial system.

In the Congress, and in the Senate, there were several bills introduced for Glass Steagall. There are 200 national organizations in the United States which have signed a resolution for the implementation of Glass-Steagall. So it's not just an idea; it's a very real issue: how you address the non-resolved banking situation, which already in 2008, almost led to a meltdown of the world financial system, and obviously, [Glass-Steagall] needs to be revived.

Now, the theoretical basis for the Glass-Steagall separation of the banks, will also mean going back to the American System of economy, something which is not so well known any more. But Alexander Hamilton, the first Secretary of the Treasury, implemented a credit system in the United States, which is very, very different than a monetary system. And that system was successfully revived by Lincoln, with the Greenback policy. It was implemented by Franklin D. Roosevelt with the Reconstruction Finance Corporation; and it was the model for Germany, based on the Reconstruction Finance Corporation, and with the help of the Marshall Plan, to rebuild Germany from a rubble field, and turn a completely destroyed economy into the most admired economic miracle in the world, up to the point when China had their own economic miracle. So, what we are proposing is not some wild, utopian idea, but something which always, when the United States was prospering, was the basis of the financial system. And it has been successfully applied in other parts of the world.

Let's go to the next slide (**Figure 2**). This is the Eurasian landmass, and to the right, you have South America. This is a combination of links among continents, islands, and development corridors, which, as a totality, is a World Land-Bridge.

The first picture you saw was the Eurasian Land-Bridge which we proposed in '91, and in the last 25 years, we have worked on the expansion of that original idea to become a World Land-Bridge. And this is now our updated version, and this report [1] is a blueprint. If we want to get the world out of the mess, and if we want to have a peace order for the 21st Century, then that should be the issue of discussion of major governments around the world. I actually call on you, if you agree with only 90% of what I'm saying, then please help us to make sure, that everybody in the Congress, everybody in the government, everybody around the world, will talk about this.

The Projects

Now, I'll just go through some of these projects, not extensively, but just to give you an idea about the incredible amount of things which are already in consideration, or, in part, in construction.

First, we have Number 1; This is the second Panama Canal, which will connect the Pacific and the Atlantic Ocean. It will be going through Nicaragua, through Lake Nicaragua. It will be 278 km long. During construction, it will employ 50,000 workers. It will have two ports, one international airport, and naturally, a lot of supporting industries, like cement, steel, other infrastructure; so it will be a complete boost for the Nicaraguan economy, and it will take only five years to build, with mainly Chinese financing.

The second project (Number 2), up in the North, is the Bering Strait tunnel. This is a proposal to connect Alaska and Siberia, and build a tunnel in the gap in-between. This tunnel would be 85 km long, and connect the transport systems of Eurasia with those of America. This has been on the table since the 1800s.

There was, in 2007, a major conference in Moscow where Mr. LaRouche and I participated, and this was greeted with great enthusiasm by a lot of academicians from the Academy of Science—and these were all men over 80, but top scientists. And they were so enthusiastic about this proposal, that they said, "Oh, in 20 years, we will be able to travel from Acapulco through the Bering Strait, all the way to Mumbai, in a much shorter time than today

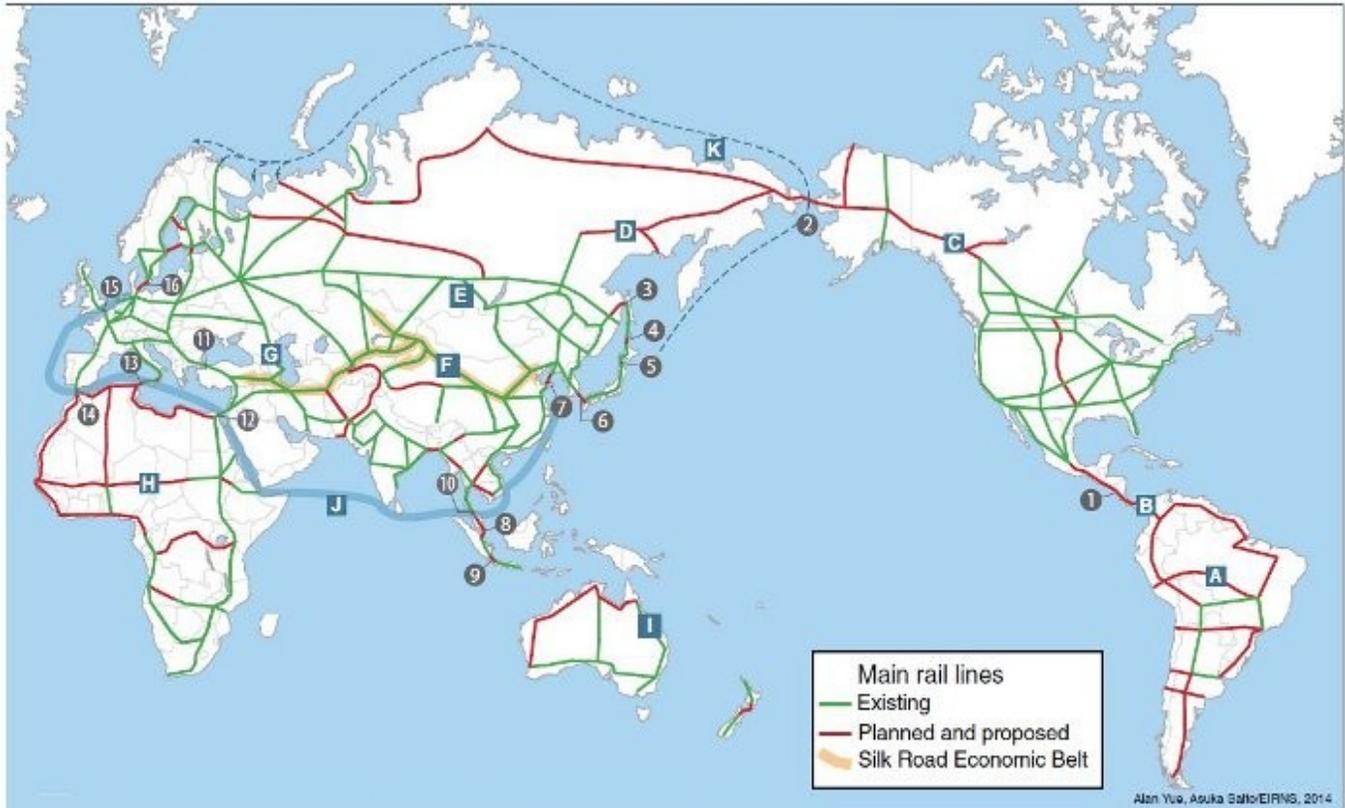
we can do by ship."

It was also proposed that the Alaskan port will be called LaRouche City, and the Siberian port will probably be called Granberg City [after Russian Academician Alexander Granberg], one of the authors of this project from Russia. China has already expressed great interest to participate in the construction of this.

Number 3 is the Sakhalin Island-Russia connection. This strait is 7.3 km at the narrowest point, and the idea is to build a tunnel from the southern end of Sakhalin Island, to Japan, and it would connect Japan with the Eurasian landmass.

The World Land-Bridge Network—Key Links and Corridors

*Committed, underway or completed.



- | | |
|---|--|
| <p>LINKS</p> <ul style="list-style-type: none"> ① *Great Inter-Oceanic Canal, Nicaragua ② Bering Strait Tunnel ③ Sakhalin Island-Mainland (Russia) Connection ④ Sakhalin-Hokkaido Tunnel ⑤ *Seikan Tunnel ⑥ Japan-Korea Undersea Tunnel ⑦ *Bohai Tunnel ⑧ Strait of Malacca Bridge ⑨ Sunda Strait Bridge ⑩ Isthmus of Kra Canal ⑪ *Bosporus Strait Rail Tunnel ⑫ *Suez Canal Expansion ⑬ Italy-Tunisia Link ⑭ Strait of Gibraltar Tunnel ⑮ *English Channel Tunnel ⑯ *Scandinavian-Continental Links | <p>CORRIDORS</p> <ul style="list-style-type: none"> A *Peru-Brazil Transcontinental Railway B Darion Gap Inter-American Railway C Alaska-Canada-Lower 48 Rail Line D The Bering Strait Connector E Trans-Siberian Corridors F *Silk Road Economic Belt G *International North-South Transport Corridor H *Cross Africa Rail Lines I Australia Ring Railway J *Maritime Silk Road K *Northern Sea Route |
|---|--|

Note: Geographical locations and corridors are shown schematically, with more than one railway combined as a single line in cases where major routes are parallel and in proximity. Maps within chapters of this report show greater detail.

Number 4, a tunnel between Sakhalin and Hokkaido; either a tunnel or a bridge, which would then link the Russian island with the Japanese island of Hokkaido. This would be at a length of 45 km, and would also connect Japan by rail to the Eurasian continent.

Number 5 is the Seikan tunnel, which opened in 1998. This is currently the largest and deepest tunnel in the world at 53.85 km, and was regarded as essential for the unification of the Japanese nation.

Number 6 is a tunnel between Japan and Korea, which connects Japan and South Korea at a length of 128 km.

Number 7 is the Bohai tunnel, which would be a tunnel under the Bohai Strait, of 100 km, making high-speed-rail connection between the two Chinese cities Dalian and Chantai, and this will take ten years to build.

Number 8 is the Strait of Malacca Bridge, which connects Malaysia and Indonesia, and that is already being financed since 2006 by the Chinese Eximbank. This is ongoing.

Number 10 is the Kra Canal, which would overcome the present bottleneck of the Strait of Malacca, which has very high traffic, and that will be either 50 or 100 km long, depending on the exact route. We have been

campaigning for that since, I think, the '80s, when Mr. LaRouche and I were conducting a conference in Bangkok, and now it is back on the agenda of the BRICS countries.

Then, Number 12, the Suez Canal expansion: This now has transformed Egypt completely, because, with el-Sisi taking over the government, he has announced that he will completely change the Egyptian situation, promising a job to every young person, and they have already built an enormous amount of kilometers since the Summer of this year.

Now, the expansion of the Eurasian Land-Bridge: We have already proposed a couple of years ago, to expand it into Europe, the Mediterranean, and to Africa. Now, as you know, with the Troika, southern Europe is an absolutely collapsing part of the world. Greece, Italy, Spain, Portugal—these countries are dying. You have an increase of the death rate, the collapse of the birth rate, the suicide rate is going up, the health sector is collapsing, and the massive, brutal austerity policy of the EU Commission is simply ruining these countries. And therefore, for Europe, becoming part of this, is a question of survival.

One project which we don't have here is the Italy-Tunisia link, which is the idea to build a bridge between the mainland of Italy and the island of Sicily, and from there, a five-track tunnel from Sicily to Tunisia. And we just had a conference in Frankfurt, where one of the authors, the engineer [Dr. Nino Galloni], one of the designers, spoke at this conference. [2]

Number 14: This is the Strait of Gibraltar. This is a very exciting project, which could start tomorrow, because between Spain and Morocco, already a couple of years ago, a feasibility study was made, and presented in 2009 to the EU Commission, which naturally, because the EU is motivated by different concerns—namely, to save the bankrupt European banks—they have not gone ahead to implement that. But it could start immediately.

The Development Corridors

Now, let's go to the corridors.

These are not just transport lines from A to B. When we developed the first Eurasian Land-Bridge, Mr. LaRouche was emphasizing very much the need to build corridors. That is, if you build a transport connection, like the Eurasian Land-Bridge, this was the idea to have an integrated system of fast trains, of highways, of waterways, and then have a corridor of about 100-km width, and then put in energy production and distribution, communication. And that way, create the infrastructure conditions for investment in industry, industrialization of agriculture; and that way, create the same kind of conditions for investment, as you normally only have at seaports, river systems, or the oceans. So, you bring the infrastructure into the land-locked areas of the planet, and that way, have a basis of overcoming the underdevelopment.

Now, Letter A: This is the transcontinental railway from Brazil to Peru.

Letter B: The Darien Gap. This would connect the Inter-American Railway all the way from Alaska to Tierra del Fuego, in Argentina. Presently, that connection is interrupted for about 100 km by the so-called Darien Gap, through swampland and forest, and it would bring a tremendous economic benefit to connect that.

Letter F is the Silk Road Economic Belt, which President Xi Jinping proposed, and that is already agreed upon, as of now, by 18 Asian and European countries. It will affect the economic life of 3 billion people on the planet.

Letter H is a cross-Africa rail-line system. The left side is the existing railway, and you can see that Africa, at this point, does not have one rail line from Dakar to Djibouti, or from the Cape of Good Hope to Cairo, because the colonial powers only would build railways from the raw material mining, to the port. That condition also exists in Latin America. If you look at the maps of Africa and Latin America, you do not have an existing intercontinental infrastructure system, and therefore, if you want to develop these two continents, really, an integrated railway system is the absolute precondition.

And Chinese Prime Minister Li Kejiang, who was in Africa this year, promised that China would help to connect all Africa capitals through a high-speed-rail system. And that is obviously extremely good; and the African countries are all much happier with such offers, than the Sunday sermons by EU officials, who say, you should do this, you should do that, but they don't deliver any infrastructure or other things.

Now, lastly, part of this is the Letter J, which is the famous Maritime Silk Road, which is really reviving the tradition, or the famous voyages, of the Chinese Admiral Zheng He in the 1400s, which was emphasized by President Xi Jinping also recently.

The Principle of Development

Now, why is this so exciting? Because if you really think about the arc of human development, it's a longer period—or not only human development, go back many hundreds of millions of years. And then you realize that the

evolution of life occurred on our planet going from the ocean, to the landmasses, with the help of photosynthesis. Then you had the development of higher biological organisms, and then finally, with the coming into being of mankind, mankind started to occupy that landmass.

In the beginning, they were settling along the rivers and ocean. But then, eventually people had the idea of building canals. One of the first ones to connect rivers was Charlemagne, who started to connect some of the European rivers, an effort which died after he died. But infrastructure development, inward into the continents, was a part of natural evolution of mankind.

And that evolution is now reaching, with the World Land-Bridge, that phase where we can open up all land-locked areas in all continents, for human settlement and habitation. And naturally, as the great German-American scientist Krafft Ehrlicke noted in a very exciting book [*The Extraterritorial Imperative*—ed.], the next phase of that infrastructure development will not stop at the planet Earth, but it will extend to nearby space, and the colonization of the Moon. Then from there, operating on nearby planets, asteroids, comets, from Earth, but with instruments which reach as the extension of the human senses, into near space and beyond.

So, you have to really look at this development as a long arc, and not say, we can't do this now. Look at all of this from the standpoint of the future. Think what enormous development mankind has made only in the last 10,000 years, since the last Ice Age, and then you have a completely different view of where we will be in 100 years—if we are not so stupid to destroy ourselves. Where will we be in 10,000 years? And you develop a much more optimistic view on what mankind is capable of doing.

Now, I should say that this entire report, and the previous efforts, are all based on the physical-economy theory of Mr. LaRouche. Now, Mr. LaRouche is the only economist who deserves that name, and I'm not saying that because I'm his wife, but because he's on the record of having been the only one who forecast every economic collapse, and every economic downfall, since 1971; but his first forecast was done effectively in the '50s. And he was always correct, while all the so-called monetarists—the Vienna School, the Keynesians, the Chicago School—they were all mistaken.

And they're using mistaken methods, because they're using statistics. They're using algorithms, one of the most absurd inventions ever, because it's the idea that you can predict human behavior on the basis of past behavior, which is completely crazy, because it eliminates creativity.

We are not robots, we are not machines, but the human species is the only species which is capable, again and again, to discover universal principles in science, in art, and in that way transform our mode of existence, by applying the results of these discoveries in the production process. And as you do that over a longer period of time, you increase the productivity of the production. You increase the productivity of the labor force. And you increase the living standard and the longevity of mankind.

Energy-Flux Density

That is uniquely what human beings, contrary to all other living species, can do. And Mr. LaRouche has developed a metric of how one measures that, and that is called energy-flux density. Because there is a direct correlation between energy-flux density applied in a production process and the living standard and the population density which can be carried at each point of the development of this process.

Now, most of you know the tragedy by Aeschylus, *Prometheus Bound*. This is a beautiful story, and it's not a myth, but it is the first, at least in writing, transmission of what technology and science can do for mankind. Because in this play, Prometheus describes, very, very beautifully, how the fire which he dared to bring from Olympus to mankind, transformed the mode of existence of human beings, by allowing for instrument production, agriculture, navigation, and all kinds of other benefits. And naturally, the evil god of Olympus, Zeus, chained Prometheus to a rock forever, having an eagle eat his liver as a punishment.

But Prometheus never regretted that he had done that [brought fire to man—ed.], because he loved mankind. And Friedrich Schiller said that that quality of Prometheus, of not regretting that he did that, despite the fact that he was tortured for eternity—that is the ability of mankind called the Sublime: that you stick to a noble principle,

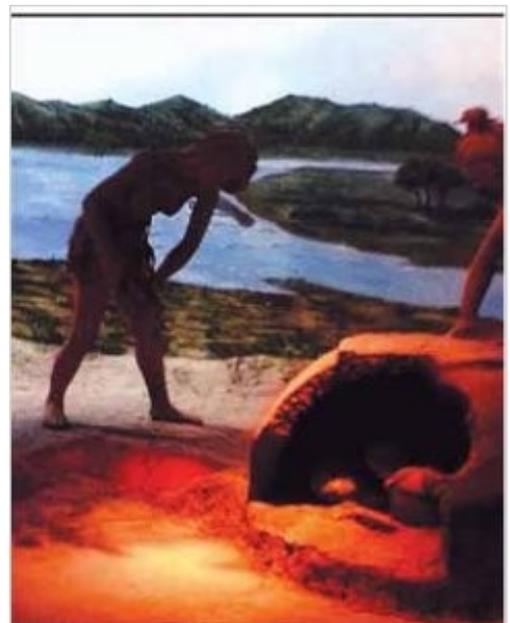


Figure 3. *The Use of Fire by Early Man*

despite the fact that the evil oligarchy is trying to move against it.

This is a picture from a museum (**Figure 3**), I think it was in Lanzhou, in China, which I had the fortune to visit this August, and they show, on the left side, this reddish spot is a fireplace; and there is a nice museum which shows actually, how, with the help of fire, mankind was able to really start to cook his food, start all kinds of techniques; so it was a big, big breakthrough, because if you don't have fire, naturally you have a very low productivity.

The Energy Density of Fuels

FUEL SOURCE	ENERGY DENSITY (J/g)
Combustion of Wood	1.8×10^4
Combustion of Coal (Bituminous)	2.7×10^4
Combustion of Petroleum (Diesel)	4.6×10^4
Combustion of H_2/O_2	1.3×10^4 (full mass considered)
Combustion of H_2/O_2	1.2×10^5 (only H_2 mass considered)
Typical Nuclear Fuel	3.7×10^9
Direct Fission Energy of U-235	8.2×10^{10}
Deuterium-Tritium Fusion	3.2×10^{11}
Annihilation of Antimatter	9.0×10^{13}

Now, if you think about the successively higher forms of chemical fire, you have the development from using wood, then you go to charcoal, to coal, to coke, eventually to fossil fuels, petroleum, natural gas, and these each time open up new technologies. So it was not just the higher energy-flux density in the fuel, but it always opened up new technologies, like metallurgy, new materials; and when you go to fission, and finally to fusion and matter-antimatter reactions, you will have an enormous change in the mode of production. Thermonuclear fusion will be the absolute change, because then you will have for the first time, energy and raw materials security, because we can just use garbage and turn it back into raw materials. So that is the way to go.

Now, if you look at the next slide (**Figure 4**), if you look at the increase of the energy-flux density, man without fire only has muscle to use, and then his capacity is about 100 watts, which is not very much. Now, 200 years ago, at the time the United States was founded, you still have a wood fire economy, that provided an estimated 2,400 to 3,000 watts per capita, which is already 30 times higher energy use than before the use of fire was invented.

Around the year 1920, when you had coal power, it was 5,000 watts, which was double the amount of the

Figure 4

wood-powered economy, which already enabled powered machines, transportation, early forms of electricity, and modern chemistry.

And with each move upward, that which was used as a fuel at the previous level, then could be used for other things. For example, you could use coal for chemical production; you can use oil, petroleum, such things, for chemistry and other things. And you're not wasting it by just burning it.

Now, today, obviously with nuclear energy, the whole issue of rare earth [elements] is becoming much more important.



Next slide (**Figure 5**).

This is the map of the nuclear power plants distributed around the world.

Next (**Figure 6**): This is an Indian prototype reactor.

Next (**Figure 7**): This is the Chinese EAST [tokamak] reactor.

Next (**Figure 8**): And this is an artist's rendition of the mining of helium-3 through the Chinese lunar missions.

Helium 3 and Fusion Power

As you know, China made a tremendous breakthrough last December, by landing its Yutu/Chang'e-3 lander on the Moon, and it is now planning to accelerate that with the aim to, in 2017, start bringing materials back from the Moon. And that is supposed to mine very large quantities of helium-3 on the Moon for future fusion production on the Earth.

And as I said, fusion technology is the absolutely *necessary* next step, in the evolution of mankind, because, as I said, it not only will mean tens of thousands of years of energy security, but it will also mean raw materials security, and therefore, will eliminate one of the big areas of tension in the world, namely, scarcity and hunger and poverty.

With fusion, the power rates for an average citizen in the United States would go up to 40,000 watts per capita, and if you compare that to an average of 2,400-3,000 watts, which is about the level of what the United States had 200 years ago, you can see the enormous need to have more energy production and high energy-flux density.

Now, Mr. LaRouche has also developed a unique measuring rod, to determine if an investment is productive or not. And that is the correlation between the energy-flux density and the potential relative population density, which is made possible through that level of energy-flux density. The category of "relative" refers to the quality of the land, and the improvements made by human beings to it, and the "potential" level means what can be accomplished through higher energy-flux densities.

Now, each level of such development is always restricted by the physical principles which are known to humankind at that point, and the ability to implement them; and obviously, each time you have a breakthrough, it redefines the entire economic platform. So each time you reach a qualitative breakthrough, every single aspect of the economy is being redefined.

So therefore, if you look at the development of the breakthroughs of the last 10,000 years: You developed physical chemistry; this transformed agriculture, irrigation, modern science, as it was developed in the period from the Middle Ages to modern times, through such thinkers as Brunelleschi and his construction of the Cupola of the Cathedral in Florence, which was a completely new breakthrough in architecture; the scientific basis for *all* modern science developed by Nicholas of Cusa; the discovery of gravitation by Kepler.

And then, if you think that we are now really at the verge of reaching a completely new paradigm of civilization, where mankind will no longer only look at the planet, but we will look at the planet from the cosmos, from the laws of the universe, from the idea how does the Solar System function; what can we do from the standpoint of space research to protect the

FIGURE 6
India's Prototype Fast Breeder Reactor, Kalpakkam



FIGURE 7
China's EAST Tokamak Reactor, Hefei



FIGURE 8
Mining Helium-3 on the Lunar Surface
(Artist's rendering)



planet? And then we will no longer have so few astronauts that we will squabble over so-called “geostrategic interests,” but that we will define the common aims of mankind, and really grow up as a human species.

Solving Water Scarcity

One very big problem which we have to solve in that, is the scarcity of water. Here (**Figure 9**), you have a map of the major deserts in the world, and you can see that from the Atlantic coast of Africa, all the way—the Sahel zone, the Sahara, the Arab Peninsula, the Middle East—all the way to China, you have one gigantic strip of desert, and that desert is growing. And it has been growing since the end of the last Ice Age. So then naturally, you have other deserts elsewhere.

Now, this creates a problem, because not only the desert, but also the desolate condition of many countries, mean that presently 4 billion people—that is more than half of the human species—do not have safe drinking water, or water for sanitation. Now obviously, that impacts food production, it limits the industrial capacity, and the industrial capacity today is already much below what is needed to nourish and maintain the livelihood of 7 billion people.

Seventy percent of the Earth’s surface is covered by oceans, so we don’t have a lack of water. It is the question of how we manage this water, and how we use this water. So this 70% is 100,000 times what the U.S. population uses, in terms of water, during one year: So it’s plenty of water.

Now, water, contrary to other raw materials, is not a finite source, which you use and then it disappears, but it functions in a cyclical type of characteristic, where it’s moving constantly from one state into the other (**Figure 10**). You have it in the form of liquid water in the oceans; it’s frozen on the icecaps; it tends to become atmospheric vapor once the Sun heats it up, and then it precipitates and goes back to the oceans. It participates in different processes in the oceans, in living bodies, in production processes and so forth. And, with each new development, and each higher energy-flux density, moving from fission to fusion, we are now, for the first time, in a position where we can manage the entire cycles of continents, of water transformation, and also create new cycles.

With desalination, which will be possible in large quantities through fission already, we can green the deserts. As part of this World Land-Bridge report, we have designed a program, whereby, if you take the entire area from the Caucasus to the Gulf States, from Afghanistan to the Mediterranean, which is essentially desert, and you apply the use of aquifers, the redirection of rivers, and the desalination of large quantities of ocean water, you can reconquer the entire desert. And you can also develop the precondition for new cities, for infrastructure. And the aim is to provide eventually an infrastructure of the density like we have it in Germany.

Germany is a perfect model—it’s now becoming less so, but it used to be a perfect model of integrated infrastructure of river systems, like the Rhine; then you have river ports; then you go to container trains, and only the end goes by truck. You should not block the highways with trucks: It’s bad for everybody, including your nerves and your health, and so forth!

So we will be able to do that, and with fission, but especially with fusion, we will do what the great Russian scientist Vladimir Vernadsky prescribed for mankind: that we will start to take over the job of the Sun on Earth, that we create weather cycles, and transform the surface of the planet.

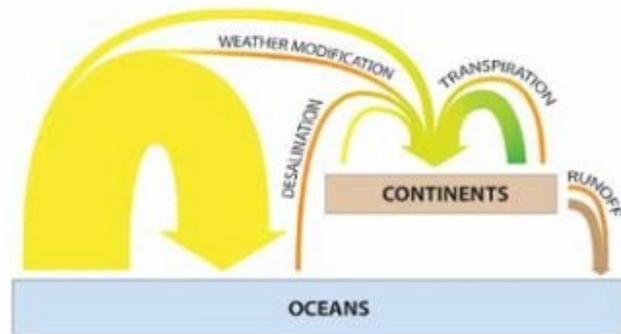
This is urgent. This is not just some nice academic idea. If you think that there are 900 million people who have no safe water to drink; you have 2.6 billion who have no sanitation systems, due to a lack of water, and this already abysmal condition, which is not worthy of the dignity of man, is made worse by insane techniques, like

FIGURE 9



FIGURE 10

Global Terrestrial Water Cycle Under Mankind’s Control



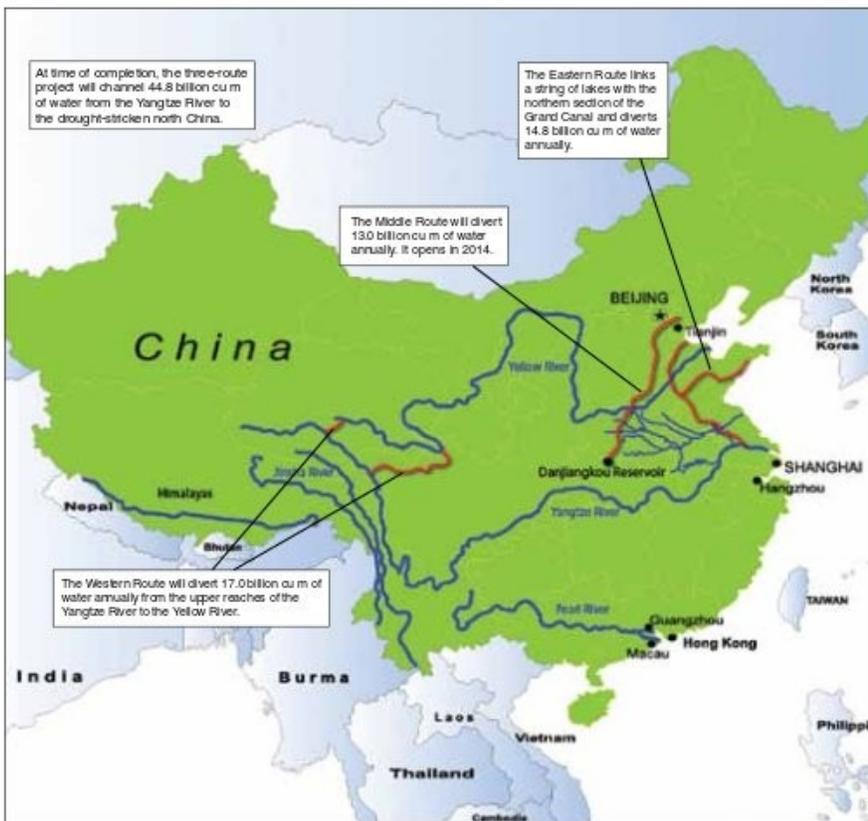
fracking, which is really completely stupid from a standpoint of physical economy. You use a higher form, namely water, to extract a lower form! And it's simply, economically, a very short-sighted thing; and, even more criminal, or equally criminal, the use of food, in a starving world for fuel—biofuel!

Solving the Water Crisis

If we want to create new water, as I said, in many cases we can tap into the aquifers, which are many, and I don't have a map here, but there are known aquifers with large quantities of water, in all continents. But the problem is, it replenishes too slowly for the pace of human development. There is also an enormous amount of freshwater precipitation over the continents, but it's very unevenly distributed, and the only way you can remedy that is by the development of basic infrastructure. You have to build canals, dams, reservoirs, pumps, irrigation, water purification, sanitation and so forth. And that is also extremely underdeveloped in many continents.

There are two or three examples of large-scale water management; one was Franklin D. Roosevelt's Tennessee Valley Authority project, which still is in part functioning today; but in the present day, there are only two ways to resolve that water shortage: One, again, is China. The China South to North Water Transfer System (Figure 11), which is a proposal which we made in '91 in our original Eurasian Land-Bridge concept; and in the meantime, China is well along in doing that, by redirecting the flows of the Yangtze headwaters Fountain Spring area, which is very rich in water, and redirect that to the Huang Ho [Yellow River] basin.

FIGURE 11
South-North Water Diversion Project



And it has different routes: The eastern route became operational in December 2013, and brings water to the eastern provinces of Jiangsu, Anhui, and Shandong; by the middle of 2015, the Middle Route Project will be completed, which will bring water to Beijing and Tianjin and the neighboring regions; and this September, testing for this began. And the Western Route is still in the planning stage.

Now, very excitingly, at the recent SAARC summit in Nepal, Prime Minister Modi announced a similar gigantic project for India. He discussed the feasibility of linking the Sharda River, which flows through the Himalayas, north-south along the Indian-Nepal border, with the waters of the Yamuna River, which flows from west to east in the Ganga Valley, and the Prime Minister of Nepal, Sushil Koirala, agreed that India and Nepal would build this together.

This all goes back to the time of Indira Gandhi, with whom, as some of you know, we cooperated on a 40-year development program for India at the time, namely, a National

Water Development Authority, which she initiated in 1982; and that institution had worked out a proposal to have 30 rivers in India linked through canals, to build up storage structures, for example, 3,000 storage structures, to build a canal of almost 10,000 miles long, and all of these projects were designed to create 34 GW of hydropower, irrigation for 35 million hectares of agricultural land, to transfer 175 billion cubic meters of water per year. And that would have tremendously increased food production, protected the population against floods and drought, and reduced the imbalances of the water precipitation in the different regions. And Prime Minister Modi just has announced that he wants to revive all that.

So I think this is absolutely fantastic.

China's Economic Miracle

Let me just spend a couple of minutes on the Chinese economic miracle, because that is key to understand the tremendous potential all of this has.

China has completed an economic miracle in 30 years—what many industrial countries needed several centuries to accomplish. What Europe, the United States, needed 200 years to do, China did in 30 years.

I was, for the first time in China, in 1971, in the middle of the Cultural Revolution, and China was *completely* undeveloped. I was in Shanghai and Beijing, and other cities, and for 100,000 bicycles, you had 1 car. And it was totally undeveloped. And if you go to China now, especially since the economic reforms of Deng Xiaoping, China has *completely* changed.

Admittedly—and the Chinese government is the first to admit that—there were some mistakes made in the beginning of this development, when China accepted to be a place for cheap-labor production for the export markets of the United States and Europe, which has resulted in some environmental problems which now need to be corrected.

But since about 10 years ago, I would also say that China has moved more and more away from simply copying other countries' technologies—and nobody should make a big fuss about China copying technologies; as long as the NSA shoplifts technologies around the globe, I think we should better leave that issue aside! And also, you know, every country does that! It's simply a known secret that every country does it, so don't make a big fuss about it.

But since about 10 years ago, in many important areas, China has moved away, and is becoming an inventor of new technology! And the best example is the already mentioned Yutu and Chang'e lunar mission; China is now very ambitious to become the leading space nation in the world, maybe together with Russia and India, by the year 2030. But I think they are on a good track to do better than that.

China therefore is pursuing a science-driver approach and puts a lot of emphasis on higher education of its young people. Just to mention a couple of the extraordinary infrastructure projects of the last two decades: China has built the largest dam in the world, the Three Gorges Dam, which opened in 2008, which is generating 22,500 MW of electricity per year, and also helps to control the floods on the Yangtze, and therefore saves the lives of thousands of people.

It has built an 11,028-km-long high-speed-rail track since 2000, and will have completed 18,000 km by 2015. And I can tell you from my own experience, China has now developed a high-speed-rail system which is really the best in the world. I traveled from Beijing to Shanghai on a Chinese-made high-speed train which was more quiet, more calm, more steady, than any other train I have ridden on in Europe or the United States, ever. So I would say that the Chinese fast-train system is the trademark for China, like what the machine-tool is for Germany. I think the fast-train system is, for China, like the poster child.

It has also the only commercial maglev in the world, from Pudong to Shanghai inner city. It has the greatest water-transfer program in the world, which I just mentioned. And it has expanded the manufacturing work force from 85.9 million in 2002, to 105.9 million in 2012, which is now three times the labor force of the U.S., Japan, and Germany *combined*. And, the work forces of these three countries declined in the same period by 10%, down to only 32.9 million.

China also has started, in the last decades, to built 100 new cities of up to a million inhabitants each, and they have a commitment of building 100 more new cities by the year 2020. They have already built 21 nuclear power stations, with 28 more in construction, which will triple the nuclear production by 2020, at which point, it will still only mean 6% of the entire energy requirements will be coming from nuclear, compared to 74% in France, for



China's high-speed/maglev train system is the best in the world. Shown: the maglev train in Shanghai.

example; but compared to the zero percent in Germany by the year 2020, it will look very good. And I'm very unhappy about the exit from nuclear energy, which is one of the two ways Mrs. Merkel is destroying the German economy.

The Counter-Example: The Trans-Atlantic Sector

If you look at that, the New Silk Road is really nothing but the offer by Xi Jinping to extend that economic miracle to other countries, and whoever wants to participate, can, because it's an open concept. And, given the fact that you have a lot of propaganda, and the people in the trans-Atlantic sector are in a very bad mood—if you ask people in the United States or in Germany, "Let's do this," they say, "Oh, no! You can't do it, you can't do anything anyway."

And people are culturally very pessimistic, through the paradigm shift which has taken place in the last 50 years, especially since the assassination of John F. Kennedy, who was the last President who had that kind of a policy for the United States. Remember the Apollo Project; remember the idea to overcome poverty in the developing countries, which Kennedy was in the process of doing. That all stopped with the his assassination. And the takeover of more and more banking interests, more and more environmentalism, greenism, which has resulted in the present desolate condition of Europe and the United States.

People are so convinced that politics is "dirty"—look at the recent midterm elections, which even the *Washington Post* admitted were bought by "dark money"! What does that mean, "dark money"? If the nature of dark money is dark, therefore, nobody knows where it comes from; if it can buy Senate and Congressional seats, maybe then, the issue of democracy in the United States is not doing so well! For the people who are so upset about Hong Kong, if dark money decides the U.S. election, maybe we need a democratic movement in the United States! (We do, actually—it was not a rhetorical question.)

Therefore, because people are living under this kind of a world outlook, they cannot imagine that what China is offering, and what the BRICS countries are offering, is something different. They say, "There must be an evil plan behind it! China is trying to take over the world! India's population will outnumber the world soon, all by itself!" So they cannot imagine that there is a completely different philosophy.

But I insist that there is, and I would like to challenge all of you, to look at it, yourself: Look at the policies of Modi. Modi, for example, recently made a beautiful speech, where he said the BRICS represents the first time there exists an alliance of countries which is not bound by their present capacity, but by their future potential. India has a very young labor force—I think 60% are under 30 years old, something like that—it has an unbelievably young labor force, which is now in the Modi revolution: the idea to educate them, and then provide a labor force for other countries which have demographic problems—like Germany, for example, which is shrinking; Italy, Catholic Italy is shrinking! They have the lowest birth rate in Europe, maybe even in the world! So India is offering to help there.

And I have come to the conclusion, that what *especially* President Xi Jinping expresses—and I have read *many* of his speeches, not all of them, but a lot of them, and I looked at his policies—and I have come to the conclusion that China right now is engaged in reviving the 5,000-year-old history of China, by not focusing only on the creation of the People's Republic after '49.

For example, China is involved in a major restoration of ancient cultural treasures. For example, I visited, in my trip in August, the Dunhuang Mogao Grottoes, which is a Buddhist grotto spanning over hundreds of years, or even more than a thousand years, and is one of the great relics of the Buddhist religion. They've digitized images from these grottoes, so that more and more people can go and study the ancient history.

The ancient Silk Road is one of the most exciting things to look at (**Figure 12**). The ancient Silk Road was an exchange of goods, but also technologies: silk producing, porcelain producing, gunpowder, paper-making, book printing—technologies were exchanged! Knowledge was exchanged, and brought all participating countries forward. The same goes for the New Silk Road, but with modern technologies: Fusion power, space travel, and other vanguard technologies will bring mankind forward.

Confucian Philosophy

Xi Jinping recently had a major conference in Beijing, meeting with the foreign policy bodies—the Politburo, the Standing Committee, all the major bodies—and he laid down a comprehensive approach of Chinese foreign policy, which has many elements. It has the Silk Road, the Maritime Silk Road, the BRICS collaboration, the new model for major power cooperation, and all of these are based on principles which we in Europe knew from the Peace of Westphalia: the absolute respect for the sovereignty of another country; the non-interference; not using your own advantage to overpower another one; and just have the kind of peace basis the world now needs!

And this is very much in line with Confucian philosophy, which after all, was created by Confucius as a reaction to

the previous period, when China was involved in wars and disunity; and therefore, the key philosophy about the Chinese outlook is the desire to have a harmonious world.

That's what people don't understand here, but I can assure you, I have enough of my own experience and studied it, and I can assure you it is exactly what is true. China has completely rejected the 10 years of the Cultural Revolution, and never wants to have again such a disruption of society, and wants to really have harmonious relations with all neighbors and all countries of the world.

FIGURE 12

Sun Yat-sen's Vision of a China Rail Network



The same goes for India: India has a beautiful, almost 5,000-year-old history, going back all the way to the Vedic writings, which have fundamental principles about the order of the cosmos, and why the political and economic conditions on the planet must be brought into cohesion with the laws of the cosmos, the laws of the physical universe. And these countries believe that! It's their philosophy!

If you don't believe me, I would challenge you to study it, and remedy and correct your views which come from the *Washington Post* and such papers. And they're really not truthful at all.

The German philosopher Hegel, who I normally don't like, because he was a step down from Friedrich Schiller, but he wrote in his *Phenomenology of the Mind*, one sentence which I think applies, and that is that the servant, the

lackey, the valet— *der Kammerdiener* —cannot imagine that his employer, whom he serves as a valet, can be a world-historical individual. And Hegel says: This is not because the world-historical individual is not a world-historical individual, but because the valet is a valet.

And that is, I think, why the Europeans and the U.S. *cannot* imagine that these countries are different.

So I think that that is the reason. And what we have to do is we have to organize reasonable forces, in Europe—and you wouldn't believe it, but there are such forces, despite the present appearance of Mrs. Merkel, for example, who has joined Mr. Cameron with her confrontation against Russia—I think it's very stupid and bad. We have to talk to the industries, to trade unions, to many, many other groupings and tell them: Look, why don't you join? Join the BRICS, join the Silk Road and join the reconstruction of the planet, and let's move together to the next era of civilization, which is the next phase of evolution, in which the identity of mankind will be more and more that of a creative species.

I think, and that's been my conviction for a long time, if we manage to get out of this present geopolitical squabbling, over raw materials, over territorial gains, over all of these things, we can really understand that we, as mankind, can only survive if we have the view of the astronauts. All the astronauts who come back from space say, "When you look at the planet Earth from space, you don't see borders, you don't see conflicts, you only see one planet! One mankind!"

And I'm absolutely convinced that we have to come to this kind of collaboration on the common aims of mankind, and define the present from the future; that we think, where do we want mankind to be in a hundred years from now, in a thousand years from now, in 10,000 years from now—and we want mankind to exist then, don't we? Then, let's throw overboard all



Confucian philosophy was created by Confucius (551-479 B.C.) as a reaction to the previous period, in which China was rent by wars and disunity; still today, the Chinese outlook is characterized by the desire to have a harmonious world.

these stupid axiomatic assumptions which presently conduct policy, and which are bringing us to the brink of extinction, because we are close to that if this stuff against Russia and China continues.

I think what is needed, therefore, in the United States, is exactly what Prime Minister Modi called for for India, “a mass movement for development.” I think we have to intervene; for example, we shouldn’t have marches because of Ferguson; what happened. This will not remedy the situation. But if we would bring development into the United States, into Mexico, into the Caribbean, into Latin America, where it is already happening, all these problems would be solved! The problem of the United States is not race. Sure, you have racial conflict, but if you would have the same kind of excitement, like we see right now in China, in India—in India right now there is complete enthusiasm about what Modi is accomplishing—if we had that in the United States—. You have right now droughts in California, in Texas; there are now many towns where you have water being brought in to distribute, because it’s already dry! People are setting up mobile showers, for people to be able to shower. They’re transporting hundreds of thousands of beef cattle, because there is no grass any more there. Don’t you think it would be time to have real development projects, as we see in China, in India right now? Can we not build a hundred new cities in the United States? Or at least five, I mean, let’s start modestly: five new cities, science cities, beautiful cities: Give people hope! Right now!

Let’s close down Wall Street and create hope in the United States.

* EIR December 12, 2014 Vol 41 No. 49 larouchepub.com

[1] EIR [Special Report](#): “The New Silk Road Becomes the World Land-Bridge,” December 2014.

[2] Complete conference coverage can be found on the [Schiller Institute website](#)



**Video from The New Paradigm Weekly Report:
Michael Billington on `The New Silk Road Becomes The World Land-Bridge.**

<http://www.comiterepubliquecanada.ca/article5353.html>

II. RECENT PROJECTS OF THE BRICS NATIONS AND THEIR ALLIES

- Wang Mengshu: Building a Railway Is Far More Meaningful than Fighting Wars
- President el-Sisi in China: Egypt Will Be a Mainstay of the New Silk Road
- Russia/India Nuclear Agreements To Build Plants, and Cooperate on Education, Manufacturing, and R&D
- China Signs Accords to Help South Africa Develop Nuclear Power
- The Chang'e-5T Service Module Is Off to Deep Space; Will Return to the Moon

Wang Mengshu: Building a Railway Is Far More Meaningful than Fighting Wars

24 December

"When people talk of watches, they think of Switzerland. When they think of small electronics, they think of Japan. When they think of space, they think of America, and talking about machinery, they think of Germany. Now when they think of high-speed rail, China becomes the brand name."

Wang Mengshu
Global Times

LPAC—Wang Mengshu, quoted extensively in the newly released EIR Special Report "[The New Silk Road Becomes the World Landbridge](#)" discussing China ambitious rail projects, was interviewed by the *New York Times* on Dec. 18, promoting the Bering Strait Tunnel and US-Canada-Russia-China cooperation.

Described by the Times as "one of China's top railway construction engineers and a scholar with the Chinese Academy of Engineering specializing in tunnel and underground projects," Wang told the Times that the Bering Strait tunnel was "a wish and a dream of not only China's railway experts but also railway engineers in Russia, Canada and the U.S. whom I have spoken to."

He continued:

"The technology developments in recent years in high-speed railway and underwater tunnels make it possible. It is a dream, but one that is within reach. The Chinese central government is not seriously considering it, not yet. But why not? We have the technology, and it is a good thing to do. It would benefit generations to come, and the environment.

"As railway engineers, we think it would be a great legacy to leave for future generations. It would connect continents. It would be a grand structure of human engineering."

On the technical feasibility, Wang said:

"It is merely a little over 200 kilometers. We have the technology. It is technically feasible. The Bohai Bay tunnel, 125 kilometers between Dalian and Yantai [on which Wang is the senior engineer], has already passed the scientific feasibility debate and entered the 13th Five-Year Plan. Building tunnels is not about the length. It has more to do with how deep it is in the sea than length."

He added that it is now entirely a political question:

"It depends on whether governments of the four countries can work together, make this dream come true and leave this amazing legacy for our children. And that depends on how the governments of the four countries prioritize. Some governments like to spend their resources on fighting wars. I think building a railway is far more meaningful than fighting wars. I believe the priority of the Chinese government is to serve the people. If other governments can also make serving the people a priority, this railroad will become a reality."

President el-Sisi in China: Egypt Will Be a Mainstay of the New Silk Road

24 December

EIRNS—President of Egypt Abdel Fattah el-Sisi began his historic official visit to China, declaring:

"Egypt will be a mainstay in the initiative of Chinese President Xi Jinping to revive the ancient China's Silk Road trade route."

el-Sisi arrived yesterday, for a four-day visit. In his speech before the Egyptian-Chinese business council, el-Sisi added that the new Suez Canal Development Project will be crucial in the Silk Road initiative .

A statement by the Egyptian Presidency prior to the visit, declared that the visit will be "marking excellent relations between the two countries. This visit will usher in a new phase of relations between the two countries, as China has expressed an interest in promoting their relationship to the level of 'strategic partnership'—a level China maintains with only a limited number of countries globally," Presidential spokesperson Alaa Youssef said in the statement.

The visit includes meetings with Chinese President Xi Jinping in Beijing, and with other officials, including Prime

Minister Li Keqiang, National People's Congress Chairman Zhang Dejiang, Minister of Commerce Gao Hucheng, and Minister of the International Department of the Chinese Communist Party Central Committee Wang Jiarui.

el-Sisi extended an official invitation to visit Egypt to Chinese President Xi Jinping, following an official reception held for the Egyptian President at the Great Hall of the People today. The two leaders announced the establishment of a "bilateral comprehensive strategic partnership."

The two nations will sign 25 agreements, mainly in energy and transport, according to the State Information Service of Egypt. High on the agenda are economic development projects and cooperation in science and technology.

Some of the highlights so far include:

- Discussion on the construction of a high-speed train to connect Alexandria, on the Mediterranean coast, south to Aswan, near Sudan;
- An electric railway network in the densely populated Cairo-Nile Delta region;
- Meetings with private Chinese companies at which el-Sisi will sign agreements with the Egyptian-Chinese Business Council, and hold meetings first with representatives of China's top 20 economic groups, and then with 100 companies and 25 tourism companies.

Speaking before the Egyptian-Chinese Business Council, el-Sisi said, "I come bearing a message from the Egyptian people, who made two revolutions within three years in order to regain their country and redirect their revolution to the right direction. This population is now inviting you to form a serious partnership and have constructive cooperation to achieve development." He invited his hosts to attend the Egyptian investment conference in Egypt next March.

el-Sisi will visit one of China's main industrial hubs, the city of Chengdu, to tour factories and plants specializing in energy and technology.

On Dec. 23 el-Sisi held a meeting with presidents of Chinese universities, whom he asked to provide more scholarships for Egyptian students to study in China, and for Chinese students to study in Egypt, and thereby enhance bilateral cooperation in education and training. In addition he called for an Egyptian-Chinese initiative to expand joint cooperation in science and technology, and technical education, so that Egypt could achieve the desired progress. This could be furthered, he said, by Chinese universities creating establishments in Egypt to make good use of China's scientific and technological progress, el-Sisi added.

Having established diplomatic relations in 1956, Egypt was the first Arab country to recognize the People's Republic of China. China is Egypt's second-largest trading partner globally, with bilateral trade totalling \$10.3 billion in 2013, of which \$1.9 billion comprised Egyptian exports to China and \$8.4 billion imports from China, according to government figures.

Russia/India Nuclear Agreements To Build Plants, and Cooperate on Education, Manufacturing, and R&D

13 December

EIRNS—During Russian President Vladimir Putin's visit in India yesterday, an array of nuclear cooperation agreements were signed, covering three broad areas. The first, is specifically to build the 3rd and 4th Russian reactors at Kudankulam, which will "operationalize" the General Framework Agreement signed in April for the two plants. Russia built the first two reactors at the site, which can accommodate probably a half dozen more plants. The two sides, however, have to renegotiate the price, because Indian law requires that the reactor vendor carry all the liability, should anything go wrong. This has caused Russia to increase the cost of the plants to India, because the original agreement did not have the liability requirement in it.

Second, there was a Strategic Vision for Strengthening Cooperation in Peaceful Uses of Atomic Energy, under which Russia will build additional reactors. Prime Minister Narendra Modi said there would be "at least 10 more reactors." He said that "it will include manufacture of equipment and components in India," which "supports our Make in India policy." Looking farther ahead, Putin said that the document "contains plans to build over 20 nuclear power plants in India," that Russia could build over a longer period of time, and offered that Russia was able and anxious to do so. Putin also said that there will be cooperation in building Russian-designed plants in third countries, meaning Indian components for Russian-built plants that are sold to other countries, indicating Russia's

confidence in Indian manufacturing. Rosatom director Sergei Kiriyyenko reported that Russian nuclear plant orders over the next ten years now top \$100 billion.

Third, there will be cooperation in R&D on innovative nuclear plants, including thorium reactors. Russian nuclear specialist Oleg Tashlykov, professor at the Russian Federal University, nuclear energy department, who was obviously on the trip, was very impressed with India's fast breeder reactor technology: "We were quite surprised by the development in India," he said. "India is the leader in fast breeder technology. It is a crucial part of India's nuclear strategy."

China Signs Accords to Help South Africa Develop Nuclear Power

6 December

EIRNS—During President Jacob Zuma's visit to Beijing, yesterday China and South Africa signed a series of accords, including a Memorandum of Understanding, to advance South Africa's nuclear energy industry. South Africa will soon choose the vendor that will build its new nuclear plants, and is preparing the groundwork for that expansion.

According to [World Nuclear News](#), the MoU was signed by the Nuclear Energy Corporation of South Africa (Necsa) and China's National Nuclear Corporation (CNNC) to officially establish a partnership, through which CNNC will support South Africa's industry.

A second agreement, a framework one, enables cooperation on the financing of new nuclear power plant construction in South Africa, through China's State Nuclear Power Technology Corporation, the Industrial and Commercial Bank of China, and South Africa's Standard Bank Group.

And the third agreement will provide training to about 300 South African nuclear professionals, including in-service training. It will be launched in March 2015.

During his visit, Zuma told a meeting of the China-South Africa Business Forum that South Africa regards the Memorandum of Understanding on nuclear cooperation "as a mechanism which will enhance mutual exchange of information, best practices, and lessons learnt in the nuclear energy sector, which will also encourage and identify additional opportunities for cooperation."

The Chang'e-5T Service Module Is Off to Deep Space; Will Return to the Moon

6 November

LPAC —After releasing the Return Module that landed back on Earth Nov. 1, the Service Module on the Chang'e-5T mission, which does not come back, has been reassigned a mission further in space. It is headed to the [Earth-Moon L-2 libration point](#), where, 37,000 miles past the Moon, there is a gravitational balance between the Earth and Moon. A spacecraft can "park" there, virtually motionless. The Chang'e-2 lunar orbiter was similarly repurposed, sent to the L-2 point, and then on to a fly-by of near-Earth asteroid, Toutatis.

But [space scientist Emily Lakdawalla](#) reports today that, according to *China Military Online*, the Chang'e-5T Service Module will not stay at the L-2 point, or travel further, but will return to lunar orbit. It then could provide communications support for China's future missions to the Moon.

Lakdawalla explains that with an orbiter in place, a future Chinese lunar lander would not be limited to sites that are in line-of-sight with the Earth, but could even be placed on the lunar far-side, which is poorly explored, never seen from Earth.

There is speculation that there will be a Chang'e-4 mission, which would re-do, likely with significant up-grades, a lunar lander and rover mission, to augment what was learned on the Chang'e-3 lander and Yutu mission, last December.

III. ONLY NUCLEAR ENERGY CAN PROVIDE THE REQUIRED ENERGY-FLUX DENSITY FOR THE SUCCESS OF THE BRICS DEVELOPMENT DYNAMIC

Interviews :

- *With Ramtanu Maitra*

The BRICS Development Paradigm and Canada's Noble Task

- *With Dr. Srikumar Banerjee*

Nuclear Fission: Humanity Is Missing Out On a Good Opportunity

- *With Dr. Ahmed Hussein*

The Dual Fluid Reactor - The Public Is Ready For Nuclear Power

Interview with Ramtanu Maitra

The BRICS Development Paradigm and Canada's Noble Task

Reviving the CANDU Spirit

21 November

Ramtanu Maitra is a nuclear engineer and the New Delhi Bureau Chief for Executive Intelligence Review who has played a central role with Lyndon and Helga LaRouche for over thirty years to bring about what has now emerged with the BRICS development paradigm. He was interviewed on November 21, 2014 by Robert Hux for the Committee for the Republic of Canada.

Robert Hux - There is a dramatic change around the world with the emergence of a New Just World Economic Order associated with the BRICS nations (Brazil, Russia, India, China and South Africa). What do you have to say about this?

Ramtanu Maitra - Well, I think that this is a natural evolution of things which, in fact, should have happened before. Failure of the old international economic order, steered by the trans-Atlantic nations, has created a situation in which there was absolutely no incentive, or cash, available to the developing nations to develop. In the meantime, the population was going up, the requirements were becoming larger.

The BRICS really is the name coined by a Goldman Sachs fellow. His name is Jim O'Neil, I think. But it consists of five nations —Brazil, Russia, India, China and South Africa. Now what was already happening before, is that within the Eurasian landmass, the Chinese were already developing since 1980. Then they reached a point whereby to continue with their growth, they needed to interlink Asia with Europe, through what they call the New Silk Road. Now, they have added an additional item, which is the Maritime Silk Road, which is by going to Africa, Ibero America and North America, etc. by sea.

But before the BRICS came to life in 2014, China had already started doing this. Then, a couple of things happened. The first, to begin with, particularly in Brazil in July of this year, Dilma Rousseff of Brazil, South Africa's Jacob Zuma, Russia's Vladimir Putin, India's Narendra Modi, and China's Xi Jinping got together. All five of them seem pretty dynamic. They wanted to go ahead and develop their areas, and they also made evident that the old international economic order is completely bankrupt, because it has been looted by the financial districts and the bankers and speculators of western nations.

So, I would say that the BRICS were around for a few years. It came to life at Fortaleza in Brazil, when these five leaders, of which Modi was the newest one, and Xi Jinping was pretty new too, came together, and Putin came to realize from the kind of operations that were being carried out by the Western nations to undermine and even to break up Russia, by coercing Georgia, Ukraine, to act against Russia; and through various operations inside Russia in places such as Chechnya, Dagestan, Ossetia, and so forth. Putin came to realize that from the security point of view, and also from every other point of view, his alignment with China and India - which are practically congruent to each other - will be a strategy which will allow him to secure and develop Russia. Stabilize Russia, and stabilize Russia's borders. So this thing happened in mid-July. This is where they started the formation of the New Development Bank and the Contingency Reserve Arrangement (CRA), and then later, in early November, China announced along with many other Asian countries formation of the Asian Infrastructure Investment Bank.

So, it seems the Asian Infrastructure Investment Bank is specifically set up for Asia's development, infrastructure development in Asia.

The New Development Bank of the BRICS and the CRA are for any nation that wants to have an access to them. That is basically what has been said. These banks have not been set up as yet. They will be set up in 2015. But the secretariats of these groups are now working out various formulations. What is expected is that these development banks will be making available financing money for developmental purposes. Unlike the conditionality-based loans of the World Bank and the IMF which never allowed the developing countries to secure enough money to independently develop their countries, these loans will not have those kinds of conditionality-strings attached.



Ramtanu Maitra

So, there was an enormous requirement for this. And these five leaders came together, and said that it is time now to make fresh efforts to develop the world. And there was no exclusion policy. Every nation is allowed to come in. The West is allowed to come in, and all that. Importantly, these five countries also considered that the security and development should go hand in hand, and of course, infrastructure development is very important.

But, let me tell you something else. That long before this Jim O'Neill fellow came out with his BRICS name, in 1995, Mr. Lyndon LaRouche had mentioned to Indian leaders, when he met them subsequently a number of times, telling these leaders that it is time to look at Russia, India and China— three together— as an engine for growth. Now, that was when the thinking started. But at that point in time, Russia was still going through the dismantling of the Soviet Union. And what followed after that was outright looting of Russia, by the speculators in Russia, the oligarchs and the various other forces.

Russia was very weak. India had not yet started to grow at a rapid pace. China was growing, but China's financial reserves were not sufficient enough at that time for this thing to flower. In 1999, I attended in New Delhi an international conference, in which the Russians were there, the Chinese were there, and of course the Indians were there. With the help of the Russian Academy of Sciences, Dr. Rybakov, who was then head of the St. Petersburg Branch of the Institute of Oriental Studies; and then from China there was one of the leading scholars from the China Institute of Contemporary International Relations (CICIR), Professor Ma Jiali; and from India the Chairman of the Maulana Azad Institute of Asian Studies of Calcutta, Dr. Devendra Kaushik, who was also heading the conference.

Following the conference, I formed a triangular association: China, India, and Russia. I was the convenor. In 1999 this happened. The conference sponsored by the then-Indian Prime Minister Atal Behari Vajpayee.

We got it (the triangular association) registered in India. I think it got registered in Russia as well. But the Chinese participant from CICIR, Ma Jiali, told me it is very difficult to register anything in China which is foreign-based. So, it didn't get registered there. But subsequently, I held a press conference in New Delhi and a lot of people came, including the Russian embassy press officer. A number of press people came. But they started looking at me with peculiar eyes, you know. They asked: "What are you talking about? Russia and China are at loggerheads. India and China are going in two completely different directions. They think in two different ways. How do you think that this thing will work out?" My answer was: It is not because I am pushing them to form this union. This is an obvious thing that they have to adopt, simply because, the old monetary international order is bankrupt. The leaders of this monetary order are now entirely involved in helping the looting that is taking place in the form of speculation and funny money. All of us will soon find out that there is no other alternative, but we have to do it. And the problem was, I would like to point out, that in this period of time between 1999 and 2014, a number of things were beginning to happen. One of those was that the U.S. became even weaker and had got involved in a number of wars, and its credibility went down further. And in 2007 the economic collapse came, the crash from which we haven't recovered, nobody has recovered. Those things happened.

And now China has become a very major source of cash, because it has at its disposal foreign exchange reserves of over \$3.9 trillion. India has still \$350 to \$360 billion in reserve. Russia has about \$400 plus billion in reserve. Now after this thing, BRICS, that is, I think, the Chinese initiated this new monetary order, and Russia, and India's leaders have realized that now is the time to do this.

So, I think that it is a very opportune time now. It is a very opportune time for the world to develop. All it needs is that these three fellows, along with the Brazilians and the South Africans, should move forward. None of them by themselves can develop. Brazil represents just only one country in a huge sub-continent of Ibero America that needs a huge amount of development.

Africa, of course all of us know, has been completely devastated over the years by the colonial powers. So, with these five, and then there are many others in Asia, such as Japan, South Korea and Indonesia - will surely be coming into this, all will be pitching in. If the West comes in with Europe, the United States, and Canada, then there is a shot that within the next generation or the generation after, say about 30 years later, you may see a world which is a sort of world that we, Mr. LaRouche and us, were always hoping for, praying for, and working for. So, this is an opportunity which exists today.

Would you say, Tanu, that when the financial crisis hit in 2007, that China and perhaps other of these countries decided that they would not do what was done in Europe and the United States with the "quantitative easing", the massive government-backed bailout of the bad speculative debts of the "too-big-to-fail" banks?

By 2007, China had already developed to the point - developed its reserves and manufacturing ability - that they did not feel immediately threatened. They didn't create the kind of funny money and looting of the real economy

that was done to the people of the richer nations, and which brought about the collapse.

But China was looking beyond protecting itself from collapse. China saw that now is the time to move ahead and develop the region. China can bring in various reserves and continue to grow. Because China still needed to grow. But in 2007 and 2008 they were very clear headed about it. "We need to grow. And we can do it, provided that we follow the basic economic principle that the fundamental of economic development adopted by the Americans in 19th and 20th century under Lincoln and Roosevelt." They knew nothing else could protect an economy. So that was their realization, as was the realization of Japan in the post-World War II period. The Japanese also had the same understanding. They have moved away from that since. But that realization, I think, is the seed which eventually led to what you see today as the tree— BRICS.

So, the essential change required in the United States, Europe and Canada must begin with the Glass-Steagall Act that separates commercial banking from investment banking. That would simply eliminate all those speculative debts that have no value. Then we could actually collaborate with these BRICS nations.

Absolutely! That's what Franklin D. Roosevelt did, and the United States was rebuilt into a magnificent power over the next 30 to 35 years. I will tell you something which most Americans don't talk about. But, between 1955 and, say 1978 - if you take these 23 years and look at the United States, you'll see some fascinating things. And you would wonder where this came from. It came from Roosevelt's policy of the Glass-Steagall Act that allowed the Banks to invest in real physical economy. In these 23 years, the United States built about 90 nuclear power plants.

In the next forty years since 1978, it has only built 10 or so. They built the entire highway system, in Eisenhower's period, within 12 years, starting from 1955 to 1967. And then, almost from scratch the space program started. And they landed people on the Moon by 1969. If you look at that period, this is all the fruits of the tree which was based on infrastructure. Infrastructure was magnificent, at that point in time. But we have moved away from all that, and now everything has collapsed. Now is the time for the West to rebuild all these things.

In some ways, conditions are better now. Whereas in the 1950s and the 1960s, you didn't have Russia, you didn't have China and you didn't have India who could contribute to this venture in a significant way. But now, they can contribute in a significant way. So, you consider the part of the world which is undeveloped and the other part of the world, that is Russia, China and India, since they are contiguous, Asia, Central Asia, Eurasia all the way to the Middle East. So, this is a wonderful opportunity, as far as I can see, provided we, and everybody else, could move the Western leaders to see the light. That is the problem that needs to be resolved.

What kind of time-frame are we talking about here Tanu? Is this something that would play out over, say, 3 to 5 years, or are we talking about a much longer generational perspective?

Things like this are very difficult to forecast. How long would it take to put all things in place? What is important in all this is the momentum. If you really go gung ho, and do it with full focus, and full realization that this is what is to be done in order to build a better future, then the time period can be cut down to say 25 to 30 years. But, between today and this 25 years that I'm talking about, a whole lot of things will begin to develop. And millions and millions of people, if not billions, will get start getting benefit out of those developments.

In order to do the development without disparity, it will take 25 to 30 years. That should be the minimum. But, within 4 or 5 years you will see some benefits are emerging for millions and millions of people. So, there is really no end point, but there is only a starting point. The process of development will do more than what meets the eye.

One of the things that Lyndon LaRouche has pointed to a couple of years ago is the irony that on a recent anniversary of the birth of Franklin Roosevelt, this occasion was celebrated much more in Russia than in the United States. Which, I guess may indicate that they are looking much more at the need to maintain the growth of the physical economy than the United States and Europe have in the period since the Roosevelt and Kennedy Presidencies. Would you say that there is a similar appreciation of the ideas of Franklin Roosevelt in India and China over this recent period?

Not if you go by names. But, they do recognize that the U.S.'s infrastructure development, the successes that they achieved between 1940s going into the 1960s. They know that these are the examples that they must follow. This is what is needed. You have to develop your infrastructure. Because, you should know that Asia was the worst victim of colonization. Not the worst. I should not say that. Africa was the worst. But Asia was a major victim of colonization by the European countries and during this long colonization period they really didn't build any infrastructure. Their fear always was: infrastructure means development, and development means the locals will be pushing us out of the colonies. So they kept the development of infrastructure to the minimum, for their military movement, taking resources through ports and such kinds of things were done They did the minimal amount of

infrastructure that was needed to bring back the looted minerals and reserves. But, virtually every contiguous country in Asia was kept separate. There was no integration. If you look at the South East Asian nations, starting with Myanmar, South of Myanmar is Thailand, south of Thailand is Malaysia. Then East of Thailand is Cambodia, Laos and Vietnam. But you won't find a single railroad that connects one to the other. Each one was kept as a separate entity by one colonial power or the other. The same thing was done in India. There is no connection between India and Afghanistan. It never was built.

There is no connection between Afghanistan to all the way to Kazakhstan, in Central Asia - to Tajikistan, Uzbekistan, Turkmenistan, Kyrgyzstan, Russia. It didn't exist! The Soviets did a lot in Central Asia, in terms of infrastructure.

But, the understanding that infrastructure is the key to economic development, that the Asians understood from, I would say, American System economists like Alexander Hamilton, Peshine Smith, Henry Carey, Matthew Carey. Those were the great economists of the United States, who, of course, were the sources of inspiration for Lincoln and for Roosevelt, as well.

So, if you talk to these people they will say, the American tradition of developing infrastructure is what we realize is necessary for Asia and Eurasia as well. So, Roosevelt, not by name, but anybody and everybody will tell you that Roosevelt was a great leader.

Could you describe some of the physical projects that are now underway in India, China and Russia? I know that you have said before that no nation in the world has actually approached the question of energy production from the need to make nuclear power the mainstay of the economy. Is that something which is able to be dealt with under this new collaboration of nations which is now emerging?

Well, I don't see at this point in time that any country has committed itself fully to make nuclear power their only source of electricity generation. But then, I must qualify that with a statement. 400 million people in India are without electricity. I think about 100 million in China as well. Now when you are sitting in the chair of the leader and you are looking at your country's people, and if you have a conscience, your first objective will be, how quickly can I provide them with electricity? Now when you are caught in that trap - you can call it a trap - then you will seek what is available. What is the easiest and most available thing you have? One is, of course, hydro-power; another is coal-fired power plants. Now coal is a two century old source of power, and there are plenty of companies that can produce many boilers, many furnaces. So coal is always available and coal is not considered as a strategic material. It is a strategic material, but not in the way that uranium is. Uranium is considered a dangerous material because of its capability to destroy large populations when it is used wrongfully.

So, the choices that China has at this point in time are not many. It has gone very big with coal as its power generation source. There was a period, I think a couple of years back, when they were installing, on an average, almost 500 megawatts of coal-fired plants every week - so fifty two of those a year.

So the Indians, the Chinese and everybody else who do not have - and nobody really has - the required capability to develop many nuclear reactors, they will go for coal. But, they also must realize, and I think there is a bit of realization which is sinking in now, that coal is not a sustainable source of energy. Because you will run out of coal, and it also has very dangerous aftereffects.

It pollutes. It creates a huge amount of fly ash which is highly toxic, and which destroys the land and destroys your water. So, the sooner you get rid of coal, the better. That realization is there.

But the other option, of course, is for you to go nuclear. And they want to go nuclear. But you have to develop a huge infrastructure to develop nuclear power generation at a level in which you will be able to meet the annual growth of your electricity demand. At this point in time, my research shows the world can produce only 30 reactors per year. Now thirty reactors, I'm averaging it out, is about 30,000 megawatts. Now China itself adds 30,000 megawatts of electrical capacity a year. So there is an enormous shortfall in reactor manufacturing. Because what has been done by these environmentalist movements, the greenies and all that, by targeting nuclear as the focus of their anti-development program, by labelling nuclear power as dangerous. Many companies have moved out of nuclear reactor manufacturing. So only 30 nuclear reactors can be manufactured per year.

My calculation, at this point in time, is that the world needs to produce between 200 and 250 reactors per year. And such a huge number, if you consider that to be a huge number, can only be manufactured by the large nations. You cannot expect that the small nations will be able to gear up their engineering and manufacturing, materials sectors and manpower in such a way that they will be able to produce a significant number of reactors. India, China, Russia, the U.S., Brazil, South Africa and Canada. Those countries already have well developed engineering capabilities, manufacturing capabilities and manpower as well. They should now move towards

manufacturing 30 to 40 all by themselves. When I see that, then I will say, okay, now these countries have made their commitment that they will have nuclear power as their only source of electricity generation. Because there will be nothing else available, other than nuclear fission now and later, of course even better, nuclear fusion when it comes into existence Nuclear fission requires a number of things, but all of these can be recycled and can be reused. So in a certain sense it is a completely renewable energy source. But this has not as yet taken place.

And, as I said, I qualify this by saying because of the exigency, because you have to provide electricity to people, you should look for what is the thing you have in hand which you can use to generate electricity? And, when you make that search, coal comes in as a handy item. And hydro yes, but hydro has its limitations, it can only work where there is a fast flowing river. But coal you can put up almost anywhere you want.

What would you say to Canadians that they can do to open up the opportunities which would come from an alliance of Canada with the BRICS nations?

I will just say first of all, that China and also Russia have proposed cooperation on the [Bering Strait rail tunnel](#) which would open up the Arctic for development. China is doing some amazing things [moving water](#) from the southern parts of China into the arid northern parts of China. The western United States and northern Mexico have been hit by a devastating drought which may continue for many years, not because of global warming, but because of long term changes in our solar system and galaxy. A water diversion project even greater than that of China, the [North American Water and Power Alliance \(NAWAPA\)](#) was designed in the 1950s and 1960s to deal with these kinds of problems, but it wasn't built.

I would say for Canada the most important thing to do is to go ahead and push the United States to go with the NAWAPA project. That water project would allow the United States to regenerate itself and become the bread basket of the world. I mean there are a number of countries that can be breadbaskets provided adequate input is given in the form of power, water, seeds etc.

The second area in which Canada has an enormous capability is in the nuclear sector. Canada is the pioneer in the design and manufacture of the CANDU-pressurized heavy water reactor, which can use natural uranium without enrichment. The ability of these heavy water reactors to make more efficient use of available uranium supplies by reusing the spent fuel from pressurized water reactors, as well as more efficiently use other fuels such as plutonium and thorium, is an important consideration. In addition, since CANDU-PHWR reactors use pressure tubes instead of the pressure vessels which can only be manufactured by a handful of countries having the heavy forging presses, this is one way of overcoming a major bottleneck in the construction of nuclear plants worldwide.

Canada has 19 operational CANDU reactors domestically and has exported these reactors to, or built them in technology sharing agreements with: Pakistan (1 unit), India (2 units), China (2 units), South Korea (4 units), Argentina (1 unit) and Romania (2 units).

Canada is also the only country which has a design for a large capacity (1000 megawatt plus) heavy water reactor, the Advanced CANDU Reactor, ACR-1000. The only other country which really has developed heavy water reactors in a major way is India. From the two CANDU reactors which India obtained from Canada, India has developed their own heavy water reactors. They presently have 18 operational heavy water reactors with 4 more under construction. But India has not scaled it up beyond 500 megawatts.

So as you can see, the heavy water reactors have not been adopted as widely as the pressurized light water reactors, so far. Many countries do not want to do it because heavy water by itself is another industrial sector. You have to manufacture heavy water. You cannot get heavy water from outside. A lot of countries do not want to get into that. But the bigger countries see that it is no big deal for them to manufacture heavy water. And if it is going

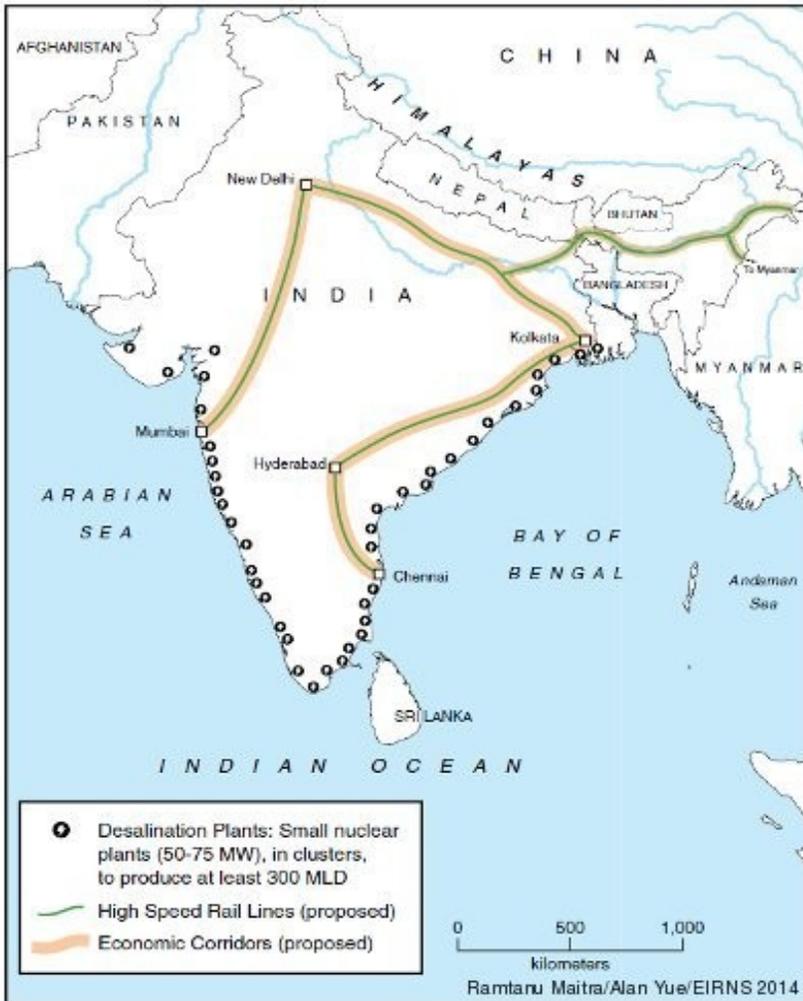


Advanced CANDU Reactor, ACR-1000 is a Gen III+, 1200 MWe CANDU reactor with online refuelling and heavy water moderation, but new features such as light water cooling and the use of low enriched uranium (1.5% U-235) for greater fuel burn-up, lower heavy water inventory and a more compact core.

to be the source for power generation, then it is a simple little task to perform.

So, India is going to go very big on the heavy water reactors. Canada, of course, can contribute in a very significant way by not only producing a large number of these large capacity heavy water reactors and then exporting them to India and China, and whoever else has the heavy water manufacturing capability, but they can also contribute by helping India and China, in particular, to make large capacity heavy water reactors.

That's one part of it.



India-Proposal High Speed Rail, Economic Corridors Coastal Nuclear-Desalination Plants

The second part of it, this world needs an enormous amount of desalination. Desalination in coastal areas would solve an enormous amount of problems that many of these large countries face because of lack of fresh water. They have to divert river water used for agriculture to meet commercial and domestic demands. In coastal areas, instead of doing that, desalination can take over all these responsibilities. But, for desalination, you don't need a huge reactor. You need small reactors.

You can put them in clusters. You can make 50 megawatt reactors, and put, over a period of time, 8, or 10, or 12, or 20 of them together as the population in the area grows, and the demand increases, as activities increase. Now nobody is going to make these 50 or 75 megawatt reactors because the mood in India and China that I see is to meet the demand for large scale electricity consumption. So they will go for larger reactors. And in the meantime the desalination process, which is almost as important as the power generation process, will remain vastly neglected. Now, in this Canada can play a very significant role by creating an assembly line of 75 megawatt, or 50 megawatt, or even 100 megawatt heavy water reactors, which don't need very much heavy water. And then roll them by, like you make cars.

As far as I'm concerned between India, Pakistan and China, they will need

anything between 500 to 1000 of these reactors for their coastal desalination purposes. They have long coastal lines. I think this is the task that Canada is perfectly capable of doing. They have all the technologies. And they could make good money out of this as well, and be happy that they have performed a very noble task.

Okay. I think that is a good picture for what Canadians have to do. So thank you for your time Tanu.

Interview with Dr. Srikumar Banerjee

Nuclear Fission: Humanity Is Missing Out on a Good Opportunity

19 September 2014

"Dr. Banerjee gave this interview to EIR, at the Aug. 25-29, 2014 Pacific Basin Nuclear Conference in Vancouver, Canada. [1]"

EIR: Dr. Banerjee, at the Pacific Basin Nuclear Conference here in Vancouver, B.C. today, you gave the luncheon lecture in honor of Dr. Wilfred Bennett Lewis. You are the Homi Bhabha Chair Professor at the Bhabha Atomic Research Centre in India. In your lecture, you said that these two people—Dr. Homi Bhabha from India and Dr. Wilfred Bennett Lewis from Canada—are the people most responsible for the development of the Pressurized Heavy Water Reactor (PHWR), also known in Canada as the CANDU reactor. Could you tell us something about who these two people were and what they did?

Dr. Srikumar Banerjee: For me, Dr. Bhabha was definitely the main architect of the Indian nuclear program. I mentioned in my lecture that he and Lewis were together at the Cavendish Laboratory. Then Homi Bhabha came back to India, just before the war, and stayed on; although he came for a vacation, he could not go back to Europe. Then he continued his work on physics, and later he got involved in the development of the atomic energy program in the country. He was a great scientist. He was a good artist. He had a tremendous taste in architecture. And the most important of his contributions was in building great scientific institutions. At that time, of course, it was just after the Second World War, when Bhabha and Lewis were thinking of the prospect of nuclear energy, primarily nuclear fission energy. Both of them also talked about fusion, but the emphasis was on fission, which was almost realized at that time as a deployable source for electricity generation. Their concern was, how to control the way of doing it on a commercial scale, and getting the energy solution for the world.

Both Lewis and Bhabha put a big emphasis on the issue of sustainability of nuclear energy.

It is not often stressed, but if you are only taking into account the uranium 235 as the fissile isotope, and that's the only fissionable isotope available in nature, then nuclear energy's life will not be very long. With the global increase in demand for energy, uranium-235 will get exhausted very quickly. Of course, I am not taking into account the large uranium reserves in seawater. But extracting uranium from seawater and exploiting that energy is perhaps a bigger challenge than something which is competitive, even with fusion. But if you take the fertile isotopes into account, uranium 238 and thorium 232, then we have really an inexhaustible form of energy in nuclear fission. Early in this period, both Bhabha and Lewis realized that, and have emphasized this point in their papers.



Dr. Srikumar Banerjee

Nuclear Is Declining in the West

EIR: At the conference today, it was mentioned that there are presently 72 new nuclear reactors under construction in the world today. However, it is notable that almost two thirds of these new reactors are being built in just a handful of countries, namely, the BRICS (Brazil, Russia, India, China, and South Africa) and Argentina. Do you have any thoughts on why one part of the world would be undergoing this kind of development, which largely does not exist in the rest of the world?

Banerjee: You see, it is due to the development aspiration in a large part of the world. In places like Canada, the United States, and Western Europe, energy demand is not growing! And it will not grow in the foreseeable future. The reason is the population in these places has stabilized and in some cases is slightly declining. Per capita energy consumption has reached a level of saturation; machinery and buildings are becoming much more energy efficient. I am often asked this question: When Germany is gradually reducing the contribution of nuclear energy and finally has a plan to abandon it, why in India are we talking of expansion in the nuclear contribution?

The point is, one cannot compare the situations in Germany and India. If you look at the German situation for the last ten years, if I am not incorrect, there is a decline in the total electricity demand in Germany, whereas in India, total electricity consumption has more than doubled during this period.

Germany also has the option of imports of a lot of energy, from France, from the Czech Republic—they are nuclear. So one can manage the total supply; particularly, supplying the base load.

Solar and wind energy have a very important role to play and nobody should neglect them. They have to be exploited to the fullest extent. But the point is, even if you exploit them to the fullest extent, you cannot meet the base load requirement in countries where the growth in demand for energy is phenomenal.

In India, in the last six to seven years, total energy production has doubled. Even now there is a big scarcity. I just showed in my presentation, that from today to 2032, another 18 years, the total electricity production has to increase four times to sustain an economic growth of 8-9%. But if all the additional capacity is built on the basis of thermal power, we will be generating 3 to 4 billion tons more of CO₂ annually. A major part of the coal needs to be imported, as Indian coal has about 40% ash. We must, therefore, increase the share of primary energy sources, namely, solar, wind, and nuclear, substantially, though thermal power will continue to dominate in the immediate future.

In China today, of the total electricity, only 2.1% is nuclear. But the expansion programs in nuclear, solar, and wind are quite impressive.

EIR: China is now building 27 new nuclear reactors, which sounds like a lot. But, if you ask how many new nuclear plants they are building per capita; that drops it dramatically.

Banerjee: Yes. And then you have to see how much nuclear is going to contribute. Even for China: They will still be depending on coal burning to a substantial extent. India also cannot avoid it.

EIR: Something like 79% of China's electricity production comes from coal.

Banerjee: Growth in electricity consumption cannot be slowed down. It is the most essential ingredient for development. It is not in the domain of luxury. Consumption is 700 kilowatt-hours per capita in India, which is one-fourth of the world average. This is what is available for everything. Electricity is needed for transportation, education, health care, agriculture, and industry, and each of these sectors is growing rapidly. Such growth scenarios are not there in countries where these basic needs have been grossly met.

As far as other forms of primary energy are concerned, India is rapidly expanding the installed capacity in wind and solar. But one cannot exceed the capacity factor beyond 25%. The Sun does not shine all the time. Neither does the wind blow. What is the implication of that? Say you need 100 megawatts. But, if the capacity factor is 25%, you have to install 400 MW and also have suitable means of storage.

EIR: At the conference today, the share of nuclear power in electricity generation by 2030 was actually projected to go down, which is an alarming trend. If there were a significant increase in demand for new nuclear plants, would there be enough capacity to build them?

Banerjee: The big damage which has been done worldwide is to the supply chain. The manufacturing places are now extremely few, for example, for the light water reactors, which are, I would say, the fastest to construct.

EIR: The pressure vessels.

Banerjee: Pressure vessel manufacturing is now available only in a limited number of countries—Japan, Korea, China, and Russia. India still doesn't have it, but we have a plan to enter into that. Steelmaking in India is reasonably good; also, the forging and making the large welded vessels of specialty steels. These technologies are available. A joint venture company is set up which can take up manufacturing of nuclear pressure vessels, and Indian industries have the capability of making many critical components of nuclear reactors.

Fourth-Generation Reactors

EIR: Do you see a role for fourth-generation nuclear reactor technologies, for example, the molten salt thorium reactor?

Banerjee: Enhanced safety, better utilization of fissile and fertile materials, and reduction of radioactive waste burden, are the major incentives for the development of fourth-generation reactors. The molten salt reactor is very important because it addresses all these points. It is inherently safe, as the molten salt core can be dumped through some passive frozen valves in a few safe storage units in case of any temperature rise beyond a safe limit. The reactivity in terms of fissile content in the core can be precisely adjusted with on-line introduction of fuel

and removal of poison. The reactor operates at near ambient pressure and there is no issue of high-pressure containment structure. It has on-line reprocessing facility and, therefore, facilitates conversion of fertile to fissile and incineration of long lived radioactive waste.

Finally, it can use thorium, which gets converted into fissile uranium-233 and can operate with a rather small addition of extra fissile material. But the molten salt reactor requires reprocessing. If you are not doing reprocessing on-line, then the molten salt reactor is no great fun.

We have just started work on the molten salt reactor. But in the initial phase of thorium utilization, India has made quite a bit of progress, as we have irradiated thoria fuel in PHWRs, studied their performance, and also studied reprocessing of the spent fuel. The design of the advanced heavy water reactor, to which I devoted some time in my lecture, is essentially a technology demonstrator in which about two thirds of the energy output will be from thorium. This, however, will be in solid oxide fuel.

Fusion and Helium-3

EIR: Perhaps you could also say something about the role of thermonuclear fusion in the longer term, particularly given China's recent lunar landing and their interest in setting up the space infrastructure to mine the lunar surface for helium-3, an ideal fusion fuel.

Banerjee: It is very important. India is also a partner on ITER [the International Thermonuclear Experimental Reactor], as China is. So we are working as community of nations towards fusion. I fully support that as a scientific endeavour. But, as an energy solution, that is still way ahead of us. And while you are talking of fusion, you must also see, where will the fuel come from? In fact where do we get tritium from, for first-generation deuterium-tritium fusion?



*"It is very easy to debate on this in the comfort of an air conditioned room ,," said Dr. Banerjee. "But if you have a really cold Winter in Europe or America, then you realize the importance of power."
Shown: the Kalpakkam prototype fast breeder reactor in Tamil Nadu, India. Right now the limited manufacturing capability is an impediment in the rapid growth of nuclear power in the world.*

If you look at the PHWR, it is a good source of tritium. If you use deuterium, when it is neutron irradiated, it becomes tritium. We always say that there is plenty of fuel available in seawater. Deuterium is only a tiny portion of seawater. But you can collect it, like we are doing.

EIR: I was just thinking about the role of China, Russia, and India, which you have just mentioned. There are common themes which we have seen in the investigation into molten salt thorium reactors, into breeder reactors, into fusion. What ways do you see the collaboration of these countries and other countries with India into the future?

Banerjee: It is happening. One is a scientist-to-scientist interaction, and doing something for curiosity satisfaction. But once it becomes a major effort, the resources are to be shared, and things like that, then it means an interaction on a much higher plane, a government-to-government level. Fortunately, with ITER, this has happened. There are seven members in ITER. It has a big price tag. We know that India is not a rich country. But, I think we give fusion its due importance. That's why, in spite of that, India is providing the finance which is required, towards the development of fusion power.

With fusion power, when they ask, "Can you give us a time when it will tie your city to the grid?" I think if somebody gives an answer, it will be premature.

In my opinion, in the energy debate we are definitely neglecting something that is technologically proven, environmentally benign, commercially attractive, and has a very good overall safety record. That is fission energy, which may need a little bit of tweaking, I would say. With that you can make the molten salt reactor and the breeder reactor, and make them successful and commercially operative.

But I think that some doubts come in terms of fear. Fear of radiation or fear of accidents. This is why I think that humanity as a whole is perhaps missing out on a good opportunity. Fifty years ago these fears were not there and we could go forward to make energy available in plenty in many countries.

EIR: Well certainly we need a society that is much more educated in real science if this is going to advance properly.

Banerjee: Yes. See, it is very easy to debate on this in the comfort of an air-conditioned room. But if you have a really cold Winter in Europe or America, then you realize the importance of power.

[1] EIR, September 19, 2014 http://www.larouchepub.com/eiv/public/2014/eirv41n37-20140919/48-51_4137.pdf

Interview with Dr. Ahmed Hussein

The Dual Fluid Reactor

The Public is Ready for Nuclear Power

20 November

Dr. Ahmed Hussein is Professor Emeritus of physics at University of Northern British Columbia currently stationed at TRIUMF, Canada's National Laboratory for particle and nuclear physics in Vancouver, British Columbia. He is also an Associate Member of the Institute for Solid State Nuclear Physics (IFK) in Berlin, Germany. He was interviewed on September 16, 2014 by Robert Hux for [21st Century Science & Technology](#).



Dr. Ahmad Hussein

Robert Hux – Dr. Hussein, we met you recently at the Pacific Basin Nuclear Conference here in Vancouver, where you presented a very interesting new design for a nuclear fission reactor. [1] How does your design differ from the nuclear fission reactors which have been developed since the 1950s?

Dr. Ahmed Hussein – Our reactor, called the Dual Fluid Reactor (DFR) [2], was designed to solve many of the problems which exist now with the current reactors that people are afraid of. Current reactors have some designs that actually originated in the military use of nuclear power in the old days of the Manhattan Project, and they were adapted to civilian use. The issues of safety have been addressed, and improved, in various generations of civilian reactors, but at a high cost. So the result is that building the reactor with all these safety measures to make it safe for operation actually added significantly to the cost of the reactor. However, one should know that even though the construction cost is high, the operational cost is much lower than fossil fuel power stations.

The other problems with these reactors are the amount of waste that these reactors produce, which has to be stored for a large number of years, and the concern for proliferation due to the need for enriched fuel. However, current reactors are much better and cleaner sources of energy than fossil fuels, the safety has improved, and I must add that a current 1000-MW nuclear power station produces about one cubic meter of waste per year which

can be safely stored, and that should be compared to the millions of tons of green house gases and the 320,000 tonnes of ash containing toxic heavy metals and tens of thousands of tonnes of sulphur and nitrogen oxides that are produced by fossil fuel power stations.

Furthermore, nuclear power reactors do not emit any radioactive materials into the atmosphere during operation, while coal-fired stations emit radioactive materials that are mixed naturally with coal.

Our reactor concept has a simpler design that avoids most of the problems that we have right now. And it will actually make nuclear power a lot cheaper, safer, mostly carbon-free, and better to use than any other energy source.

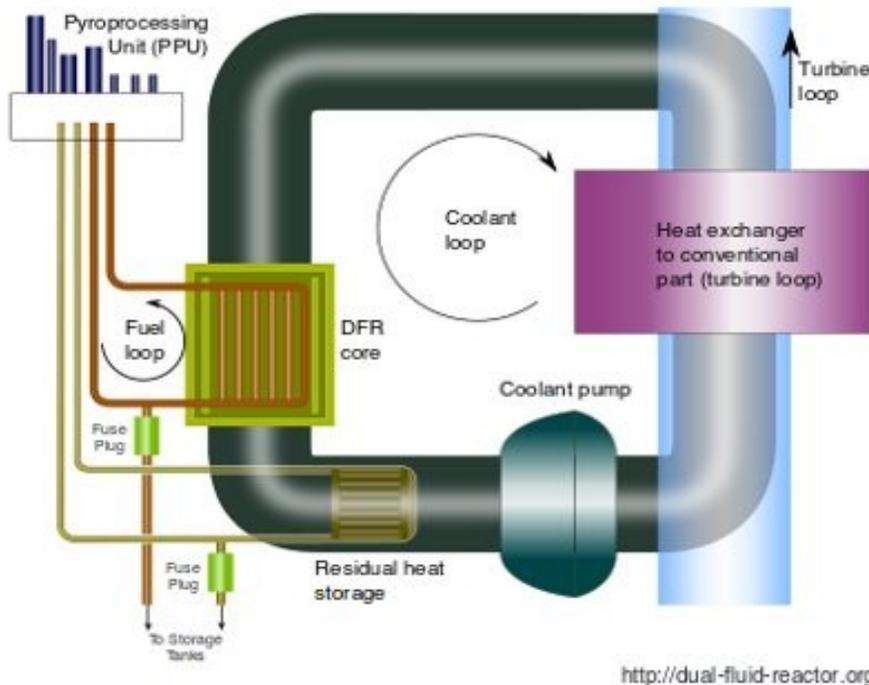


Figure 1. Close-up of the DFR core region with part of the coolant cycle and the short-lived fission products storage inside the coolant conduit ahead of the core.

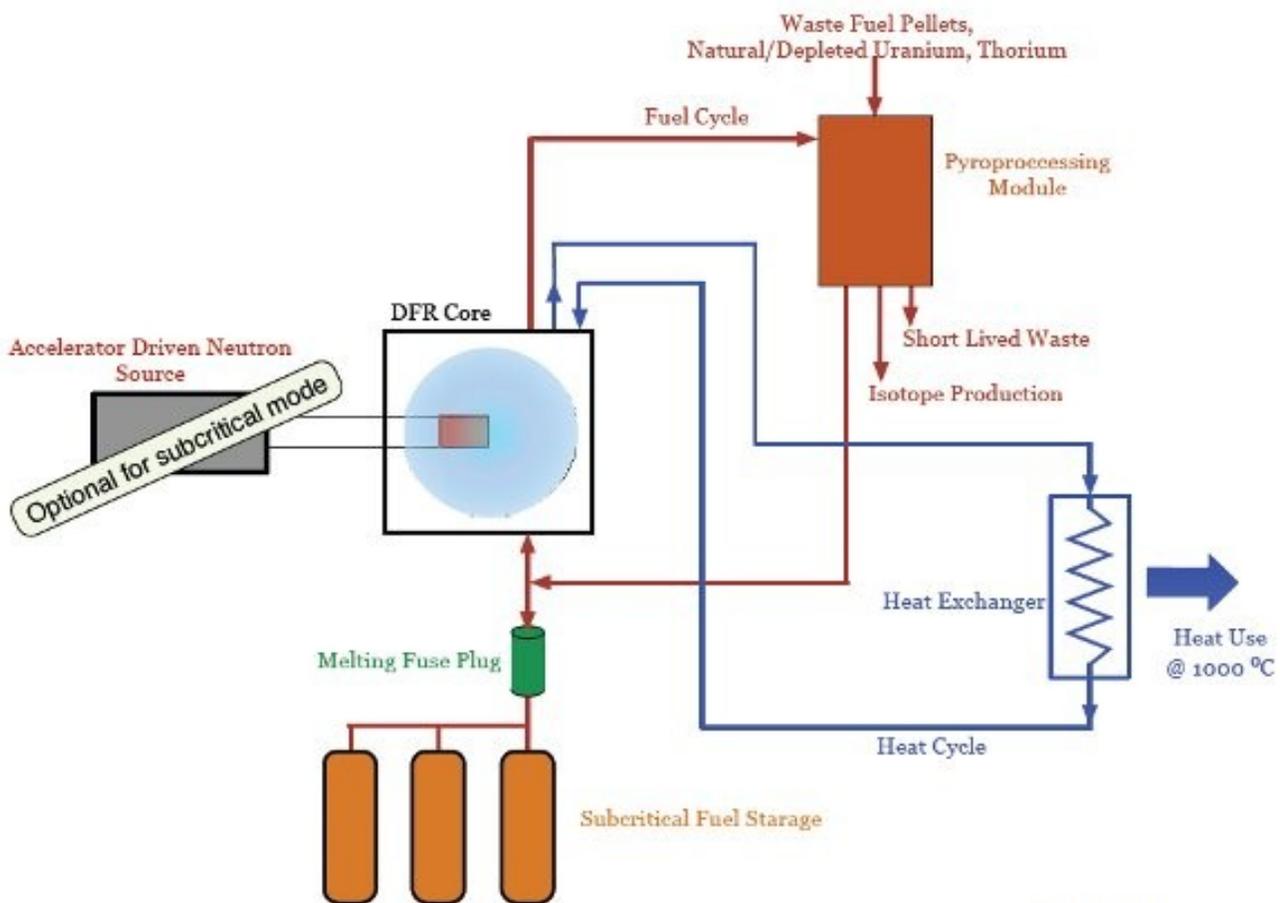
Can you describe how your reactor works?

The reactor is really very simple. It is a fast, molten salt, metal-cooled reactor. Although, it bears resemblance to other reactor designs, it is actually different from all of them. The important feature of our design, that makes it unique, is that it uses two fluids: one as a fuel, and the other as a coolant. (Figure 1) This allows us to optimize each fluid for its specific function, in contrast to all existing molten salt reactor designs that use one fluid as fuel and coolant. This simple feature opens up the way to a host of improvements that makes our reactor unique among all generation-IV reactor designs.

The fuel fluid is molten natural uranium (U) or natural thorium (Th) salts (for example tri-chloride) while the coolant fluid is molten lead. The fuel is prepared from natural U or Th in an online “pyro-processing unit” (Figure 2). The liquid fuel is then pumped into the reactor core where a “critical mass” of fuel within a confined space creates the conditions for a self-sustaining fission chain reaction, producing energy that is carried by the circulating molten lead outside of the reactor to a heat exchanger.

The molten salt fuel allows continuous extraction of fission products, which are stored as liquid outside the reactor core and cooled with the same molten lead which cools the reactor core, until ready for shipment to medical or industrial uses, or stored in a passively-cooled location within the reactor facility.

Moreover, the liquid fuel can be easily replenished by addition of small amounts of new fuel.



<http://dual-fluid-reactor.org>

Figure 2. DFR fuel and cooling loops. The pyro-processing module prepares the molten salt fuel which is pumped into the DFR core, and continuously extracts and separates useful isotopes from short term waste. Molten lead carries the heat from the DFR core and fission products out of the reactor to the heat exchanger. In case of loss of cooling, melting fuse plugs allow the molten salt fuel and the fission products to be drained out of the reactor core, safely shutting the reactor down.

You said that the DFR reactor is a “fast” reactor. Why is that important?

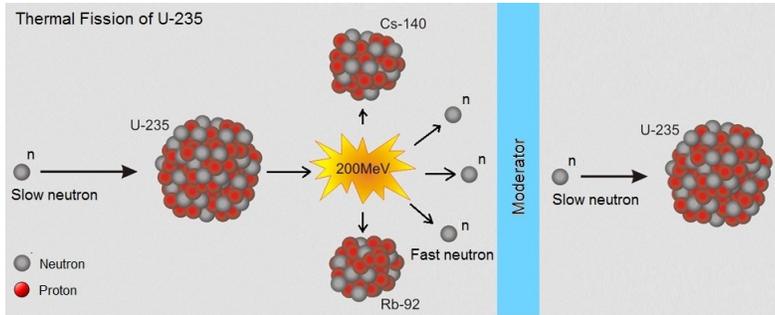


Figure 3. Thermal nuclear fission of U-235 initiated by the capture of a slow neutron produces two smaller atoms (Rb-92 and Cs-140 shown here only one possibility among many) and an average of 2-3 fast neutrons, which can be slowed down by interaction with a moderator (water, heavy water or graphite) to increase probability of capture by another U-235 nucleus and initiate a chain reaction.

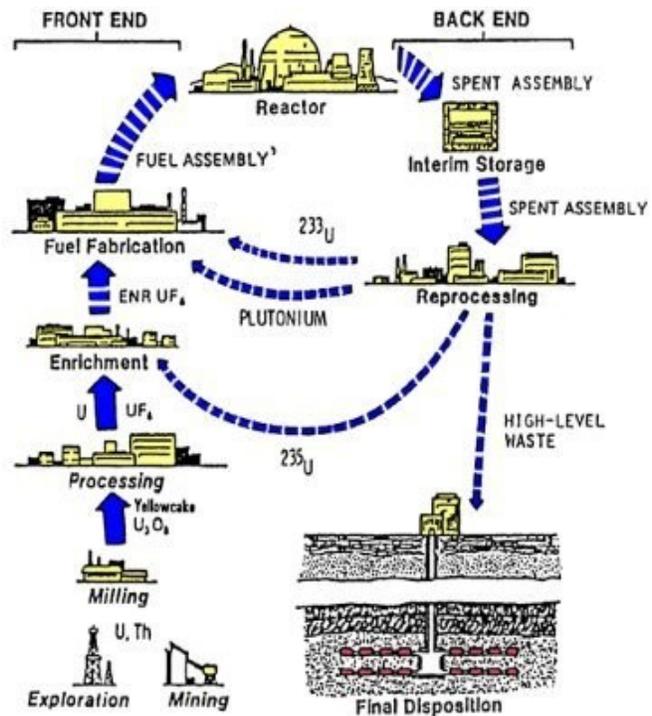
There are two kinds of reactors: fast reactors and “slow” or “thermal” reactors. Most of the existing reactors in the world, such as the Pressurized Water Reactor (PWR) or the CANDU-Pressurized Heavy Water Reactor, are thermal reactors. Thermal reactors are designed to take advantage of the fact that there is a very large probability for a “fissile” or “fissionable” atom, such as uranium 235, to absorb a neutron into its nucleus and break up (“fission”) into two smaller atoms plus a few more neutrons to sustain a fission chain reaction, if the neutron has a low energy and is moving slowly. [3] But when the atom fissions, it releases a large amount of energy and the new neutrons are travelling very fast, too fast to be easily captured by another

fissile atom.

So, in a thermal reactor the fast neutrons are slowed down (and they become thermal neutrons) by adding to the reactor core a light-weight material called a moderator (e.g., water, heavy water or graphite) which is capable of efficiently absorbing the excess neutron energy. Although water is the best moderator because its molecules contain hydrogen whose nucleus (a proton) has a mass nearly equal to that of the neutron, water has the disadvantage of also absorbing some of the neutrons.

Most existing thermal reactors in the world and especially the ones that use water as a moderator or coolant cannot sustain a fission chain reaction, or criticality, using the 0.7% U-235 present in natural uranium. These reactors must increase the amount of U-235 to 3-5% through a complex and very expensive process called enrichment. The next best moderator is heavy water (deuterium oxide), whose molecules contain a heavy isotope of hydrogen, called deuterium, which has one neutron and a proton, and has the advantage that it not only does not absorb many neutrons but also releases some of its neutrons into the reactor core while moderating the fission-produced neutrons. Those extra neutrons make it possible to use natural uranium in heavy water-moderated reactors. Consequently, although the CANDU-PHWR reactors do not need enrichment of U-235, they do require a moderator, heavy water, which is produced through a complex and expensive process.

Thermal reactors have further drawbacks. First, they cannot burn any more than 0.7% of the uranium (U-235) present in natural uranium ore. Second, current reactors use solid fuel rods and the only way to control the power output is by using control rods. These rods are made of a material like cadmium that absorbs neutrons in large quantities. Control rods



NRC

Figure 4. The closed nuclear fuel cycle of existing nuclear reactors. On the front end, uranium is mined, milled, converted into uranium hexafluoride, enriched to 3-5% U-235, and fabricated into fuel rods for use in light water reactors. Heavy water reactors (e.g., CANDU) do not require enrichment.

On the back end, six countries (China, France, India, Japan, Russian Federation and the UK) have a closed fuel cycle policy which reprocesses spent fuel to create new reactor fuel.

All other countries have a “once through” fuel cycle in which spent fuel is stored in cooling pools at the reactor site, and is then stored in dry casks awaiting burial. With the DFR reactor, mining and fuel fabrication are dramatically reduced, since nearly 100% of the uranium is consumed and the fuel is molten salt. In addition, uranium enrichment, reprocessing, and geological disposal of the used fuel are not required.

move, mechanically, in and out of the reactor core. Partial insertion reduces the power output of the reactor and complete insertion shuts the reactor down. This system is susceptible to mechanical failure and consequent loss of reactor control. Third, while a thermal reactor cannot fission either the remaining 99.3% of the uranium (U-238), or thorium (Th-232), it can convert these fertile materials into fissionable isotopes of plutonium (Pu-239) and uranium (U-233), and it produces many other heavy elements, called actinides and medium weight elements called fission fragments. Most of these elements are heavily radioactive. The actinides, most of which cannot be burned in a thermal reactor, along with the fission fragments, accumulate in the fuel rods and continuously produce large amount of heat due to their radioactive decay. As a result the fuel rods need continuous active cooling even when the reactor is shut down. Failure of this active cooling could lead to core meltdown. Fourth, after the fuel in the rods is depleted, the rods, containing the actinides and fission fragments, are removed from the core and must be stored for a very long time (thousands to hundreds of thousands of years) in safe and secure sites that are geologically stable.

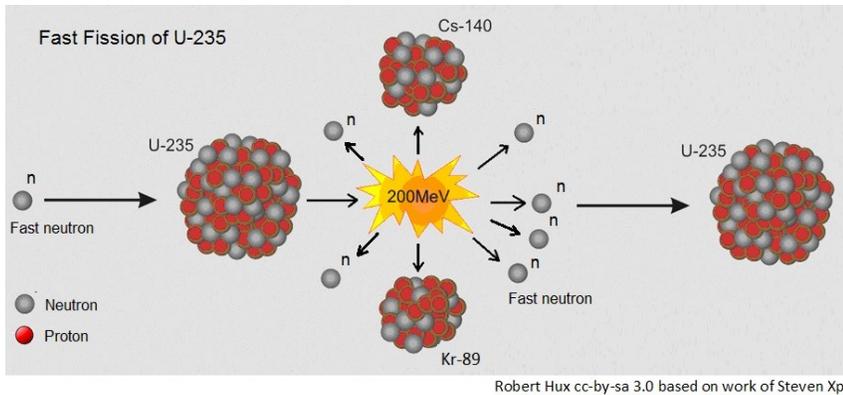


Figure 5. Fast nuclear fission of U-235 producing two typical fission products.

Fast Reactors with liquid fuel like DFR, on the other hand, operate with fast neutrons. So, they do not need a moderator. Although the probability of fast fission is lower than thermal fission, this is compensated to some extent by the fact that fast fission produces more neutrons (about 4-6 neutrons per fission vs. 2-3 for thermal fission). Those extra neutrons can also be used to change U-238 into the fissionable Pu-239; thus, while consuming its initial fuel, fast reactors produce new fuel right inside the reactor core.

Consequently, fast reactors consume almost 100% of natural uranium. Similar to thermal reactors, fast reactors cannot “initially” reach criticality with natural uranium. However, once the fast reactor is started up with the initial load of enriched fuel, it can be refuelled with natural uranium or thorium. Fast reactors can also use as fuel the waste (or better said, slightly used fuel) from existing reactors or the plutonium and uranium that are extracted from dismantled nuclear weapons. As a result, the life of nuclear fuels will extend to thousands of years.

In both types of reactors, fertile U-238 (or Th-232) is converted into fissile Pu-239 (or U-233) as well as other actinides, but fast reactors are more efficient in this process than thermal ones. As I mentioned before, many of the actinides have very long half lives. [4] Thermal reactors cannot burn the produced actinides, while fast reactors are actually very efficient in burning them. As a result, fast reactors produce much less radioactive waste with much shorter half-lives than thermal reactors.

So rather than using water as the coolant like most of the reactors we’ve discussed, your reactor uses molten lead.

Yes. Using molten lead allows the reactor to operate at a very high temperature, making it a very efficient reactor. Using molten salt fuel and molten lead coolant provide many passive safety features that make DFR an extremely safe reactor.

The operating temperature of the reactor is ...

The operating temperature of the DFR is 1000 degrees Celsius. At this temperature the efficiency of heat transfer is quite high. We can achieve this because we are using molten lead as a coolant, which melts at 327 degrees Celsius and boils at 1750 degrees. In addition, we can operate at this high temperature at atmospheric pressure; another simplifying factor of our design. You can contrast the DFR with the PWR and the CANDU which use water for cooling the reactor. Water, as you know, boils at 100 degrees so the reactor would have to operate at lower than 100 degrees which would mean an extremely poor efficiency of heat transfer. So, the PWR and the CANDU operate at very high pressure in order to raise the boiling point of water, so they can operate at temperatures up to 350 degrees. The pressure needs to be as high as 70 to 150 times atmospheric pressure. This very high pressure is required to achieve a modest heat transfer efficiency. Reactor designs to accommodate such high pressure are quite complex and expensive.

Does the lead coolant of the DFR have any advantages over other coolants used in fast reactors?

Fast reactors generally require liquid metal to cool the high-power-density reactor cores. Since the pioneering work on fast reactors at Idaho's Argonne National Laboratory beginning in the early 1950s, which resulted in the Experimental Breeder Reactor-1 (EBR-1) and its successor EBR-2, the focus both in the United States and around the world has been on the use of sodium or sodium-potassium coolants.

However these materials aggressively react with air, water and various structural materials; they absorb neutrons to form short-lived, but highly radioactive species (like Na-24) which can release enough heat to form vapour bubbles in the liquid sodium coolant. These bubbles reduce neutron absorption, causing the fission rate to increase (positive void coefficient) and the reactor to run out of control. Consequently elaborate measures are required to ensure safe operation of these reactors, such as a sealed reactor vessel with a pressure greater than atmospheric pressure, double-walled piping and an intermediary cooling cycle, measures which have increased the costs of sodium-cooled fast reactors significantly above that of PWR reactors.

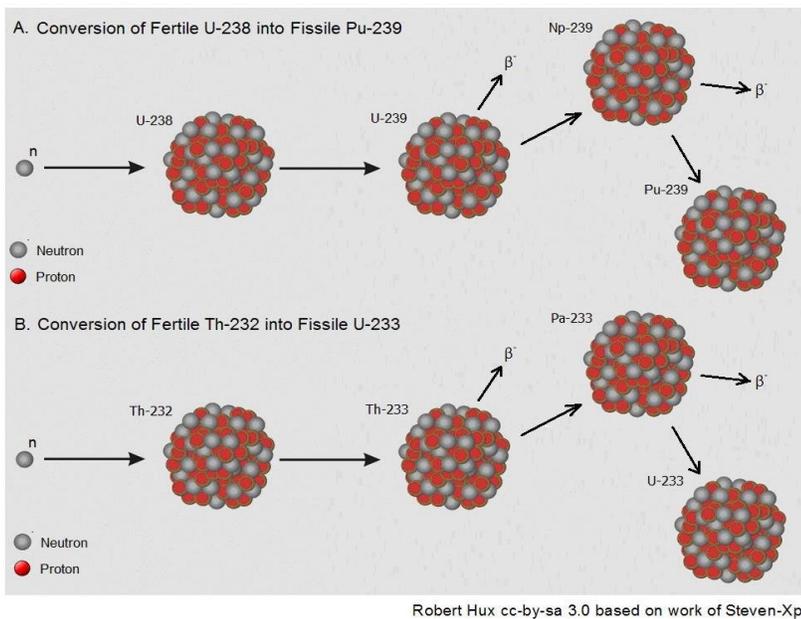


Figure 6. The real potential of nuclear fission depends on the use of fast reactors to efficiently create new fissile materials, through two paths: A. Conversion of the non-fissile uranium (U-238) into fissile Pu-239. B. Conversion of the more abundant thorium (Th-232) into fissile U-233. Molten salt fast reactors with online separation of fission products, like DFR, do not need to shut down the reactor to reprocess the used fuel rods. The Pu-239 and U-233 (as well as the other actinides) can be consumed inside the reactor.

Lead, on the other hand, is a very stable element and does not interact much with other elements. It absorbs fewer neutrons than sodium. Some radioactive isotopes could form in lead after long exposure in the reactor, but they decay back to stable lead. Moreover, lead does not moderate (slow down) the fast neutrons as much as sodium does. So a lead-cooled fast reactor like the DFR which continuously removes the fission products (which can absorb neutrons) will have a greater number of neutrons available to perform useful work.

For example, if the DFR was operated to breed plutonium from the U-238 in natural uranium, it would take about 4 years to produce enough fuel for another reactor, similar to the present construction time for a nuclear plant. On the other hand, sodium-cooled fast reactors (such as the French Superphénix or the Russian BN reactors) with PUREX-reprocessing plants have a doubling time of 30-40 years. Breeding U-233 from thorium would have a longer doubling time than this because U-233 produces fewer fission neutrons than Pu-239.

What are the passive safety features you mentioned before?

Liquid fuel allows the use of fuse plugs that are actively cooled to stay solid during normal operation, but if, for any reason, the cooling of the reactor is lost and the core temperature rises, the fuse plugs melt, draining the fuel from the reactor core into subcritical storage tanks, as seen in Figure 2. This way the reactor never experiences core melt down. In addition, since it is a fast reactor with liquid fuel, the reactor does not need control rods or a moderator and has no mechanically moving parts in the core. These features simplify the core and reduce to a large degree the need for active safety.

As already mentioned, liquid fuel also allows the continuous extraction of fission products, and their safe storage and active cooling by the molten lead outside the reactor core. The radioactive decay of those fission products continues to produce heat even after the reactor shuts down. Their storage also has fuse plugs (Figure 1) so they can be drained into self-cooling tanks in case of coolant loss. With the burn up of the very long-lived actinides, the major source of radioactivity in the reactor comes from the fission products. However, the fission products which are not presently useful need to be stored for much shorter times (up to 300 years), which can be safely done within the reactor facility. Further, all isotopes that are useful for medicine or industry (like for example molybdenum-99/technetium-99m) can easily be extracted continuously to be processed and shipped out.

Moreover, in the case of loss of coolant (the most serious accident in a nuclear power reactor) even before the temperature increase can melt the fuse plugs, as the temperature rises above normal operating temperature the reactor becomes “subcritical” and begins to shut itself down, due to the negative temperature coefficient of the DFR.

One more thing, the reactor itself does not need water to operate, so it can be built in a subterranean location, while electricity generation that may need water to operate can be placed above ground. That makes the reactor a lot more secure and much safer compared to current designs.

How long would it take to build a demonstration reactor and then move to commercialization?

Our estimate, currently, is between ten and fifteen years. So far we have been studying the mathematics and the behaviour of the reactor as well as selecting proper materials for the reactor core. We haven’t yet done any actual building. We just submitted a proposal to the European Union Commission for a research grant to study many aspects of the reactor, and after that we can move on to build a prototype. We think we can build a prototype to show that the reactor works, in between 7 and 8 years, maybe ten, and then another five years to actually produce a full-sized reactor.

Do you expect any major hurdles while building a prototype?

There will be hurdles of course, but I am not expecting any show-stoppers. The important issue here is that we are not inventing any new technologies: we are putting together several existing and proven technologies in an out-of-the-box way of thinking. Molten salt fuel and fuse plugs were proven to work successfully in the molten salt experimental reactor built and operated at Oak Ridge National Laboratory back in 1960s. The pyro-processing methods have been developed and used in the few waste reprocessing facilities built in France and elsewhere, and finally the Russian alpha class nuclear submarines successfully used a molten mixture of lead and bismuth as coolant. There will be problems in putting all these technologies together, but they will be the kind of problems which are solvable in my opinion.

What kind of response are you getting from, for example the Canadian government or other governments around the world, in terms of being willing to invest in something like this?

The situation with nuclear power is unfortunately similar to the car industry. If you look at the car industry now you find that most of the engines in cars nowadays are more or less the same engine that Henry Ford invented a hundred years ago. It’s the same situation with nuclear power. The companies that produce nuclear reactors have their designs, they keep changing safety issues to the extent that new reactors are safer than the old ones, but the basic design is still the same design that came out from the Manhattan Project. Many of the reactor producers are reluctant to get into new designs. So we are struggling with that, but we are still trying and we are hoping to have a breakthrough soon.

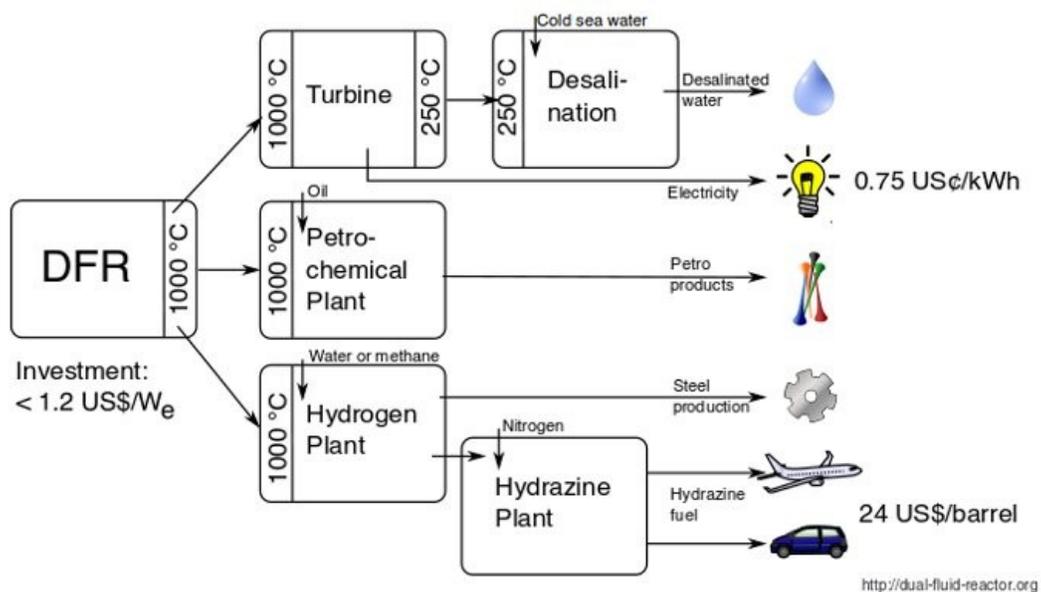


Figure 7. DFR applications.

We haven't contacted the Canadian government yet, but I just found out recently that the Canadian government has a section in the National Science and Engineering Research Council (NSERC) for funding projects related to generation-IV nuclear reactors. Actually the DFR can be considered as generation IV+. So, I am in the process of putting together a group of interested Canadian scientists and engineers to submit an application to NSERC for a research grant to complement the European proposal.

Do you think that this new kind of technology could help us reverse the opposition to nuclear power that has developed in the last several decades?

I really think so. We are meeting some opposition; however, I have been giving talks in many different places, and found the public is actually ready for nuclear power. They realize how terrible fossil fuels are. They are ready for nuclear power, particularly with something like the DFR which actually solves most of the problems with the current reactors. The public I think, is ready. A couple of years ago we had an experience in Germany that showed the public was very much interested in nuclear power, even though the government is shutting down nuclear reactors. So it looks like the public is really ready for it. Except that they haven't yet moved toward putting pressure on governments to replace fossil fuel based power stations with nuclear ones. We are trying very hard to educate the public about our reactor which is extremely safe, carbon-free during operation, and a lot cheaper to build and operate than any existing power source including wind, solar and coal. We are predicting that the cost of electricity produced by a DFR will be one-third of that produced by coal. The cheap electricity will make the production of synthetic carbon-free automotive fuels like hydrazine, and water desalination economically viable while keeping the environment clean.

At a certain point you have to bring in a higher energy flux density than even nuclear fission, namely thermonuclear fusion. What is your perspective on fusion?

Nuclear fusion, in my opinion, is the ultimate energy source, particularly the deuterium-deuterium fusion; the fuel is abundantly available everywhere. So this is really the ultimate source of energy. Unfortunately, it is still not available yet, but there are currently concerted efforts taking place around the world like the ITER (International Tokamak Experimental Reactor) facility in France and General Fusion here in Vancouver, and laser fusion in the United States. But it doesn't look like we are going to have a working fusion reactor in the near future.

So in the meantime, to stop the problem with fossil fuels, I think we should switch to nuclear power and keep the current reactors going, and build new ones. And hopefully in 20 or 30 years nuclear fusion will be available, and then I think that everything else should shut down and rely on fusion alone.

Finally, I would like to mention that the concept of the dual fluid reactor was developed by a group of nuclear physicists, including myself, in the Institute for Solid- State Nuclear Physics (IFK) in Berlin, Germany. [5]

[1] A. Huke, G. Ruprecht, D. Weisbach, S. Gottlieb, A. Hussein and K. Czerski, The Dual Fluid Reactor- A New Concept for a Highly Effective Fast Reactor, paper presented at 19th Pacific Basin Nuclear Conference. Vancouver, British Columbia, Aug. 24-28, 2014.

[2] <http://dual-fluid-reactor.org>

[3] Uranium has two components which are distinguished by the mass and natural abundance of their atoms: uranium 238 (99.3%) and uranium 235 (0.7%).

[4] The half life, $t_{1/2}$, is the time required for half of the atoms of a given isotope to undergo radioactive decay into a different isotope. The major radioactive emissions from irradiated nuclear fuel, after the fission products, come from actinides: plutonium (Pu-239, $t_{1/2} = 24,100$ years and Pu-240, $t_{1/2} = 6,561$ years) and isotopes of neptunium, americium and curium with half lives ranging from 2.4 days (Np-239) to 2.1 million years (Np-237).

[5] <http://festkoerper-kernphysik.de>

APPENDICES

- *The Four New Laws to Save the U.S.A. Now!*

NOT AN OPTION: AN IMMEDIATE NECESSITY

by Lyndon LaRouche

- VIDEO-Forging Fusion: Physical, Chemical, Nuclear, Fusion!

- *Sign Online* - The U.S. and Europe must have the Courage to Reject Geopolitics and Collaborate with the BRICS

- Press Release:

Prominent Leaders back Resolution calling for the U.S. and Europe to have the Courage to Reject Geopolitics and Collaborate with the BRICS

The Four New Laws to Save the U.S.A. Now! **NOT AN OPTION: AN IMMEDIATE NECESSITY**

By Lyndon LaRouche

The following statement is for immediate action by all associates in all regions of the National Caucus of Labour Committees and its associated practice. The priority is assigned to all means and measures of public action, nationally and internationally, without reservation. That priority is existential for the policies of our republic, and for the general information of, and by all relevant circles world-wide, beginning this date of June 8, 2014.

1. THE FACT OF THE MATTER

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 name for that direct breakdown-crisis throughout those indicated regions of the planet, is the presently ongoing introduction of a general "Bail-in" action under the several, or more governments of that region: the effect on those regions, will be comparable to the physical-economic collapse of the post-"World War I" general collapse of the economy of the German Weimar Republic: but, this time, hitting, first, the entirety of the nation-state economies of the trans-Atlantic region, rather than some defeated economies within Europe. A chain-reaction collapse, to this effect, is already accelerating with an effect on the money-systems of the nations of that region. The present acceleration of a "Bail-in" policy throughout the trans-Atlantic region, as underway now, means mass-death suddenly hitting the populations of all nations within that trans-Atlantic region: whether directly, or by "overflow."

The effects of this already prepared action by the monetarist interests of that so-designated region, will, unless stopped virtually now, will produce, in effect, an accelerating rate of genocide throughout that indicated portion of the planet immediately, but, also, with catastrophic "side effects" of comparable significance in the Eurasian regions.

The Available Remedies

*The only location for the immediately necessary action which could prevent such an immediate genocide throughout the trans-Atlantic sector of the planet, requires the U.S. Government's now immediate decision **to institute four specific, cardinal measures: 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: (1) 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 as National Banking.*

The actually tested, successful model to be authorized is that which had been instituted, under the direction of the policies of national banking which had been actually, successfully installed under President Abraham Lincoln's superseding authority of a currency created by the Presidency of the United States (e.g. "Greenbacks"), as conducted as a *national banking-and-credit-system placed under the supervision of the Office of the Treasury Secretary of the United States*.

For the present circumstances, all other banking and currency policies, are to be superseded, or, simply, discontinued: as follows. Banks qualifying for operations under this provision, shall be assessed for their proven competence to operate as under the national authority for creating and composing the elements of this essential practice, which had been assigned, as by tradition, to the original office of Secretary of the U.S. Treasury under Alexander Hamilton. This means that the individual states of the United States are under national standards of practice, and, not any among the separate states of our nation.

(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 of the United States. The creation of credit for the now urgently needed increase of the relative quality and quantity of productive employment, must be assured, this time, once more, as was done successfully under President Franklin D. Roosevelt, or by like standards of Federal practice used to create a general economic recovery of the nation, per capita, and for rate of net effects in productivity, and by reliance on the essential human principle, which distinguishes the human personality from the systemic characteristics of the lower forms of life: the net rate of increase of the energy-flux density of effective practice.

This means intrinsically, a thoroughly scientific, rather than a merely mathematical one, and by the related increase of the effective energy-flux density per capita, and for the human population when considered as each and all as a whole. The ceaseless increase of the physical-productivity of employment, accompanied by its benefits for the general welfare, are a principle of Federal law which must be a paramount standard of achievement of the nation and the individual.

(4) "Adopt a Fusion-Driver 'Crash Program.'" The essential distinction of man from all lower forms of life, hence, in practice, is that it presents the means for the perfection of the specifically affirmative aims and needs of human individual and social life. Therefore: the subject of man in the process of creation, as an affirmative identification of an affirmative statement of an absolute state of nature, is a permitted form of expression. Principles of nature are either only affirmation, or they could not be affirmatively stated among civilized human minds.

Given the circumstances of the United States, in particular, since the assassinations of President John F. Kennedy, and his brother, Robert, the rapid increase required for even any recovery of the U.S. economy, since that time, requires nothing less than measures taken and executed by President Franklin D. Roosevelt during his actual term in office. The victims of the evil brought upon the United States and its population since the strange death of President Harding, under Presidents Calvin Coolidge and Herbert Hoover (like the terrible effects of the Bush-Cheney and Barack Obama administrations, presently) require remedies comparable to those of President Franklin Roosevelt while he were in office.

This means emergency relief measures, including sensible temporary recovery measures, required to stem the tide of death left by the Coolidge-Hoover regimes: measures required to preserve the dignity of what were otherwise the unemployed, while building up the most powerful economic and warfare capabilities assembled under the President Franklin Roosevelt Presidency for as long as he remained alive in office. This meant the mustering of the power of nuclear power, then, and means thermonuclear fusion now. Without that intent and its accomplishment, the population of the United States in particular, faces, now, immediately, the most monstrous disaster in its history to date. In principle, without a Presidency suited to remove and dump the worst effects felt presently, those created presently by the Bush-Cheney and Obama Presidencies, the United States were soon finished, beginning with the mass-death of the U.S. population under the Obama Administration's recent and now accelerated policies of practice.

There are certain policies which are most notably required, on that account, now, as follows:

Vernadsky on Man & Creation

V.I. Vernadsky's systemic principle of human nature, is a universal principle, which is uniquely specific to the crucial factor of the existence of the human species. For example: "time" and "space" do not actually exist as a set of metrical principles of the Solar system; their only admissible employment is for purposes of communication is essentially nominal presumption. Since competent science for today can be expressed only in terms of the unique characteristic of the human species' role within the known aspects of the universe, the human principle is the only true principle known to us for practice: the notions of space and time are merely useful imageries:

Rather:

The essential characteristic of the human species, is its distinction from all other species of living processes: that, as a matter of principle, which is, rooted scientifically, for all competent modern science, on the foundations of the principles set forth by Filippo Brunelleschi (the discoverer of the ontological minimum), Nicholas of Cusa (the discoverer of the ontological maximum), and the positive discovery by mankind, by Johannes Kepler, of a principle coincident with the perfected Classical human singing scale adopted by Kepler, and the elementary measure of the Solar System within the still larger universe of the Galaxy, and higher orders in the universe.

Or, similarly, later, the modern physical-scientific standard implicit in the argument of Bernhard Riemann, the actual minimum (echoing the principle of Brunelleschi), of Max Planck, the actual maximum of the present maximum, that of Albert Einstein; and, the relatively latest, consequent implications of the definition of human life by Vladimir Ivanovich Vernadsky. These values are, each relative absolutes of measurement of man's role within the knowledge of the universe.

This set of facts pertains to the inherent fraud of the merely mathematicians and the modernist "musical performers" since the standard of the relevant paragon for music, Johannes Brahms (prior to the degenerates, such as the merely mathematicians, such as David Hilbert and the true model for every modern Satan, such as Bertrand Russell, or Tony Blair).

The knowable measure, in principle, of the difference between man and all among the lower forms of life, is found

in what has been usefully regarded as the naturally upward evolution of the human species, in contrast to all other known categories of living species. The standard of measurement of these compared relationships, is that mankind is enabled to evolve upward, and that categorically, by those voluntarily noëtic powers of the human individual will.

Except when mankind appears in a morally and physically degenerate state of behavior, such as within the cultures of the tyrants Zeus, the Roman Empire, and the British empire, presently: all actually sane cultures of mankind, have appeared, this far, in a certain fact of evolutionary progress from the quality of an inferior, to a superior species. This, when considered in terms of efficient effects, corresponds, within the domain of a living human practice of chemistry, to a form of systemic advances, even now leaps, in the chemical energy-flux density of society's increase of the effective energy-flux-density of scientific and comparable expressions of leaps in progress of the species itself: in short, a universal physical principle of human progress.

The healthy human culture, such as that of Christianity, if they warrant this affirmation of such a devotion, for example, represents a society which is increasing the powers of its productive abilities for progress, to an ever higher level of per-capita existence. The contrary cases, "the so-called zero-growth" scourges, such as the current British empire are, systemically, a true model consistent with the tyrannies of a Zeus, or, a Roman Empire, or a British (better said) "brutish" empire, such as the types, for us in the United States, of the Bush-Cheney and Obama administrations, whose characteristic has been, concordant with that of such frankly Satanic models as that of Rome and the British empire presently, a shrinking human population of the planet, a population being degraded presently in respect to its intellectual and physical productivity, as under those U.S. Presidencies, most recently.

Chemistry: The Yardstick of History

We call it "chemistry." Mankind's progress, as measured rather simply as a species, is expressed typically in the rising power of the principle of human life, over the abilities of animal life generally, and relatively absolute superiority over the powers of non-living processes to achieve within mankind's wilful intervention to that intended effect. Progress exists so only under a continuing, progressive increase of the productive and related powers of the human species. That progress defines the absolute distinction of the human species from all others presently known to us. A government of people based on a policy of "zero-population growth and per capita standard of human life" is a moral, and practical abomination.

Man is mankind's only true measure of the history of our Solar system, and what reposes within it. That is the same thing, as the most honoured meaning and endless achievement of the human species, now within nearby Solar space, heading upward to mastery over the Sun and its Solar system, the one discovered (uniquely, as a matter of fact), by Johannes Kepler.

A Fusion economy, is the presently urgent next step, and standard, for man's gains of power within the Solar system, and, later, beyond.



<http://www.comiterepubliquecanada.ca/article5401.html>

VIDEO-Forging Fusion: Physical, Chemical, Nuclear, Fusion!

Sign Online - The U.S. and Europe must have the courage to reject geopolitics and collaborate with the BRICS

The [International Schiller Institute](#), founded by Helga Zepp-LaRouche, issued the following statement, for international circulation, to garner support for immediate action.



In today's nuclear age, the consequence of a geopolitical policy of confrontation with Russia and China can only be the thermonuclear extinction of the human race. Therefore, every effort must be made to cooperate to solve the multiple crises facing humanity.

The BRICS nations (Brazil, Russia, India, China and South Africa) have united to pursue a policy of economic development not just for their individual countries, but for the benefit of the people of all nations. To that end, they have created a New Development Bank to invest billions in necessary development projects.

China recently initiated the Asian Infrastructure Investment Bank (AIIB), joined by over 20 Asian nations as founding members, and has set up a Silk Road Development Fund.

At the APEC conference in Beijing, Chinese President Xi Jinping invited President Obama to join the efforts of China and other Asian nations, including Russia, in the development of the New Silk Road.

These initiatives are not geopolitical in nature. Contrary to the Transpacific Partnership (TPP) advocated by Obama, which excludes Russia and China, the BRICS-related initiatives including the Chinese proposed Free Trade Area of the Asian Pacific (FTAAP), are inclusive. They are based on the concept expressed by the late Pope Paul VI that the "new name of peace is development." Thus, in Australia at the recent G-20 meeting, both Xi Jinping and Indian Prime Minister Modi spoke of the twin goals of achieving global peace and ending poverty through economic development.

There is no problem in the world that cannot be solved by such an approach, and conversely, no problem that will be solved without it.

Such cooperation between the U.S., Russia, China and India, among other nations, is necessary to defeat the Ebola pandemic in Africa.

The terrorist threat represented by ISIS and Al-Qaeda is aimed equally at Russia, China, and India, as well as the U.S. and Europe. It can only be defeated through a new security architecture based on cooperation.

The policy of conducting "color revolutions" under the pretext of democracy, represents a policy of war, even if that term is not used, because its aim is to topple governments with the aid of foreign money. It has to stop. The campaign to impose sanctions on Russia for its opposition to such "color revolutions" and to a Nazi coup in Ukraine, is only exacerbating the global crisis. An approach based on mutual cooperation to achieve the common ends of mankind throughout Eurasia and beyond, would instead create the basis for global peace.

While the U.S. has abandoned the Kennedy space program, the Chinese are committed to a lunar program focused on the exploitation of helium-3 for the purpose of generating unlimited fusion energy. With collaboration between the U.S., Europe, Russia, China and India, among other nations, man could finally realize Johannes Kepler's vision of mastery of the laws of the solar system for the benefit of man.

Only such an approach would restore the United States and Europe to their original purpose as expressed in the European Renaissance and the American Revolution, a purpose which the U.S. and Europe have increasingly abandoned, and the rest of the world has now adopted and is now urging them to readopt.

We therefore call upon the U.S. and Europe to abandon the suicidal geopolitical policies of the past which led to the two previous World Wars and are leading to a third, and to build a future for all humanity by readopting the principle of the Treaty of Westphalia, by basing foreign policy on the principle of the "benefit of the other," which ended the Thirty Years War in Europe, and on John Quincy Adams' concept of a "community of principle among sovereign nation states."

That is the only course coherent with the true nature of man as the only creative species. Any other course is based on a concept of man as an animal, and leads to human extinction. As patriots of our own nations, and as citizens of the world, we call on our fellow citizens and the leaders of our nations to have the courage to break the current cycle of escalating bestiality, by accepting the generous offer to collaborate with the BRICS.

*First name _____
*Last name _____
*Title _____ *Institution or Organization _____
*City _____ *Province _____
*Phone number _____
*Email _____

(*): Mandatory field

Institutional or Organizational affiliations are listed for identification purposes only, and do not imply endorsement by the institution or organization.

With my signature, I agree that my name may eventually be made public.

Press Release:

Prominent leaders back Resolution calling for the U.S. and Europe to have the courage to reject geopolitics and collaborate with the BRICS

A grouping of [more than 100 prominent politicians, businessmen, academics, scientists and artists](#) from 20 countries have publicly endorsed a resolution calling on the U.S. and Europe to collaborate with the BRICS nations in the interest of peace and economic development (see below for signatures). The resolution, sponsored by the Schiller Institute, was issued in response to the offer of China's President Xi Jinping for the United States to join China's New Silk Road development program and abandon the policies of confrontation with particularly Russia and China.

The prominent signers are joined by more than 1000 ordinary citizens from these and other nations who urgently want their governments to abandon the policies of confrontation and collaborate with the BRICS countries based on the Treaty of Westphalia's principle of the "benefit of the other." The Schiller Institute intends to continue to garner support for the resolution from intellectual leaders and ordinary citizens alike to create a mass movement for economic development and peace.

Helga Zepp-LaRouche, founder of the Schiller Institute said:

"The idea of collaboration with Xi Jinping's offer to cooperate with the New Silk Road is the most important peace initiative to get the world away from the edge of confrontation and war. Collaboration on this initiative is a fantastic perspective for mankind. I am calling on all people to distribute this resolution and help us get more support for it."

Add your name to the statement. *Sign Online here*



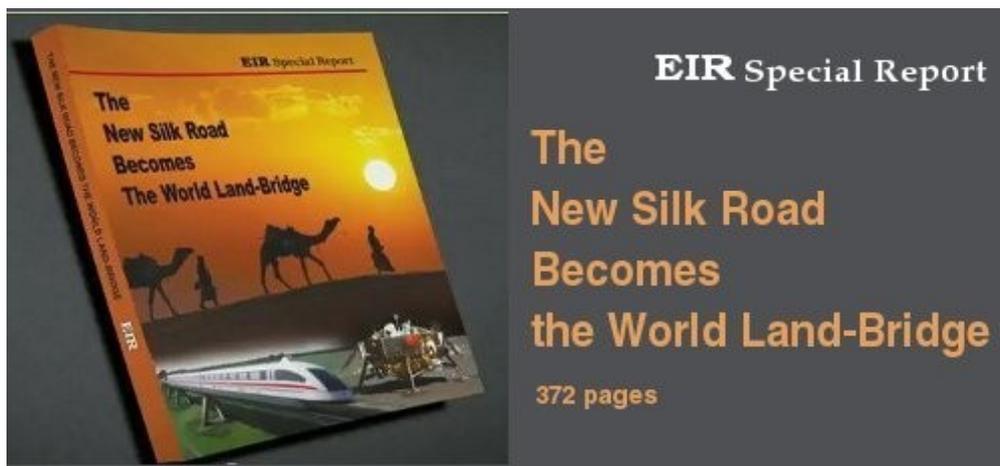
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'The New Silk Road Becomes the World Land-Bridge' EIR Special Report

21 November 2014 —Mankind's future is being shaped today by an international movement for real economic development, led by the nations of the BRICS (Brazil, Russia, India, China, South Africa). In contrast to the current bankrupt Trans-Atlantic financial system, this new movement is building corridors of development, expanding nuclear power production, and pioneering in space exploration—fostering the new technologies and creative spirit which can uniquely bring the planet out of the current threats of pestilence, starvation, and war.

EIR has been at the very centre of shaping this new movement, which can be seen as a realization of the vision and plans for a New World Economic Order put forward by Lyndon and Helga LaRouche, and their movement, in the early 1970s. For 40 years, the LaRouches and EIR have been on an organizing drive to spread the ideas which could spark just such a development. [See "[LaRouche's 40-Year Record: A New International Economic Order](#)," at www.larouchepac.com]

1996 marked a major landmark in this process, when Mrs. Helga Zepp-LaRouche participated in a conference on the Eurasian Land-Bridge perspective in Beijing, China. In the wake of that conference, EIR produced its Eurasian Land-Bridge Special Report "**The Eurasian Land-Bridge: The 'New Silk Road'-Locomotive for Worldwide Economic Development**", which laid out how the impetus then being developed in China, could spread throughout the planet.



EIR Special Report, "The New Silk Road Becomes the World Land-Bridge," is the exciting sequel to the 1996 report, updating the enormous progress that has been made on the development plans laid out in that earlier report, and presenting extensive development plans for every part of the world, driven by a crash fusion power program, and the replacement of the bankrupt monetary system with a credit-based system of national banking.

For the Contents, Click on <http://www.comiterepubliquecanada.ca/article5245.html>

You can purchase the 372 page EIR Special Report "*The New Silk Road Becomes the World Land-Bridge*" in PDF format for \$200. and or in hard copy for \$250.

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