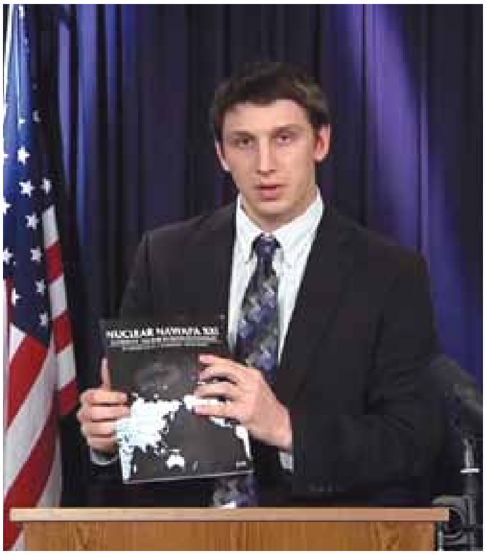
LAROUCHEPAC WEBCAST

# Creating the Trans-Pacific Fusion Economy

The LaRouchePAC Basement Research Team held a webcast on Dec. 6, 2013, under the above title, featuring presentations by Benjamin Deniston and Meghan Rouillard. Moderator Jason Ross opened with a quote from the American economist Henry Carey's 1851 pamphlet, "The Harmony of Interest," which identified "two systems" before the world: one, the British System, which "looks to pauperism, ignorance, depopulation, and barbarism"; the other, the American System: "the only one ever devised the tendency of which was that of elevating, while equalizing, the condition of man throughout the world."

Once again, said Ross, "two systems are before the world, which present themselves today as the trans-Atlantic world and the Pacific orientation."

The two presentations reproduced below (edited for *EIR*), represent the intention to revive the American System of economic advancement and scientific discovery on behalf of the general welfare.

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*Benjamin Deniston discussed the unique power of human creativity to produce advances in energy-flux density, such as that envisioned with thermonuclear fusion, which will make endless human progress possible.*

## A New Idea of Physical-Economic Progress

**Benjamin Deniston:** We're going to engage in a discussion on the prospects for creating a new, global economic system. And looking at the reality of the shift already ongoing toward the Asia-Pacific region of the planet, we have a serious orientation toward growth, toward progress. We're going to discuss both the specific projects involved in this pro-development Pacific orientation, and the governing economic principles, the concepts, the new ideas that need to govern this new era of development of mankind.

As we published in a special report, "Nuclear NAWAPA XXI, Gateway to a Fusion Economy," here is the region of development that we're looking at (**Figure 1**). We can see that we're looking at an integrated concept of development, stretching from the Mississippi in North America, through

FIGURE 1
**The Trans-Pacific Development Concept**

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the western half of the continent of North America, with the keystone project being NAWAPA XXI [North American Water and Power Alliance], which we'll get into more detail on. That takes us up into the Arctic region, into Alaska, into Northern Canada, with the prospect of developing not only the northern components of NAWAPA, but the long-awaited Bering Strait rail connection, a tunnel connecting the tip of Alaska with Siberia—a set of tunnels, most likely—enabling high-speed rail transportation and connection between these entire land-masses of North America and Eurasia, and development projects stretching into Siberia, down into China, and Southeast Asia. And we already see an orientation from China, with the proposal of the Chinese President for a New Silk Road orientation, which is a similar concept of developing the territory, now moving across Eurasia, toward Europe.

What we have focused on in our work with Lyndon LaRouche, on the prospect for this development program to be made a reality, is the key role of fusion power as the driver. And to get into that, and some of the related issues, I'm going to discuss the need to develop a new idea of physical economic progress, a concept that I think has been lost to many Americans following the past decades of zero-growth ideology.

This is a type of progress that is unique to mankind, and it was more familiar to older generations: the idea that people saw their lives, their work, their employment, their commitment as a generation, to improving the conditions of life for those who came after them. The idea that every generation should be a successive stage of development, a successive improvement in what should be, and can be, an endless process of development for mankind.

And I stress *endless.* Because there is a very large Solar System, and very large galaxy sitting before mankind. So the idea that there's any limit to the potential growth for many, many, many generations down the line is hard to imagine. Their conditions of life, their living standards, their benefits, have been physically created by the actions of their parents' and grandparents' generation, and they in turn see their actions as the causal force creating a better society for the next generation.

This has to return as a governing concept to the United States, a very anti-green, anti-zero-growth, pro-development concept. And every individual inherently has the right to participate in that process of successive generations of development.

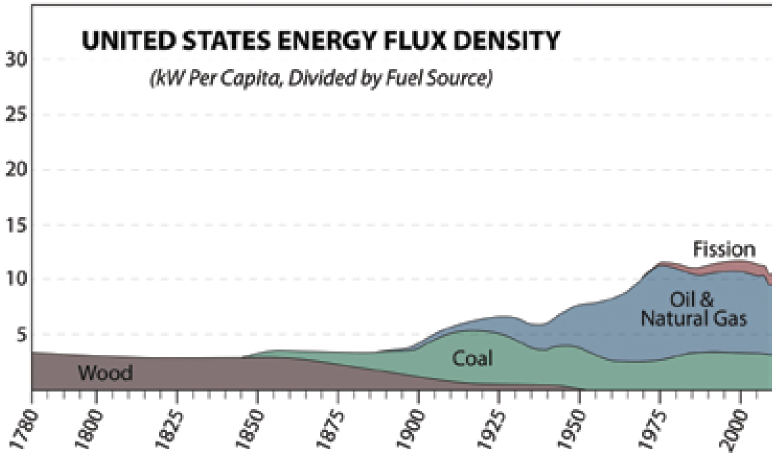
## The Secret Driver of Economic Growth

Where does this potential for progress come from? If you take a physical approach to economics, which Mr. LaRouche has specialized in, you could study what we could call the productive powers of labor: the ability for a labor force to produce more needed goods than it can consume. There are certain requirements for society, physical requirements: Mankind's existence depends upon these physical economic processes—food, agriculture, industry—the physical means of existence for society.

Now, for mankind, you have an interesting phenomenon, where a potentially smaller portion of the population can end up producing more of those needed goods, and at a higher quality. You have a concept of the productive capabilities of the labor force, driven by scientific and technological progress, which then enables fewer people to produce all the food requirements, or industrial requirements; you free up more of your population to participate in science, in education, in Classical artistic activity. You free up more of your population to develop and focus on the creative aspects of society, which then become the real secret driver of economic growth.

But again, even this idea of increasing the productive powers of labor, increasing the productivity of a labor force—where does that power really come from? I want to try to illustrate this by going to a reference that Mr. LaRouche has often made, going back to the evidence of the use of fire by a human-type creature, way back in the deep history of mankind. And what I would want to emphasize about this, is when you see the existence of the first use of controlled fire, as a means of controlled activity, you see evidence for what I would call a non-biological existence of the human species, evidence that the human species defines its existence, not by simply the nature of the biological body, but as a function of something completely different, that doesn't exist in any other animal species that we know of.

FIGURE 2



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So, you have the emergence of fire. Fire is used to cook food. Fire is used to provide warmth. Fire is used to make tools. Fire is used to generally improve the conditions of life, to enable a larger population, a larger population density, fundamentally changing the relationship of the human species to the biosphere around it, the environment around it. And, to illustrate this, you can take one way to look at it: If somebody were to try to study this change in ecological terms, the standard methods used to study the nature of an animal species and its relationship to the biosphere, you would see a change that you would only think would be attributed to biological evolution, an evolutionary upshift to a higher-order species.

But for mankind, there's no biological change. Mankind's development doesn't depend upon biological shifts, but it comes from a unique force which we identify as the creative powers of the human mind, a seemingly immaterial process. If you tried to weigh a scientific discovery, or smell a scientific discovery, or taste a scientific discovery, you'd have a hard time. But we see that scientific discoveries have controlling effects in the universe; they are physically efficient in changing mankind's ability to act and improve the planet, and improve the conditions of life on the planet.

So, this is the unique power of mankind, and completely transcends any idea of biological existence, any sense-perceptual idea of what the human being is. This process of the development and application of the creative powers of the human mind, is the essence and the core of what makes mankind uniquely mankind. And so, it's been through this process that mankind has become the most powerful force on the planet.

## Energy-Flux Density

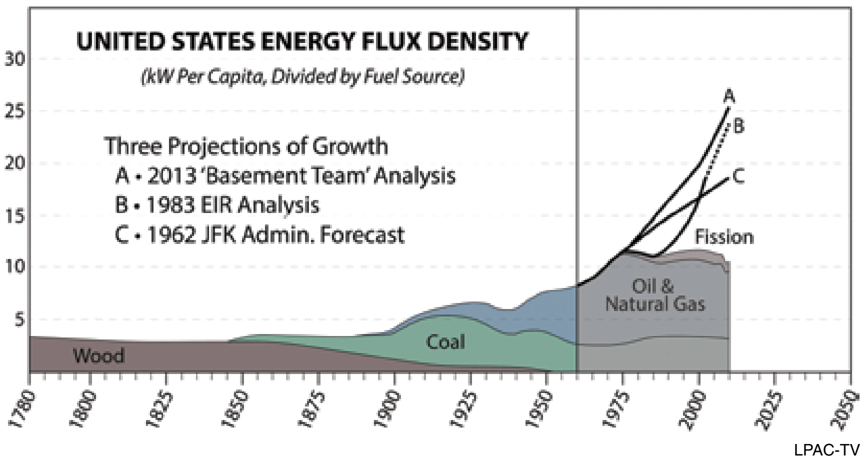
I think the work of the Ukrainian-Russian scientist Vladimir Vernadsky in discussing this, is very profound, very apt. He titles one of his books *Scientific Thought as a Planetary Phenomenon:* the emergence of scientific thought as now a controlling geological force on the planet.

One thing to look at here is a shadow of this process, an effect of the growing power of scientific thought and technological advance, and that is the concept of energy-flux density, the measurement of not just energy usage, but of the rate of energy usage, either per individual in society, or per area of the national territory. And this becomes an important corollary, an important shadow, an important effect, associated with the development of human society at higher and higher levels.

We can look at a case study of this in the history of the United States (**Figure 2**), where we see the development of the U.S. economy from its founding, up to the present, associated with the process of increasing the power per individual, in this case measured in kilowatts per capita, in society. The point is the relative change, the relative increase. And each revolution, each leap, to higher levels of energy-flux density, as is indicated in

Figure 2, can be divided by the fuel source associated with those shifts. And you can see that there is a succession of moving to higher- and higher-order power sources that are associated with not only increasing the energy-flux density, but you could, referring to the earlier example, describe it as almost a species-type transition, where there's a fundamental revolution in mankind's power for action, power for control, power for improvement of the economy, of the biosphere, of the territory he's inhabiting.

FIGURE 3

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Each of these shifts comes with totally new degrees of freedom in society; new chemical processes, new resource bases are opened up. Materials that weren't accessible before for any efficient utilization, now become tools of use for the betterment of society.

Now this was the case up until—as you can see in Figure 2—the period of 1970, and after, where you had a levelling-off of increase in energy-flux density. And I should just note that this chart shows a levelling-off; this particular illustration doesn't necessarily convey the decline process—the zero-growth, green paradigm—that took over the United States following the assassination of Kennedy, a process of attritional collapse. We were wearing down our infrastructure, using up our existing resource capabilities, and having to expend greater and greater amounts of economic activity just to maintain a certain mode of existence. That has brought us to the point that this whole system now is breaking down.

And a huge component of that has been, over this last 40-year period, the outsourcing of productive jobs, the shifting of jobs out of the United States, and to places like China; not just any jobs. The actual jobs that create and sustain the physical means of existence have increasingly left the United States: We don't have the in-depth capability in the United States to have a full economic recovery program by ourselves, because of the destruction of the U.S. industrial capability. And one of the most important factors in the recent period, was the shutdown and dismantling of the auto sector, which represented one of the last in-depth, large-scale industrial machine-tool capabilities of the United States, famous for what it allowed us to do during the World War II mobilization, where we could out-produce our enemies by orders of magnitude.

That would be the type of force we would need to apply to an economic recovery today, to make NAWAPA real, to make these high-speed rail projects real, to make the Bering Strait project real.

## Toward a Fusion Economy

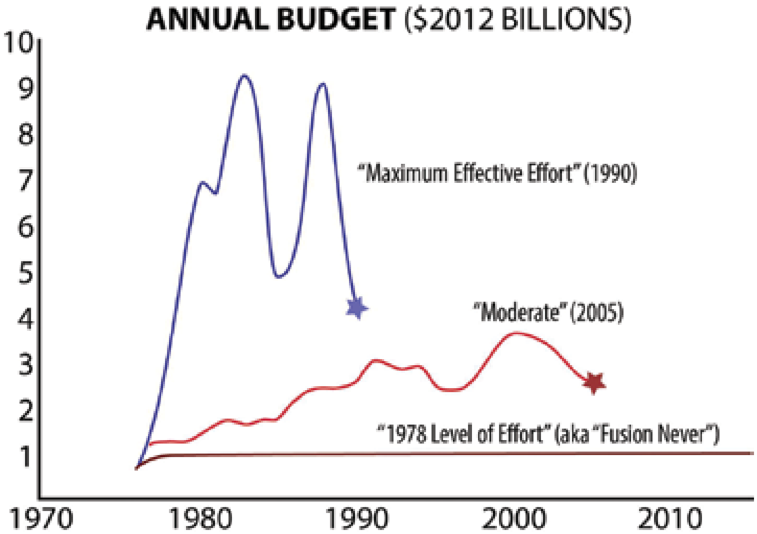
**Figure 3** shows the same energy-flux density over the history of the United States, with three different approaches. I'm going to start with curve **C,** showing how the energy-flux density per capita was expected to grow as of the assessments in 1962 by the Kennedy Administration. This was largely based on understanding the power and the role of nuclear fission as the next revolution in mankind's economic potential.

Now, if you look at curves **A** and **B,** these are estimates that include the prospects for a higher-order source, which again needs to become the driving factor in the recovery and the development program today, which is fusion, thermonuclear fusion. Fission, the splitting of heavy elements, is hundreds of thousands of times more powerful, more energy-dense, than any chemical fuel. Fusion is millions of times more energy-dense that any kind of chemical fuel—coal, oil, oxygen, hydrogen, what have you.

So, estimate **A,** the top curve, is a rough approximation of our own analysis in the Basement Team as to what the rate of growth very well could have been, had we continued a serious pro-growth orientation since the early 1960s. Curve **B** is an approximation of what type of growth could have been seen had the world gone with Mr. LaRouche's SDI [Strategic Defense Initiative] program, which included, as an integral part, what some were referring to at the time as a second industrial revolution, a new economic revolution based on fusion-era technologies—the development of plasma-processing technologies, laser-based manufacturing systems, technologies moving toward the domain of a fusion economy. And those were the prospects we had before us.

I want to emphasize that this could have been done. And the prospects for fusion—there's kind of a bad joke going around on fusion, where they say it's perpetually 30 years away. If you asked the community in the mid-1970s, how long will it take us to get to fusion power, to build a demonstration fusion power reactor, they said, 30 years. If you ask people today how long will it take to build a demonstration fusion power reactor, they will say, 30 years. So, it's this bad joke that fusion is always 30 years away, and the lie had been spread that this is because it's too hard: There are technological challenges you just can't overcome; there are scientific challenges you just can't overcome. It's just too complex. All this money's been dumped into it, and it's not going to happen; it's just too hard.

FIGURE 4

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## Multiple Designs for Fusion Reactors

That is not true. And I want to take a minute to really emphasize this point. We have the results of a 1976 study by the U.S. Energy Research and Development Administration [ERDA]. This was a precursor to the Department of Energy. It was a four-volume study, the first in-depth study of what it would take to build a demonstration fusion system. And they were serious: They were not just talking about one reactor. They were saying there are different avenues to pursue; there are different designs that show different potential prospects. We don't know exactly which ones are going to play out the best, so we'll pursue multiple designs for fusion reactors. There are certain infrastructure and materials challenges involved, so we'll build systems to develop the materials needed. We'll build systems to provide the fuel.

It was a full, comprehensive study, not just on the science, but the engineering, and everything involved in making fusion a reality. [ERDA] said: How quickly can we do it? Well, it depends upon the level of investment. We know we need to build these systems. We know we need to build these types of reactors, these test systems and demonstration reactors. The current flagship project, ITER, being built in France, which is itself an excellent machine, but under this idea, it would have been completed by the 1980s as part of a staged process.[1]

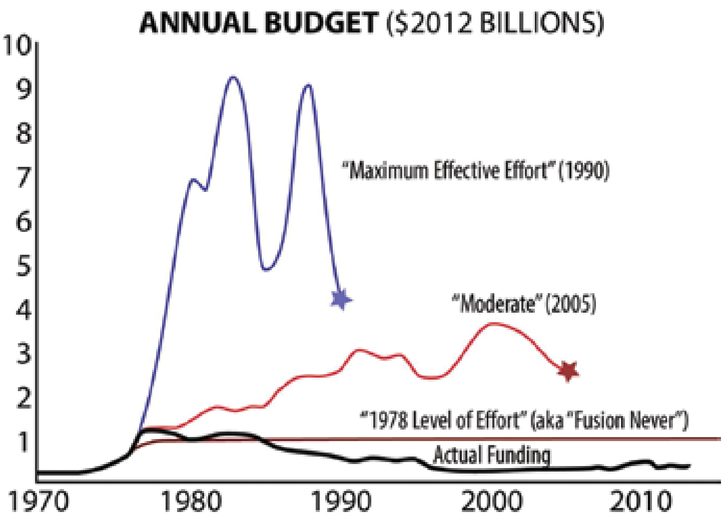
They [ERDA] said, if we put the maximum effort into it, just say this is a top national priority, we'll fund whatever needs to be funded to develop fusion power, because we know this is going to be a revolution for all mankind: With fusion, the oceans become an effectively unlimited supply of fuel—so you're effectively talking about the greatest revolution in human economy we've had up to this point. If you give the full maximum efforts, you can see here the yearly budgetary requirements (**Figure 4**), and they predicted, by about 1990, you could have a demonstration fusion reactor putting power on the grid, demonstrating the potential for fusion technology.

They had various estimates of slightly slower paths, and the slowest that they suggested was the "moderate" path, which expected to provide a demonstration reactor by 2005. So, again, it could have happened by now.

They also made a point that should be very heavily emphasized, which is, if you don't provide a certain level of investment, we *know* that we probably won't

1. For more on ITER, see "The World Needs the U.S. Fusion Program," *EIR*, Dec. 20, 2013.

FIGURE5

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make the breakthrough. If you don't provide a certain minimal level of investment, then we know we're probably not going to be able to have the density of activity to actually get an operating fusion system. This was indicated by asking, what if they just continued the projected budget of 1978 into the future? And the conclusion was that it's very possible that you would never get fusion power under that type of investment. You just don't have enough money to build the systems you need, to figure out the questions, and to take those answers and implement them in the next stage in any type of effective way.

So, that was known as of the mid-1970s.

**Figure 5** shows the actual funding. And this makes clear that we never even tried. The idea that fusion is always 30 years away, is just a bad, sick joke. We never even tried. The commitment was never made to seriously make this a reality.

The reason I emphasize this is because the prospects for fusion power are there. What needs to change is the zero-growth paradigm. The reason that fusion was never pursued, that it was suppressed, the reason fission was never pursued in any serious way and was suppressed, is because of this zero-growth, green paradigm, which, as you saw in the energy-flux density curves, also contributed to the complete levelling of any growth of energy-flux density per capita over the past 40 years, and as we're experiencing right now today, has led to the complete destruction of the U.S. economy.

## The Prospects for Fusion Power

Now, I want to focus on two case studies to illustrate some of the potentials, the prospects, for fusion power, fusion technologies. And the reason why I wanted to emphasize these funding curves was to make the point that we are much closer than most people admit. A few independent estimates by different sources looking into this, have given 10 to 15 years as a rough, completely feasible range of time in which we could develop a demonstration fusion power reactor. So, you're looking at a prospect of 10, 12, maybe 15 years, if we actually decide to do it, which, as you can see, we haven't done.

This is going to be critical, not because we're going to be able to have fusion reactors next week, but because the trans-Pacific development program has to be centered on fusion as the driver, the technology driver, the power driver, for the whole program. And to give a brief sense of why that's the case, I want to look at two case studies.

For the first one, I'm looking at the question of productive powers of labor. This can be seen if you examine the history of iron production, throughout the history of the United States (**Figure 6**). Iron is a useful

FIGURE 6

**IRON PRODUCTION**

| | Energy Flux Density (Gigajoule / m² / hour) | Power of Labor (Tons / worker / year) | Power of Technology (Tons / terajoule) |
|---|---|---|---|
| **1830** (*Charcoal era*) | 2.6 | 10 | 4 |
| **1860** (*Anthracite era*) | 6.3 | 21 | 16 |
| **1900** (*Carnegie era*) | 18 | 70 | 45 |
| **1950** (*WWII era*) | 24.3 | 120 | 75 |
| **1970** (*Space era*) | 29 | 183 | 80 |
| **Future** (*Fusion era*) | 360 | – | 200 to 275 |

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case study to examine. It's the most used element to human society, by weight, of the entire Periodic Table. It's the main component of steel, and so iron is an integral part of the core, the backbone, of any modern industrial economy.

Now, if we look at the history of iron production, and at the energy-flux density of the production methods—again, the point here is not to get stuck on the nature of the measure itself. Here, we are looking at billions of joules per square meter, per hour, or gigajoules per square meter per hour. The point is you're measuring a rate of flow of energy, per area, per time, of the blast furnace that's producing the iron, in this case.

The point is, the relative changes: In the 1830s, wood/charcoal- based technologies, you had the energy-flux density value of these metrics of 2.6, which enabled production of about 10 tons of iron per worker per year. This is the idea of productive power of labor. How much could each individual in society produce?

Now, as you see the energy-flux density increasing, up to the 1860s, with the beginnings of coal, up to 1900, 1950, 1970, you see a continuous increase in energy-flux density of production methods. This is associated with moving to coal, to coke, a dense form of coal; moving to technologies to actually blast pure oxygen into the furnace, to have a higher temperature, a higher rate of activity. And as you can see, an order of magnitude increase in the energy-flux density is associated with almost a 20-fold increase in the power of labor. Each individual operative, each individual worker, in the iron industry as a whole—the amount that he produces per year went up dramatically—from 10 tons of iron per year, to 183 tons in the space-era technologies of the 1960s, before we entered a collapse phase. It's actually declined significantly since then.

People talk about jobs. What kind of jobs? We need high-technology jobs. The kind of jobs that Obama has created, jobs for jobs' sake, jobs at Taco Bell, jobs in the service sector, don't necessarily mean anything to society. We need jobs that are associated with high technologies, high energy-flux densities, around new science-driver programs that are associated with increasing the productivity of each individual, incorporating new scientific discoveries, new scientific concepts, into the means of application, into the means of production.

It's also useful to note [in Figure 6] that in addition to the production per worker, the production per amount of energy also increased. This is measured in trillions of joules, but the point is, the amount of iron produced per unit of energy went up in this case, many-fold, going from 4 tons per unit of energy, to 80 tons.

Now, this can continue to much higher levels, especially if you go to a fusion-era system, where you can look at energy-flux densities going an order of magnitude higher, or greater, dealing with plasma-based processing systems. We are able to super-heat a gas, such that it becomes a plasma—the protons and the electrons separate out. You have a magnetized gas that you can increase to incredibly high temperatures. We haven't even found a limit to the temperatures we could raise these things to. And you could engage in materials processing, industrial processing, at much higher degrees of efficiency.

In the chart (Figure 6), you can see that you can further increase the productivity per unit energy, up from 80 to somewhere between 200 to almost 300 tons per unit energy. And again, this was just taking iron as a case study. The same applies for other metals: for aluminum, for cement production. You generally can increase the productivity of all types of manufacturing and materials processing.

### What Are 'Natural Resources'?

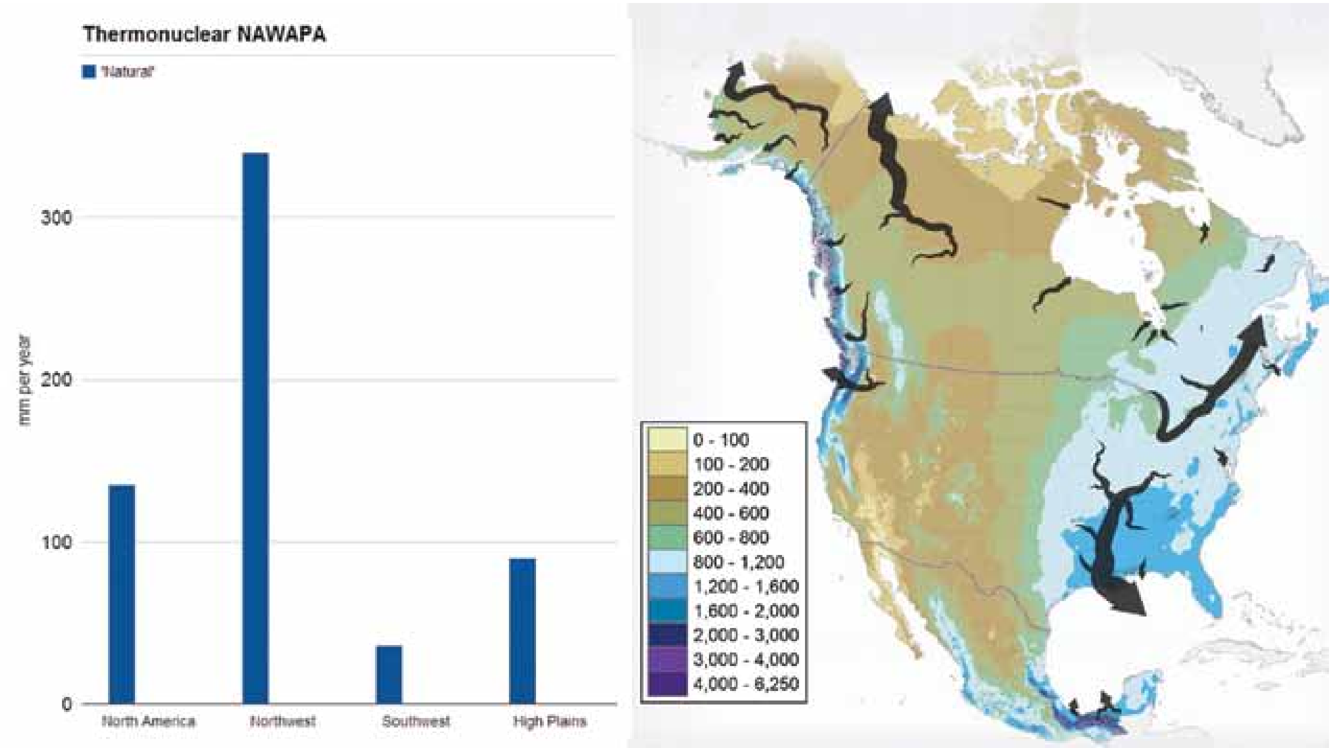
This also opens up a completely new mode of chemistry, a completely new concept of natural resources. The very idea of natural resources, using that term, really implies a fraudulent concept. It implies the resources are defined by what's *natural,* what's *there,* what they are. But that's not true; that's a total fraud. The resources are defined by something completely different.

Take uranium, for example: 150 years ago, uranium didn't mean much of anything to human society. I was told by one person that there was some slight usage of uranium to tint the color of glass for glass-making. So, it was a resource in that sense, and that was it. It was pretty much otherwise a constituent component of dirt and rock, relatively useless.

Today, it's one of the most energy-dense forms of power fuel that we have available to us. What changed? Did the uranium change? Did the resource itself change? Where was the change?

We had an entire scientific revolution, coming out of the turn of the century, in which individuals such as Max Planck and Albert Einstein were central figures—they didn't develop every aspect of nuclear fission tech-

FIGURE 7
**North American Rainfall**

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nology, but they were leading figures in a revolution of investigating the domain of the very small, and Einstein's discovery that matter and energy are actually interrelated and part of the same thing, which is a governing principle behind the energy-release of fission and fusion reactions.

Certain leading, remarkable individuals, drove a scientific revolution, which then completely transformed mankind's access to natural resources, such that now, things like uranium, and fusion fuels from ocean water, become conceivably, potentially, natural resources. It enabled higher modes of energy-flux density. All this as a shadow, as an effect, created by the power of the scientific thought of mankind, the power of scientific discoveries, which is the source of progress.

## The NAWAPA Revolution

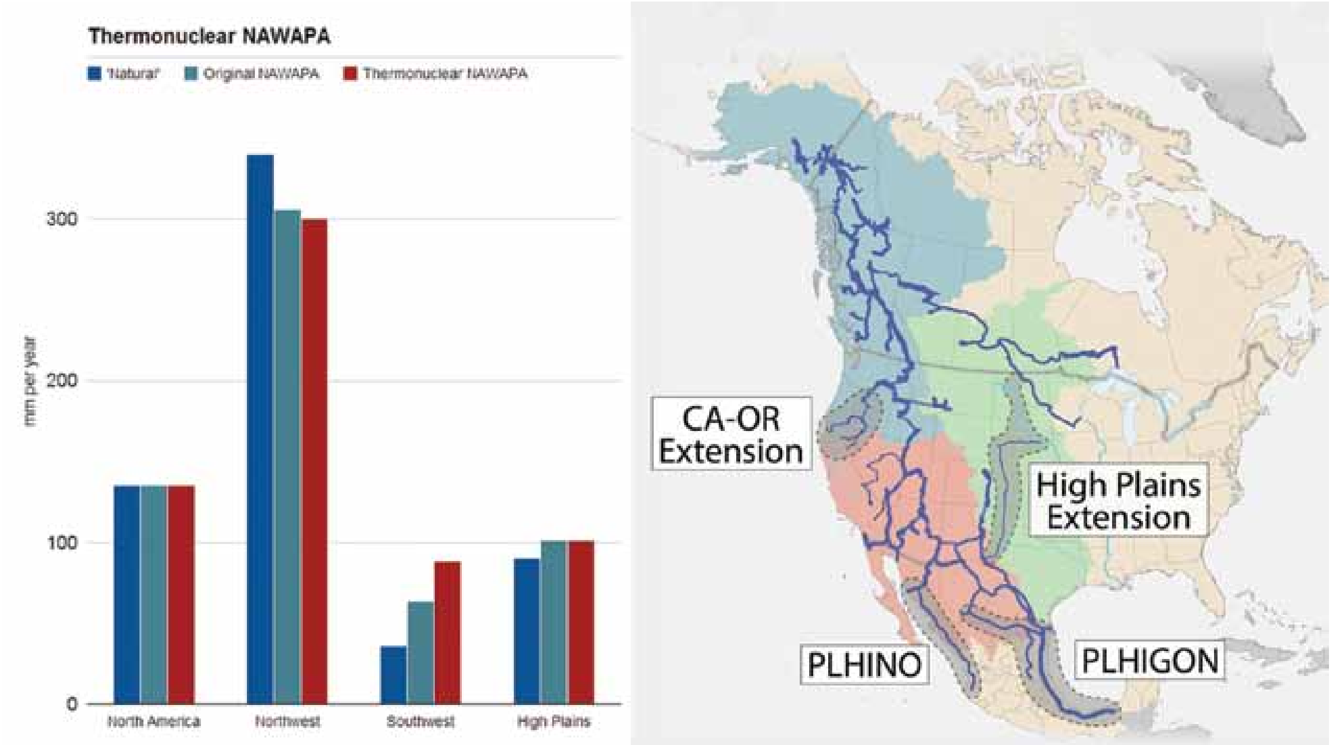
So, now I want to take one more case study, to look at this in a slightly different fashion, which is the NAWAPA program—which is a continental water- and power-management program, and this can be used to illustrate a second example of the role of energy-flux density, which is energy-flux density applied per area of territory.

As most inhabitants of the North American continent are aware, we have a major desert in the Western region of the continent. We have here the map (**Figure 7**) illustrating the precipitation—rainfall and snowfall—yearly average, for the entire continental territory. The purples and dark blues and blues are very high levels; the brown, the yellow are very low levels. So, you can see the East Coast, for example, and the whole Eastern third of the continent has a much higher range of precipitation over the whole territory.

The West Coast, the Western third, has, overall, very little; and the black arrows represent major river systems; the thickness of the arrow corresponds to how big the river is, how much flow of water comes out of the river. The Mississippi is the largest, and other major systems are indicated by the arrow systems.

What you see on the West Coast is an interesting phenomenon, where there's actually a very large amount of precipitation along the northern coast, along a small strip of territory, just inland of the Pacific Ocean. And that's because you have a very large mountain range right along the Western coast of the continent, which blocks a huge amount of moisture from the Pa-

FIGURE 8
**NAWAPA: Redistribution of Water**

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cific Ocean from travelling inland, and bringing water into the inner regions of the continent. The moisture flows through the air, hits this mountain range, is forced up to a higher elevation where it condenses, and falls back down as rain and snow.

And then, much of this water—which the Sun works very hard to evaporate from the ocean and get it up in the atmosphere and make it do something productive, like participate in plant life, participate in the growth of crops and forests—this water that had to go through the whole process to get onto land, then just runs right back off into the ocean, because it hits this mountain range and falls back in. So, it's a completely wasteful natural orientation of the continental system.

The bars on the left (Figure 7), are just another way of expressing this, which is the water availability for different regions of the continent. The one on the far left is the average for the entire continent of North America; the very tall bar next to that is the Northwest region, which I was just describing, where you have a very, very high amount of water availability on average. The third bar, the very low one, is the entire Southwest. So the entire southwestern quarter of the continent, stretching from California, Nevada, Utah, down into Mexico—this entire region has a very low level of water availability per area.

Now, the point is that the way this exists naturally makes for a very low level of productivity of the continental water cycle. As I mentioned, the oceans are being evaporated by the Sun, it's bringing new water onto the continent; that water participates in processes on the continent—rivers, forests, grasslands, agriculture, human society—and then the water eventually returns to the oceans again. There are a lot of complexities in the details, but as a whole, you can easily conceive of the entire thing as an input-output system. And what we measure with NAWAPA, is how we can increase the productivity of that water cycle, increase the productivity of every unit amount of water; how productive is the average gallon of water, for example.

In **Figure 8**, we can see what NAWAPA will do to redistribute the water. You can see the redistribution proportions in the graphs on the left. It will redistribute a relatively small percentage of the water available in that northwestern quadrant, which you can see on the map, highlighted in blue, and through the system of rivers, canals, tunnels, we can bring that water down into the Southwest, and down into the high plains regions, and actually have a more equitable distribution of the water of the system.

Now, what we've done with the Basement Team, in working through this project, is not only revive this original project, which was designed in the early 1960s, but look at the application of the potentials of nuclear fission and thermonuclear fusion to enable a greater utilization of the entire water cycle. You can create a much more efficient system by using nuclear fission and fusion systems, than you could otherwise.

The original NAWAPA design was dependent upon hydropower running some of this collective water off into the ocean, to generate electricity, to then use that electricity to pump the rest of the water throughout the continent. If you use higher forms of power, with nuclear fission, and we should really be thinking about fusion, you can actually utilize more of that water, bring it down into the Southwest, and what you're doing is a very interesting subject of the application of higher energy-flux density, literally increasing the productivity of the entire continental water cycle.

The amount of green plant life that can be created by the North American water cycle, can increase. The amount of plant life and photosynthetic activity, be it in cropland, grasslands, forests, the amount of productive utilization of water, can be increased such that on average, you can literally say the value of the average gallon of water of the North American system would be increased by NAWAPA, and further increased by the NAWAPA XXI nuclear-driven program.

And this also carries greater multiplier effects, because of water that's inland, when it evaporates off the land. On the West Coast, 60% of the water, it's estimated, that evaporates from the land area of the West Coast, will end up falling back down again as rain on another part of the continent. And that can be increased even further by the role of plant life itself, especially by forests. And forests will actually increase the flow of water from below the surface up into the atmosphere, and then fall again as rain.

So, through this entire system, driven by the application of a fusion driver, we can dramatically increase the productivity of the entire continental system.

So, these two case studies illustrate why thermonuclear fusion has to be our critical driver in this whole program.